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# Rural Economic Effects of the Conservation Reserve Program in North Dakota

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**Abstract**

The Conservation Reserve Program (CRP), enacted in 1985, provides conservation benefits and agricultural supply control through voluntary, long-term retirement of crop land. Large-scale, long-term land retirement programs produce, in varying degrees, negative effects on those businesses and economic sectors that provide agricultural inputs and services. While the effects of the CRP on agriculture are well understood, economic assessments of the market-value of conservation benefits from the program accruing to rural economies remains largely undocumented. One of the conservation benefits of the program is wildlife habitat, which has bolstered upland bird, waterfowl, and big game populations. Growing wildlife populations have contributed to increased consumptive and non-consumptive wildlife-based recreation. This study addressed the net economic effects of decreased agricultural activity and increased recreational activity associated with the CRP in six rural areas of North Dakota from 1996 through 2000.

The negative effects of the CRP on agricultural revenues were based on the level of economic activity that would have occurred in the absence of the program. The net change in revenues from CRP land returning to agricultural production in the six study areas was estimated at $76 million or about $56 per CRP-acre. However, returning CRP lands to agricultural production was estimated to lower commodity prices and reduce agricultural revenues on non-CRP lands by $25.9 million. The combined effect was estimated at $50.2 million annually or $37 per CRP-acre in the study areas.

The CRP affects many types of outdoor recreation; however, hunting was identified as the most influenced type of recreation in North Dakota. Recreational impacts were determined by comparing pheasant, waterfowl, and deer hunter numbers before and after the CRP, assigning the relative role the CRP has played in the change in hunter numbers, allocating a percentage of the change in hunter numbers to each study area, and applying seasonal hunter expenditure patterns to the change in hunter numbers. Average annual CRP-related hunter expenditures in the six study areas were estimated at $12.8 million or $9.45 per CRP-acre. Overall, recreational revenues averaged 26 percent of the agricultural losses.

The degree to which CRP-based hunting revenues in rural areas offset agricultural losses varied throughout the state. In several cases, hunting expenditures offset a substantial portion of the agricultural losses, while in other areas, the net economic loss from the program remains high. The net economic effects of the program in western and central North Dakota were the most favorable, whereas the effects were least favorable in eastern areas of the state. In North Dakota, the net economic effect of losses in agricultural revenues and gains in hunting-based recreational expenditures indicated that several areas of the state are not as economically burdened by the CRP as previous research has suggested.

Key Words: Conservation Reserve Program, Economic Impacts, Rural Economies

## Highlights

The Conservation Reserve Program (CRP) is one of several long-term land retirement programs over the last half century that have been an integral part of U.S. farm policy. The primary focus of the program, when enacted in 1985, was to retire marginal and erodible crop land, provide income stability to landowners, bolster supply control efforts, and increase land- and water-based conservation benefits. Subsequent rounds of Federal legislation have emphasized greater environmental and wildlife benefits, reduced average payment rates, and changed enrollment criteria. Despite these changes, the program has remained popular with North Dakota landowners. The state had 3.3 million acres of CRP land in 2000, and ranked third nationally in enrollment acreage.

Large-scale, long-term land retirement programs produce, in varying degrees, negative effects on those businesses and economic sectors that provide agricultural inputs and services. However, the CRP, by creating substantial wildlife habitat, has helped bolster upland bird, waterfowl, and big game populations and growing wildlife populations in the 1990s have contributed to increased consumptive and non-consumptive wildlife-based recreation. The net economic effects of decreased agricultural activity and increased recreational activity associated with the CRP were examined in six rural areas of North Dakota from 1996 through 2000. The six study areas had high CRP participation and represented a cross section of geographical, agricultural, and natural resource characteristics in North Dakota.

Agricultural effects of the CRP were estimated under the premise that the program was discontinued in 1996. In the absence of the program from 1996 through 2000, rural economies would experience economic gains from CRP lands returning to agricultural production and incur economic losses caused by lower commodity prices as a result of CRP land returning to agricultural use.

Based on post-CRP land use intentions of contract holders, adjusted crop yields, anticipated crop prices, and estimated government farm program payments, average gross agricultural revenues among the six study areas would have ranged from $65 to $149 per CRP-acre from 1996 to 2000. Gross agricultural revenues that would have occurred in the absence of the program were estimated at $123.6 million annually. After subtracting CRP payments from gross agricultural revenues, the net change in revenues on CRP lands in the six study areas was estimated at $76 million or about $56 per acre. Lower commodity prices, resulting from program termination, were estimated to reduce agricultural revenues on non-CRP lands in the six study areas by $25.9 million. Economy-wide agricultural losses (foregone revenues to rural economies due to the CRP) in the six study areas were estimated at $50.2 million annually or $37 per CRP-acre.

The two forms of wildlife-based recreation most influenced by the CRP in North Dakota are hunting and wildlife viewing. Due to a lack of data describing wildlife viewing activities, only impacts from pheasant, waterfowl, and deer (firearm and archery) hunting activities were used to estimate the recreational impacts of the CRP. The change in resident and nonresident

hunter numbers from pre-CRP (1982-1986) levels to post-CRP (1996-2000) levels was estimated at 78,400 individuals. Based on information from interviews with wildlife biologists and trends in license sales and wildlife population indices, the statewide increase in resident and nonresident hunters attributable to the CRP was estimated at 54,500 individuals. Pheasant, waterfowl, and deer hunting comprised 30 percent, 44 percent, and 26 percent of the increase, respectively.

Each study area was allocated a percentage of the CRP-based change in resident and nonresident duck and pheasant hunters based on hunting destination information. Deer hunters were allocated using percentages of total statewide tags in each study area. Resident hunters were further divided by urban and rural residence, depending upon hunting category. Rural resident hunters were further split between those living in the study area (i.e., local) and those living elsewhere in the state (i.e., nonlocal). Hunter numbers in each study area were multiplied by average seasonal hunting expenditures by hunting category and hunter residence, and adjusted for rural spending and new wealth considerations.

Total CRP-related hunter expenditures in the six study areas were estimated at $12.8 million annually from 1996 through 2000. Expenditures from resident hunters represented 61 percent of the total. About 52 percent of all hunter expenditures was from waterfowl hunting. Pheasant hunting accounted for 32 percent of CRP-related expenditures. Hunting-related expenditures from the program varied from $6 to nearly $12 per CRP-acre in the study areas. Recreational revenues were estimated to offset 26 percent of the agricultural losses associated with the program.

The net effect of agricultural losses (foregone revenues) and recreational gains (hunting expenditures attributable to the CRP) differed greatly among the study areas. One study area was estimated to offset 88 percent of lost agricultural revenues with recreational expenditures. Three other areas were able to offset a reasonable amount (26 percent to 41 percent) of lost agricultural revenues through recreational activity. Two study areas captured little of the lost agricultural revenues through recreational activity. The net economic effects of the program in western and central areas of the state were the most favorable, whereas the economic effects were least favorable in eastern areas of the state.

Estimates of the net effect of the CRP on local economies were based on data from 1996 through 2000 and only included revenues from selected hunting activities. Including more current hunter participation levels and incorporating expenditures from all recreational activities associated with the CRP would improve the net effects estimated in this study. Despite data limitations associated with the study, the net economic effect of losses in agricultural revenues and gains in hunting-based recreational revenues indicated that several areas of the state are not as economically burdened by the CRP as previous research has suggested. Due to changes in hunter participation and Federal farm program legislation, the analysis presented in this study may not accurately or precisely predict future economic effects of the program.

# Rural Economic Effects of the Conservation Reserve Program in North Dakota

**Dean A. Bangsund, F. Larry Leistritz, Nancy M. Hodur***

## INTRODUCTION

The Conservation Reserve Program (CRP) was originally established in 1985 to take marginal and erodible crop land out of production and place it into permanent cover (U.S. Congress 1985). The primary objective of the legislation was to reduce soil erosion on highly erodible crop land, with secondary goals of reducing the supply of farm commodities, providing income support to program participants, and improving environmental benefits, such as reduced sedimentation, improved water quality, and additional wildlife habitat (U.S. Department of Agriculture 1997). Sign-up for the program was capped at 40 to 45 million acres in 1985. The Food, Agriculture, Conservation, and Trade Act of 1990 extended the CRP through 1995. The 1990 legislation shifted the program's focus to meet various water quality and other environmental goals. Emphasis on greater environmental benefits continued in 1994, as the U.S. Department of Agriculture allowed the early release of some contracts, provided certain provisions were met. The goal was to replace those contracts with land that would yield greater environmental benefits, with sign-up criteria stipulating more rigorous standards for water quality, soil control, and wildlife habitat. Program enrollment was capped at 38 million acres through 1995, but in 1995 and 1996, additional early-out provisions were offered to qualifying contracts in an attempt to enroll land yielding greater environmental benefits. In 1996, the Federal Agriculture Improvement and Reform Act further modified CRP legislation by placing additional emphasis on environmental and wildlife benefits (U.S. Department of Agriculture 1997). The sign-up process was shifted to an environmental benefits index based on a national ranking system to determine the amount of acreage approved in any state.

Since the CRP was established in the mid-1980s, the program has remained popular with landowners, despite changes in the program's emphasis, sign-up criteria, and payment rates. The program's popularity, combined with the environmental benefits of the program, has created interest in the program's environmental and economic impacts (Harris et al. 1989, Young and Osborn 1990, Osborn 1993, Hoag et al. 1995, Diebel et al. 1996, Batie et al. 1997). Numerous studies have focused on quantifying and valuing the various environmental benefits of the program (for example, see Ribaudo 1988, 1989; Ribaudo et al. 1989, Ribaudo et al. 1990, Dunn 1993, Feather et al. 1999), in addition, much study has focused on the effects of the program on wildlife habitat (for example, see Allen 1993, 1996; Johnson and Schwartz 1993, Riley 1995, King and Savidge 1995, Johnson and Igl 1995, Carmichael 1997, Swanson et al. 1999). While many assessments of the program's environmental impacts (e.g., water quality, air quality, soil retention, soil productivity, wildlife habitat) have shown substantial benefits, the value of those non-market benefits from the CRP are not captured or transacted in economies (Siegel and Johnson 1991). As such, those benefits provide little to no stimulus for state and local economies.

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Long-term land retirement programs historically have been popular among North Dakota landowners. For example, in 1960, North Dakota landowners enrolled 2.7 million acres, or about 10 percent of the state's total crop land in the Soil Bank program (Taylor et al. 1961). In recent years, participation in the Conservation Reserve Program has been even more extensive. In 1997, North Dakota landowners had enrolled 3.4 million acres in the CRP. Since then, total enrollment in the state has fluctuated between 3.1 and 3.3 million acres.

Economic impacts of long-term land retirement programs have long been a concern in areas of high participation (Barr et al. 1962, Kaldor 1957, Paulson et al. 1961, Schmid 1958). Reductions in crop inputs, labor requirements, machinery use, and crop volumes have negative effects on farm supply and agricultural service sectors. These effects can be substantial in small agriculturally-dependent trade centers. In addition, previous research on the effects of the Soil Bank program suggests that participation in these programs could be associated with increased off-farm employment by farm operators and could facilitate farm consolidation and rural-to-urban migration (Barr et al. 1962, Kaldor 1957, Taylor et al. 1961). In order to mitigate these effects, the program limits enrollment to 25 percent of the crop land in any county.

Assessment of the ongoing economic impacts of the Conservation Reserve Program continues to be of interest, despite numerous studies conducted in the early years of the program (Van der Sluis and Peterson 1994, Venhuizen 1996, Hamilton and Levins 1998). Economic impact analysis generally includes only changes in economic activity that are captured in the marketplace. Since many of the economic effects of the program can be directly linked to changes in agricultural activity, most economic impact studies of the CRP have examined the impact of taking crop land out of production and placing it into permanent cover. These analyses generally focused on the effects of reduced agricultural inputs on agribusiness firms and the resultant effects on local and state economies. Many of the economic impact assessments of the CRP were conducted relatively early in the program's history (Devino et al. 1988, Martin et al. 1988, Mortensen et al. 1990, Broomhall and Johnson 1990, Hyberg et al. 1991). At that time, CRP enrollment was still increasing in many regions, and permanent cover on many CRP tracts was not fully established.

While long-term crop retirement programs generally produce, in varying degrees, negative effects on those businesses and sectors that provide agricultural inputs, those programs generate positive economic effects in other areas of the economy. The Conservation Reserve Program has greatly enhanced wildlife habitat in the northern Great Plains. Increased quantity and quality of wildlife habitat has directly led to substantial growth in upland bird, waterfowl, and big game populations. These increases in wildlife populations have in turn led to increases in wildlife-related recreation, primarily hunting, and to a lesser extent, wildlife viewing. The increase in wildlife habitat, and corresponding increases in wildlife populations were not as readily identifiable during the first years of the CRP as they have been in more recent years. As such, the economic benefits accruing to local and regional economies through increased consumptive and non-consumptive recreational activities were not included in the economic impact studies conducted early in the program's history (Siegel and Johnson 1991). Some research has attempted to place value on the increase in wildlife populations for small-game

hunters and for non-consumptive wildlife viewing (Ribaudo et al. 1989, John 1994, Allen and Ekstrand 1995, Johnson et al. 1994). However, few studies have attempted to evaluate the trade-offs between decreased regional economic activity associated with reductions in agricultural activities and increased regional economic activity resulting from additional outdoor recreation attributable to the CRP (Siegel and Johnson 1991).

Expenditures by individuals pursuing outdoor recreation can have substantial economic effects on local and regional economies (Wallace et al. 1991, Baltezore and Leitch 1992, Lewis et al. 1998, U.S. Fish and Wildlife Service 1998). Hodur et al. (2002)[1] reported that program participants indicated that the CRP in North Dakota has increased hunting/trapping and wildlife/bird watching activities in the state. Contract participants and local individuals interviewed throughout the state indicated the CRP has had positive effects on both the number of individuals hunting and the amount of time spent hunting (Hodur et al. 2002). While the number of resident hunters has increased slightly in the 1990s, the number of non-resident hunters in North Dakota has increased substantially (ND Game and Fish Department 2001). Questions remain regarding the overall economic effects (agricultural and recreational) of the CRP in North Dakota. The purpose of this report is to assess the economic effects of changes in agricultural and recreational activities due to the CRP in North Dakota.

## OBJECTIVES

This report is part of a larger study to examine various socio-economic, population, and public service effects of the Conservation Reserve Program in North Dakota. The purpose of this report is to evaluate the overall economic effects of the Conservation Reserve Program on rural economies in North Dakota. Specific objectives include:

1) estimate losses in agricultural revenues in rural economies from the CRP,

2) estimate gains in recreational revenues in rural economies from the CRP, and

3) estimate the net economic effects of the CRP in rural economies in North Dakota.

[1] The Department of Agribusiness and Applied Economics conducted a study of the socio-economic, demographic, and public service effects of the CRP on rural economies in North Dakota. Two reports cover the results of the study. Hodur et al. (2002) reported the results of a mail survey of CRP participants and interviews with rural leaders and business people. This report examines the economy-wide effects of the CRP on rural economies in North Dakota.

## PROCEDURES

The goal of this study is to estimate the agricultural revenues that would have occurred on land currently enrolled in the Conservation Reserve Program and estimate the increase in hunter expenditures associated with the program. Agricultural revenues, that would have occurred on CRP lands, were compared to estimates of the expenditures associated with outdoor recreation activities attributable to the CRP. The purpose of the comparison is to determine to what extent increased recreational expenditures associated with the CRP have offset the economic activity that would have occurred if the program was not available.

The comparison of lost agricultural revenues and added recreational revenues required two major efforts. First, agricultural revenues that would have been generated from CRP lands had those tracts been actively farmed were estimated. Second, the amount of recreational expenditures accruing to rural economies due to the CRP was estimated. The following sections describe the data and procedures.

### Study Design

Since the main goal of the study was to evaluate the effects of the CRP on rural economies in North Dakota, enrollment statistics were obtained for CRP acreage by county (Farm Service Agency 1997-2001a). Several counties in North Dakota, from 1996 through 2000, averaged more than 100,000 acres enrolled in the CRP (Figure 1). Sixteen counties, grouped into six areas, were selected for study based on different geographical, agricultural, and natural resource characteristics in the state (Figure 2). Each of the study counties has relatively high CRP participation, measured both in total acreage and percentage of total crop land enrolled (Table 1).

A random sample of 3,150 CRP participants in the 16 counties were surveyed to obtain information on (1) CRP land characteristics, (2) effects of CRP on area agriculture and agribusiness, and on the respondent's farming operation (if applicable), (3) CRP effects on recreation, (4) respondent's attitudes toward the CRP, and (5) respondent characteristics. Results from the mail survey were summarized by Hodur et al. (2002). Of specific use in this study was information obtained on crops grown and relative yields on land prior to enrollment, post-CRP land use intentions, and information on recreational activities associated with the CRP.

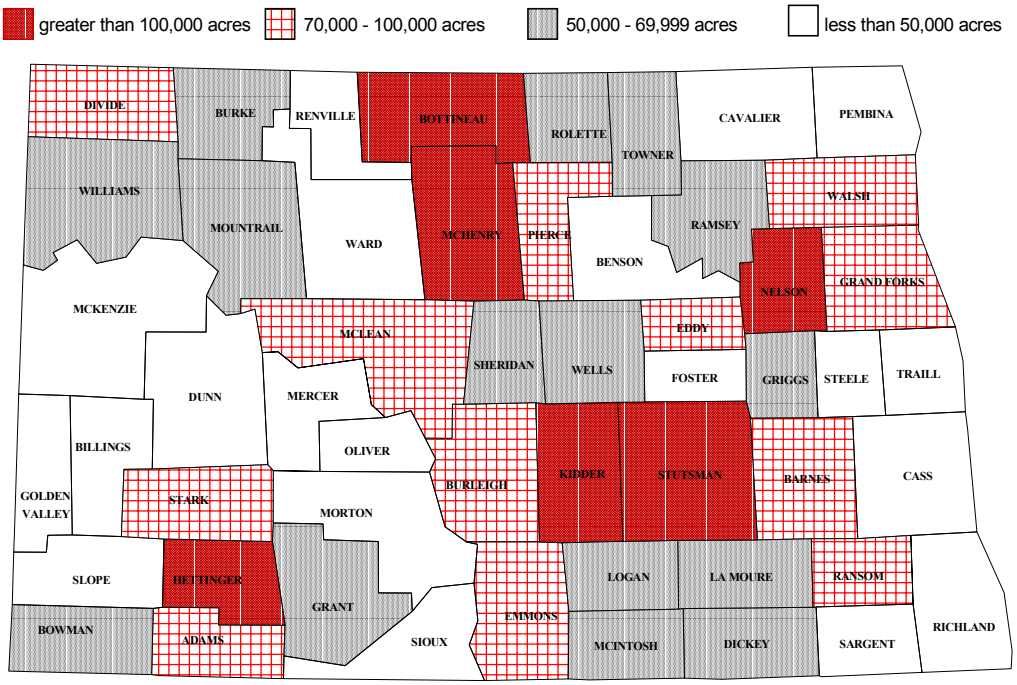


Figure 1. Conservation Reserve Program Enrollment, by County, Average 1996 through 2000
Source: Farm Service Agency (1997-2001a).

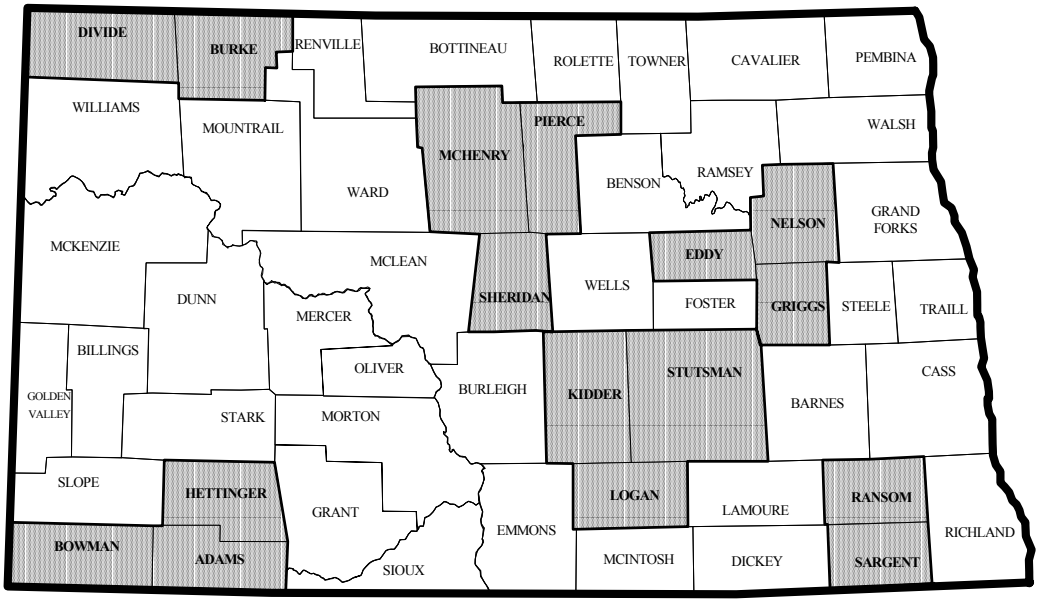


Figure 2. Counties and Multi-county Areas Selected for Assessing Effects of the Conservation Reserve Program on Rural Economies

Table 1. Acreage Enrolled in Conservation Reserve Program in Study Counties, North Dakota, 1996 through 2000

| Study Counties | CRP Acreage 1996 | 1997 | 1998 | 1999 | 2000 | Average | Percent of Crop Land |
|---|---|---|---|---|---|---|---|
| Adams | 84,130 | 93,903 | 79,618 | 72,004 | 73,571 | 80,645 | 21.5 |
| Bowman | 88,615 | 77,389 | 58,983 | 61,252 | 62,512 | 69,750 | 20.8 |
| Burke | 55,016 | 55,512 | 47,920 | 46,559 | 50,238 | 51,049 | 11.2 |
| Divide | 98,016 | 100,082 | 81,534 | 66,968 | 73,380 | 83,996 | 15.1 |
| Eddy | 58,149 | 74,575 | 70,407 | 72,939 | 73,787 | 69,971 | 27.1 |
| Griggs | 39,971 | 62,385 | 75,153 | 80,923 | 82,028 | 68,092 | 21.4 |
| Hettinger | 101,624 | 113,957 | 100,333 | 111,106 | 112,405 | 107,885 | 18.7 |
| Kidder | 108,210 | 114,883 | 104,993 | 109,910 | 111,636 | 109,926 | 26.4 |
| Logan | 58,514 | 75,486 | 67,294 | 59,853 | 61,179 | 64,465 | 22.5 |
| McHenry | 120,061 | 124,984 | 110,189 | 115,262 | 116,347 | 117,369 | 17.2 |
| Nelson | 60,786 | 108,030 | 112,924 | 124,661 | 126,472 | 106,575 | 24.2 |
| Pierce | 63,797 | 84,756 | 77,178 | 80,874 | 81,596 | 77,640 | 17.5 |
| Ransom49,324 | 72,215 | 72,350 | 76,691 | 82,009 | 70,518 | 19.6 | |
| Sargent | 28,599 | 48,092 | 50,241 | 37,185 | 41,622 | 41,148 | 10.2 |
| Sheridan | 64,224 | 61,875 | 57,450 | 59,663 | 62,402 | 61,123 | 18.0 |
| Stutsman | 167,464 | 188,604 | 178,267 | 177,047 | 181,843 | 178,645 | 18.1 |
| Total | 1,246,500 | 1,456,728 | 1,344,834 | 1,352,897 | 1,393,027 | 1,358,797 | 18.8 |
| North Dakota | 2,910,923 | 3,355,695 | 3,3138,229 | 3,169,095 | 3,313,292 | 3,177,447 | 14.2 |
| Study Counties as Percent of state | 42.8 | 43.4 | 42.9 | 42.7 | 42.0 | 42.8 | — |

Source: Farm Service Agency (1997-2001a).

## Agricultural Effects

Several steps were required to estimate the agricultural revenues that would have occurred had the CRP not been extended in 1996. First, post-CRP land use was estimated. Second, the type and amount of crops that would likely have been grown on land returning to crop production were determined. Third, yields for commodities grown were estimated. Finally, likely crop prices and farm program payments that would have been received had CRP land been farmed were estimated.

### Land Use

The first major conservation program for long-term crop retirement was started in the 1950s (U.S. Congress 1956). The initiative was commonly known as the Soil Bank program. Upon program termination in 1970, about 80 percent of crop land enrolled in the Soil Bank program returned to crop production (Laycock 1991).

Numerous studies have attempted to determine the post-CRP land use intentions of program participants. Diebel et al. (1996) summarized post-CRP land use intentions based on several surveys of CRP contract holders in 12 major CRP states and based on a national survey by the Soil and Water Conservation Service conducted in 1993. Substantial differences in post-CRP land use were evident in various regions of the United States. Post-CRP land use depended largely on the acreage of CRP that was planted to trees. Despite regional differences, about 63 percent of CRP acreage nationwide would likely be returned to crop production (Diebel et al. 1996). Another one-third would remain in grass production for haying, grazing, or wildlife habitat. Miscellaneous uses comprised the remaining land.

Hill (1993) examined land use intentions of CRP participants in North Dakota in the early 1990s. Hill (1993) surveyed 900 contract holders and found that 52 percent of their CRP lands would return to crop production. About 18 percent of CRP acreage would be used for pasture and hay land. Four percent of CRP land would be left in permanent cover without haying or grazing. The remaining land uses were to rent out the land (21 percent), sell the land (4 percent), and 'other' uses (1 percent).

The results from Hodur et al. (2002) were similar to the results found by Hill (1993). Hodur et al. (2002) surveyed 3,150 CRP contract holders in 16 counties in North Dakota. Contract holders indicated that upon program termination or if they elected not to re-enroll their contracts upon expiration, 62 percent of CRP acreage would return to crop production, 13 percent would be used for hay production, and 9 percent would be used for livestock grazing. About 2 percent of CRP land would be left in permanent cover without haying or grazing. The remaining land uses were to sell the land (10 percent), rent out the land (1 percent), and 'other' uses (1 percent).

Data obtained from the survey of CRP contract holders by Hodur et al. (2002) was used to determine post-CRP land uses. Four possible 'uses' of post-CRP lands were considered: crop production, hay production, livestock grazing, and permanent cover. To arrive at an overall land use pattern for post-CRP acreage, the percentage of land indicated by survey respondents that would be used for crops, hay, grazing, and permanent cover was multiplied by the acreage enrolled for each respondent. The acreage of CRP lands that would be sold or rented was then estimated, and reallocated to agricultural use based on the ratio of crop, hay, and grazing uses. It was assumed that land sold or rented would return to agricultural use. Other uses were evaluated based on each reason provided by survey respondents. For example, some survey respondents indicated their 'other' use would be to leave CRP in permanent tree plantings. Those 'other' land uses that could be categorized as permanent cover were reallocated to that land use. Likewise, some CRP contract holders indicated they were unsure of future use because current CRP tracts were partially flooded or 'it would depend upon economics'--those land uses were reallocated to the four major land uses (i.e., crop, hay, pasture, permanent cover) based on the initial ratios. The final result produced estimates of four possible land uses for post-CRP lands in each of the six multi-county study areas (Table 2).

Table 2. Post-Conservation Reserve Program Land Use Intentions of Contract Holders, by Study Area, North Dakota, 2002

| Study Area | Post-CRP Land Use | | | |
|---|---|---|---|---|
| | Crop Production | Hay | Grazing | Permanent Cover |
| | % | | | |
| Adams, Bowman, Hettinger | 66.7 | 17.4 | 10.4 | 5.4 |
| Burke, Divide | 62.6 | 22.8 | 12.6 | 2.0 |
| Eddy, Griggs, Nelson | 76.9 | 11.5 | 9.6 | 2.1 |
| Kidder, Logan, Stutsman | 71.4 | 18.1 | 9.3 | 1.1 |
| McHenry, Pierce, Sheridan | 68.0 | 15.0 | 15.3 | 1.6 |
| Ransom, Sargent | 81.8 | 6.9 | 9.4 | 1.9 |
| Overall | 71.7 | 15.1 | 10.8 | 2.5 |

Source: Hodur et al. (2002).

The amount of CRP land that would return to crop production varied from nearly 82 percent in Ransom and Sargent Counties to 63 percent in Burke and Divide Counties (Table 2). Overall, 72 percent of CRP land would return to crop production in the six study areas. Leaving CRP in grass and managing the land for hay production was the next highest use at 15 percent. The amount of CRP land used for hay production varied from 7 percent in Sargent and Ransom Counties to nearly 23 percent in Burke and Divide Counties. Using CRP land for livestock grazing represented the next highest use at 11 percent. About 2 percent of CRP land would remain in permanent cover without haying or grazing.

Crops Grown

Crops that would likely have been raised on CRP lands from 1996 through 2000 could be determined from either the prior crop history on those lands as reported by contract holders or from agricultural crop statistics in each county. Each method was used to estimate a crop mix.

Crop yields and planted acreage of all major crops grown from 1996 through 2000 were compiled to develop composite acres for each multi-county study area (ND Agricultural Statistics Service 1997-2001; Farm Service Agency 1997-2001a). The composite acre approach is a technique used to represent the type and amount of crops grown in a given region on a per-acre basis. A composite acre will not necessarily represent what any single producer would grow in any particular year, but rather collectively represents an average of what all producers grow in a region.

The percentage of land planted to each major crop in the multi-county areas was determined by dividing planted acreage of each crop by the total planted acreage of all major crops. Crops which represented 3 percent or more of the multi-county area's total planted crop land were included in the composite acre. The acreage of crops representing less than 3 percent of the area's total planted crop land were added to the acreage of crops retained in the composite acre based on the relative percentage of each crop's share of total planted acreage. Final percentages of the major crops grown in the regions were then re-calculated by dividing new acreage (actual planted acreage plus acreage allocated from minor crops) by total planted acreage.

Some differences existed in the two methods of determining crop mixes on post-CRP land. The survey of CRP participants did not ask how much land enrolled in the CRP was summer fallowed, while the composite acre approach included summer fallow in the crop mix. Survey questions were general to all of the participant's CRP land, and did not clarify when the land was enrolled in the CRP. Some survey participants may have reported crops grown on CRP land as far back as the mid 1980s. The composite acre approach only used crop statistics from 1996 to 2000. Some changes in the amount of crops grown in various areas of the state have occurred since the CRP was initiated (ND Agricultural Statistics Service *various years*). These changes are most evident in the eastern portion of the state where the percentage of row crops, particularly soybeans, has increased (Bangsund and Leistritz 1999). In the western areas of the state, the use of summer fallow has decreased since the CRP was initiated (ND Agricultural Statistics Service *various years*). The composite acre approach included prevented planting in the crop mix (Risk Management Agency 2001). CRP survey participants were not asked if any land in the CRP was prevented from being planted prior to enrollment.

Although both methods resulted in similar crop mixes, some differences were evident (Table 3). In Adams, Bowman, and Hettinger Counties, the current crop mix showed less emphasis on small grains than the estimate from survey participants. In Burke and Divide Counties, the current crop mix included much less spring wheat than indicated by survey participants. The difference is due to a shift to durum and prevented planted acreage. Fusarium Head Blight in other regions of the state has shifted durum acreage further west in the state (Nganje et al. 2001). Few major differences in crop mixes were found in Eddy, Griggs, and Nelson Counties, except the current crop mix had slightly more emphasis on oil seed crops (i.e., canola and sunflower). Likewise, no major differences in crop mixes were found in Kidder, Logan, and Stutsman Counties and McHenry, Pierce, and Sheridan Counties, except a somewhat larger mix of alfalfa and oil seed crops are currently raised when compared to pre-CRP crop history. As expected, the current crop mix in Ransom and Sargent Counties showed a greater emphasis on row crops versus small grains in the current crop mix when compared to pre-CRP crop history.

Table 3. Estimated Crop History on Land Prior to Conservation Reserve Program Enrollment and Current Crop Mix on non-Conservation Reserve Program Lands, by Study Area, North Dakota, 1996 through 2000

| | Study Areas | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Adams Bowman Hettinger | | Burke Divide | | Eddy Griggs Nelson | | Kidder Logan Stutsman | | McHenry Pierce Sheridan | | Ransom Sargent | |
| Crop | Survey Response | NDASS Average | Survey Response | NDASS Average | Survey Response | NDASS Average | Survey Response | NDASS Average | Survey Response | NDASS Average | Survey Response | NDASS Average |
| | percentage of crop acreage | | | | | | | | | | | |
| Spring Wheat | 68.7 | 55.3 | 38.0 | 14.0 | 41.3 | 38.1 | 45.5 | 43.9 | 55.7 | 39.5 | 36.0 | 35.2 |
| Durum | 10.9 | 9.8 | 42.5 | 53.6 | 8.1 | 5.5 | 9.3 | 6.2 | 5.8 | 8.5 | 1.2 | 0.0 |
| Barley | 5.8 | 4.0 | 8.2 | 4.7 | 18.2 | 18.2 | 10.7 | 9.9 | 11.3 | 13.8 | 10.3 | 0.0 |
| Oats | 4.9 | 3.8 | 4.3 | 0.0 | 3.9 | 0.0 | 8.4 | 5.0 | 11.5 | 4.1 | 2.6 | 0.0 |
| Oil Sunflower | 3.9 | 0.0 | 2.1 | 0.0 | 19.4 | 11.6 | 12.5 | 12.5 | 7.6 | 10.0 | 14.4 | 6.6 |
| Non-oil Sunflower | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 5.5 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Canola | 0.4 | 0.0 | 0.0 | 0.0 | 0.7 | 3.9 | 0.5 | 0.0 | 0.3 | 5.3 | 0.2 | 0.0 |
| Dry Beans | 0.0 | 0.0 | 0.0 | 0.0 | 0.9 | 3.7 | 0.2 | 0.0 | 0.0 | 0.0 | 3.8 | 4.3 |
| Corn | 1.2 | 0.0 | 0.0 | 0.0 | 2.3 | 0.0 | 2.9 | 0.0 | 1.5 | 0.0 | 21.4 | 18.3 |
| Soybeans | 0.2 | 0.0 | 0.0 | 0.0 | 0.4 | 3.6 | 0.3 | 0.0 | 0.0 | 0.0 | 7.8 | 25.5 |
| Alfalfa | 3.5 | 14.8 | 3.0 | 3.7 | 3.9 | 5.1 | 7.3 | 16.7 | 2.3 | 9.8 | 1.3 | 4.4 |
| Summer fallow | na | 12.2 | na | 16.7 | na | 0.0 | na | 0.0 | na | 0.0 | na | 0.0 |
| Other (survey) | 0.6 | na | 1.9 | 0.0 | 0.9 | na | 2.4 | na | 4.0 | na | 1.0 | na |
| Prevented planting | na | 0.0 | na | 7.3 | na | 4.8 | na | 5.9 | na | 9.1 | na | 5.8 |

na – not applicable.

Sources: Hodur et al. (2002), ND Agricultural Statistics Service (1997-2001), and Farm Service Agency (1997-2001a).

The crop history on land prior to CRP enrollment, as reported by survey participants, was not used since it was impossible to determine when those crops were grown (i.e., the survey was not specific to when land was enrolled in the CRP). Also, since the survey only asked how crops yielded on land enrolled in the CRP relative to yields obtained on non-CRP land, county average yields still had to be compiled. This study assumed that in the absence of the CRP from 1996 to 2000, land enrolled in the program (i.e., the percentage returning to crop production) would be used to raise crops in the same ratio as crops currently grown on non-CRP lands.

Crop, Hay, and Pasture Yields

Average yields were estimated for each crop from 1996 through 2000. Crop yields were weighted by annual acreage to generate a 5-year weighted average county yield. Weighted average county yields were then weighted by the 5-year average acreage of each crop in each county to arrive at an average crop yield for each of the multi-county groups.

Since the CRP initially targeted marginal and highly erodible crop land, the CRP survey asked contract participants to report how past crop yields on land enrolled in the CRP compared to yields on land not enrolled in the CRP. The question was not specific to individual crops. The yield differences reported by survey respondents were weighted by their reported CRP acreage to produce a county-wide average yield difference for land enrolled in the CRP. County average yield differences were then averaged in each multi-county study area. The 5-year average crop yields for each multi-county group were then adjusted by the average yield differences obtained from the survey of CRP participants. Thus, current yields on non-CRP lands obtained from the ND Agricultural Statistics Service were adjusted to reflect likely yields had those crops been raised on land enrolled in the CRP (Table 4). Short-term yield increases due to improved soil productivity (e.g., organic matter, soil tilth) on CRP land are likely to occur (Schuman et al. 1994, Gebhert et al.1994); however, those yield effects were not addressed in this study.

Hay and grazing yields that would likely be obtained from CRP land were provided by Sedivec (2002). Hay and grazing yields were based on typical CRP stands (i.e., grass/legume combinations), average precipitation, and less than average soil productivity for each of the six multi-county study areas. Hay yields were estimated to be 30 percent higher in the first year of cutting due to collection of stand residue (i.e., dead grass, stems) (Sedivec and Solseth 1998). A 5-year average was calculated by including a 30 percent yield increase in year one. Grazing output from CRP land assumed a 25 percent annual grazing efficiency (i.e., 50 percent disappearance of total forage, of which 50 percent is grazed and 50 percent is lost due to trampling, defecation, and senescence). Yields obtained from Sedivec (2002) were not adjusted for yield differences obtained in the mail survey since (1) the survey was specific to crop yields and (2) the yields were already based on less than average soil productivity.

Table 4. Estimated Average Yields on Post-Conservation Reserve Program Lands, by Study Area, North Dakota, 1996 through 2000

| Post-CRP Land Use | Study Areas: Adams, Bowman, Hettinger | Burke, Divide | Eddy, Griggs, Nelson | Kidder, Logan, Stutsman | McHenry, Pierce, Sheridan | Ransom, Sargent |
|---|---|---|---|---|---|---|
| Yield Difference (%)[a] | -7.2 | -7.1 | -3.4 | -1.7 | -7.7 | -6.2 |
| Crop Production[b] | | | | | | |
| Spring Wheat (bu/acre) | 26.4 | 22.7 | 26.6 | 26.5 | 23.3 | 33.8 |
| Durum (bu/acre) | 28.0 | 25.0 | 17.2 | 17.8 | 21.5 | -- |
| Barley (bu/acre) | 37.2 | 38.3 | 47.9 | 49.4 | 42.3 | -- |
| Oats (bu/acre) | 22.8 | -- | -- | 32.0 | 30.6 | -- |
| Oil Sunflower (lbs/acre) | -- | -- | 1337 | 1326 | 1194 | 1310 |
| Non-oil Sunflower (lbs/acre) | -- | -- | 1106 | -- | -- | -- |
| Canola (lbs/acre) | -- | -- | 1160 | -- | 1149 | -- |
| Dry Beans (lbs/acre) | -- | -- | 1197 | -- | -- | 1298 |
| Corn (bu/acre) | -- | -- | -- | -- | -- | 88.2 |
| Soybeans (bu/acre) | -- | -- | 24.0 | -- | -- | 30.5 |
| Alfalfa (tons/acre) | 1.4 | 1.6 | 2.0 | 1.8 | 1.7 | 2.9 |
| Hay Production | | | | | | |
| Grass Hay (tons/acre) | 1.1 | 1.2 | 1.5 | 1.7 | 1.4 | 1.8 |
| Pasture | | | | | | |
| Grazing (AUMs/acre)[c] | 0.88 | 0.97 | 1.2 | 1.36 | 1.12 | 1.54 |

[a] The percentage difference in past crop yields on land enrolled in the CRP compared to yields on land not enrolled in the CRP.
[b] Average yields from 1996 through 2000 adjusted for yield difference between CRP land and non-CRP land.
[c] One Animal Unit Month (AUM) is equivalent to 780 lbs of forage. AUM capacities based on 50 percent disappearance, of which 50 percent is consumed by grazing animals.
Sources: Hodur et al. (2002), ND Agricultural Statistics Service (1997-2001), and Sedivec (2002).

## Crop, Hay, and Pasture Prices

Estimating crop prices in the absence of the CRP is problematic. Several effects would be difficult to quantify, such as market price response to additional crop supply. Also, producer decisions on which crops to raise would be to some extent influenced by changes in crop prices. In addition, farm program legislation in the absence of a conservation program retiring crop land and its effects on prices received by farmers would be impossible to project. An accurate estimation of non-CRP crop prices would require a separate analysis and was beyond the scope this study.

Few recent studies have attempted to estimate the effect terminating the CRP would have on crop prices. Before the development of the 1996 Federal Agriculture Improvement and Reform Act, several studies examined the effect on commodity prices of bringing CRP acreage back into production. Lane and Reeve (1994) examined the issue of post-CRP commodity prices by reporting the analyses performed by several economists on anticipated prices for certain commodities over an 8-year period from 1995 to 2002. One analysis evaluated the effects on crop prices over an extended period since contract acreage would come back into production gradually as existing contracts expired. Much of the basis for that analysis included continuing set aside requirements in future farm program legislation. Also factored into the projected prices were assumptions on future world supply and demand for various commodities and anticipated future levels of U.S. domestic supply and disappearance. Prices were expected to be 7 percent less for wheat and 5 percent less for both corn and soybeans. Another analysis estimated, upon the final expiration of all CRP contracts, the U.S. domestic price response to additional supply for wheat and corn. Wheat prices were expected to be 10 percent lower, and corn prices were expected to be 6 percent lower.

Heimlich and Osborn (1993) estimated the effects of changes in future demand for wheat and corn and the corresponding effects on the future use of CRP land, assuming the program was terminated. Two scenarios were developed. One scenario was based on increased future demand (15 percent) for wheat and corn. The other scenario was based on reduced demand (5 percent) for wheat and corn. Both scenarios assumed continued low acreage reduction requirements in future farm legislation. If future domestic demand increased, crop prices were projected to increase 20 percent for corn and between 10 to 14 percent for wheat, and would result in most CRP land returning to crop production. If future domestic demand decreased, prices for corn and wheat would decrease 15 percent. Further, Heimlich and Osborn (1993) reported that acreage reduction programs would have to be set at about 30 percent to maintain crop prices, and most CRP land with a crop base would likely be used to meet acreage reduction requirements.

Diebel et al. (1996) indicated that future price effects resulting from CRP land returning to crop production would be dependent upon specific acreage reduction provisions in future farm legislation, type of cover established on CRP land, and future world supply and demand factors. Most of the studies conducted in the mid 1990s on the price effects of returning CRP land to production placed heavy emphasis on farm program provisions and baseline data on world and domestic supply and demand. Considering the changes made to farm legislation (i.e., elimination of acreage set asides) and world trade agreements in the mid- to late-1990s, previous research on the price effects of returning CRP land to production was not used in this study.

A briefing paper published in 2001 by the Food and Agricultural Policy Research Institute (FAPRI) examined the effects of a 10 percent reduction in planted acreage of all U.S. farm program crops (FAPRI 2001). The study included domestic yield response, slippage, and changes in international supply that would result from increased U.S. crop prices. Crop prices were estimated to increase, and remain above projected levels (i.e., what the prices were likely to be without the 10 percent change in planted acreage) from 2003 through 2010. The price increases,

averaged from 2003 to 2010, would be 6 percent for wheat, 14 percent for corn, 7 percent for soybeans, 14 percent for barley, and 17 percent for oats. Young (2002) indicated that the results of the FAPRI study would be applicable for estimating the price effects of returning CRP land to production, since (1) the amount of returning CRP acreage would closely approximate the same acreage involved with a 10 percent change in planted acreage nationwide, and (2) baseline projections for future crop prices would be current with existing trade programs, domestic farm policies, and world supply and demand fundamentals. Young (2002) also indicated that the magnitude of the price effects would be similar, albeit opposite of the effects projected in the FAPRI study. Young (2002) suggested the downward pressure on crop prices resulting from CRP returning to production would be somewhat less in magnitude than the effects described in the FAPRI (2001) report. The decrease in crop prices was estimated at 70 percent of the price change found in the FAPRI report (Table 5).

Table 5. Estimated Crop Prices in the Absence of the Conservation Reserve Program, North Dakota, 1996 through 2000[a]

| | Study Areas | | | | | |
|---|---|---|---|---|---|---|
| Crops | Adams Bowman Hettinger | Burke Divide | Eddy Griggs Nelson | Kidder Logan Stutsman | McHenry Pierce Sheridan | Ransom Sargent |
| Spring Wheat ($/bu) | 2.97 | 3.11 | 3.24 | 3.22 | 3.14 | 3.27 |
| Durum ($/bu) | 3.02 | 3.34 | 2.65 | 2.98 | 3.24 | -- |
| Barley ($/bu) | 1.69 | 1.79 | 1.76 | 1.73 | 1.69 | -- |
| Oats ($/bu) | 0.86 | -- | -- | 0.94 | 1.00 | -- |
| Oil Sunflower ($/cwt) | -- | -- | 9.70 | 9.43 | 9.40 | 10.15 |
| Non-oil Sunflower ($/cwt) | -- | -- | 13.95 | -- | -- | -- |
| Canola ($/cwt) | -- | -- | 9.23 | -- | 9.49 | -- |
| Dry Beans ($/cwt) | -- | -- | 15.85 | -- | -- | 16.21 |
| Corn ($/bu) | -- | -- | -- | -- | -- | 2.03 |
| Soybeans ($/bu) | -- | -- | 5.18 | -- | -- | 5.15 |
| Alfalfa ($/ton) | 51.37 | 50.73 | 50.26 | 50.57 | 51.46 | 50.93 |
| Grass Hay ($/ton) | 30.84 | 30.84 | 30.84 | 30.84 | 30.84 | 30.84 |
| Grazing ($/AUM) | 21.88 | 14.53 | 15.56 | 19.08 | 15.47 | 20.86 |

[a] Post-CRP crop prices were based on 5-year average prices received by farmers adjusted by the following rates: wheat, non-oil sunflower, alfalfa, grass hay, and dry edible beans (-4.4%), barley (-9.9%), oats (-15.5%), soybeans, oil sunflower, and canola (-4.4%), and corn (-10%).

Sources: ND Agricultural Statistics Service (1997-2001), FAPRI (2001), and Young (2002).

Crop prices received by farmers in the six multi-county study areas for the most common crops raised were averaged from 1996 through 2000. Average crop prices were then adjusted using the price changes estimated in the FAPRI (2001) report. Several crops that would likely be raised on post-CRP land in North Dakota were not included in the FAPRI (2001) report. For those crops, prices were reduced by the same percentage as similar crops. Crop prices for wheat, non-oil sunflower, alfalfa, grass hay, and dry edible beans were reduced by 4.4 percent. Barley price was reduced by 9.9 percent. Soybean, oil sunflower, and canola prices were reduced by 5 percent. Corn price was reduced by 10 percent. Oats price was reduced by 15.5 percent (Table 5).

Grass hay prices for 1996 through 2000 were used to estimate an average 5-year price (ND Agricultural Statistics Service 1997-2001). The first year's price for grass hay was reduced by one-third due to reduced quality of initial hay from CRP lands (Sedivec and Solseth 1998). The increase in grass hay acreage throughout the state, resulting from haying CRP lands, was estimated at 214,000 acres or 16.9 percent of the state's 5-year average acreage. Due to the relatively large change in grass hay acreage, grass hay prices were reduced by 8.7 percent (twice the rate of alfalfa). The estimated average post-CRP price for grass hay was $30.84 per ton (Table 5).

Pasture rental rates for 1996 through 2000 were used in combination with estimated grazing land carrying capacities to determine rental rates per animal unit month (AUM)[2] (ND Agricultural Statistics Service 1997-2001, Bangsund and Olson 1993) (Table 5). Pasture rental rates were not adjusted for an increase in grazing land. The state had about 10.4 million acres of grazing land in 1997 (U.S. Department of Agriculture 1999). Based on the survey by Hodur et al. (2002), the amount of post-CRP lands used for pasture (about 350,000 acres statewide) would only increase total grazing acreage in the state by 3.4 percent. Changes in the amount of grazing land in other states resulting from the termination of the CRP was assumed to have no effect on grazing rental rates in North Dakota.

Government Payments

In the absence of the Conservation Reserve Program, farmers would likely have received some type of government payment on land currently enrolled in the CRP from 1996 through 2000. However, estimating those payments is difficult. The exact composition of Federal farm programs and the amount of funding available in the absence of a Conservation Reserve Program would be impossible to accurately predict.

To estimate an approximate government payment per acre for post-CRP land in the absence of the program, total annual government farm program payments per county were determined from 1996 through 2000 (Farm Service Agency 1997-2001b). Farm program

[2] An AUM is an average amount of forage needed to feed one animal unit (AU) for one month. An AU is typically considered a mature cow weighing approximately 1,000 pounds or an equivalent grazing animal(s) based on an average feed consumption of 26 pounds of dry matter per day (Shaver 1977).

payments over the period can be categorized as direct payments to producers (i.e., not tied to production) and payments tied directly to crop production.

Production Flexibility Contract (PFC) payments from 1996 through 2000 and Market Loss Assistance (MLA) payments from 1998 through 2000 represented direct payments to producers (i.e., those not tied to production). The remaining government payments per county (i.e., those tied to production) were estimated by subtracting PFC and MLA payments from total government payments.

Legislation in the 1996 Federal Agriculture Improvement and Reform Act allowed for PFC payments to be made on base acres, even if those lands were not subsequently cropped (Swenson 2002) (Table 6). However, producers could not receive a PFC payment for land enrolled in the CRP. Although MLA payments were created in subsequent years, rules for distributing those payments were the same as PFC payments. Thus, from 1996 through 2000, landowners would receive a PFC and MLA payment on the base acres of land that had been enrolled in the CRP whether the land was grazed, hayed, or returned to crop production (Table 6). However, government payments tied to production would only be received on CRP land returning to crop production.

Program payments tied to crop production were divided by total acres farmed in each county (component 1) to calculate an average payment per acre cropped. Next, PFC and MLA payments were divided by base acres farmed in each county, multiplied by base acres in the CRP, and divided by total CRP acres in each county (component 2). Base acres farmed equaled total farmed acres in each county multiplied by percentage of farmed acres in program base (i.e., state average was applied to each county) (Swenson 2001). Base acres in the CRP equaled total CRP acres in each county multiplied by the percentage of CRP acres in program base (i.e., state average was applied to each county) (Swenson 2001).

Components 1 and 2 were combined and multiplied by total farmed acres plus CRP acres per year in each county. To arrive at an average payment per acre weighted by acreage across all counties, total annual payments (components 1 and 2) in each county were summed to arrive at a 5-year total, and then divided by the 5-year total acreage farmed plus 5-year total CRP acreage. The above method of estimating farm program payments in the absence of the CRP allowed total MLA and PFC payments in each county to be adjusted slightly upward to reflect additional base acres farmed (i.e., base acres in the CRP that would be put back into production), and the method assumed crop land enrolled in the CRP had a similar proportion of base acres as land not enrolled in the CRP. The technique also provided an estimate for farm program payments tied to production to be included on CRP lands that returned to crop production.

Information on prevented planting payments for North Dakota was obtained from the Risk Management Agency (2001). Average indemnity payments were estimated for each study county for 1997 through 2000. The average county payment per prevented planted acre was then averaged for each multi-county study area (Table 6).

Table 6. Estimated Annual Government Payments on Post-Conservation Reserve Program Lands placed into Crop Production, Hayland, Pasture, and Other Uses, and Estimated Crop Insurance Indemnities on Prevented Planted Acreage, North Dakota, 1996 through 2000

| Study Counties | Estimated Government Payment[a] | | Prevented Planting Indemnities[b] |
|---|---|---|---|
| | Crop Production | Hay, Grazing & Other Uses | |
| | $/acre | | |
| Adams, Bowman, and Hettinger | 20.18 | 11.41 | 26.57 |
| Burke and Divide | 15.64 | 11.29 | 39.03 |
| Eddy, Griggs, and Nelson | 31.59 | 17.44 | 36.30 |
| Kidder, Logan, and Stutsman | 24.55 | 13.73 | 37.48 |
| McHenry, Pierce, and Sheridan | 21.76 | 13.11 | 29.25 |
| Ransom and Sargent | 33.30 | 16.76 | 50.86 |

[a] Based on assuming the Conservation Reserve Program was terminated in the 1996 Federal Agriculture Improvement and Reform Act.
[b] Payment rates expressed as dollars for each acre of prevented planting.
Sources: Farm Service Agency (1997-2001b), Risk Management Agency (2001), and Swenson (2001, 2002).

**Recreational Effects**

The link between the Conservation Reserve Program and increased recreational activity is relatively straightforward. The CRP has created a substantial amount of wildlife habitat for a variety of game and non-game species (Feather et al. 1999). The increased habitat, combined with other factors, has led to increased wildlife populations (e.g., upland game, waterfowl, deer, furbearers). Abundant populations of game and non-game species have influenced the number of individuals participating in outdoor recreational activities (e.g., hunting, wildlife viewing). As individuals partake in outdoor recreation activities, they incur expenses for food, transportation, lodging, and activity-related gear and supplies (e.g., clothing, ammunition). While some of these expenditures are made near their home residence, other expenditures are made in route and in the area where the recreational activity takes place. Expenditures by resident and non-resident outdoor recreationists can be an economic stimulus to many areas of the state.

The problem in determining the amount of economic stimulus created by increased recreational activities in rural areas due to the CRP stems from a lack of quantitative data. To arrive at an estimate of expenditures from outdoor recreation that is the result of the CRP, the influence of the CRP on wildlife populations, recreational activities, and corresponding expenditures must be determined. The following sections describe 1) concept of economic base and how it relates to determining the impact of outdoor recreational expenditures, 2) trends over the past 25 years for resident and nonresident license sales, wildlife populations, and game harvest statistics, 3) expenditure patterns of resident and nonresident hunters, and 4) the procedures used to estimate the amount of economic activity created by hunter expenditures in rural areas attributable to the CRP.

Economic Base

Outdoor recreation expenditures in rural areas can be assessed using an economic base approach. Economic base describes the industries, sectors, or common economic activities that bring 'new' money into an area. Economic base data represent sales of goods and services produced within an area to entities outside the area (Leistritz 1998). The area in question can be any reasonable geographical unit--county, multi-county region, state, multi-state area, etc. Also, goods and services considered 'sales to final demand' vary by area definition.

Economic base activities represent only a portion of all economic activity in an area. Other industries (sometimes called derivative or residentiary) are those whose existence derives from the presence of basic (primary sector) industries (Hertsgaard et al. 1984). The spending and respending of economic base or primary sector dollars creates spillover (multiplier) effects, which in turn support other sectors of the economy. Outdoor recreation expenditures would be considered part of the tourism sector. At the state level, the tourism sector includes expenditures by out-of-state visitors for retail items (e.g., souvenirs, meals, clothing, gas, convenience items) and sales of business and personal services (e.g., tours, motel/hotel accommodations, campgrounds, guide fees). In North Dakota, the role outdoor recreation expenditures play in contributing to the economic base of the state is largely determined by whether expenditures are made from resident or nonresident recreationists. However, when an economy becomes smaller, such as a multi-county area, new wealth (i.e., increase in primary sector revenues) can come from both in-state and out-of-state sources.

Generally, all expenditures made by nonresident hunters would be considered new wealth, both to the local and state economy. Expenditures made by resident hunters can also be considered new wealth to a rural economy if the hunters do not live in the immediate region where the expenditures occur. In this case, resident expenditures would represent new wealth to the rural economy, but not necessarily to the state economy. For example, expenditures from a resident hunter, who lives in eastern North Dakota, but spends money while hunting in western North Dakota, would represent new wealth for the western region, but not necessarily to the state. Other situations where resident hunter expenditures could be considered new wealth include the retention of hunting expenditures that would, in the absence of in-state hunting opportunities, otherwise leave the state. For example, if a resident hunter normally pursued upland game in another state but instead chose to pursue similar opportunities in North Dakota, those expenditures would be considered new wealth to the local and state economy. Similarly, if residents decide to pursue hunting activities rather than spend their discretionary income pursuing other recreation activities outside of the state, those expenditures would be considered new wealth to both the local and state economy. For example, if a hunter decides to pursue upland game in the state instead of traveling to Minnesota for a football game, then those expenditures would be considered new wealth. However, if a resident decides to go hunting rather than participating in another recreational activity within the state, those expenditures would be considered a shift in discretionary spending, rather than representing new wealth to the state. For example, rather than attending a music concert in a major trade center, an individual instead decides to hunt upland game within the state. However, the expenditures from the above

example could represent new wealth to a local economy. A number of factors must be considered when determining how much of the recreational expenditures captured in the state and in local economies can be considered new wealth versus a shift in discretionary spending. In most cases, the rules governing the use of hunter expenditures discussed above would also apply to expenditures from other outdoor recreational activities (e.g., birdwatching).

Trends for License Sales, Wildlife Populations, and Harvest Statistics

To determine the effects of the CRP on hunting activities, data for license sales, wildlife populations, and selected game harvest statistics from 1975 through 2000 were compiled (ND Game and Fish Department 2001). Annual data were analyzed for trend differences for 12 years prior to 1987 (i.e., 1975 through 1986) and for 14 years starting in 1987 (i.e., 1987 through 2000). The year 1987 was used as the dividing point between evaluating pre-CRP and post-CRP trends.

Ordinary least squares regression was used to develop trend lines for two periods--1975 to 1986 and 1987 to 2000. Regression using continuous data from 1975 through 2000 will likely produce different results than those of the pre- and post-CRP periods. The results of the regression are presented in graphical format. Tests of statistical significance were not performed. In most cases, the trends (i.e., the lines plotted in each graph) are dependent upon the period examined. Factors influencing the trends are not revealed using this analysis. Data was not normalized for population, acreage, or other factors.

The CRP was actually initiated in 1985; however, in 1986 nationwide enrollment in the program was only 2 million acres (U.S. Department of Agriculture 1997). Substantial CRP acreage did not appear in North Dakota until around 1987 (Figure 3) (Farm Service Agency 2000). Although CRP acreage was increasing in the late 1980s, time lags exist from the point when agricultural land is converted into permanent cover and when wildlife populations materially or visibly respond to the increase in habitat. Thus, wildlife populations can not be expected to increase as rapidly as land was placed into the CRP in the late 1980s. Also, other factors were affecting wildlife populations (e.g., drought in the late 1980s, wet cycle in the 1990s) during and after the major increase in CRP acreage in the state. Hunter participation (i.e., license sales), like wildlife populations, is likely to lag behind the rapid increase in CRP acreage in the state.

*Resident License Sales*

As a measure of the number of resident hunters in North Dakota, general game and sportsman licenses were combined for 1975 through 2000 (Figure 4) (ND Game and Fish Department 2001). The combination of general game and sportsman licenses does not represent an absolute measure of the number of resident hunters since some landowners who only hunt on their own land and do not purchase a license may not be accounted for in the measure. However, most hunting activities in the state either require a general game or sportsman license. General game and sportsman licenses do not differentiate the number of hunters by type of hunting.

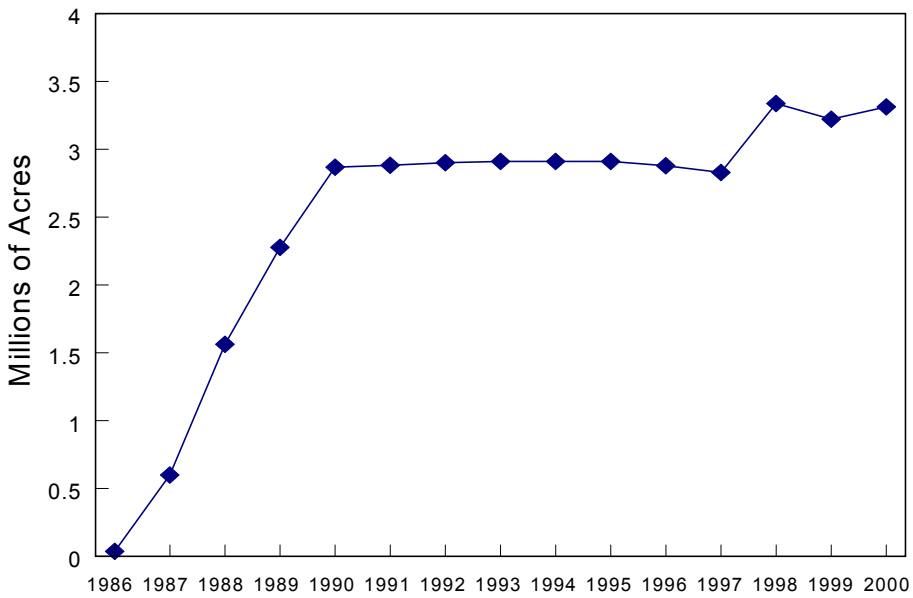


Figure 3. Cumulative Conservation Reserve Program Acreage, North Dakota, 1986 to 2000
Source: Farm Service Agency (2000).

Resident license purchases trended lower from 1975 through 1986 (Figure 4). License sales in the late 1980s were the lowest of the 26-year period examined, and correspond closely with drought conditions in the state at that time. Resident license sales have trended upward since the late 1980s, although some of the reason for the sharp upward trend from 1987 to 2000 can be attributable to low hunter numbers during the statewide drought conditions prevalent in the late 1980s. Resident license sales in 2000 were the highest level to date (data for 2001 was not available) (ND Game and Fish Department 2001). Although not statistically verified, resident license sales appear to be more variable in the post-CRP period than in the pre-CRP period.

Resident and nonresident firearm-deer licenses were combined since nonresident firearm-deer hunter numbers are limited to 1 percent of resident firearm hunters by hunting unit (ND Game and Fish Department 2001). Thus, the number of nonresident firearm-deer hunters parallel the number of resident hunters. The pre- and post-CRP trends in the total number of firearm-deer licenses sold are similar and deer hunter numbers have been steadily increasing during the 1975 to 2000 period (Figure 5).

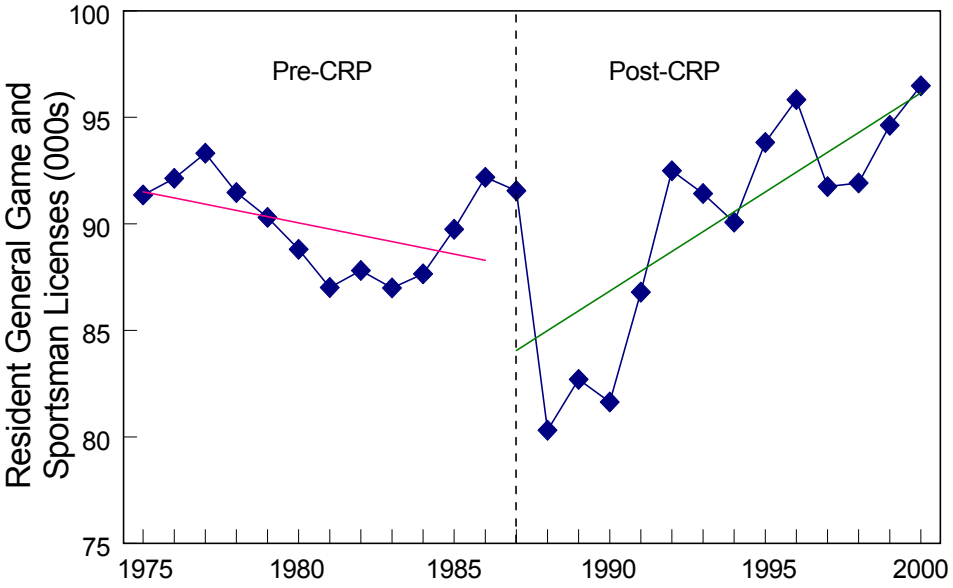


Figure 4. Resident General Game and Sportsman Licenses, North Dakota, 1975 to 2000
Source: ND Game and Fish Department (2001).

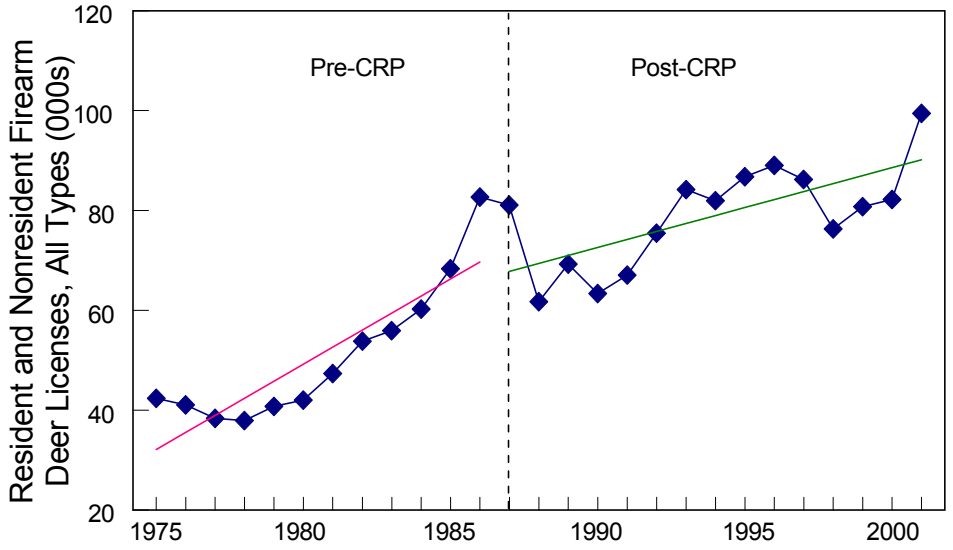


Figure 5. Resident and Nonresident Firearm-Deer Licenses, North Dakota, 1975 to 2000
Source: ND Game and Fish Department (2001).

The number of resident pheasant hunters is estimated annually by a small game hunter survey conducted by the ND Game and Fish Department (Tripp 1976-2001). The number of resident pheasant hunters in North Dakota was trending upward prior to the establishment of the CRP and has continued since the CRP began (Figure 6). Although not statistically verified, more variability appears to exist in the number of resident pheasant hunters since the initiation of the CRP. The number of resident pheasant hunters, in the post-CRP period, seems to correspond with changes in statewide pheasant populations. Resident hunter numbers peaked in 1992, which corresponds with high pheasant populations (Tripp 1976-2001). Resident pheasant hunter numbers also decreased substantially after the harsh 1996-1997 winter, which reduced pheasant populations in many areas of North Dakota. In the late 1990s, pheasant populations rebounded, as did the number of resident hunters.

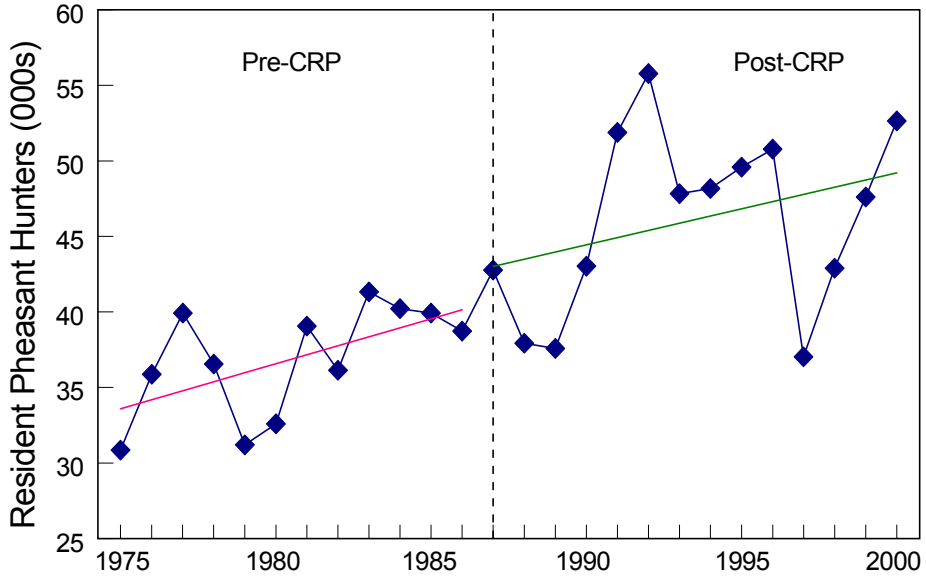


Figure 6. Number of Resident Pheasant Hunters, North Dakota, 1975 to 2000
Source: Tripp (1976-2001).

The number of resident waterfowl hunters is estimated annually through hunter surveys conducted by the ND Game and Fish Department (Schroeder 1976-1979, Johnson 1980-2001). For most of the 1975 to 2000 period, trends in the number of resident waterfowl hunters did not match any other resident or nonresident hunter patterns (Figure 7).

In 1975, the ND Game and Fish Department estimated the number of resident waterfowl hunters at 67,900. By contrast, in 1992 that estimate dropped to 22,800 resident hunters. Hunter numbers decreased by 45,100 over the period, averaging a drop of 2,700 hunters per year. Starting in 1993, hunter numbers increased, and continued to increase through the mid 1990s. Following the low point in 1992, hunter numbers recently peaked at about 35,900 hunters in

1998. However, the recent average number of resident waterfowl hunters (1996 through 2000) is only 56 percent of the number of resident waterfowl hunters in 1975 (Figure 7).

A fundamental change[3] in the number of resident waterfowl hunters occurred from 1975 through 1992. Further, the number of resident waterfowl hunters trended differently than for other hunter numbers (e.g., pheasants, deer) and was different than trends in wildlife indices over the period. The dramatic decline in the number of resident waterfowl hunters is likely due to a host of factors; however, an analysis of those factors is beyond the scope of this report (Appendix A). As a result, trend lines for the pre-CRP and post-CRP periods for resident waterfowl hunters were not developed, instead alternative trends were examined over periods that do not coincide with this study's pre- and post-CRP time frames (Appendix A). Because a basic premise of this study was to apply a percentage of the change in hunter numbers as a result of the CRP, and since the loss of resident waterfowl hunters in the state from 1975 to 1992 is clearly outside of the influences of the CRP, and does not appear to be directly linked to wildlife populations, alternative procedures were developed to estimate changes in recent resident waterfowl hunter numbers resulting from the CRP (Appendix A).

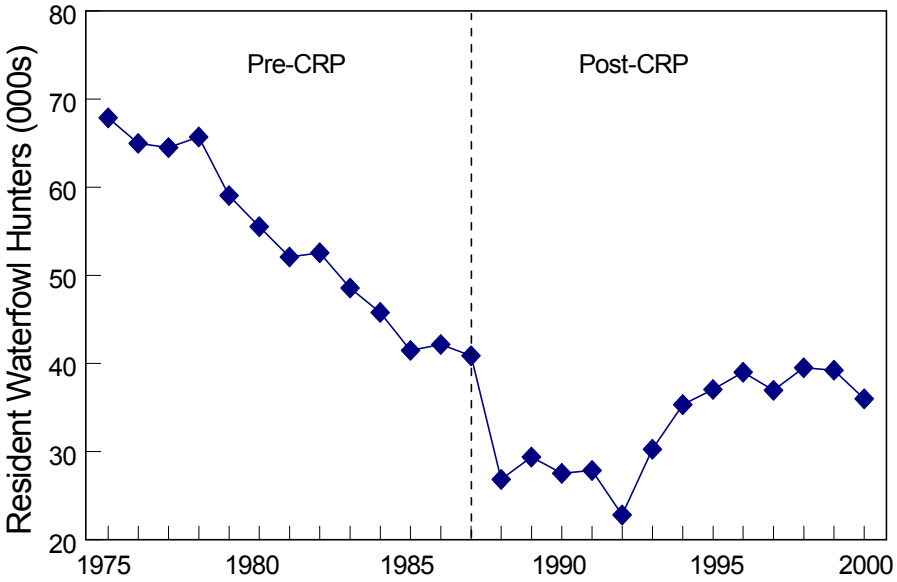


Figure 7. Number of Resident Waterfowl Hunters, North Dakota, 1975 to 2000
Sources: Schroeder (1976-1979) and Johnson (1980-2001).

[3]In the case of the number of resident waterfowl hunters, the change is not entirely explained by demographic, social, regulatory, or resource-based factors. Methodologies and estimation techniques used to determine hunter numbers were unchanged over the period (ND Game and Fish Department 2001).

*Nonresident License Sales*

Generally, small game and general game license sales are required for nonresident hunters in North Dakota. In addition to small and general game licenses, nonresident waterfowl hunters are required to purchase a North Dakota waterfowl license. Also, in addition to a general game license, nonresident deer hunters are required to have a nonresident firearm-deer tag or purchase a nonresident bow hunting license. If they only hunt deer they are not required to purchase a small game license.

The number of nonresident hunters purchasing small and general game licenses remained relatively unchanged from 1975 through the early 1990s (Figures 8 and 9). However, sales of nonresident small and general game licenses have increased substantially since the early 1990s. From 1990 to 2000, nonresident small game license sales increased 340 percent. Similarly, over the same period nonresident general game licenses increased 294 percent. As expected, both nonresident small and general game license sales show nearly identical trends.

Nonresident waterfowl hunter numbers remained largely unchanged from the mid 1970s to the mid 1980s (Figure 10). License sales dipped in the late 1980s, probably due to dry conditions in the state. However, as the state experienced a wet weather cycle starting in 1990s, nonresident waterfowl hunters increased dramatically. From 1990 to 2000, nonresident waterfowl license sales increased 356 percent.

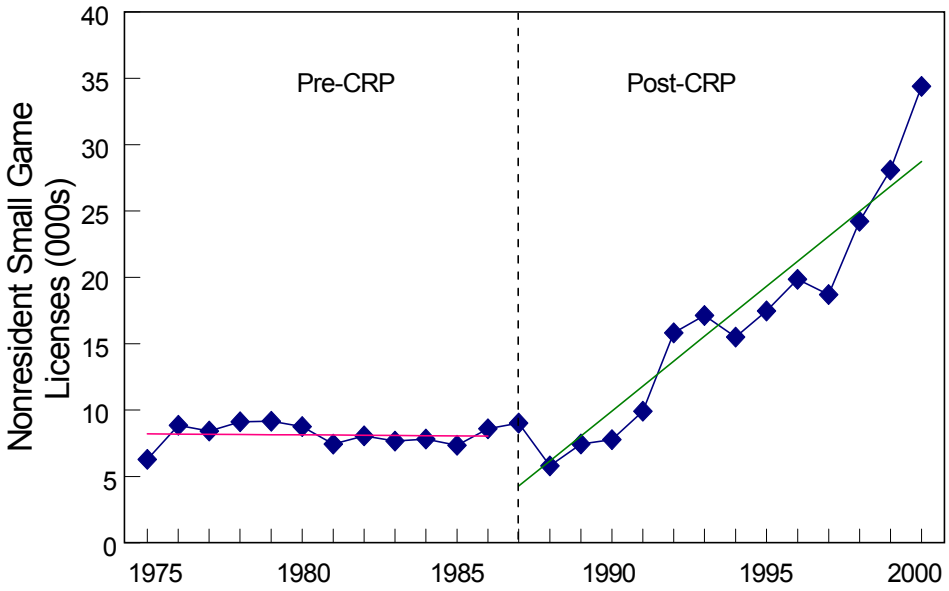


Figure 8. Nonresident Small Game Licenses, North Dakota, 1975 to 2000
Source: ND Game and Fish Department (2001).

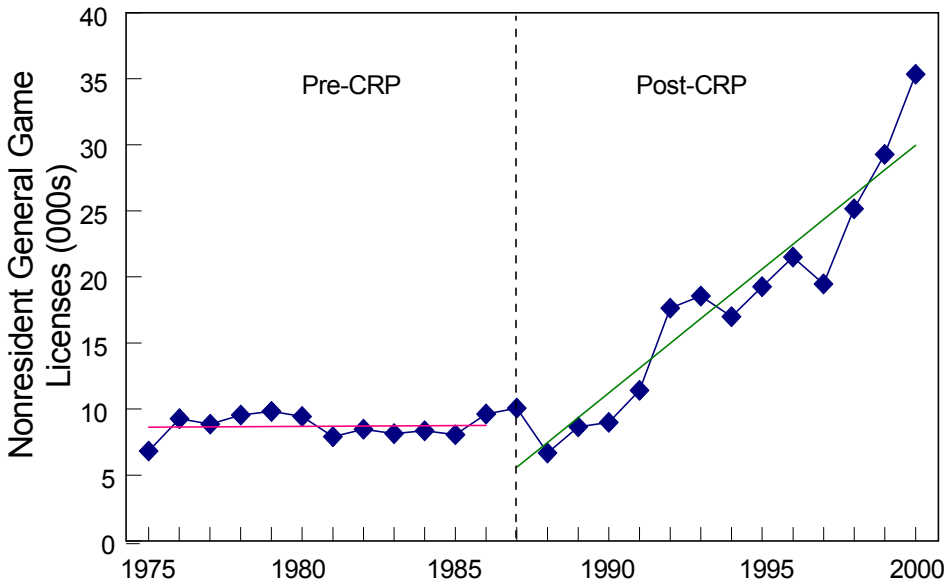


Figure 9. Nonresident General Game Licenses, North Dakota, 1975 to 2000
Source: ND Game and Fish Department (2001).

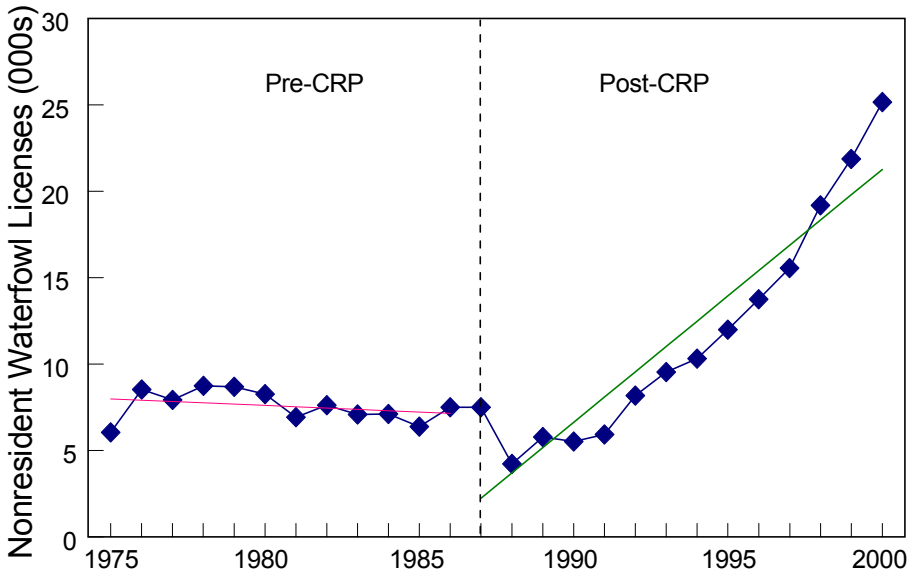


Figure 10. Nonresident Waterfowl Licenses, North Dakota, 1975 to 2000
Source: ND Game and Fish Department (2001).

Although nonresident hunters wishing to pursue upland game are required to purchase a small game and general game license, not all nonresident hunters who purchase small and general game licenses hunt upland game. Because North Dakota does not issue a specific license only for upland hunting, license sales alone do not indicate the number of nonresident hunters pursuing upland game. The ND Game and Fish Department conducts an annual small game hunter survey to estimate the number of pheasant hunters (Tripp 1976-2001). Based on the small game survey, the number of nonresident pheasant hunters (data on other upland hunting was not compiled for this study) has steadily increased in North Dakota since the mid 1970s (Figure 11).

The percentage change in nonresident pheasant hunter numbers has been similar for both pre- and post-CRP periods. The number of nonresident pheasant hunters increased 374 percent from 1975 to 1987 and 395 percent from 1987 to 2000. However, in terms of hunter numbers, the increase has been much greater in the post-CRP period. From 1975 to 1987, the average increase in nonresident pheasant hunters was about 193 individuals annually. The average increase in nonresident pheasant hunters was about 691 individuals annually from 1987 to 2000.

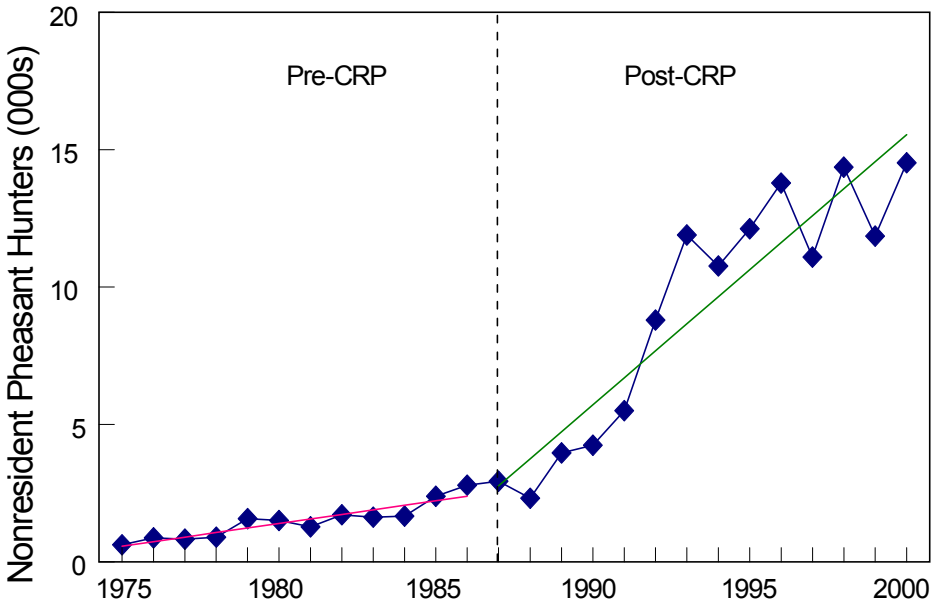


Figure 11. Nonresident Pheasant Hunters, North Dakota, 1975 to 2000
Source: Tripp (1976-2001).

*Total License Sales*

Total sales, for all license types, from 1975 to 2000 were compiled (ND Game and Fish Department 2001). While several license types are included in the totals that have little or no direct connection with the CRP (e.g., antelope, elk, moose, turkey), total license sales provide an

overall picture of hunting participation levels in North Dakota over the last 26 years. Total licenses sold were increasing prior to the CRP and have continued to increase after the CRP was initiated (Figure 12). License sales were stagnant from 1975 to 1980, but increased rapidly during the early and mid 1980s. License sales dropped in the late 1980s, increased rapidly in the early 1990s, but stabilized during the mid 1990s. In the late 1990s, total license sales again increased.

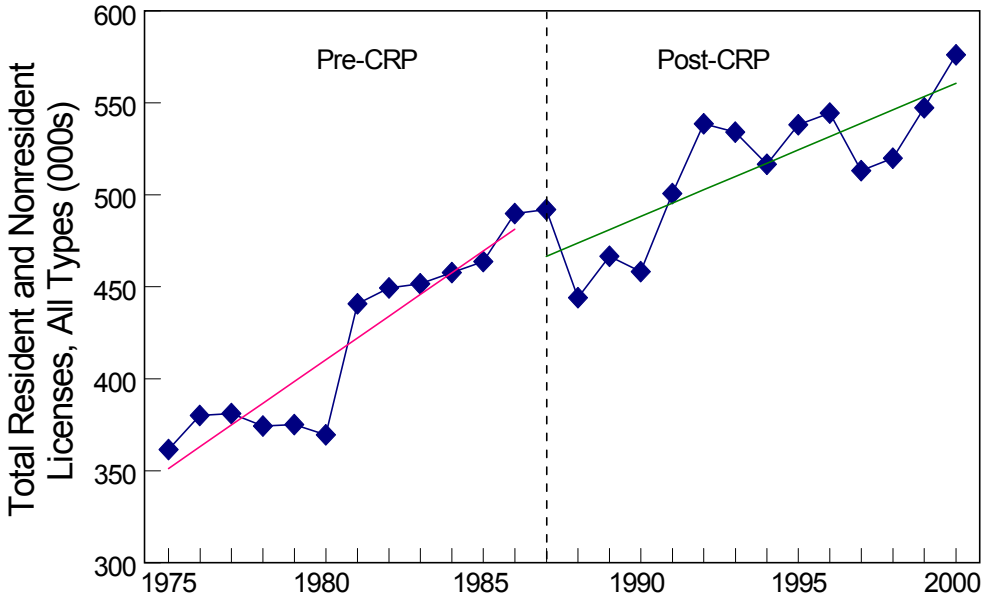


Figure 12. Total License Sales, All Types, North Dakota, 1975 to 2000
Source: ND Game and Fish Department (2001).

*Wildlife Population Indexes*

Three data series were used to estimate the populations of pheasant, deer, and waterfowl in North Dakota from 1975 to 2001. The primary purpose for generating population indexes was to provide trend information for pre- and post-CRP periods.

The ND Game and Fish Department conducts annual spring (e.g., cock pheasant crow counts), fall (e.g., rural mail carriers' visual counts), and winter (e.g., sex ratio counts) assessments of the pheasant population in North Dakota (Tripp 1976-2001). These assessments are made at different times of the year to measure various aspects of the pheasant population. Brood size, nesting success, crowing counts, sex ratios, and roadside counts are all used to estimate the density and abundance of pheasant populations at different times of the year. However, actual statewide bird numbers (i.e., a single number representing total pheasant

population) are not estimated, rather each year's population is reflected in various indexes that represent percentage changes from the previous year's numbers. A spring breeding population index provides a realistic measure of the change in pheasant populations over time; however, one component of the index, winter sex ratios, is dependent upon sufficient snow cover. In many winters, sufficient snow cover was not available in enough locations in the state to calculate a spring breeding index. Thus, continuous data for the spring breeding index was not available (Tripp 1976-2000).

Pheasant harvest data was used as a rough proxy for annual statewide pheasant population. Pheasant harvest data is subject to the number of hunters, bag limits, length of season, pheasant populations, and hunting conditions throughout the season in any particular year. As such, harvest data is not necessarily a true indication of each year's statewide pheasant population. However, harvest trends over time are likely to reflect general changes in pheasant populations. Pheasant harvest is estimated annually with the small game hunter survey conducted by the ND Game and Fish Department (Tripp 1976-2001).

Statewide pheasant harvest trended upward from the mid 1970s to the late 1980s (Figure 13). However, starting in 1990, pheasant harvest increased dramatically, culminating in a state record pheasant harvest in 1992. To put the increase in perspective, statewide pheasant harvest in 1992 was 151 percent higher than the average annual harvest in the 1980s. Statewide pheasant harvest dropped in 1993, but again reached near record levels in 1996. The severe winter of 1996-1997 resulted in a substantial drop in pheasant harvest the following year with statewide harvest at levels similar to those of the mid 1980s (Figure 13). Pheasant harvest since 1997 has continued sharply upward, but is still lower than the peak harvest years in the mid 1990s.

Harvest data clearly show the CRP has impacted pheasant populations in the state. However, CRP lands in many parts of the state only provide some of the yearly habitat needs for pheasants. Much of the pheasant range in North Dakota is subject to severe winter conditions, and under those situations, most CRP tracts in the state fail to provide adequate winter habitat for pheasants (ND Game and Fish Department 2002). When spring nesting and brood conditions are good and are combined with mild winters, pheasant populations in the state have increased dramatically. However, pheasant populations have declined just as dramatically when the state has experienced prolonged severe winters. Sufficient and abundant winter habitat remains a factor limiting pheasant populations in many areas of the state (ND Game and Fish Department 2002).

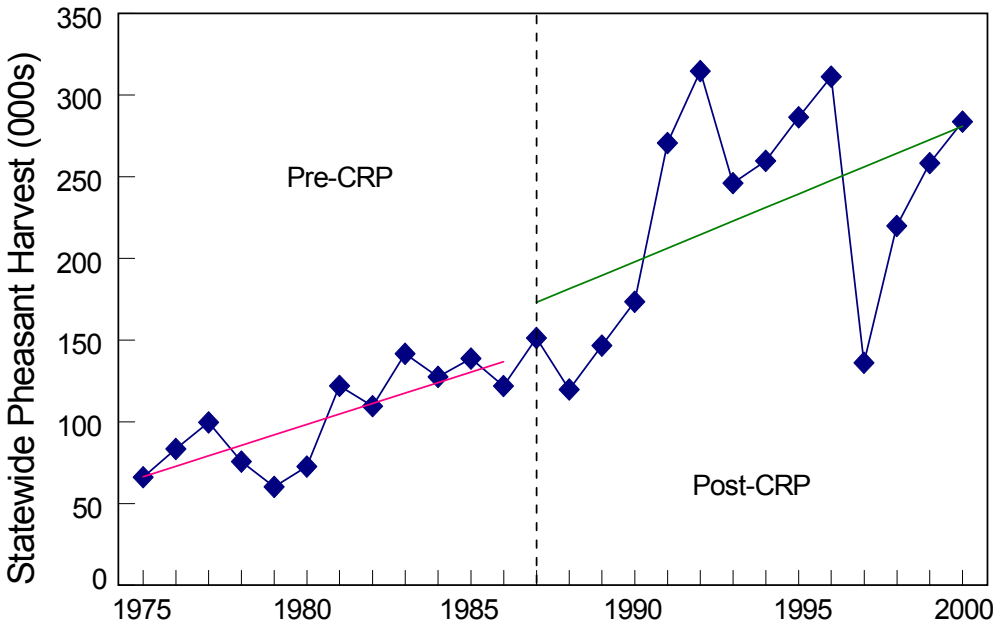


Figure 13. Statewide Pheasant Harvest, North Dakota, 1975 to 2000
Source: Tripp (1976-2001).

Total available firearm-deer tags and estimated annual harvest were used as proxies for annual deer populations. The number of firearm-deer tags made available in any given year is mostly based on estimates of deer population. In some cases, depredation and other factors may influence the number of firearm-deer tags available in some hunting units. Deer harvest estimates are based on surveys conducted by the ND Game and Fish Department. Several factors will influence the number of deer harvested, including number of hunters, number of tags issued, deer populations, length of season, and hunting conditions throughout the season in any particular year. As such, harvest data is not necessarily a true indication of each year's statewide deer population. However, deer tags and harvest trends over time are likely to reflect general changes in deer populations (ND Game and Fish Department 2002).

The number of firearm-deer tags in North Dakota has generally been increasing since the early 1980s (Figure 14). Total tags available remained steady during the mid to late 1970s. Statewide, deer tags increased 98 percent from 1980 to 1986, but then decreased nearly 30 percent in the following two years. The trend for statewide deer tags again increased in the early to mid 1990s. While the number of deer tags decreased in 1998, they have since steadily increased through 2001. The number of deer tags available in 2001 was the highest on record (ND Game and Fish Department 2001).

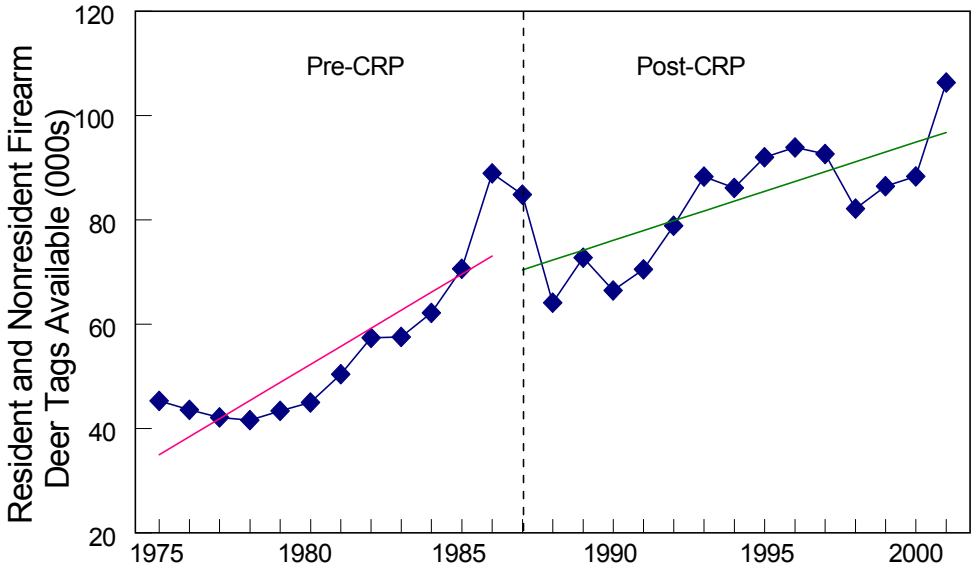


Figure 14. Total Firearm-Deer Tags Available, North Dakota, 1975 to 2001
Source: ND Game and Fish Department (2001).

Statewide deer harvest is estimated annually by hunter surveys (ND Game and Fish Department 2001). The overall trend in deer harvest in the pre-CRP period was increasing, due mostly to sharp increases in deer harvest in the early to mid 1980s (Figure 15). Total statewide deer harvest decreased in the late 1980s, stabilized for a few years, and then increased during the mid 1990s. However, for several years following 1995, statewide deer harvest decreased. From 1998 through 2001, deer harvest increased dramatically. The overall trend for deer harvest in the post-CRP period has been increasing, although at a lesser rate than the state experienced in the pre-CRP period (Figure 15).

Several deer hunting units in the state overlap closely with several study counties. However, only seven deer hunting units had continuous annual data (i.e., 1975 through 2001) for firearm-deer tags. Many current deer hunting units have undergone changes in their boundaries which make comparisons over time difficult. Seven hunting units were used to examine the effects of the CRP on deer populations in study counties (Figure 16).

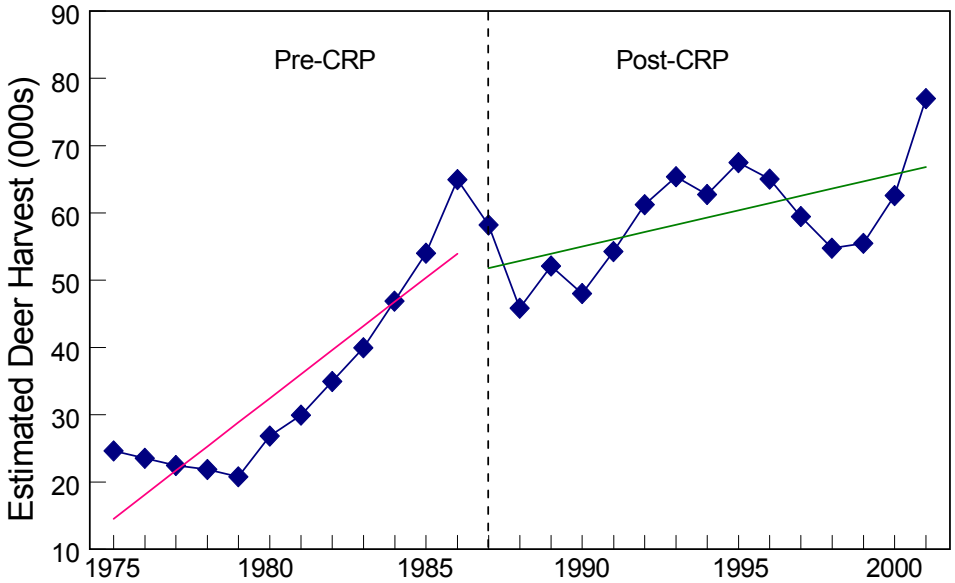


Figure 15. Estimated Deer Harvest, North Dakota, 1975 to 2001
Source: ND Game and Fish Department (2001).

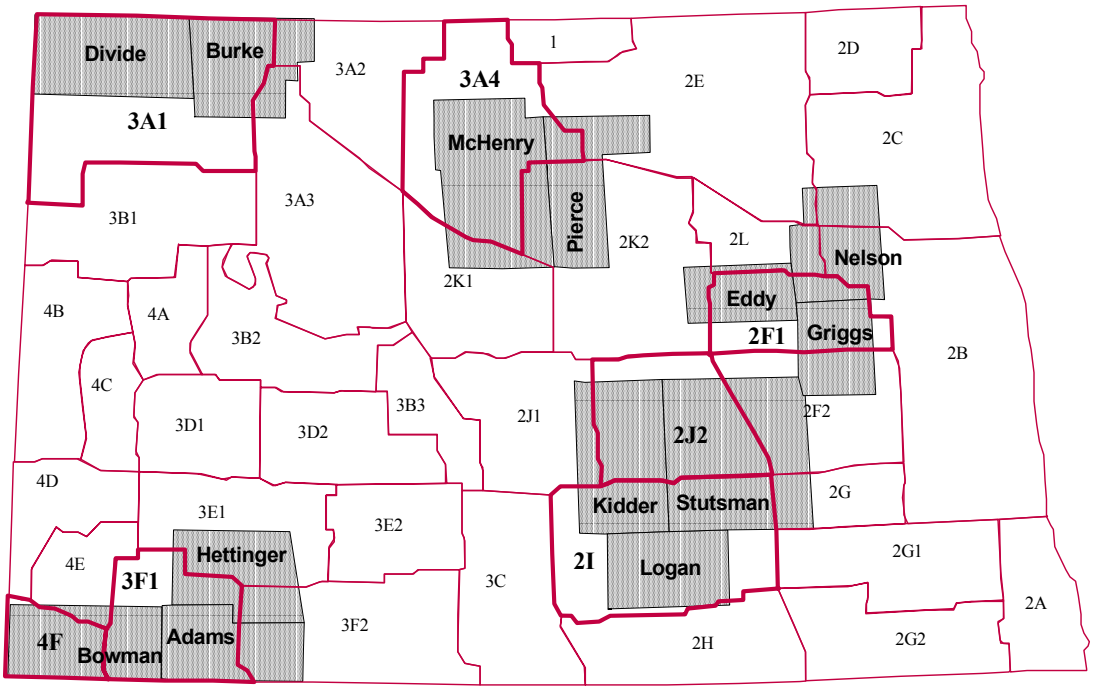


Figure 16. Selected Deer Hunting Units and Conservation Reserve Program Study Counties, North Dakota

Trends in the number of deer tags in the hunting units that correspond with CRP study counties paralleled the trends found statewide for both pre- and post-CRP periods (Figure 17). The increase in deer tags in hunting units that corresponded with study counties in the late 1980s was not as substantial as the increase statewide. However, the increase in deer tags for the study counties in the post-CRP period appears to be somewhat greater than statewide trends.

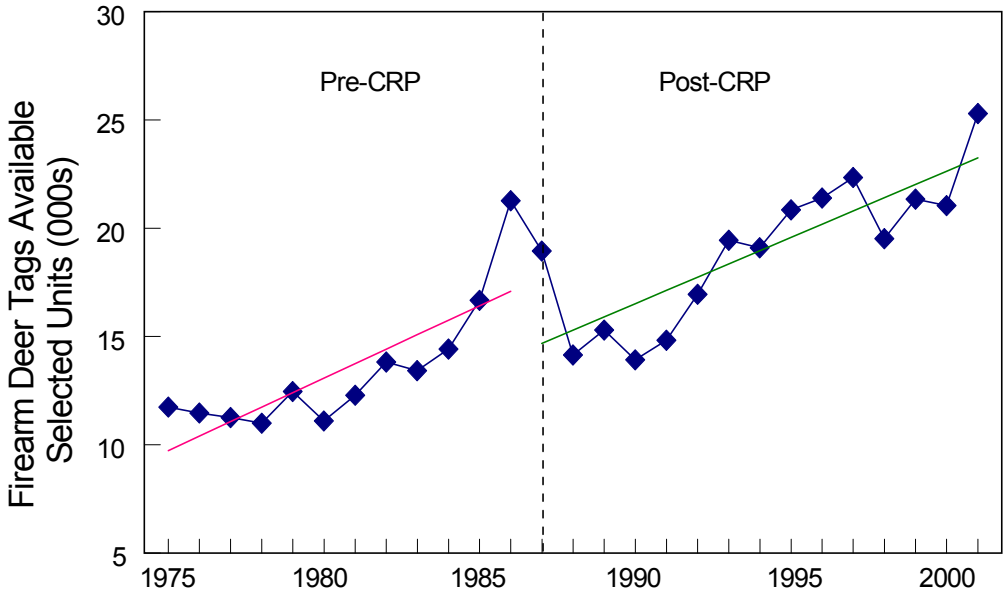


Figure 17. Estimated Deer Tags in Selected Hunting Units which Correspond with Study Counties, North Dakota, 1975 to 2001
Source: ND Game and Fish Department (2001).

The ND Game and Fish Department and the U.S. Fish and Wildlife Service both conduct annual statewide surveys of duck breeding populations in the spring (ND Game and Fish Department 2002). The techniques and methodologies used by the two agencies are similar, but not identical, and as a result, different estimates of the state's duck breeding population are generated. Although the two assessment techniques produce similar estimates of duck breeding populations, the ND Game and Fish Department's duck breeding population index is generally lower than that produced by the U.S. Fish and Wildlife Service (Figure 18). Estimates for breeding population of resident Canada geese were not obtained for this study.

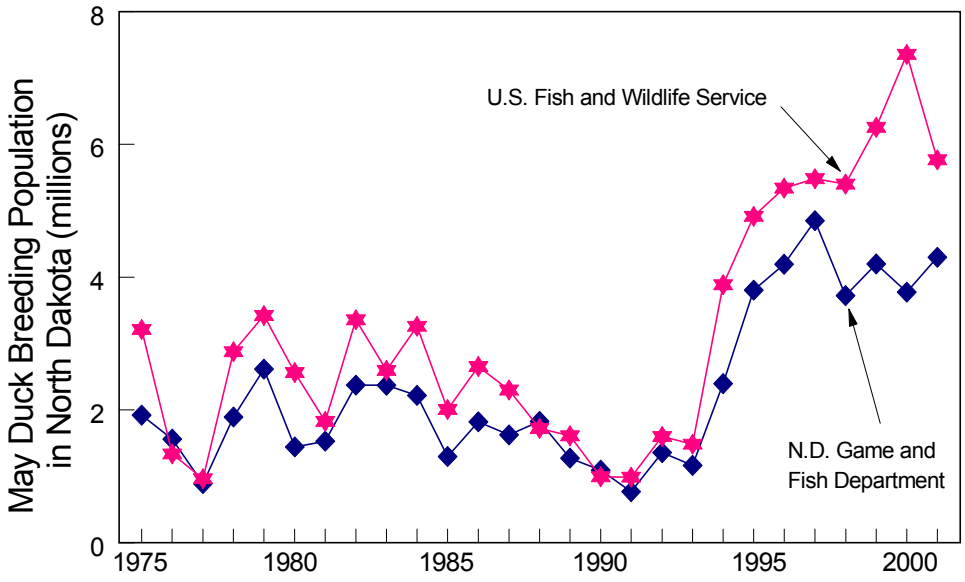


Figure 18. May Duck Breeding Population in North Dakota, North Dakota Game and Fish Department and United States Fish and Wildlife Service, 1975 to 2001
Source: ND Game and Fish Department (2001).

The general trend in duck breeding population in the state in the pre-CRP period was slightly increasing (Figures 19 and 20). Both indices show duck numbers fluctuated from 1975 through the mid 1980s, with populations declining from 1986 to 1991. However, in the mid 1990s, which coincides with the start of a wet weather cycle and an increase in water habitat in the state, duck populations increased rapidly. According to the ND Game and Fish Department, duck breeding population in the state peaked in 1997, but according to the U.S. Fish and Wildlife Service, duck breeding population in North Dakota peaked in 2000. Both estimates show duck populations increased dramatically in the post-CRP period (Figures 19 and 20).

Conservation Reserve Program lands by themselves will not support waterfowl. However, when CRP lands are combined with water habitat, nesting success for waterfowl is greatly enhanced (Reynolds et al. 2001). Regions of the state that contain the greatest concentration of water habitat (i.e., prairie pothole region of North Dakota) also contain substantial amounts of CRP lands. The synergistic effect of combining the two habitat types (i.e., water, nesting cover) has resulted in substantial increases in waterfowl populations. Other contributing factors include reduced predatory effects from fox and coyote in many breeding regions, favorable habitat conditions in waterfowl wintering areas, and a sustained wet cycle that has over time allowed breeding populations to build (ND Game and Fish Department 2002).

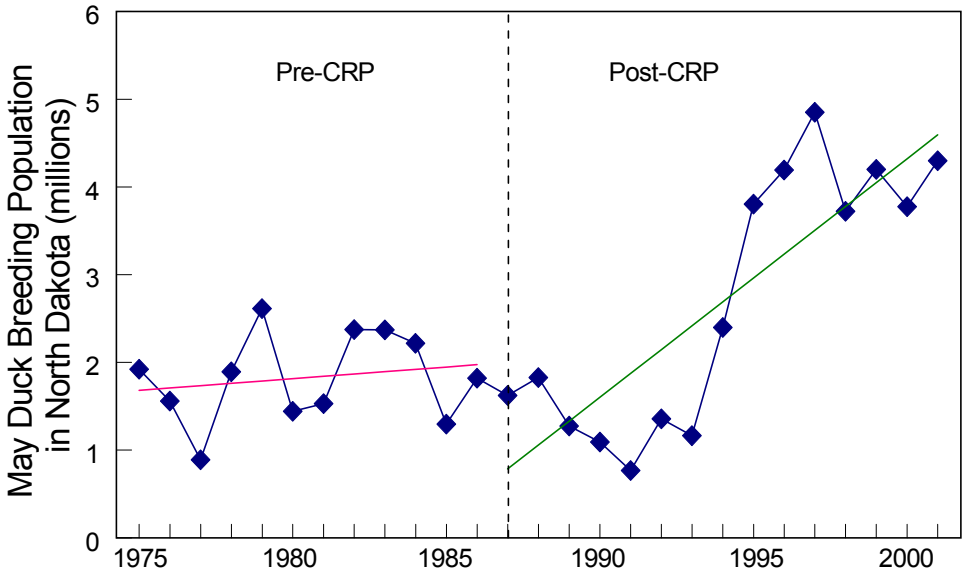


Figure 19. May Duck Breeding Population in North Dakota, Estimated by the North Dakota Game and Fish Department, 1975 to 2001
Source: ND Game and Fish Department (2001).

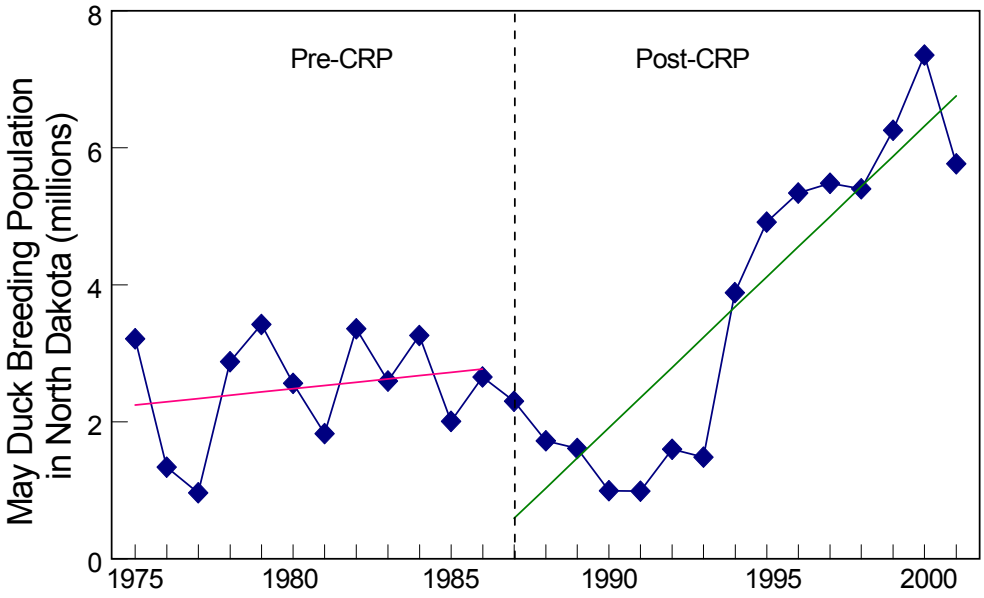


Figure 20. May Duck Breeding Population in North Dakota, Estimated by the United States Fish and Wildlife Service, 1975 to 2001
Source: ND Game and Fish Department (2001).

Outdoor Recreation Expenditures

The CRP has had positive effects on several forms of outdoor recreation, especially hunting and wildlife viewing. Hunting is the largest single outdoor recreational activity directly influenced by the CRP in North Dakota (Hodur et al. 2002, ND Game and Fish Department 2002), followed by wildlife viewing.

In 1996, wildlife-viewing expenditures in North Dakota were estimated at $36 million (U.S. Fish and Wildlife Service 1998). The U.S. Fish and Wildlife Service's definition of wildlife viewing was broad, and included individuals whose primary recreational activity was to observe or identify birds or other wildlife, photograph wildlife, feed birds or other wildlife on a regular basis, maintain natural areas of at least one-quarter acre where benefit to wildlife was the primary concern, maintaining habitat (i.e., shrubs, crops, forages) where benefit to wildlife is the primary concern, and visiting parks for the purpose of observing, feeding, or photographing wildlife (U.S. Fish and Wildlife Service 1998). The CRP has likely influenced wildlife viewing recreation; however, insufficient data on wildlife viewing participants (i.e., residence of participants, spending patterns), location of wildlife viewing activities, and how wildlife viewing recreation has been affected by the CRP prevents including those activities in this study.

The magnitude and importance of hunter expenditures in North Dakota have been estimated periodically since 1976 (Lewis et al. 1998, Baltezore and Leitch 1992, Baltezore et al. 1987, Anderson and Leitch 1984, Kerestes and Leitch 1983, Leitch and Kerestes 1982, Leitch and Scott 1978). Expenditures for hunting activities in North Dakota in 1996 were nearly seven times greater than expenditures for wildlife viewing (U.S. Fish and Wildlife Service 1998, Lewis et al. 1998)[4]. Resident hunters were estimated to have spent about $222 million in hunting related activities (excluding license purchases) in North Dakota in 1996 (Lewis et al. 1998). Nonresident hunters in North Dakota were estimated to have spent $15 million (excluding license purchases) in the state in 1996. Combined resident and nonresident hunter expenditures were estimated at $237 million in 1996 (Lewis et al. 1998). However, not all expenditures made by resident and nonresident hunters are incurred in rural areas of the state (Lewis et al. 1998).

Lewis et al. (1998) surveyed both resident and nonresident hunters and anglers who purchased licenses in North Dakota in 1996. The survey randomly sampled hunters based on type of licensed purchased. The purpose of the survey was to determine hunter profiles (i.e., age, income, residence), expenditure patterns (e.g., type of expense, amount of expense, location where expenses were incurred), and participation and harvest statistics. Expenditures were estimated and tracked separately based on purchases of durable and nondurable goods made in North Dakota. Durable goods would represent arrows, firearms, clothing, traps, vehicles, optics, decoys, etc. Nondurable goods would be food, ammunition, film, lodging, access fees, game processing, transportation, etc.

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[4]Although wildlife watching expenditures (U.S. Fish and Wildlife Service 1998) were compared to hunting expenditures (Lewis et al. 1998), methodologies between the two studies differed. As a result, some of the difference between the two estimates may be attributable to differences in study methods.

Lewis et al. (1998) compiled daily and seasonal expenditures for durable and nondurable purchases for resident and nonresident hunters by type of hunting activity (Table 7). Resident average daily expenditures ranged from $17 for fall turkey gratis hunters to $450 for archery-antelope hunters. Seasonal expenditures ranged from $50 for fall turkey gratis hunters to $1,777 for archery-antelope hunters. Nonresident average daily expenditures ranged from $118 for archery-antelope hunters to $150 for archery-deer hunters. Seasonal expenditures for nonresidents ranged from $466 for firearm-deer hunters to $957 for archery-deer hunters (Table 7).

Table 7. Average Seasonal and Daily Expenditures, by Hunting Activity, Resident and Nonresident Hunters, North Dakota, 1996

| Hunting Activity | Expenditures per Hunter[a] | | | |
|---|---|---|---|---|
| | Resident | | Nonresident | |
| | Daily | Season | Daily | Season |
| | 1996 dollars | | | |
| Pronghorn Antelope | | | | |
| Archery | 450 | 1,777 | 118 | 685 |
| Firearm | 387 | 623 | na | na |
| Gratis | 70 | 117 | na | na |
| Special Big Game | 325 | 976 | na | na |
| Deer | | | | |
| Archery | 99 | 1,270 | 150 | 957 |
| Firearm | 174 | 632 | 145 | 466 |
| Muzzleloader | 442 | 1,168 | na | na |
| Gratis | 82 | 201 | na | na |
| Furbearer | 220 | 1,215 | na | na |
| Small Game[b] | | | 131 | 705 |
| Waterfowl | 193 | 1,226 | | |
| Upland | 246 | 1,289 | | |
| Wild Turkey | | | | |
| Fall[c] | 263 | 418 | na | na |
| Fall Gratis | 17 | 50 | na | na |
| Spring | 359 | 705 | na | na |
| Spring Gratis | 48 | 200 | na | na |

[a] Expenditures exclude purchases of licenses.
[b] For resident hunters, small game activities were split into waterfowl and upland hunting. For nonresidents, waterfowl and upland hunting were not evaluated separately.
[c] Fall turkey tags included both early and late fall seasons.
na=not applicable or included in other category.
Source: Lewis et al. (1998).

While some hunter expenditures are incurred near an individual's home residence, other expenditures are made in route and in the area where game is pursued. Lewis et al. (1998) estimated the amount of expenditures made in rural areas of North Dakota by urban resident hunters and nonresident hunters. Although the amount of rural expenditures made by rural hunters was not estimated by Lewis et al. (1998), the ND Game and Fish Department developed estimates of rural spending by rural resident hunters for some hunting categories using data from Lewis et al. (1998). A rural area was defined as any community with less than 2,500 people. The total and relative amount of seasonal expenditures made in rural areas of the state varied by residence of hunter and by hunting activity (Table 8). Nonresident rural seasonal expenditures in North Dakota ranged from $306 for firearm-deer hunters to $718 for archery-deer hunters. The amount of seasonal expenditures made by urban resident hunters in rural areas varied from $342 for firearm-deer hunters to $637 for upland hunters. Rural residents' seasonal expenditures in rural areas of North Dakota ranged from $385 for firearm-deer to $849 for archery-deer hunters.

The estimates produced by Lewis et al. (1998) for rural/urban spending by urban resident and nonresident hunters has one shortcoming. The classification of 'urban' versus 'rural' used by Lewis et al. (1998) is consistent with the definition used by the Bureau of the Census. However, other government agencies sometimes use a 'metro' versus 'non-metro' definition to delineate 'rural' versus 'urban' classifications. Metro classifications can be more restrictive and generally use higher population levels than the urban classification (i.e., 2,500 population) used by the Bureau of the Census. Lewis et al. (1998) assumed the difference between rural expenditures and total seasonal expenditures represents hunting-related expenses incurred in communities with a population over 2,500. However, not all communities over 2,500 in population arguably fit the definition of urban in North Dakota. Several North Dakota cities, over 2,500 in population, are located in rural areas, yet they capture and benefit from hunter expenditures, and differ greatly from the state's large, regional trade centers. Based on the analysis by Lewis et al. (1998), differentiating hunter expenditures in rural cities over 2,500 in population (e.g., Valley City, Jamestown, Dickinson, Wahpeton, Williston, Devils Lake, Rugby) and the state's four regional trade centers (i.e., Fargo, Bismarck, Minot, and Grand Forks) is impossible. The methodology used by Lewis et al. (1998) underestimates the amount of hunter expenditures made in many 'rural' areas of the state by using a broad definition for urban areas.

Table 8. Seasonal Expenditures in Rural and Urban Areas of North Dakota, by Resident and Nonresident Hunters, by Activity, 1996

| Hunting Activity | Urban Resident Hunters[a] | | Rural Resident Hunters[a] | | Nonresident Hunters | |
|---|---|---|---|---|---|---|
| | Rural Areas | Urban Areas | Rural Areas | Urban Areas | Rural Areas | Urban Areas |
| | 1996 $ | | | | | |
| Deer | | | | | | |
| Archery | 520 | 623 | 849 | 566 | 718 | 239 |
| Firearm | 342 | 442 | 385 | 109 | 306 | 160 |
| Small Game[b] | | | | | 550 | 155 |
| Waterfowl | 637 | 792 | 729 | 218 | na | na |
| Upland | 637 | 928 | 729 | 230 | na | na |

[a] Estimated by ND Game and Fish Department using data from Lewis et al. (1998). Seasonal expenditures exclude purchases of licenses.
[b] For resident hunters, small game activities were split into waterfowl and upland hunting. For nonresidents, waterfowl and upland hunting were not evaluated separately.
Source: Lewis et al. (1998).

**Methods for Assessing Recreational Impacts**

The first step in assessing the impact of the CRP on hunting activities was to compare the change in hunter numbers before and after the CRP. The number of hunters prior to the CRP was based on an average from 1982 to 1986, while post-CRP hunter numbers were based on an average from 1996 to 2000. Only upland[5], waterfowl, firearm-deer, and archery-deer hunting were considered in the analysis. Upland, waterfowl, and deer were considered the game types most affected by the CRP and those hunting activities represented over 80 percent of all hunters in 1996 (Lewis et al. 1998). Turkey, furbearer, big game (i.e., elk, moose, sheep), and antelope hunting were not included in the study. The number of hunters, in both periods, were obtained from ND Game and Fish Department reports or estimated using data on license sales in conjunction with hunter participation rates.

The average number of hunters in the pre-CRP period was subtracted from the post-CRP period since the CRP cannot be credited with the level of hunter activity prior to its existence. Similarly, not all of the change in hunter participation between the two periods can be attributed to the program. The impact of the CRP on the change in hunter numbers was estimated (i.e., these factors represented a 'best estimate') for each of the four hunting categories based on wildlife and hunter trends, secondary sources, and input from wildlife biologists. The 'best estimate' factors were applied to the change in hunter numbers (i.e., active hunters) for pre- and

[5]Upland hunting in North Dakota generally consists of pheasant, grouse, and partridge. Interviews with ND Game and Fish Department biologists suggested the effect of the CRP on upland game was most prevalent with pheasants. When possible, data specific to pheasant hunting was used, instead of the more general category of upland hunting.

post-CRP periods yielding estimates of the number of resident and nonresident hunters attributable to the program.

The counties where resident and nonresident hunters most frequently pursue waterfowl and pheasants were obtained from North Dakota Game and Fish Department (2001). Survey information for 1996 and 2000 was used to estimate the hunting destinations for residents and survey information for 1996 and 1999 (most recent year available) was used to estimate hunting destinations for nonresident hunters. The destinations for resident and nonresident waterfowl hunters were estimated by averaging survey data for duck hunting, since survey data for goose hunting included destinations for those pursuing light geese (e.g., snows, blues). Hunting destination data was used to allocate the number of resident and nonresident hunters attributable to the program to the six multi-county study areas.

The distribution of firearm-deer hunters in the study counties was largely determined from the number of tags available by deer hunting zones (ND Game and Fish Department 2001). Deer hunting zone boundaries were overlaid with county boundaries since nearly all deer hunting zones do not correspond with county boundaries. The percentage of the total area that each study county represented in each deer hunting zone was estimated and applied to the average number of tags available in that zone from 1996 to 2000. The number of tags available in each of the six multi-county study areas was then summed and divided by the average (1996 to 2000) statewide tags available. The relative percentage of average statewide tags in each of the study areas was then used to allocate the number of firearm-deer hunters attributable to the CRP. Archery-deer hunters were allocated using the firearm-deer percentages calculated in each study area.

Resident pheasant, waterfowl, firearm-deer, and archery-deer hunters in each multi-county study area were divided into urban and rural hunters based on information from Lewis et al. (1998). Rural resident pheasant, waterfowl, firearm-deer, and archery-deer hunters were further divided into local participants (i.e., those living within the multi-county study area) and other rural participants (i.e., those living in a rural area elsewhere in North Dakota) based on 'best estimates' that corresponded with the location of the study area and the type of hunting. For example, it was perceived that most of the rural resident hunters pursuing waterfowl in Adams, Bowman, and Hettinger Counties would be individuals living in the area. Considering the geographic distance of the study area from other areas of the state, the relatively sparse waterfowl hunting opportunities in the study area, and the relative abundance of more enticing waterfowl hunting opportunities elsewhere in the state, the number of individuals willing to travel to that study area for waterfowl hunting would be low. The factors used to allocate the number of rural resident hunters that were local residents versus those that were nonlocal residents living elsewhere in the state were based on 'best estimates' from anecdotal information.

The number of resident rural hunters, resident urban hunters, and nonresident hunters were multiplied by the typical seasonal expenditures for each hunting type. Resident urban hunters' and nonresident hunters' expenditures in rural areas of North Dakota were obtained from Lewis et al. (1998). The breakout of rural and urban expenditures by rural resident hunters

was developed by the ND Game and Fish Department using data from Lewis et al. (1998). Hunter expenditures from Lewis et al. (1998) were inflated to 2000 dollars using the Consumer Price Index (U.S. Department of Labor 2002). Four multi-county study areas match the rural criteria used by Lewis et al. (1998) to breakout rural versus urban spending by hunters. However, two study areas each contain one trade center over 2,500 in population and hunter expenditures in those cities would be classified as urban. In those study areas, 70 percent of urban expenditures by urban resident and nonresident hunters, 90 percent of urban spending by local rural resident hunters, and 70 percent of urban spending by nonlocal rural resident hunters was assumed to be captured locally.

## RESULTS

The following sections provide estimates of the agricultural revenues that land enrolled in the CRP would likely have generated if the program was discontinued, county-wide effects of reduced crop prices in the absence of the CRP, and the amount of hunter expenditures attributable to the CRP. The agricultural and recreational economic impacts from the program are evaluated by assessing the change in local economic activity that would occur in the absence of the CRP. Three effects (i.e., from an economic activity perspective) would likely occur in the absence of the program. First, much of the land currently enrolled in the program would return to some form of agricultural use. Second, the additional volume of grain from returning CRP land to crop production would have depressing effects on commodity prices. Finally, local economies would lose recreational revenues associated with the program.

### Agricultural Effects

Revenues that would have likely occurred on CRP lands from 1996 through 2000 were estimated based on post-CRP land use intentions of contract holders, adjusted crop yields, anticipated crop prices, and estimated government farm program payments (Appendix B). Typical gross revenues for CRP land returning to crop production ranged from about $79 per acre in Burke and Divide Counties to $170 per acre in Ransom and Sargent Counties (Table 9). Typical revenues for hay production from CRP lands ranged from $47 per acre in Adams, Bowman, and Hettinger Counties to $76 per acre in Ransom and Sargent Counties. Typical revenues from grazing CRP lands ranged from $25 per acre in Burke and Divide Counties to $49 per acre in Ransom and Sargent Counties (Table 9). Land left in permanent cover was assumed to generate revenues equal to the estimated government payment (see Table 6). Based on the ratios of crop, hay, grazing, and permanent cover use of post-CRP lands, average agricultural revenues per acre ranged from $65 in Burke and Divide Counties to $149 in Ransom and Sargent Counties (Table 9). The average for all study areas was estimated to be $91 per acre.

Regional agricultural revenues were estimated by multiplying average per-acre revenues by the estimated acreage of post-CRP crop, hay, grazing, and permanent cover use in each of the six study areas. Gross agricultural revenues from post-CRP lands varied from $8.7 million per year in Burke and Divide Counties to $33.1 million per year for Kidder, Logan, and Stutsman Counties (Table 10). Total gross agricultural revenues from post-CRP land use in the six study

areas was estimated at $123.6 million annually (Table 10). Crop production accounted for 85 percent of all agricultural revenues.

Table 9. Per-Acre Agricultural Revenues for Post-Conservation Reserve Program Lands, North Dakota, 1996 through 2000

| Post-CRP Agricultural Revenues | Study Areas: Adams Bowman Hettinger | Burke Divide | Eddy Griggs Nelson | Kidder Logan Stutsman | McHenry Pierce Sheridan | Ransom Sargent |
|---|---|---|---|---|---|---|
| | $ per acre | | | | | |
| Crop Production | 86.12 | 79.37 | 128.36 | 108.30 | 96.07 | 170.10 |
| Hay Production | 47.37 | 50.52 | 66.47 | 69.30 | 58.87 | 75.60 |
| Grazing | 30.66 | 25.39 | 36.11 | 39.68 | 30.44 | 48.88 |
| Permanent Cover | 11.41 | 11.29 | 17.44 | 13.73 | 13.11 | 16.76 |
| Average[a] | 69.53 | 64.63 | 110.11 | 93.76 | 79.08 | 149.22 |

[a] Average agricultural revenues per acre of post-CRP land were determined by weighting crop, hay, grazing, and permanent cover revenues by percentage of land use (see Table 2).

Table 10. Annual Gross Agricultural Revenues for Post-Conservation Reserve Program Lands, North Dakota, Average 1996 through 2000

| Post-CRP Agricultural Revenues | Study Areas: Adams Bowman Hettinger | Burke Divide | Eddy Griggs Nelson | Kidder Logan Stutsman | McHenry Pierce Sheridan | Ransom Sargent |
|---|---|---|---|---|---|---|
| | 000s $ | | | | | |
| Crop Production | 14,843 | 6,710 | 24,134 | 27,313 | 16,744 | 15,529 |
| Hay Production | 2,133 | 1,556 | 1,870 | 4,423 | 2,261 | 584 |
| Grazing | 823 | 431 | 845 | 1,309 | 1,195 | 514 |
| Permanent Cover | 160 | 31 | 89 | 55 | 55 | 36 |
| Totals[a] | 17,959 | 8,728 | 26,938 | 33,100 | 20,254 | 16,663 |

[a] Totals may not equal due to rounding.

While total gross agricultural revenues generated from post-CRP land use was estimated at $123.6 million, the net agricultural effect on the local economy of terminating the CRP is not equal to gross revenues. CRP land currently receives a contract payment, which would disappear without the program. The difference between gross agricultural revenues and contract payments would represent the net agricultural effects on post-CRP lands. After subtracting

contract payments, the net change in agricultural revenues on CRP lands in the six study areas was estimated at $76 million or about $56 per CRP-acre (Table 11).

Table 11. Net Change in Agricultural Revenues on Post-Conservation Reserve Program Lands, North Dakota, 1996 through 2000

| | Average 1996 through 2000 | | Net Change | |
|---|---|---|---|---|
| Study Counties | Agricultural Revenues | Contract Payments | Per Acre | Total |
| | ---------- $/acre ---------- | | - $ - | 000s $ |
| Adams, Bowman, and Hettinger | 69.53 | 31.46 | 38.07 | 9,833 |
| Burke and Divide | 64.63 | 33.61 | 31.02 | 4,189 |
| Eddy, Griggs, and Nelson | 110.11 | 34.43 | 75.68 | 18,514 |
| Kidder, Logan, and Stutsman | 93.76 | 34.77 | 58.99 | 20,825 |
| McHenry, Pierce, and Sheridan | 79.08 | 34.73 | 44.35 | 11,359 |
| Ransom and Sargent | 149.22 | 47.88 | 101.34 | 11,317 |
| Average/Total | 90.99 | 35.03 | 55.96 | 76,038 |

In the absence of some other form of supply control policy, and assuming no additional changes occur in commodity supply and disappearance, returning CRP lands to agricultural production would have put downward pressure on commodity prices during the 1996 to 2000 period. Estimating the precise price effects of eliminating the CRP is difficult; however, ballpark price effects of increased production were estimated from secondary sources (see pages 12-15). All price effects assumed no additional supply control provisions in Federal farm legislation over the 1996 through 2000 period. Further, a reduction in commodity prices not only affects revenues on CRP lands returning to agricultural production, but also affects revenues on non-CRP lands. Small changes in commodity prices have disproportionately large changes in local economic impacts. As a result, three price reduction scenarios were used to show the sensitivity of the study results to the level of post-CRP commodity prices.

Commodity price reductions used in this study were based on 70 percent of the price changes described by FAPRI (2001). Two alternative scenarios were developed to show the relative importance of price changes on agricultural revenues. Prices were also adjusted by 40 percent (i.e., price reductions were less than estimated in the 70 percent scenario) and 100 percent (i.e., price reductions were greater than estimated in the 70 percent scenario) of the levels estimated by FAPRI (2001). When the 70 percent price change was used on average prices received by farmers over the 1996 to 2000 period, crop prices for wheat, non-oil sunflower, alfalfa, grass hay, and dry edible beans were reduced by 4.4 percent, barley price was reduced by 9.9 percent, soybean, oil sunflower, and canola prices were reduced by 5 percent, corn price was reduced by 10 percent, and oats price was reduced by 15.5 percent.

The annual economy-wide agricultural impacts (i.e., change in agricultural revenues on CRP and non-CRP lands) of terminating the CRP with the three post-CRP price scenarios were estimated (Table 12). Based on the 70 percent scenario, net agricultural revenues (i.e., crop production revenues less contract payments) from CRP lands in the six study areas would have increased by $76 million. However, reduced prices, from CRP termination, would have lowered agricultural revenues on non-CRP lands in the six study areas by $25.9 million. The overall effect (gains in agricultural revenues) in the study areas was estimated at $50.2 million.

Using the 40 percent scenario, net agricultural revenues (i.e., crop production revenues less contract payments) from CRP lands in the six study areas would have increased by $78.3 million and agricultural revenues on non-CRP lands in the six study areas would have decreased by $14.8 million. The annual overall effect, increased revenues from CRP lands and decreased revenues on non-CRP lands, in the study areas was estimated at $63.6 million (Table 12).

With the 100 percent scenario, net agricultural revenues (i.e., crop production revenues less contract payments) from CRP lands in the six study areas would have increased by $73.7 million. Agricultural revenues on non-CRP lands in the six study areas would have been reduced by $37 million as a result of lower prices. The annual overall effect of increased revenues from CRP lands and decreased revenues on non-CRP lands was estimated at $36.8 million (Table 12).

Relatively small changes in crop prices resulted in substantially different overall effects of terminating the CRP. With the 40 percent scenario, the economy-wide agricultural impacts were estimated at $63.6 million, compared to $36.8 million with the 100 percent scenario. Using wheat as an example, the price difference between the 40 percent scenario and the 100 percent scenario was $0.12 per bushel. Spring wheat and durum acreage combined represent the greatest post-CRP land use in all study areas (see Table 3). Thus, small changes in post-CRP crop prices can have substantial effects on agricultural revenues.

Based on the 70 percent scenario, the annual economy-wide agricultural impacts (i.e, change in agricultural revenues on CRP and non-CRP lands) of terminating the CRP ranged from $1.6 million in Burke and Divide Counties to $15.7 million in Kidder, Logan, and Stutsman Counties (Table 12). Based on the 40 percent scenario, the annual economy-wide agricultural impacts of terminating the CRP ranged from $2.9 million in Burke and Divide Counties to $18.6 million in Kidder, Logan, and Stutsman Counties. Based on the 100 percent scenario, the annual economy-wide agricultural impacts of terminating the CRP ranged from $0.3 million in Burke and Divide Counties to $12.8 million in Kidder, Logan, and Stutsman Counties (Table 12). Under the 100 percent scenario, Burke and Divide Counties would be close to losing the same amount of agricultural revenues without the program as with the program, since county-wide reductions in agricultural revenues on non-CRP lands were only $346,000 less than the net revenues gained from CRP lands returning to agricultural production.

Table 12. Annual Economy-wide Direct Economic Effects from Changes in Agricultural Revenues with Termination of the Conservation Reserve Program, Study Areas, 1996 through 2000

| Price Scenario/ Post-CRP Changes | Study Areas: Adams Bowman Hettinger | Burke Divide | Eddy Griggs Nelson | Kidder Logan Stutsman | McHenry Pierce Sheridan | Ransom Sargent | Total |
|---|---|---|---|---|---|---|---|
| | 000s $ | | | | | | |
| 40 Percent FAPRI[a] | | | | | | | |
| Change on CRP Lands Returning to Production | 10,142 | 4,347 | 19,013 | 21,465 | 11,714 | 11,666 | 78,348 |
| Crop Revenues on Non-CRP Lands | (1,845) | (1,474) | (2,627) | (2,838) | (2,948) | (3,031) | (14,764) |
| Net Change | 8,296 | 2,873 | 16,386 | 18,627 | 8,766 | 8,635 | 63,584 |
| 70 Percent FAPRI[b] | | | | | | | |
| Change on CRP Lands Returning to Production | 9,833 | 4,189 | 18,514 | 20,825 | 11,359 | 11,317 | 76,038 |
| Crop Revenues on Non-CRP Lands | (3,229) | (2,580) | (4,598) | (5,128) | (5,019) | (5,304) | (25,858) |
| Net Change | 6,604 | 1,609 | 13,916 | 15,697 | 6,341 | 6,013 | 50,180 |
| 100 Percent FAPRI[c] | | | | | | | |
| Change on CRP Lands Returning to Production | 9,525 | 4,032 | 18,015 | 20,185 | 11,005 | 10,967 | 73,728 |
| Crop Revenues on Non-CRP Lands | (4,613) | (3,686) | (6,568) | (7,418) | (7,089) | (7,577) | (36,952) |
| Net Change | 4,912 | 346 | 11,447 | 12,766 | 3,916 | 3,390 | 36,776 |

[a] Prices were reduced from the 1996-2000 average by 2.5 percent for wheat, alfalfa, non-oil sunflower, and dry edible beans, 2.9 percent for oil sunflower, soybeans, and canola, 5.7 percent for barley and corn, 8.9 percent for oats, and 5 percent for grass hay. Price reductions derived from FAPRI (2001).

[b] Prices were reduced from the 1996-2000 average by 4.4 percent for wheat, alfalfa, non-oil sunflower, and dry edible beans, 5 percent for oil sunflower, soybeans, and canola, 9.9 percent for barley and corn, 15.5 percent for oats, and 8.7 percent for grass hay. Price reductions derived from FAPRI (2001).

[c] Prices were reduced from the 1996-2000 average by 6.2 percent for wheat, alfalfa, non-oil sunflower, and dry edible beans, 7.1 percent for oil sunflower, soybeans, and canola, 14.2 percent for barley and corn, 22.1 percent for oats, and 12.5 percent for grass hay. Price reductions derived from FAPRI (2001).

**Recreational Effects**

Four categories of hunting (i.e., pheasant, waterfowl, firearm-deer, archery-deer) were used to estimate the recreational impacts of the CRP. When averaged from 1982 to 1986 (pre-CRP period) and from 1996 to 2000 (post-CRP period), the change in resident and nonresident hunter numbers was estimated at about 78,400 (Table 13). Hunter numbers were determined from a combination of license sales and participation rates and from estimates derived from hunter surveys (ND Game and Fish Department 2001, Johnson 1980-2001, Schroeder 1976-1979, Tripp 1976-2001). Resident waterfowl hunter numbers were estimated using a forecasting procedure comparing estimated hunter numbers without the CRP to actual hunter numbers (Appendix A). About 67 percent of the statewide increase came from resident hunters, most of which were waterfowl and firearm-deer hunters. The change in pheasant hunters, both resident and nonresident, was about 18,000 and accounted for nearly 23 percent of the increase in hunter numbers. Waterfowl hunters, both resident and nonresident, increased by 40,300 and represented about 51 percent of the increase in hunter numbers. Resident and nonresident firearm-deer hunters increased by about 18,700 and accounted for 24 percent of the increase in hunter numbers. Archery-deer hunting accounted for 2 percent of the increase in hunter numbers.

After determining the change in hunter numbers from the pre-CRP and post-CRP periods, the relative weight or role the CRP has played in the change in hunting levels was estimated and applied to the change in hunter numbers. To estimate the specific role of the CRP on hunting activity levels, a 'best estimate' based on interviews with wildlife biologists, license sales trends, and trends in wildlife population indices was used.

Using 'best estimates', 90 percent of the change in the number of pheasant hunters in the state was attributable to the CRP. Increases in pheasant populations were primarily a result of additional nesting habitat created by the CRP. A small percentage of the increase in pheasant populations since the CRP was initiated, and subsequent increases in pheasant hunting, was perceived to be due to more winter habitat, changes in agricultural practices, and reduced predatory pressures from mange in fox and coyote populations. The trend in nonresident pheasant hunters was increasing slightly in the state from 1975 through 1986; however, dramatic increases in nonresident pheasant hunters have coincided with the CRP.

The CRP, based on 'best estimates', was responsible for 60 percent of the increase in the number of waterfowl hunters. Although waterfowl hunting in the state includes duck, dark geese (e.g., Canada geese), light geese (e.g., snow geese), swans, coots, and mergansers, the additional waterfowl hunters in the state were assumed to represent individuals who primarily hunt duck and dark geese. Both ducks and resident dark geese have benefitted from the CRP, whereas light geese have not likely been materially affected by the CRP. Much of the weight placed on the role of the CRP in waterfowl populations was based on research by Reynolds et al. (2001). Although the state experienced a wet weather cycle that restored wetlands and increased water habitat during the mid 1990s, additional water without sufficient and adequate nesting cover would not have produced the dramatic increase in duck and dark geese populations in the state.

Table 13. Change in Resident and Nonresident Pheasant, Waterfowl, Firearm-Deer, and Archery-Deer Hunter Numbers, North Dakota, Averaged from 1982 through 1986 and 1996 through 2000

| | Pre-CRP[a] | | Post-CRP[b] | | Change | | |
|---|---|---|---|---|---|---|---|
| Hunting Type | Resident | Nonresident | Resident | Nonresident | Resident | Nonresident | Total |
| Pheasant[c] | 39,274 | 2,037 | 46,197 | 13,125 | 6,923 | 11,088 | 18,011 |
| Waterfowl[d] | see notes | 5,077 | 38,142 | 18,974 | 26,425 | 13,897 | 40,322 |
| Firearm-Deer | 63,670 | 548 | 82,023 | 887 | 18,353 | 339 | 18,692 |
| Archery-Deer[e] | 9,202 | 155 | 9,935 | 801 | 733 | 646 | 1,379 |
| Totals | 112,146 | 7,817 | 176,297 | 33,787 | 52,434 | 25,970 | 78,404 |

[a] Pre-CRP hunter numbers based on averages from 1982 to 1986.
[b] Post-CRP hunter numbers based on averages from 1996 to 2000.
[c] Resident and nonresident pheasant hunter numbers obtained from Tripp (1976-2001).
[d] Resident waterfowl hunter numbers obtained from Schroeder (1976-1979) and Johnson (1980-2001). The number of resident waterfowl hunters due to the CRP was determined using alternative methods (see Appendix A). Number of resident waterfowl hunters in the pre-CRP period was not included due to the alternative estimation procedure. Nonresident waterfowl hunter numbers were based on license sales, and participation rates obtained from Baltezore and Leitch (1992) and Lewis et al. (1998). Johnson (1980-2001) assumed 100 percent participation of nonresident waterfowl license sales; however, participation rates found by Baltezore and Leitch (1992) and Lewis et al. (1998) suggested the participation rate for nonresident waterfowl licenses was less than 100 percent.
[e] Archery-deer hunter numbers determined from participation rates and license sales (ND Game and Fish Department 2001 and Baltezore and Leitch 1992).

Seventy percent of the increase in the number of deer hunters was attributable to the CRP. Most of the state is primarily inhabited with white-tail deer, which have responded well to the increase in habitat provided by the CRP. Deer populations in the state were increasing prior to the CRP; however, the CRP was perceived to be largely responsible for maintaining the trend throughout the 1990s.

Overall, the increase in resident and nonresident hunters attributable to the program was estimated at about 54,500 (Table 14), or about 70 percent of the change in hunter numbers from the 1982-1986 period to the 1996-2000 period. Pheasant hunters comprised about 30 percent of the increase in hunters attributable to the CRP. Waterfowl hunters represented about 44 percent of the increase, and deer hunters, both firearm and archery, accounted for about 26 percent of the change in hunter numbers.

Table 14. Estimated Number of Resident and Nonresident Pheasant, Waterfowl, Firearm-Deer, and Archery-Deer Hunters Attributable to the Conservation Reserve Program, North Dakota, Averaged from 1982 through 1986 and 1996 through 2000

| | Change in Statewide Hunters[a] | | | Percentage of the Change Attributable | Change in Hunters due to CRP | | |
|---|---|---|---|---|---|---|---|
| Hunting Type | Resident | Nonresident | Total | to the CRP | Resident | Nonresident | Total |
| Pheasant | 6,923 | 11,088 | 18,011 | 90 | 6,231 | 9,979 | 16,210 |
| Waterfowl | 26,425 | 13,897 | 40,322 | 60 | 15,855 | 8,338 | 24,193 |
| Firearm-Deer | 18,353 | 339 | 18,692 | 70 | 12,847 | 238 | 13,085 |
| Archery-Deer | 733 | 646 | 1,379 | 70 | 513 | 452 | 965 |
| Totals | 52,434 | 25,970 | 78,404 | | 35,446 | 19,007 | 54,453 |

[a] Difference between pre-CRP hunter numbers (1982 to 1986 average) and post-CRP hunter numbers (1996 to 2000 average).

The change in the number of nonresident hunters in the state as a result of the CRP was matched with information on where nonresidents primarily hunt in North Dakota. Based on surveys conducted in 1996 and 1999, the ND Game and Fish Department (2001) identified the counties that nonresident hunters primarily hunt pheasants, ducks, and geese[6]. The surveys revealed the 16 study counties were listed as the primary destination for about 37 percent of nonresident waterfowl hunters and 43 percent of nonresident pheasant hunters (Table 15). While the study counties comprise about 26 percent of the state's land area, about 43 percent of the state's CRP acreage was in the study areas (Table 15). Collectively, the study counties received a disproportionate share of nonresident waterfowl hunters when compared to land area. However, a better measure would involve comparing waterfowl hunter numbers to a composite index of water and CRP acreage in the study counties, but data on water resources/habitat in the study counties was not compiled. The allocation of nonresident pheasant hunters matched the collective percentage of state CRP acres in the study counties.

Kidder, Logan, and Stutsman Counties had the highest destination among the study areas with 13 percent of all nonresident duck hunters (Table 15). McHenry, Pierce, and Sheridan Counties were the primary destination for 12 percent of nonresident duck hunters. The remaining study areas received 4 percent or less of all nonresident waterfowl hunters. Adams, Bowman, and Hettinger Counties represented the highest destination for nonresident pheasant hunters (18 percent) among the study areas (Table 15). Burke and Divide Counties were second with 11 percent of nonresident pheasant hunters. Kidder, Logan, and Stutsman Counties were

[6]Goose hunting destination information was available for both resident and nonresident hunters, but was not used since it was impossible to determine what influences snow goose hunters had on the destination percentages.

the primary destinations for over 7 percent of nonresident pheasant hunters. The remaining study areas received 4 percent or less of all nonresident pheasant hunters.

Table 15. Average Destination for Nonresident Pheasant and Waterfowl Hunters Among Study Areas, 1996 and 1999 Average

| Counties/ Study Areas | Percentage of Nonresidents Indicating Counties were Primary Hunting Destination | | Percentage of State | |
|---|---|---|---|---|
| | Duck Hunting | Pheasant Hunting | Land Area | CRP |
| Adams, Bowman, Hettinger | 0.83 | 17.99 | 4.7 | 8.1 |
| Burke, Divide | 3.63 | 11.39 | 3.5 | 4.3 |
| Eddy, Griggs, Nelson | 4.37 | 0.18 | 3.4 | 7.7 |
| Kidder, Logan, Stutsman | 12.95 | 7.41 | 6.6 | 11.1 |
| McHenry, Pierce, Sheridan | 11.55 | 4.07 | 5.6 | 8.1 |
| Ransom, Sargent | 3.30 | 1.81 | 2.5 | 3.5 |
| Total | 36.63 | 42.86 | 26.2 | 42.8 |

Source: ND Game and Fish Department (2001).

The number of additional resident hunters as a result of the CRP was also matched with information on where residents primarily hunt in North Dakota. Based on surveys conducted in 1996 and 2000, the ND Game and Fish Department (2001) identified the counties that resident hunters primarily hunt pheasants and waterfowl. The 16 study counties were listed as the primary destination for about 31 percent of resident duck hunters and 28 percent of resident pheasant hunters (Table 16). When compared to relative measures of state land area and CRP acreage in the study areas, the allocation of resident pheasant and waterfowl hunters were similar to those of nonresident hunters. However, in percentage terms, the study areas collectively were not as popular for resident pheasant and waterfowl hunters as they were for nonresident hunters.

Kidder, Logan, and Stutsman Counties had the highest destination among the study areas with 11 percent of the additional resident duck hunters (Table 16). Eddy, Griggs, and Nelson Counties were the primary destination for 7 percent of additional resident duck hunters. The remaining study areas received 6 percent or less of the additional resident duck hunters. Adams, Bowman, and Hettinger Counties represented the highest destination for resident pheasant hunters (12 percent) among the study areas (Table 16). Ransom and Sargent Counties were second with 6 percent of resident pheasant hunters. The remaining study areas were the primary destinations for 4 percent or less of all resident pheasant hunters.

Table 16. Average Destination for Resident Pheasant and Waterfowl Hunters Among Study Areas, 1996 and 2000 Average

| Counties/ Study Areas | Percentage of Residents Indicating Counties were Primary Hunting Destination | | Percentage of State | |
|---|---|---|---|---|
| | Duck Hunting | Pheasant Hunting | Land Area | CRP |
| Adams, Bowman, Hettinger | 0.57 | 11.89 | 4.7 | 8.1 |
| Burke, Divide | 1.75 | 4.36 | 3.5 | 4.3 |
| Eddy, Griggs, Nelson | 7.35 | 0.22 | 3.4 | 7.7 |
| Kidder, Logan, Stutsman | 10.67 | 3.77 | 6.6 | 11.1 |
| McHenry, Pierce, Sheridan | 5.98 | 1.41 | 5.6 | 8.1 |
| Ransom, Sargent | 5.17 | 6.22 | 2.5 | 3.5 |
| Total | 31.49 | 27.86 | 26.2 | 42.8 |

Source: ND Game and Fish Department (2001).

Allocation of firearm- and archery-deer hunters was based on tags available in deer hunting units and the relative land area of each study county in the state's various deer hunting zones (Table 17). Based on each study area's share of statewide deer tags, the study areas were assigned a percentage of the increase in deer hunters. The change in the number of available deer tags was only examined in the 1996 to 2001 period. Changes in zone boundaries prevented making comparisons for years prior to the CRP. Also, the number of available tags will not always translate directly into the number of deer hunters, since some units have extra doe tags left unclaimed and hunters in many zones obtain more than one tag. The number of statewide deer hunters was obtained from the ND Game and Fish Department (2001). The number of hunters per zone was not used due to changes in zone boundaries over time. Archery-deer hunters were allocated using the percentages derived for firearm-deer hunters.

Collectively, 31 percent of all tags available from 1996 through 2001 were in the six study areas. Eddy, Griggs, and Nelson Counties and Kidder, Logan, and Stutsman Counties each averaged over 7 percent of the state's total tags during the period (Table 17). The share of state tags was lower in the western study groups (Adams, Bowman, Hettinger had 2.7 percent and Burke and Divide had 3.3 percent).

Table 17. Allocation of Resident and Nonresident Deer Hunters, Study Counties, North Dakota, 1996 through 2001

| Study Counties | Deer Zone | Land Area of Study Counties in Various Zones[a] | Number of Tags[b] | Share of Total State Tags[c] |
|---|---|---|---|---|
| | | -- % – | | -- % -- |
| Adams, Bowman, Hettinger | 3E1 | 40 | 353 | |
| | 3F1 | 75 | 813 | |
| | 3F2 | 25 | 288 | |
| | 4E | 15 | 140 | |
| | 4F | 98 | 878 | |
| | | | 2,471 | 2.70 |
| Burke, Divide | 3A1 | 55 | 2,649 | |
| | 3A2 | 10 | 265 | |
| | 3A3 | 5 | 124 | |
| | | | 3,038 | 3.32 |
| Eddy, Griggs, Nelson | 2B | 12 | 1,068 | |
| | 2C | 12 | 599 | |
| | 2E | 3 | 139 | |
| | 2F1 | 75 | 3,763 | |
| | 2F2 | 20 | 727 | |
| | 2K2 | 10 | 392 | |
| | 2L | 25 | 471 | |
| | | | 7,157 | 7.81 |
| Kidder, Logan, Stutsman | 2F2 | 33 | 1,199 | |
| | 2G | 25 | 385 | |
| | 2J1 | 15 | 135 | |
| | 2J2 | 80 | 3,213 | |
| | 2I | 75 | 1,950 | |
| | | | 6,883 | 7.51 |
| McHenry, Pierce, Sheridan | 2E | 10 | 462 | |
| | 2J1 | 15 | 135 | |
| | 2K1 | 40 | 683 | |
| | 2K2 | 40 | 1,567 | |
| | 3A4 | 60 | 2,040 | |
| | | | 4,887 | 5.33 |
| Ransom, Sargent | 2G1 | 55 | 2,438 | |
| | 2G2 | 45 | 1,725 | |
| | | | 4,163 | 4.54 |
| Total | | | 28,600 | 31.21 |

[a] Determined by overlaying county boundaries on deer hunting zone boundaries and estimating the percentage of land area occupied by each study county within each deer hunting zone.
[b] Average of tags available in the zone from 1996 through 2001 multiplied by the percentage of land area of each study county within the zone.
[c] Study counties' average total tags in all zones divided by state average tags available from 1996 through 2001.
Source: ND Game and Fish Department (2001).

The number of pheasant and waterfowl hunters attributable to the CRP in each study area was based on applying destination information to the change in hunter numbers, and each study area was allocated a number of firearm and archery-deer hunters based each county's share of available deer tags (Table 18). Kidder, Logan, and Stutsman Counties were estimated to have the most resident hunters (as a result of the CRP), while Adams, Bowman, and Hettinger Counties had the most nonresident hunters. Kidder, Logan, and Stutsman Counties had the most hunters (resident and nonresident) as a result of the CRP, followed by McHenry, Pierce, and Sheridan Counties, and Adams, Bowman, and Hettinger Counties. Adams, Bowman, and Hettinger Counties had the most pheasant hunters as a result of the CRP, Kidder, Logan, and Stutsman Counties had the most waterfowl hunters, and Eddy, Griggs, and Nelson Counties had the most deer hunters. Ransom and Sargent Counties had the fewest overall hunters as result of the CRP (Table 18). Adams, Bowman, and Hettinger Counties and Burke and Divide Counties were the only study areas to have more nonresident hunters as result of the CRP than resident hunters.

Waterfowl hunting had the most resident and nonresident hunters (about 8,000) attributable to the CRP in the study areas (Table 18). Pheasant hunting was second with about 6,000 resident and nonresident hunters. About 4,400 resident and nonresident firearm-deer hunters were estimated to be attributable to the CRP in the study areas. The least amount of resident and nonresident hunters attributable to the CRP was archery-deer with about 300 individuals (Table 18).

The number of additional resident hunters in the six study areas was estimated at about 10,900 (Table 18). The number of resident hunters in the study areas was estimated to be about 31 percent of the statewide change in resident hunter numbers as a result of the CRP. Of the resident hunters, about 5,000 were waterfowl, 4,000 were firearm-deer, 1,700 were pheasant, and 160 were archery-deer.

The number of nonresident hunters attributable to the CRP in the study areas over the period was estimated at about 7,500 (Table 18). The number of nonresident hunters in the study areas was estimated to be about 40 percent of the statewide change in nonresident hunter numbers as a result of the CRP. Of the nonresident hunters, about 4,300 were pheasant, 3,100 were waterfowl, 75 were firearm-deer, and 141 were archery-deer.

Total resident and nonresident hunters attributable to the CRP in the study areas, averaged from 1996 through 2000, were estimated at about 18,400, about 34 percent of total statewide change in resident and nonresident hunters. Resident and nonresident hunters represented 59.1 and 40.9 percent of the total change in hunter numbers in the study areas, respectively.

Table 18. Number of Hunters as a Result of the Conservation Reserve Program, by Study Area and Hunting Type, North Dakota, 1982 through 1986 and 1996 through 2000 Averages

| Hunter Residence/ Hunting Type | Study Areas: Adams Bowman Hettinger | Burke Divide | Eddy Griggs Nelson | Kidder Logan Stutsman | McHenry Pierce Sheridan | Ransom Sargent | Total |
|---|---|---|---|---|---|---|---|
| Resident Hunters | | | | | | | |
| Pheasant | 741 | 274 | 12 | 237 | 87 | 386 | 1,737 |
| Waterfowl | 90 | 277 | 1,165 | 1,692 | 948 | 820 | 4,992 |
| Firearm-deer | 346 | 426 | 1,003 | 965 | 685 | 584 | 4,009 |
| Archery-deer | 14 | 17 | 40 | 39 | 27 | 23 | 160 |
| Total | 1,191 | 994 | 2,220 | 2,933 | 1,747 | 1,813 | 10,898 |
| Nonresident Hunters | | | | | | | |
| Pheasant | 1,795 | 1,137 | 18 | 739 | 406 | 181 | 4,276 |
| Waterfowl | 69 | 303 | 364 | 1,080 | 963 | 275 | 3,054 |
| Firearm-deer | 6 | 8 | 19 | 18 | 13 | 11 | 75 |
| Archery-deer | 12 | 15 | 35 | 34 | 24 | 21 | 141 |
| Total | 1,882 | 1,463 | 436 | 1,871 | 1,406 | 488 | 7,546 |
| Combined Residence | | | | | | | |
| Pheasant | 2,536 | 1,411 | 30 | 976 | 493 | 567 | 6,013 |
| Waterfowl | 159 | 580 | 1,529 | 2,772 | 1,911 | 1,095 | 8,046 |
| Firearm-deer | 352 | 434 | 1,022 | 983 | 698 | 595 | 4,084 |
| Archery-deer | 26 | 32 | 75 | 73 | 51 | 44 | 301 |
| Total | 3,073 | 2,457 | 2,656 | 4,804 | 3,153 | 2,301 | 18,444 |

Resident hunters, in each of the six study areas, were sub-divided into urban and rural residence, depending upon hunting category. Urban resident hunters were defined as individuals living in communities with a population of 2,500 or greater and represented about 48 percent, 53 percent, 55 percent, and 57 percent of all resident firearm-deer, archery-deer, pheasant, and waterfowl hunters, respectively (Lewis et al. 1998) (Table 19). Rural resident hunters were further sub-divided between those living in the study area (i.e., local) and those living elsewhere in the state (i.e., nonlocal). For example, a hunter living in Harvey would be classified as a rural hunter, and that individual may hunt locally, or travel to another location in the state to hunt. The reason for allocating rural hunters as local or nonlocal was because of the implications for determining new wealth in the study areas. The percentage of local and nonlocal rural hunters in each of the six study areas represented a 'best estimate' based on the perceived local hunting opportunities in the study area, the availability and proximity of other hunting opportunities elsewhere in the state, and the relative size of the rural population in the region. For example, rural resident waterfowl hunters in Adams, Bowman, and Hettinger Counties were estimated to be primarily comprised of local individuals, since greater or more abundant waterfowl hunting

opportunities exist in other areas of the state, and it was perceived that few rural hunters in other regions of the state would be willing to forgo opportunities to hunt waterfowl locally and travel to that particular region of the state to pursue waterfowl.

Table 19. Breakout of Rural and Urban Resident Hunters Attributable to the Conservation Reserve Program, by Hunting Type and Study Area, North Dakota, 1982 through 1986 and 1996 through 2000 Averages

| | Study Areas | | | | | | |
|---|---|---|---|---|---|---|---|
| Hunter Residence/ Hunting Type | Adams Bowman Hettinger | Burke Divide | Eddy Griggs Nelson | Kidder Logan Stutsman | McHenry Pierce Sheridan | Ransom Sargent | Total |
| Urban Resident Hunters[a] | | | | | | | |
| Pheasant | 411 | 152 | 7 | 131 | 48 | 214 | 963 |
| Waterfowl | 51 | 157 | 662 | 961 | 538 | 466 | 2,835 |
| Firearm-deer | 165 | 203 | 477 | 459 | 326 | 278 | 1,908 |
| Archery-deer | 7 | 9 | 21 | 21 | 14 | 12 | 84 |
| Total | 635 | 521 | 1,167 | 1,572 | 926 | 970 | 5,790 |
| Rural Resident Hunters[a] | | | | | | | |
| Pheasant | 330 | 122 | 5 | 106 | 39 | 172 | 774 |
| local (%) | 10 | 10 | 90 | 30 | 60 | 40 | 22.5 |
| nonlocal (%) | 90 | 90 | 10 | 70 | 40 | 60 | 77.5 |
| Waterfowl | 39 | 120 | 503 | 731 | 410 | 354 | 2,157 |
| local (%) | 90 | 60 | 20 | 20 | 20 | 30 | 25.1 |
| nonlocal (%) | 10 | 40 | 80 | 80 | 80 | 70 | 74.9 |
| Firearm-deer | 181 | 223 | 526 | 506 | 359 | 306 | 2,101 |
| local (%) | 20 | 30 | 20 | 20 | 30 | 40 | 28.2 |
| nonlocal (%) | 80 | 70 | 80 | 80 | 70 | 60 | 71.8 |
| Archery-deer | 7 | 8 | 19 | 18 | 13 | 11 | 76 |
| local (%) | 20 | 30 | 30 | 30 | 50 | 50 | 35.5 |
| nonlocal (%) | 80 | 70 | 70 | 70 | 50 | 50 | 64.5 |
| Total | 557 | 473 | 1053 | 1,361 | 821 | 843 | 5,108 |

[a] Rural and urban percentages by hunting type were obtained from Lewis et al. (1998). Local and nonlocal percentages represent 'best estimates' by study authors.

The number of hunters by residence and type of hunting were multiplied by average seasonal expenditures. Expenditures obtained from Lewis et al. (1998) were adjusted to reflect 2000 dollars using the Consumer Price Index (U.S. Department of Labor 2002). In the case of rural local hunters, 42 percent of their rural expenditures were assumed to represent 'new money' in the study areas (Baltezore and Leitch 1992). All of the rural spending by rural nonlocal hunters were considered new wealth to the study areas. Likewise, rural spending by urban hunters was considered new wealth to the study areas. In the case of Kidder, Logan, and Stutsman Counties and McHenry, Pierce, and Sheridan Counties, 70 percent of urban expenditures by urban resident hunters, 70 percent of urban expenditures by rural nonlocal hunters, 70 percent of urban spending by nonresident hunters, and 90 percent of urban expenditures by rural local hunters, was assumed to be captured by the study areas' major trade centers (Table 20).

Table 20. Assumptions on New Wealth Created by Rural and Urban Resident and Nonresident Hunters Attributable to the Conservation Reserve Program, North Dakota, 1996 through 2000

| Hunter Residence | Location of Expenditures | Amount of Expenditures Considered New Wealth To Local Economy |
|---|---|---|
| Resident | | |
| Urban | rural[a] | 100% |
| | urban | 0%, 70%[b] |
| Rural--local[c] | rural | 42% |
| | urban | 0%, 90%[b] |
| Rural--nonlocal[c] | rural | 100% |
| | urban | 0%, 70%[b] |
| Nonresident | rural | 100% |
| | urban | 0%, 70%[b] |

[a] Rural expenditures were defined by Lewis et al. (1998) to occur in communities with a population less than 2,500. Urban expenditures were classified as occurring in communities with a population of 2,500 or greater.

[b] Second percentage applies only to Kidder, Logan, and Stutsman Counties and McHenry, Pierce, and Sheridan Counties. The first percentage applies to the remaining four study areas that do not contain an urban trade center.

[c] Local rural hunters were defined as those living in the study area. Nonlocal rural hunters were defined as those living in rural areas outside of the study area.

Information on how much time was spent by resident and nonresident hunters by hunting destination was not available. For example, it was unknown if a nonresident, who indicated on a ND Game and Fish Department Survey that Stutsman County was his/her primary destination for waterfowl hunting, spent his/her entire time hunting in that county or spent only a portion of his/her time in that county. Stutsman County may have been that individual's primary destination, but the individual could have spent time hunting elsewhere in the state. Due to a lack of data, seasonal expenditures were used with the allocation of hunters in each of the study areas, although it is likely that not all of the hunters in those areas spent their entire time hunting in those regions, and as a result, would not have incurred all of their seasonal expenses in that study area. Conversely, hunters who indicated their primary hunting destination was an area not included in this study may actually have spent time hunting in one of the study areas, and subsequently spent a portion of their seasonal expenses in the study areas. The study assumed that the two likely scenarios would offset each other, and the use of seasonal expenditures was valid for estimating the impact of hunter expenditures.

The following sections describe the amount of hunter expenditures attributable to the CRP and represent an annual average during the 1996 through 2000 period. Expenditures were estimated by multiplying the number of resident and nonresident hunters in the study area by seasonal expenditures for each hunter residence and type of hunting. Hunting expenditures presented will not represent the total impact from all hunting-related activity, but rather represent only hunter expenditures resulting from the CRP. Each of the six study areas receives higher amounts of hunter expenditures than presented in the following sections; however, the CRP is not the only reason for an increase in hunting activity in the state. Because many factors have contributed to the change in hunter numbers the state is currently experiencing, the estimates provided for each study area will be less than the total impact from hunting-related activities in those areas.

Adams, Bowman, and Hettinger Counties

Total CRP-related hunter expenditures in Adams, Bowman, and Hettinger Counties averaged $1.9 million annually from 1996 through 2000 (Table 21). Expenditures from resident hunters represented 39 percent of the total or about $0.7 million. Urban resident hunters accounted for about 54 percent of all resident hunter expenditures. Nonresident expenditures were estimated at $1.1 million or 61 percent of all hunting expenditures.

Adams, Bowman, and Hettinger Counties are popular destinations for resident and nonresident pheasant hunters, which accounted for 87 percent of all CRP-based hunter expenditures. Resident pheasant hunting expenditures were estimated to be $0.5 million. Nonresident pheasant hunting expenditures were estimated at $1.1 million. Waterfowl and deer hunting activities accounted for 13 percent of CRP-related hunting expenditures.

Table 21. New Wealth Created by the Conservation Reserve Program from Hunter Expenditures, Adams, Bowman, and Hettinger Counties, 1996 through 2000 Averages

| Residence of Hunter | Type of Hunting Activity | | | | |
|---|---|---|---|---|---|
| | Pheasant | Waterfowl | Firearm-Deer | Archery-Deer | Total |
| | 000s of 2000 $ | | | | |
| Rural Resident[a] | | | | | |
| Local | 11.1 | 11.8 | 6.4 | 0.4 | 29.6 |
| Nonlocal | 237.6 | 3.2 | 61.3 | 5.6 | 307.7 |
| Total | 248.7 | 15.0 | 67.7 | 6.0 | 337.3 |
| Urban Resident[b] | 287.3 | 35.7 | 61.9 | 4.0 | 388.9 |
| Urban and Rural Resident | 536.1 | 50.6 | 129.6 | 10.0 | 726.2 |
| Nonresident | 1,083.3 | 41.6 | 2.0 | 9.5 | 1,136.4 |
| Total | 1,619.4 | 92.3 | 131.6 | 19.4 | 1,862.7 |
| | % | | | | |
| Share of all resident expenditures | 73.8 | 7.0 | 17.8 | 1.4 | |
| Share of all nonresident expenditures | 95.3 | 3.7 | 0.2 | 0.8 | |
| Share of all expenditures | | | | | |
| Resident | 28.8 | 2.7 | 7.0 | 0.5 | 39.0 |
| Nonresident | 58.2 | 2.2 | 0.1 | 0.5 | 61.0 |

[a] Rural resident hunters defined as those living in rural areas or in communities with a population less than 2,500. Local rural hunters defined as those living in the study county. Nonlocal rural hunters live elsewhere in the state.
[b] Urban resident hunters defined as those living in communities with a population of 2,500 or greater.

## Burke and Divide Counties

Total CRP-related hunter expenditures in Burke and Divide Counties averaged $1.4 million annually from 1996 through 2000 (Table 22). Expenditures from resident hunters represented 38 percent of the total or about $0.5 million. Urban resident hunters accounted for about 56 percent of all resident hunter expenditures. Nonresident expenditures were estimated at $0.9 million or 62 percent of all hunting expenditures.

About 62 percent of hunter expenditures in the study area was from pheasant hunting, while waterfowl hunting accounted for one-quarter of CRP-related expenditures. Firearm-deer and archery-deer hunting accounted for 13 percent of all hunter expenditures. Resident and nonresident pheasant hunting expenditures were estimated to be $0.2 million and $0.7 million, respectively.

Table 22. New Wealth Created by the Conservation Reserve Program from Hunter Expenditures, Burke and Divide Counties, 1996 through 2000 Averages

| Residence of Hunter | Type of Hunting Activity | | | | |
|---|---|---|---|---|---|
| | Pheasant | Waterfowl | Firearm-Deer | Archery-Deer | Total |
| | 000s of 2000 $ | | | | |
| Rural Resident[a] | | | | | |
| Local | 4.0 | 24.2 | 11.9 | 0.8 | 40.9 |
| Nonlocal | 88.0 | 38.4 | 65.9 | 5.6 | 197.9 |
| Total | 92.0 | 62.6 | 77.8 | 6.4 | 238.8 |
| Urban Resident[b] | 106.3 | 109.8 | 76.2 | 5.1 | 297.4 |
| Urban and Rural Resident | 198.3 | 172.4 | 154.0 | 11.5 | 536.2 |
| Nonresident | 686.2 | 182.9 | 2.7 | 11.8 | 883.6 |
| Total | 884.5 | 355.2 | 156.7 | 23.3 | 1,419.8 |
| | % | | | | |
| Share of all resident expenditures | 37.0 | 32.1 | 28.7 | 2.1 | |
| Share of all nonresident expenditures | 77.7 | 20.7 | 0.3 | 1.3 | |
| Share of all expenditures | | | | | |
| Resident | 14.0 | 12.1 | 10.8 | 0.8 | 37.8 |
| Nonresident | 48.3 | 12.9 | 0.2 | 0.8 | 62.2 |

[a] Rural resident hunters defined as those living in rural areas or in communities with a population less than 2,500. Local rural hunters defined as those living in the study county. Nonlocal rural hunters live elsewhere in the state.
[b] Urban resident hunters defined as those living in communities with a population of 2,500 or greater.

Eddy, Griggs, and Nelson Counties

Total CRP-related hunter expenditures in Eddy, Griggs, and Nelson Counties averaged $1.5 million annually from 1996 through 2000 (Table 23). Expenditures from resident hunters represented 82 percent of the total or about $1.2 million. Urban resident hunters accounted for about 54 percent of all resident hunter expenditures. Nonresident expenditures were estimated at $0.3 million or 18 percent of all hunting expenditures.

Eddy, Griggs, and Nelson Counties, unlike the two western study areas, are not popular destinations for pheasant hunters. Instead of pheasant hunting contributing the majority of recreational impacts from the CRP, waterfowl and deer hunting comprise the greatest percentage of hunter expenditures. Waterfowl hunting accounted for 70 percent of all hunter expenditures. Deer hunting accounted for 29 percent of all hunter expenditures. Pheasant hunting accounted for 1 percent of CRP-related hunting expenditures.

Table 23. New Wealth Created by the Conservation Reserve Program from Hunter Expenditures, Eddy, Griggs, and Nelson Counties, 1996 through 2000 Averages

| Residence of Hunter | Type of Hunting Activity: Pheasant | Waterfowl | Firearm-Deer | Archery-Deer | Total |
|---|---|---|---|---|---|
| | 000s of 2000 $ | | | | |
| Rural Resident[a] | | | | | |
| Local | 1.7 | 33.9 | 28.0 | 2.3 | 66.0 |
| Nonlocal | 0.0 | 321.6 | 155.5 | 12.1 | 489.2 |
| Total | 1.7 | 355.6 | 183.5 | 14.5 | 555.3 |
| Urban Resident[b] | 4.9 | 462.8 | 179.0 | 12.0 | 658.7 |
| Urban and Rural Resident | 6.6 | 818.4 | 362.6 | 26.4 | 1,214.0 |
| Nonresident | 10.9 | 219.7 | 6.4 | 27.6 | 264.5 |
| Total | 17.4 | 1,038.1 | 369.0 | 54.0 | 1,478.5 |
| | % | | | | |
| Share of all resident expenditures | 0.5 | 67.4 | 29.9 | 2.2 | |
| Share of all nonresident expenditures | 4.1 | 83.0 | 2.4 | 10.4 | |
| Share of all expenditures | | | | | |
| Resident | 0.4 | 55.4 | 24.5 | 1.8 | 82.1 |
| Nonresident | 0.7 | 14.9 | 0.4 | 1.9 | 17.9 |

[a] Rural resident hunters defined as those living in rural areas or in communities with a population less than 2,500. Local rural hunters defined as those living in the study county. Nonlocal rural hunters live elsewhere in the state.
[b] Urban resident hunters defined as those living in communities with a population of 2,500 or greater.

Kidder, Logan, and Stutsman Counties

Total CRP-related hunter expenditures in Kidder, Logan, and Stutsman Counties averaged $4.1 million annually from 1996 through 2000 (Table 24). Expenditures from resident hunters represented 67 percent of the total or about $2.8 million. Urban resident hunters accounted for 64 percent of all resident hunter expenditures. Nonresident expenditures were estimated at $1.4 million or 33 percent of all hunting expenditures.

Nearly 65 percent of hunter expenditures in the study area was from waterfowl hunting. Pheasant hunting accounted for 19 percent of CRP-related expenditures. Firearm- and archery-deer hunting accounted for 16 percent of all hunter expenditures. Resident waterfowl hunting expenditures were estimated at $1.9 million. Nonresident waterfowl hunting expenditures were estimated at $0.8 million.

Table 24. New Wealth Created by the Conservation Reserve Program from Hunter Expenditures, Kidder, Logan, and Stutsman Counties, 1996 through 2000 Averages

| Residence of Hunter | Type of Hunting Activity: Pheasant | Waterfowl | Firearm-Deer | Archery-Deer | Total |
|---|---|---|---|---|---|
| | 000s of 2000 $ | | | | |
| Rural Resident[a] | | | | | |
| Local | 17.6 | 82.3 | 28.8 | 4.8 | 133.4 |
| Nonlocal | 71.6 | 571.5 | 204.9 | 17.8 | 865.8 |
| Total | 89.2 | 653.8 | 233.7 | 22.5 | 999.2 |
| Urban Resident[b] | 185.0 | 1,256.6 | 328.1 | 22.0 | 1,791.7 |
| Urban and Rural Resident | 274.2 | 1,910.4 | 561.8 | 44.6 | 2,790.9 |
| Nonresident | 534.1 | 780.5 | 8.3 | 33.0 | 1,355.9 |
| Total | 808.3 | 2,690.9 | 570.1 | 77.6 | 4,146.8 |
| | % | | | | |
| Share of all resident expenditures | 9.8 | 68.4 | 20.1 | 1.6 | |
| Share of all nonresident expenditures | 39.4 | 57.6 | 0.6 | 2.4 | |
| Share of all expenditures | | | | | |
| Resident | 6.6 | 46.1 | 13.5 | 1.1 | 67.3 |
| Nonresident | 12.9 | 18.8 | 0.2 | 0.8 | 32.7 |

[a] Rural resident hunters defined as those living in rural areas or in communities with a population less than 2,500. Local rural hunters defined as those living in the study county. Nonlocal rural hunters live elsewhere in the state.
[b] Urban resident hunters defined as those living in communities with a population of 2,500 or greater.

McHenry, Pierce, and Sheridan Counties

Total CRP-related hunter expenditures in McHenry, Pierce, and Sheridan Counties averaged $2.6 million annually from 1996 through 2000 (Table 25). Expenditures from resident hunters represented 61 percent of the total or about $1.6 million. Urban resident hunters accounted for 64 percent of all resident hunter expenditures. Nonresident expenditures were estimated at $1 million or 39 percent of all hunting expenditures.

Nearly 68 percent of hunter expenditures in the study area was from waterfowl hunting. Pheasant hunting accounted for 15 percent of CRP-related expenditures. Firearm- and archery-deer hunting accounted for about 17 percent of all hunter expenditures (i.e., those due to the CRP). Resident waterfowl hunting expenditures were estimated at $1.1 million. Nonresident waterfowl hunting expenditures were estimated at $0.7 million.

Table 25. New Wealth Created by the Conservation Reserve Program from Hunter Expenditures, McHenry, Pierce, and Sheridan Counties, 1996 through 2000 Averages

| Residence of Hunter | Type of Hunting Activity: Pheasant | Waterfowl | Firearm-Deer | Archery-Deer | Total |
|---|---|---|---|---|---|
| | 000s of 2000 $ | | | | |
| Rural Resident[a] | | | | | |
| Local | 12.7 | 46.2 | 30.8 | 6.7 | 96.3 |
| Nonlocal | 15.5 | 320.4 | 127.0 | 8.2 | 471.1 |
| Total | 28.2 | 366.6 | 157.7 | 14.9 | 567.4 |
| Urban Resident[b] | 67.8 | 703.5 | 233.1 | 14.7 | 1,019.0 |
| Urban and Rural Resident | 95.9 | 1,070.1 | 390.8 | 29.5 | 1,586.4 |
| Nonresident | 293.4 | 695.9 | 6.0 | 23.3 | 1,018.6 |
| Total | 389.3 | 1,766.1 | 396.8 | 52.9 | 2,605.0 |
| | % | | | | |
| Share of all resident expenditures | 6.0 | 67.5 | 24.6 | 1.9 | |
| Share of all nonresident expenditures | 28.8 | 68.3 | 0.6 | 2.3 | |
| Share of all expenditures | | | | | |
| Resident | 3.7 | 41.1 | 15.0 | 1.1 | 60.9 |
| Nonresident | 11.3 | 26.7 | 0.2 | 0.9 | 39.1 |

[a] Rural resident hunters defined as those living in rural areas or in communities with a population less than 2,500. Local rural hunters defined as those living in the study county. Nonlocal rural hunters live elsewhere in the state.
[b] Urban resident hunters defined as those living in communities with a population of 2,500 or greater.

Ransom and Sargent Counties

Total CRP-related hunter expenditures in Ransom and Sargent Counties averaged $1.3 million annually from 1996 through 2000 (Table 26). Expenditures from resident hunters represented 78 percent of the total or about $1 million. Urban resident hunters accounted for 57 percent of all resident hunter expenditures. Nonresident expenditures were estimated at $0.3 million or 22 percent of all hunting expenditures.

About 55 percent of hunter expenditures in the study area was from waterfowl hunting. Pheasant hunting accounted for 27 percent of CRP-related expenditures. Firearm- and archery-deer hunting accounted for about 18 percent of all hunter expenditures (i.e., those due to the CRP). Resident waterfowl hunting expenditures were estimated at $0.6 million. Nonresident waterfowl hunting expenditures were estimated at $0.2 million.

Table 26. New Wealth Created by the Conservation Reserve Program from Hunter Expenditures, Ransom and Sargent Counties, 1996 through 2000 Averages

| Residence of Hunter | Type of Hunting Activity: Pheasant | Waterfowl | Firearm-Deer | Archery-Deer | Total |
|---|---|---|---|---|---|
| | 000s of 2000 $ | | | | |
| Rural Resident[a] | | | | | |
| Local | 23.2 | 35.6 | 21.7 | 2.3 | 82.8 |
| Nonlocal | 82.4 | 198.4 | 77.7 | 4.7 | 363.2 |
| Total | 105.6 | 234.0 | 99.4 | 7.0 | 446.0 |
| Urban Resident[b] | 149.6 | 325.8 | 104.3 | 6.8 | 586.6 |
| Urban and Rural Resident | 255.2 | 559.8 | 203.7 | 13.9 | 1,032.6 |
| Nonresident | 109.2 | 166.0 | 3.7 | 16.5 | 295.5 |
| Total | 364.4 | 725.8 | 207.5 | 30.4 | 1,328.1 |
| | % | | | | |
| Share of all resident expenditures | 24.7 | 54.2 | 19.7 | 1.3 | |
| Share of all nonresident expenditures | 37.0 | 56.2 | 1.3 | 5.6 | |
| Share of all expenditures | | | | | |
| Resident | 19.2 | 42.2 | 15.3 | 1.0 | 77.8 |
| Nonresident | 8.2 | 12.5 | 0.3 | 1.2 | 22.2 |

[a] Rural resident hunters defined as those living in rural areas or in communities with a population less than 2,500. Local rural hunters defined as those living in the study county. Nonlocal rural hunters live elsewhere in the state.
[b] Urban resident hunters defined as those living in communities with a population of 2,500 or greater.

All Study Areas

Total CRP-related hunter expenditures in the six study areas averaged $12.8 million annually from 1996 through 2000 (Table 27). Expenditures from resident hunters represented 61 percent of the total or about $7.9 million. Urban resident hunters accounted for 60 percent of all resident hunter expenditures. Nonresident expenditures were estimated at $5 million or 39 percent of all hunting expenditures.

About 52 percent of the hunter expenditures in the study areas was from waterfowl hunting. Pheasant hunting accounted for 32 percent of CRP-related expenditures. Firearm- and archery-deer hunting accounted for about 16 percent of all hunter expenditures (i.e., those due to the CRP).

Resident waterfowl hunting represented the single largest category of spending with nearly 36 percent ($4.6 million) of all CRP-related hunting expenditures (Table 27). Nonresident pheasant hunting was the second largest category with 21 percent ($2.7 million). The remaining categories with substantial hunter expenditures were nonresident waterfowl ($2.1 million), resident firearm-deer ($1.8 million), and resident pheasant ($1.4 million).

Kidder, Logan, and Stutsman Counties captured the most CRP-related hunter expenditures among the study areas with $4.1 million or nearly one-third of the total hunter expenditures in the study areas (Table 28). McHenry, Pierce, and Sheridan Counties were second among the study areas with $2.6 million or 20 percent of the collective total expenditures. Both of those study areas captured a major portion of their CRP-related recreational expenditures from waterfowl hunting. Adams, Bowman, and Hettinger Counties were third among all study areas with $1.9 million or 14 percent of CRP-related hunter expenditures. Adams, Bowman, and Hettinger Counties received 87 percent of their CRP-related recreational impacts from pheasant hunting. The three remaining study areas collectively only accounted for 33 percent of the total CRP-related hunting expenditures.

Kidder, Logan, and Stutsman Counties captured the most resident hunter ($2.8 million) and nonresident hunter ($1.4 million) spending. McHenry, Pierce, and Sheridan Counties were second with resident hunter spending ($1.6 million). Adams, Bowman, and Hettinger Counties were second with nonresident spending ($1.1 million). The distribution of resident and nonresident hunter expenditures associated with the CRP clearly favored study areas that could attract large numbers of waterfowl and/or pheasant hunters. Eddy, Griggs, and Nelson Counties attracted the greatest number of deer hunters, but only captured 11 percent of all study areas' CRP-related hunter expenditures.

The unequal distribution of CRP-related hunter expenditures among the study areas is partially due to the type and/or abundance of hunting opportunities in various areas of the state. Adams, Bowman, and Hettinger Counties have an advantage in providing pheasant hunting opportunities, whereas areas in the central and northern areas of the state have advantages in waterfowl hunting opportunities. Also, some of the unequal distribution of recreational impacts

from the CRP is due to the size of the study areas. All things equal, Kidder, Logan, and Stutsman Counties would be expected to capture more total CRP-related recreational impacts because of the size of the counties and amount of CRP acreage in those areas. In addition, Kidder, Logan, and Stutsman Counties and McHenry, Peirce, and Sheridan Counties captured some 'urban' spending by resident and nonresident hunters, which clearly adds to the amount of recreational expenditures in those rural economies.

The recreational impacts from the CRP were divided by program acreage in each of the study areas. The recreational impact per CRP-acre varied from $6 in Eddy, Griggs, and Nelson Counties to $11.90 in Ransom and Sargent Counties (Table 28). Average recreational revenues per CRP-acre in the six study areas was $9.45.

Table 27. New Wealth Created by the Conservation Reserve Program from Hunter Expenditures, All Study Areas, 1996 through 2000 Averages

| Residence of Hunter | Type of Hunting Activity: Pheasant | Waterfowl | Firearm-Deer | Archery-Deer | Total |
|---|---|---|---|---|---|
| | 000s of 2000 $ | | | | |
| Rural Resident[a] | | | | | |
| Local | 70.3 | 234.0 | 127.5 | 17.3 | 449.0 |
| Nonlocal | 495.1 | 1,453.6 | 692.3 | 53.9 | 2,695.0 |
| Total | 565.4 | 1,687.6 | 819.8 | 71.2 | 3,144.0 |
| Urban Resident[b] | 800.9 | 2,894.1 | 982.7 | 64.7 | 4,742.4 |
| Urban and Rural Resident | 1,366.3 | 4,581.7 | 1,802.6 | 135.9 | 7,886.4 |
| Nonresident | 2,717.1 | 2,086.6 | 29.1 | 121.7 | 4,954.5 |
| Total | 4,083.4 | 6,668.3 | 1,831.6 | 257.6 | 12,840.9 |
| | % | | | | |
| Share of all resident expenditures | 17.3 | 58.1 | 22.9 | 1.7 | |
| Share of all nonresident expenditures | 54.8 | 42.1 | 0.6 | 2.5 | |
| Share of all expenditures | | | | | |
| Resident | 10.6 | 35.7 | 14.0 | 1.1 | 61.4 |
| Nonresident | 21.2 | 16.2 | 0.2 | 0.9 | 38.6 |

[a] Rural resident hunters defined as those living in rural areas or in communities with a population less than 2,500. Local rural hunters defined as those living in the study county. Nonlocal rural hunters live elsewhere in the state.
[b] Urban resident hunters defined as those living in communities with a population of 2,500 or greater.

Table 28. New Wealth Created by the Conservation Reserve Program from Hunter Expenditures, by Study Area, 1996 through 2000 Averages

| Hunter Residence/ Hunting Type | Study Areas: Adams Bowman Hettinger | Burke Divide | Eddy Griggs Nelson | Kidder Logan Stutsman | McHenry Pierce Sheridan | Ransom Sargent | Total |
|---|---|---|---|---|---|---|---|
| | 000s of 2000 $ | | | | | | |
| Resident Hunters | | | | | | | |
| Pheasant | 536.1 | 198.3 | 6.6 | 274.2 | 95.9 | 255.2 | 1,366.3 |
| Waterfowl | 50.6 | 172.4 | 818.4 | 1,910.4 | 1,070.1 | 559.8 | 4,581.7 |
| Firearm-deer | 129.6 | 154.0 | 362.6 | 561.8 | 390.8 | 203.7 | 1,802.6 |
| Archery-deer | 10.0 | 11.5 | 26.4 | 44.6 | 29.5 | 13.9 | 135.9 |
| Total | 726.2 | 536.2 | 1,214.0 | 2,790.9 | 1,586.4 | 1,032.6 | 7,886.4 |
| Percent of Resident | 9.2 | 6.8 | 15.4 | 35.4 | 20.1 | 13.1 | |
| Nonresident Hunters | | | | | | | |
| Pheasant | 1,083.3 | 686.2 | 10.9 | 534.1 | 293.4 | 109.2 | 2,717.1 |
| Waterfowl | 41.6 | 182.9 | 219.7 | 780.5 | 695.9 | 166.0 | 2,086.6 |
| Firearm-deer | 2.0 | 2.7 | 6.4 | 8.3 | 6.0 | 3.7 | 29.1 |
| Archery-deer | 9.5 | 11.8 | 27.6 | 33.0 | 23.3 | 16.5 | 121.7 |
| Total | 1,136.4 | 883.6 | 264.5 | 1,355.9 | 1,018.6 | 295.5 | 4,954.5 |
| Percent of Nonresident | 22.9 | 17.8 | 5.3 | 27.4 | 20.6 | 6.0 | |
| Combined Residence | | | | | | | |
| Pheasant | 1,619.4 | 884.5 | 17.4 | 808.3 | 389.3 | 364.4 | 4,083.4 |
| Waterfowl | 92.3 | 355.2 | 1,038.1 | 2,690.9 | 1,766.1 | 725.8 | 6,668.3 |
| Firearm-deer | 131.6 | 156.7 | 369.0 | 570.1 | 396.8 | 207.5 | 1,831.6 |
| Archery-deer | 19.4 | 23.3 | 54.0 | 77.6 | 52.9 | 30.4 | 257.6 |
| Total | 1,862.7 | 1,419.8 | 1,478.5 | 4,146.8 | 2,605.0 | 1,328.1 | 12,840.9 |
| Percent of all areas | 14.5 | 11.1 | 11.5 | 32.3 | 20.3 | 10.3 | |
| CRP Acreage[a] | 258,280 | 135,045 | 244,638 | 353,037 | 256,132 | 111,666 | 1,358,797 |
| Recreational Revenues Per CRP Acre | $7.21 | $10.51 | $6.04 | $11.75 | $10.17 | $11.89 | $9.45 |

[a] Conservation Reserve Program acreage was an average from 1996 through 2000.

## Combined Effects

Rural economies in North Dakota are affected by the CRP primarily through loss of agricultural revenues and gains in recreational revenues. Changes in agricultural revenues occurring from land retirement were estimated early in the program's history (Mortensen et al. 1990). Estimates of recreational revenues accruing to the state from hunting activities have been periodically estimated (Lewis et al. 1998, U.S. Fish and Wildlife Service 1998). However, little

research has been conducted on comparing agricultural losses with recreational impacts from the CRP.

Revenues that would have likely occurred on CRP lands from 1996 through 2000 were based on post-CRP land use intentions of contract holders, adjusted crop yields, anticipated crop prices, and estimated government farm program payments. Based on the ratios of crop, hay, grazing, and permanent cover use of post-CRP lands, average gross agricultural revenues per acre ranged from $65 in Burke and Divide Counties to $149 in Ransom and Sargent Counties. The overall average for all study areas was estimated to be $91 per acre. Area-wide gross agricultural revenues from post-CRP lands varied from $8.7 million per year in Burke and Divide Counties to $33.1 million per year for Kidder, Logan, and Stutsman Counties. Total gross agricultural revenues from post-CRP land use in the six study areas were estimated at $123.6 million. The difference between gross agricultural revenues and contract payments would represent the net agricultural effects on post-CRP lands. After subtracting contract payments, the net change in agricultural revenues on CRP lands in the six study areas was estimated at $76 million or about $56 per acre.

In the absence of some other form of supply control in Federal farm legislation, and assuming no additional changes occur in the market fundamentals for commodity supply and disappearance, returning CRP lands to agricultural production would have put downward pressure on commodity prices during the 1996 to 2000 period. Using a crop-price scenario that represented about a 4 percent decrease in the prices for most major crops in the state, CRP termination would reduce agricultural revenues on non-CRP lands in the six study areas by $25.9 million. The overall effect, increased revenue from CRP lands returning to agricultural production and decreased revenues on non-CRP lands in the study areas, was estimated at $50.2 million.

Four categories of hunting (i.e., pheasant, waterfowl, firearm-deer, archery-deer) were used to estimate the recreational impacts of the CRP. When averaged from 1982 to 1986 (pre-CRP period) and from 1996 to 2000 (post-CRP period), the change in resident and nonresident hunters was estimated at 78,400. When the relative role of the CRP was applied to the difference in hunter numbers (i.e., post-CRP period less pre-CRP period), the increase in resident and nonresident hunters attributable to the program was estimated at about 54,500. The CRP was estimated to be responsible for about 70 percent of the change in hunter numbers from the 1982-1986 period to the 1996-2000 period. Each study area was allocated a number of pheasant and waterfowl hunters attributable to the CRP based on ND Game and Fish Department survey information, and each study area was allocated a number of deer hunters based on each county's share of available firearm-deer tags in the state. The study counties were the primary hunting destinations for about 34 percent (18,400 hunters) of the estimated 54,500 hunters the CRP has added in the state.

The number of hunters by residence and type of hunting were multiplied by corresponding seasonal expenditures to determine the amount of recreational revenues captured in the six study areas. Hunter expenditures were adjusted to reflect 'new wealth' considerations, since not all spending by residents within a local economy can be considered new money to that economy.

Total CRP-related hunter expenditures in the six study areas were estimated at $12.8 million. Expenditures from resident hunters represented 61 percent of the total or about $7.9 million. Nonresident expenditures were estimated at $5 million or 39 percent of all hunting expenditures.

The recreational impacts from the CRP were divided by program acreage in each of the study areas. The per-acre recreational impact from the program varied from $6 per acre in Eddy, Griggs, and Nelson Counties to nearly $12 per acre in Ransom and Sargent Counties. The average of recreational revenues for the six study areas was $9.45 per acre.

Average annual agricultural losses in the six study areas were estimated at $50.2 million (Table 29). Average annual recreational revenues from hunting activities associated with the CRP in the six study areas was estimated at $12.8 million. Recreational revenues were estimated to cover about 26 percent of the agricultural losses associated with the program (Table 29).

The local economy in Adams, Bowman, and Hettinger Counties lost about $18 per CRP-acre (Table 29). Recreational revenues were projected from 1996 through 2000 to offset about 28 percent of lost agricultural revenues in Adams, Bowman, and Hettinger Counties. The study area had the third highest level of recreational revenues expressed as percentage of agricultural losses. The recreational benefits of the CRP in the study area came primarily from pheasant hunting.

Recreational revenues in Burke and Divide Counties were nearly equal to the agricultural losses, and as such, the local economy does not appear to be economically burdened by the CRP. If the program was terminated, the local economy in Burke and Divide Counties would gain about $1.40 per CRP-acre.

Recreational revenues from CRP-based hunting activity in Eddy, Griggs, and Nelson Counties were projected to offset little of the agricultural revenues the area would have experienced if the program was terminated. Low recreational revenues per CRP-acre and high per-acre agricultural revenues are the two primary factors why the study area's local economy has seen lower levels of economic activity associated with the program. Recreational revenues per CRP-acre ($6/acre) were less than other study areas largely because of lower levels of pheasant and/or waterfowl hunting (i.e., relative to other areas of the state). The foregone net agricultural revenues in the region were high ($57/acre), due to the relatively greater value of crops in the region.

Table 29. Changes in Average Annual Agricultural and Recreational Revenues, Due to the Conservation Reserve Program, by Study Area, North Dakota, 1996 through 2000

| Revenue Category | Study Areas: Adams Bowman Hettinger | Burke Divide | Eddy Griggs Nelson | Kidder Logan Stutsman | McHenry Pierce Sheridan | Ransom Sargent | Total |
|---|---|---|---|---|---|---|---|
| | 2000 $ | | | | | | |
| Agriculture | | | | | | | |
| Total[a] (000s $) | (6,604) | (1,609) | (13,916) | (15,697) | (6,341) | (6,013) | (50,180) |
| Per CRP acre | (25.57) | (11.92) | (56.89) | (44.46) | (24.76) | (53.85) | (36.93) |
| Recreation | | | | | | | |
| Total (000s $) | 1,863 | 1,420 | 1,479 | 4,147 | 2,605 | 1,328 | 12,841 |
| Per CRP acre | 7.21 | 10.51 | 6.04 | 11.75 | 10.17 | 11.89 | 9.45 |
| Offset of ag losses | 28.2% | 88.2% | 10.6% | 26.4% | 41.1% | 22.1% | 25.6% |
| Gains/(Loses) | | | | | | | |
| Total (000s $) | (4,742) | (189) | (12,438) | (11,550) | (3,736) | (4,685) | (37,339) |
| Per CRP acre | (18.36) | (1.40) | (50.84) | (32.72) | (14.59) | (41.95) | (27.48) |

[a] The total net effect is a combination of revenues (gains) from putting CRP acres into agricultural production and a reduction in rural agricultural revenues (losses) from reduced prices on non-CRP lands (based on termination of the CRP). The agricultural revenues on CRP lands were based on contract holders' intended post-CRP land use, adjusted yields, and a slight decrease in 1996-2000 average producer prices. Numbers are expressed as negatives to represent lost revenues.

The local economy in Kidder, Logan, and Stutsman Counties lost about $33 per CRP-acre (Table 29). Recreational revenues were projected from 1996 through 2000 to offset about 26 percent of lost agricultural revenues. The study area had the second highest level of recreational revenues per CRP-acre ($11.75/acre). The region benefits from relatively high levels of pheasant, waterfowl, and deer hunting activities.

The local economy in McHenry, Pierce, and Sheridan Counties lost about $15 per CRP-acre (Table 29). Recreational revenues were projected from 1996 through 2000 to offset about 41 percent of lost agricultural revenues. The region benefits from having relatively high levels of waterfowl-related hunting activities.

Recreational revenues from CRP-based hunting activity in Ransom and Sargent Counties were projected to offset about 22 percent of the agricultural revenues the area would have experienced if the program was terminated. While recreational revenues were nearly $12 per CRP-acre, the area would have experienced relatively high per-acre revenues from crop production. Due to relatively high foregone agricultural revenues in the region ($54/acre), the two counties were projected to have lost about $42 per CRP-acre in local economic activity.

The net effect of agricultural losses (foregone revenues) and recreational revenues (CRP-based hunting activities) differed greatly among the study areas. Four of the six study areas were

able to offset a reasonable amount of lost agricultural revenues through recreational revenues. The local economy in Burke and Divide Counties offset the greatest amount (88%) of the agricultural losses over the study period. Alternatively, Eddy, Griggs, and Nelson Counties captured little of the lost agricultural revenues through recreational expenditures. In Eddy, Griggs, and Nelson Counties, the amount of recreational revenues per CRP-acre were low due to minor levels (i.e., relative to other areas of the state) of pheasant and waterfowl hunting, and the foregone agricultural revenues in the region per CRP-acre were high. Although Kidder, Logan, and Stutsman Counties and Ransom and Sargent Counties were able to offset between 22 to 26 percent of their agricultural losses through recreational expenditures, high foregone agricultural revenues in the region still result in relatively high losses ($33 to $42) per CRP-acre.

## DISCUSSION

The CRP has created a number of recreational and agricultural issues in rural North Dakota. Although this study examined the gains and losses in rural economic activity due to the CRP, the analysis should be viewed cautiously, as a number of assumptions were necessary to bridge data gaps. In addition, the analysis was based on a single point in time, and the results may not accurately or precisely predict future economic effects of the program.

### Key Factors

The study results are sensitive to agricultural prices and to what degree the CRP has affected hunter numbers. Determining the agricultural revenues that would be generated in the absence of the program is a key issue. Recent data suggest that if the program was terminated or if individual contract holders either cannot or choose not to re-enroll their program acreage, the vast majority of land currently enrolled in North Dakota would return to some form of agricultural use; albeit not all crop production. Assuming 70 percent of the land in the CRP was returned to crop production, the state would see an increase of about 2.3 million acres of cropped land. The majority of those acres would return to small grain production, primarily spring wheat and durum. Since North Dakota is a large producer of spring wheat and durum, the effects on regional prices for those crops may be more severe than estimated in this study. Not only would the program termination increase crop acreage in North Dakota, but similar patterns would occur throughout the United States. Thus, terminating the program would lead to relatively large increases in crop production and that would effect crop prices both regionally and nationally.

If the CRP was terminated, Federal farm legislation would likely include provisions to address the price effects from a majority of land enrolled in the program returning to crop production. Future Federal legislation and its impact is impossible to predict or accurately determine. This study based the price effects of terminating the CRP on research recently conducted by the Food and Agricultural Policy Research Institute (FAPRI). While the work performed by FAPRI is not entirely transferable to the issues examined in this study, the research was accepted as the best information available to determine the price effects of returning land enrolled in the CRP to agricultural production. Thus, even though the FAPRI research was not a

perfect match for this study, study limitations prevented a separate market analysis from being conducted.

Prices of small grains in North Dakota were predicted to decrease about 4 percent upon termination of the CRP. Lower crop prices would affect revenues on both CRP land returning to crop production and on current crop land not in the program. As a result, even small changes in crop prices would have substantial changes in rural agricultural revenues and lower revenues from non-CRP lands would offset a substantial portion of the revenues from CRP land returning to agricultural use. For example, if small grain prices decreased 4 percent, 34 percent of the revenues from CRP land returning to agricultural use would be offset by losses in crop revenues on non-CRP land. Similarly, a price decrease of 6 percent (i.e., 2 percentage points higher than this study's baseline price projections) would result in 50 percent of the revenues from CRP land being offset by losses in crop revenues on non-CRP land. Conversely, a 2 percent price decline (i.e., 2 percentage points lower than baseline projections) would mean 19 percent of the revenues from CRP land would be offset by lost crop revenues on non-CRP land. Small changes in net agricultural revenues have dramatic effects on the overall rural economic effects of the program. If terminating the CRP was assumed to reduce prices slightly (e.g., 2 percent), then the recreational revenues from the program would have offset only 20 percent of the lost agricultural revenues over the 1996 to 2000 period. However, if terminating the CRP would produce a substantial decline in crop prices (e.g., 6 percent), then recreational revenues from the program would have offset 35 percent of the lost agricultural revenues over the study period. The net overall economic effect of the CRP on rural economies is largely subject to the agricultural landscape in the absence of the program.

When evaluating the recreational revenues from the CRP, the most critical component is the level of hunting activity generated by the program. The level of hunting activity and hunting-related revenues in rural economies in North Dakota increased dramatically in the 1990s. However, not all of the change can be attributed to the CRP. Insufficient data exists to quantitatively assess the degree to which the CRP has impacted hunter numbers. Yet, qualitatively, the program has clearly played a role in the change, as have other factors over the period. Estimating how much of the change can be attributed to the program, or the synergistic effects of the program when combined with other factors is problematic.

This study used interviews with biologists and time series data on hunting activity and wildlife harvest to estimate to what degree the CRP has impacted hunting levels. The impact the CRP on the various hunting categories varied. While the CRP has created habitat for a variety of wildlife, nesting cover is perhaps the most influential aspect of the program. As could be expected, of the three hunting categories evaluated, the CRP was perceived to contribute the most to upland hunting (i.e., primarily pheasant hunting). The abundance of nesting cover, in combination with an increase in water habitat, were the primary factors contributing to substantial growth in duck and resident goose populations. However, the impact of the program on waterfowl was considered less than the impact on pheasant and deer populations. While upland grass habitat also has had positive impacts on deer populations, the effect was not considered as great as the effect on pheasants.

The degree to which the CRP is directly attributable to the change in hunter numbers affects the amount of recreational revenues that can be assigned in the study areas. For example, if the percentage of additional hunters as a result of the CRP was 10 percentage points less each for pheasant, waterfowl, and deer hunting, recreational revenues (i.e., attributable to the CRP) in the six study areas would decrease by $1.9 million or by 15 percent.

To properly determine the net economic effects of the CRP on rural economies in North Dakota, both agricultural revenues and recreational revenues must be examined. Overall economic effects of the program can vary dramatically based on subtle changes in the factors used to estimate the agricultural and recreational revenues. Since both analyses are, to various degrees, sensitive to a few key factors that are difficult to quantify, determining precise estimates of the net economic effects of the program in rural areas is difficult.

**Data Shortcomings**

Determining the new wealth created by recreational activities attributable to the Conservation Reserve Program presented several challenges. Hodur et al. (2002) reported that CRP contract holders and local community leaders in North Dakota perceived that the CRP has had substantial positive effects on hunting, and to a lesser extent, positive influences on wildlife viewing and horseback riding. However, quantifying 'substantial positive effects' into hunter numbers or participation levels is difficult (i.e., has the CRP contributed to 30, 50, 70% of the increase in hunter activity?). The following sections illustrate and discuss the data shortcomings.

From a qualitative perspective, CRP has clearly contributed to increased populations of both game and non-game species in the upper Great Plains (Feather et al. 1999, North Dakota Game and Fish Department 2002). Although some studies have generated quantitative assessments of the CRP on wildlife populations, few of those studies are applicable to North Dakota. The overall role the CRP has played in the level of pheasant and deer populations in North Dakota is unknown.

Reynolds et al. (2001) evaluated the role of the CRP in enhancing duck nesting success in the prairie pothole region of South Dakota, North Dakota, and Montana. From 1992 through 1995, daily survival rate for nesting ducks was evaluated in a number of test sites in the three states. Based on secondary data and data collected during the study, Reynolds et al. (2001) were able to compare duck nesting success before and after the CRP was introduced. Duck nesting success, based on type of habitat for five common duck species, was highest in crop land, planted cover (CRP and Waterfowl Production Areas), and idle grassland. Nesting success was lowest in right-of-ways, wetland, other land, grassland, and hayland. The ranking for crop land was influenced by high nesting success for gadwall and blue-winged teal; however, nesting success in crop land was low for pintail and mallard. Reynolds et al. (2001) commented that the CRP has helped to boost duck populations primarily through providing additional quality nesting cover and by affecting predation of duck nests. The impact of the CRP on predator effects included 1) dispersing nesting ducks, thereby lowering the concentration of duck nests such that contact with predators was decreased and 2) providing predators with greater opportunity for

securing other food sources, thereby reducing predation on nesting ducks. The authors acknowledged that other factors (e.g., abundance of ponds, water conditions, and the species composition of predators in the study area) may have also contributed to the increase in duck nesting success between pre- and post-CRP periods (Reynolds et al. 2001). Data collected during the study indicated that numbers and area of water basins did not influence nesting success in the areas studied; however, Reynolds et al. (2001) discussed other research that indicates that availability of water resources affects nesting effort (i.e., nests per hen). Although indices of fox and coyote population were used in the study, statistical tests revealed little evidence that nesting success was related to fox and coyote populations. However, fox and coyote indices were not specific to study areas and were based on county-wide estimates of predator populations, which may explain some of the lack of statistical significance.

Reynolds et al. (2001) estimated that an additional 12.4 million ducks were produced in the study area from 1992 to 1997 over what would have likely been produced had CRP tracts remained as crop land. The combined effect of high nesting success and strong nesting effort have been primarily responsible for the increase in duck population from 1992 through 1997. Reynolds et al. (2001) showed that duck nesting success has been enhanced by the CRP, and the effects of greater nesting success have contributed to increased duck populations. However, the increase in ponds and improved water conditions over the time period has likely affected duck nesting efforts. The role of water conditions and duck nesting efforts on changes in duck populations remains unquantified.

Berthelsen et al. (1989) estimated the potential production of pheasants and ducks resulting from CRP habitat in the southern High Plains region of Texas. The potential pheasant and waterfowl production, based on factors accounting for nesting success, nesting density, clutch size, fertility rates, sex ratio, and survival indexes, was estimated for selected tracts of CRP land representing both introduced and native grass mixes. The study estimated that each hectare (2.47 acres) of CRP land should produce 3.7 pheasant chicks per year and 0.03 ducklings per year in the southern High Plains region of Texas. Also, each hectare of CRP was estimated to generate 0.93 roosters and 0.01 ducks for fall hunting and 0.54 adult pheasant hens and 0.005 adult duck hens for the subsequent spring breeding season. The study concluded that high-quality nesting, brood cover, and winter cover habitat in the southern High Plains region of Texas were the greatest benefits of the CRP on pheasant and duck populations. However, Berthelsen et al. (1989) did not compare wildlife production or survivability on CRP tracts to other non-CRP habitat in the region.

Sufficient and adequate winter habitat are key factors affecting pheasant populations in North Dakota (ND Game and Fish Department 2002). Since winter habitat requirements for wildlife survivability in the upper Great Plains are different than the requirements in the southern Great Plains, it is difficult to draw any conclusions from Berthelsen et al. (1989) on the impact of the CRP on North Dakota pheasant populations. Sufficient quantitative data to estimate the specific role of the CRP in enhancing pheasant populations in North Dakota was not found.

In addition to the CRP providing wildlife habitat, other factors have simultaneously impacted wildlife populations in the state since the CRP was initiated (ND Game and Fish Department 2002). Some of those factors include 1) the 'wet cycle' much of the state experienced during the 1990s, 2) outbreak of mange on furbearer predators (i.e., primarily fox and coyote) in the 1990s, 3) changing agricultural practices (i.e., continued shift to greater conservation tillage), 4) establishment of food plots and development of key winter habitat areas, and 5) favorable weather during critical spring and winter periods[7]. The specific or quantitative role that each factor has played in maintaining or increasing wildlife populations is unknown.

While wildlife populations play an important role in participation levels for hunting activities, other factors also affect the number of hunters and time spent hunting. Few individuals would be willing to commit personal resources (i.e., time, money) to pursue game that is non-existent. Abundant game and the likelihood of an enjoyable and rewarding hunting experience will increase, to some extent, hunter participation levels, but other variables such as lifestyle factors (e.g., amount of leisure time, disposable income) and regulatory factors (e.g., limits on licenses available, land posting and access issues, limits on hunting days allowed) will also influence hunter participation. North Dakota offers hunters abundant populations of many game species with few restrictions[8]. Additional factors that may influence nonresident hunter participation in North Dakota include the availability of game in other states and access to hunting opportunities in those states. Because of the number and complexity of lifestyle, regulatory, and wildlife-population factors, this study did not examine how those factors have influenced hunting participation levels.

The primary factors that motivate individuals to choose hunting activities over other recreational activities are unknown. While Hodur et al. (2002) determined that CRP contract holders and local community leaders in North Dakota perceived that the CRP has had positive effects on the amount of time hunters spend hunting, no information was available to suggest how wildlife populations influence individuals' decisions to pursue hunting activities instead of other forms of recreation. Therefore, additional days spent hunting as a result of the CRP were not estimated and changes in hunter expenditures due to greater time spent hunting were not estimated.

Hunting destinations for rural and urban resident hunters in the state are important factors when estimating local economic impacts from hunting-based recreation. Lewis et al. (1998) estimated the percentage of rural and urban hunters in North Dakota, but to what degree rural

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[7]Weather has had both positive and negative effects on wildlife populations during the 1990s. Of particular importance was the severe winter of 1996-1997, which substantially reduced wildlife populations in many areas of the state.

[8]North Dakota had several restrictions on nonresident hunting activities over the study period, including limited days for waterfowl hunting, limited tags available for firearm-deer hunting, some limits on nonresident archery-deer hunting tags, and nonresidents were prevented from obtaining firearm tags for turkey, antelope, bighorn sheep, elk, and moose. However, no restrictions existed for upland hunting, small game hunting, predator hunting, or varmint shooting.

resident hunters pursue game near their residence versus travel to other areas of the state to pursue game is unknown. It is also unknown if the hunting destinations of urban hunters differ from those of rural hunters, since information on hunting destinations represented all resident hunters. The primary hunting destinations for rural versus urban resident hunters is important for two reasons. First, around half of resident hunters live in urban areas and travel to rural areas to hunt. Since urban hunter spending in rural areas is considered new money to local economies and urban hunters represent a substantial portion of resident hunter expenditures, specific information on the hunting destinations of urban hunters would improve the accuracy of the recreational impacts estimated in this study. Second, hunting destinations of rural hunters would also improve the accuracy of the study results. The difference between a local rural hunter versus a nonlocal rural hunter has important implications in assessing the effects of recreational revenues in rural economies. Because no data was available to distinguish the difference between rural and urban hunter destinations, destination data was applied equally to both rural and urban resident hunters and several assumptions were made on the number of rural hunters that represented local and nonlocal hunters in each study area.

Finally, very little information was available on the substitution effects of hunter expenditures. The CRP has clearly created additional hunting opportunities in the state. In the absence of those opportunities, what resident hunters would do with the disposable income currently spent on hunting has direct implications on the amount of recreational revenues that can be attributed to the program. For example, if the state did not have ample upland hunting opportunities, would residents spend their money on other recreation in the same rural economy, spend money on other hunting or recreational activities in a different location within the state, or take their money and pursue either hunting or other recreational activities out-of-state? Answers to these issues impact the amount of recreational revenues that can be attributed to the program. For example, if in the absence of the CRP, rural hunters spent money elsewhere in the state or out-of-state, then the CRP has helped retain local income that would otherwise leave the rural economy. The substitution effects of recreational spending have important considerations for rural economies, and assumptions made regarding those effects can impact study results.

In the case of rural local hunters, 42 percent of their rural expenditures were assumed to represent 'new money' in the study areas (Baltezore and Leitch 1992). Alternatively, 58 percent of rural local hunter expenditures would stay in the local economy regardless if the individual hunted. The '42 percent' figure was from a hunter survey, and represents the amount of hunter expenditures that would leave the state if ample in-state hunting opportunities did not exist. It does not address the likelihood rural hunters may pursue hunting opportunities in other areas of the state, nor does it address the substitution between hunting and other recreational activities. However, no other information was available to address these issues. It is likely the above figure underestimates the economic impact from local rural hunters in many areas of the state.

Unfortunately, some critical data needed to accurately estimate the recreational impact of the CRP in rural areas of North Dakota is not available. As a result, the authors used 'best estimates' and 'best guesses' to bridge data gaps and data shortcomings in the study. The study results accordingly are sensitive, to varying degrees, to the assumptions used in the analysis.

Other than predicting commodity prices and future farm program payments, few data problems exist in the agricultural component of the study. Most of the data problems are associated with the recreational component. Further research is needed to improve the confidence and accuracy of the economic impacts of recreational activities associated with the CRP.

**Comparison of Study Results to the Socio-Economic Assessment of the CRP**

As discussed earlier, this study is part of a larger project to address a variety of economic, demographic, and social issues pertaining to the CRP in North Dakota. As part of the overall project to evaluate the CRP in North Dakota, contract holders and local community business and civic leaders were surveyed and interviewed on a variety of CRP-related issues (Hodur et al. 2002)[9]. Perceptions of the effect of the CRP on wildlife populations, hunting activity, and recreation-based businesses were included in that assessment.

Although this analysis and the one by Hodur et al. (2002) are both part of the same project, the goals of the two studies differed. Despite different goals, results from both efforts warrant comparison. A number of issues were addressed by Hodur et al. (2002) that do not overlap with the scope of this study; however, in the areas where the issues and effects of the CRP did overlap, findings from the two studies appear consistent.

Hodur et al. (2002) surveyed 3,150 CRP contract holders in North Dakota. Contract holders overwhelmingly believed that the CRP had increased upland game and deer populations (78 and 82 percent, respectively). About half of those respondents felt the increase in upland and deer populations from CRP was 25 percent or greater. Similarly, two-thirds of all contract holders felt that the CRP had increased waterfowl and furbearer populations. The assessments of the relative effect of the CRP on wildlife populations by contract holders in the state is similar to the weighting used in this study. This study estimated that the CRP was responsible for 90 percent of the increase in pheasant hunters, 60 percent of the increase in waterfowl hunters, and 70 percent of the increase in deer hunters.

When results from the survey were compared among the six study areas, contract holders rated the effects of the CRP on upland game more strongly in the western areas of the state than in the eastern regions of the state. This pattern coincides directly with the primary hunting destinations for both resident and nonresident pheasant hunters as relatively few hunters, in recent years, have attempted to primarily pursue pheasant hunting opportunities in the eastern areas of the state. Survey respondents viewed deer populations as being substantially affected in all areas. This pattern was consistent with the change in the number of deer tags available throughout the state. Patterns between the study groups' ratings of the effects of the CRP on waterfowl populations also coincided with the primary hunting destinations for both resident and

[9]For a complete description of the study methods and results from both the survey of contract holders and the survey and interviews of business and civic leaders, see the report titled "Local Socioeconomic Impacts of the Conservation Reserve Program," by Hodur, Leistritz, and Bangsund. Agribusiness and Applied Economics Report No. 476, North Dakota State University, Fargo.

nonresident waterfowl hunters. Contract holders in the western areas of the state gave the lowest rankings for the effects of the CRP on waterfowl populations, while those in the central areas of the state gave the CRP high marks for increasing waterfowl numbers.

Local leader opinions on the effects of the CRP on wildlife populations generally mirrored those of the contract holders. While both respondent groups felt that 'upland game' and 'big game' had the greatest population growth, all wildlife species' populations were thought to have increased as a result of the CRP. Ninety percent of the local leaders felt that upland game and big game populations had increased, and 80 percent of the leaders felt that furbearer and other game populations had increased. More than 70 percent of the local leaders believed that waterfowl populations had increased.

Nearly 60 percent of survey respondents felt that hunting in their county had increased as a result of the CRP. More than one-third of the respondents indicated bird watching/wildlife viewing had increased, but a similar percentage believed there was no effect. Most respondents felt there had been no effect on other types of outdoor recreation (e.g., camping and horseback riding). When results from the survey were compared among the six study areas, contract holders rated the effects of the CRP on hunting more strongly in the western areas of the state than in the eastern regions of the state. The connection between the CRP and increased pheasant populations was evident in the responses from contract holders in Adams, Bowman, and Hettinger Counties. Hunter destination data was consistent with the contract holders' assessment of changes in hunting levels, since Adams, Bowman, and Hettinger Counties were the primary hunting destination for the most resident and nonresident pheasant hunters among all study areas. Historic hunter destination data indicated that those counties had not been as popular for pheasant hunters prior to the CRP. Conversely, contract holders in Eddy, Griggs, and Nelson Counties indicated lower levels of increased hunting activity than found in the other study areas. Again, hunter destination data indicated those counties were not as popular with resident and nonresident hunters pursuing pheasants and waterfowl as found in other study areas.

Local leaders also believe that the CRP has had a positive effect on recreational activities in North Dakota. About three-quarters of the local leaders surveyed believed that hunting had increased as a result of the CRP, with slightly less than a third indicating a substantial increase.

Contract holders and local leaders were queried regarding the effect of the CRP on both the number of hunters and the amount of time spent hunting in their area. Respondents' perception of the effects of the CRP on hunter participation and time spent hunting were overwhelmingly positive. All types of hunting (upland, waterfowl, and big game) were viewed similarly positive; however, survey respondents felt the effect of the CRP on deer hunters were viewed to primarily impact resident hunters. Since the state limits the number of nonresident firearm-deer hunters to 1 percent of available tags in any deer hunting unit, the perceptions of contract holders and local leaders were consistent with existing data on resident and nonresident deer hunter numbers. For upland hunting, three-quarters of all respondents felt that the CRP had a positive impact on both the number of hunters and the amount of time spent hunting. Nearly 70 percent of respondents felt that deer hunting had been positively impacted and 62 percent felt

waterfowl hunting had been positively impacted. The relative impact of the CRP on hunter numbers, as estimated in this study, was very similar to the respondent's perceptions.

The effects of changes in recreational activities on local businesses were generally viewed as positive by contract holders, although the degree varied somewhat by business type. Opinions on the effects of hunting activities on nonagricultural businesses were similar to the level of recreational spending estimated in this study. Survey respondents in Adams, Bowman, and Hettinger Counties perceived the impacts on several types of businesses tied to recreational activities more positively than other study areas and this region was estimated in this study to have a substantial portion of lost agricultural revenues offset by recreational spending attributable to the CRP. Contrasted with the two eastern study areas, survey respondents indicated the overall effect of recreational spending attributable to the CRP in their area was not substantial. The two eastern study areas captured less recreational revenue and had the lowest percentage of lost agricultural revenues offset by recreational revenues of all the study areas. The estimated change in hunter numbers attributable to the CRP, and the corresponding amount of recreational revenues from increased hunting activity in the six study areas mirrored the sentiments of both contract holders and local business and civic leaders.

**Other Issues**

The analysis of the net economic effects of the CRP in rural economies was entirely quantitative. While the CRP has likely improved hunter satisfaction due to game abundance, quality, and game availability, no attempts were made to address the qualitative recreational effects of the program.

The recreational impacts of the CRP are likely understated in this study. Only pheasant, waterfowl, and deer hunting activities were included in the recreational impacts of the CRP. Other types of hunting (e.g., predator, grouse, turkey) also have likely been influenced by the CRP. Although hunter participation in those categories has historically been low compared to other categories and the effects of the CRP on those hunting categories were perceived to be relatively minor, including the change in expenditures from all types of hunting would increase the level of hunting expenditures associated with the program. Wildlife watching is also an important form of wildlife-based recreation that generates substantial economic impacts in North Dakota. However, due to a lack of data, the change in wildlife-viewing activities attributable to the CRP were not included in the study. Again, while the rural economic impacts from wildlife viewing activities are not as large as the impacts from hunting activities, including changes in wildlife viewing expenditures would increase the recreational impacts estimated in this study. Other impacts of the CRP not addressed in this analysis are soil and water benefits. Improvements in soil and water quality from the CRP have been well documented. While the links between improved water quality and sport fishing would suggest that the CRP has affected fishing activities in the state, the exact nature of those effects remains unquantified. An increase in nonwildlife-based recreational activities due to the CRP would also have the potential to add to the recreational impacts of the program in some areas of the state. However, those effects were viewed to be minor compared to wildlife-based recreational activities. Including all

wildlife- and nonwildife-based recreational activities affected by the CRP would provide a more comprehensive picture of the recreational effects of the program.

The scope of this study was strictly limited to assessing hunting-based recreational revenues in rural economies that can be directly attributable to the CRP and should not be confused with the total amount of hunting-based spending that occurs in rural areas. Further, only the change in hunting activities due to the CRP, measured from the mid 1980s to the late 1990s, was estimated in the recreational estimates. Obviously, rural areas of the state were capturing hunting expenditures from resident and nonresident hunters prior to the initiation of the CRP. Not all hunting expenditures can be attributed to the CRP. Total hunting related expenditures in all study areas will be substantially greater than the amount estimated in this study.

Net economic effects of the CRP in rural economies was limited to assessing economy-wide direct expenditures and did not attempt to measure the difference in the distribution of agricultural revenues and recreational expenditures within the local economies. In the absence of the program, agricultural revenues would primarily benefit those businesses that supply inputs and services to production agriculture. Recreational revenues would primarily benefit those businesses that supply inputs and services to wildlife-based activities. The number of businesses affected in each of the two sectors was not examined. Also, it is highly unlikely that agricultural businesses would benefit from changes in recreational activity and vice versa. For example, a local elevator would not likely benefit from increased recreational activity, just as a sporting goods supplier would not likely benefit from increased agricultural production. If the recreational and agricultural effects were offsetting (i.e., recreational revenues to the local economy equaled the loss of agricultural revenues), another analysis would be warranted to estimate the effects on local employment and number of affected businesses.

Although an analysis of the secondary economic effects (i.e., multiplier effects, dollar turnover) was not performed, both agricultural revenues and recreational spending consist mostly of retail trade activity. Gross revenues from agricultural production are initialized into the local economy through spending by farmers/ranchers for production inputs and services, of which most would be categorized as retail trade. Likewise, a high percentage of recreational expenditures by hunters would also be categorized as retail trade (e.g., supplies, gas, food, etc). Both activities also affect sectors providing business and personal services--agriculture through custom work and other production-related services, and hunting through lodging and other hunting-related services. Further, agricultural activities affect personal income from land rental and retained earnings from crop production. Likewise, recreational activities affect personal income through fee hunting revenues and through retained earnings of guides/outfitters. Thus, many of the direct economic impacts from both agriculture and recreation ultimately affect the same economic sectors (i.e., retail trade, business and personal services, economy-wide personal income).

**Recap of Methods and Results**

The local economic effects of the CRP are a result of reduced gross agricultural revenues on land placed into the program and from increased recreational expenditures. The difference between gross revenues from agricultural production and contract payments represents the net agricultural loss to the rural economies of removing crop land from production. In addition to revenue effects from land enrolled in the program, other agricultural effects include the influence of the program on commodity prices. While price effects of land retirement associated with the CRP are difficult to determine, the price effects could be viewed either that current prices are higher with the program or that current prices would be lower without the program. Regardless, the program has price implications for most commodities. The net agricultural effects of the program are a combination of net revenue changes on land enrolled in the program and price effects on revenues from non-CRP lands.

Not all land enrolled in the program will return to crop production. Survey results from contract holders in the six study areas clearly indicated a preference for some acreage to remain in grass cover. Other studies conducted in the 1990s also have shown that not all enrolled acreage will return to crop production. Some of the land left in grass cover would be used for hay and pasture, with the remaining land left in permanent cover (not grazed or hayed). Because native (grass) hay and pasture generally produce less gross revenue per acre than crop production, the intended post-CRP use of land enrolled in the program must be considered in any assessment of the agricultural effects. Estimating the rural economic implications of terminating the program based on pre-CRP production patterns is not valid.

Economic leakage from landowners taking their contract payments out of the local economy or out-of-state was not considered an issue in this study. Why individuals choose to move out of a rural region is a complex issue. In most cases, individuals that retired/moved while participating in the program would have likely retired and/or moved during the same approximate time period without the program, and would have likely sold or rented their land rather than enrolling it in the CRP. [Hodur et al. (2002) reported that nearly 41 percent of all contract holders surveyed were age 65 or older]. In the event that the CRP is terminated, it is unlikely that those landowners who moved during the program will choose to move back to the same rural area. Under that assumption, the land rent they would receive (if there was no CRP) would also leave the local economy. Since per acre land rents and current contract payments were similar in most regions of the state over the study period, the amount of economic leakage was also assumed to be similar under both situations and not considered an issue in this analysis.

Factors other than CRP also have the potential to impact recreational spending. For example, waterfowl and pheasant hunting accounted for over 80 percent of all CRP-based hunting revenues and those activities will likely remain an important sources of new wealth in rural economies. Factors influencing pheasant and waterfowl hunting will have implications on CRP-based recreational impacts. Also, in all but two of the study areas, more new wealth to the rural economies was created from resident hunters than from nonresident hunters. Also, expenditures from urban resident hunters were nearly equal to the entire contribution from

nonresident hunters. When totaled in the six study areas, resident hunter spending attributable to the CRP exceeded nonresident hunter expenditures. While CRP is an important factor influencing hunting activities, other factors that affect hunting levels in the study areas will have broad implications on the amount of recreational spending captured in those rural economies.

Pheasant and waterfowl hunting provided the greatest recreational revenues from the program. As a result, regions of the state with abundant pheasant and waterfowl hunting opportunities captured more recreational revenues than regions with less abundant or fewer hunting opportunities. Also, since hunter expenditures occur in both small and large trade centers (i.e., spending is classified as rural and urban depending upon city population), those regions with larger trade centers will capture a greater percentage of total seasonal hunter expenditures than areas without larger trade centers. Those regions without a major trade center are likely to only capture the amount of expenditures classified as rural spending. Consequently, not all areas of North Dakota will be able to equally capitalize on the increasing levels of hunting activity attributable to the CRP. Those regions with attractive pheasant and/or waterfowl hunting opportunities, and those with larger trade centers, will generally capture more hunting-based recreational expenditures. Having substantial acreage of CRP in a region is not necessarily sufficient to capture large amounts of recreational revenues. Western areas of the state generally have an advantage in attracting pheasant hunters. Central regions of the state attract large numbers of waterfowl hunters and also are able to capture a greater percentage of hunter expenditures due to larger trade centers. While eastern areas of the state are not likely to attract large numbers of either waterfowl or pheasant hunters, those areas have had a major increase in deer hunters. However, expenditures from an increase in deer hunters alone will be insufficient to offset a substantial portion of the agricultural losses from the program.

The assessment of the net economic impacts of the program were based on averages from 1996 through 2000. While per-acre agricultural revenues over that period changed little, the number of individuals hunting increased dramatically. Hunter numbers have continued to increase in 2001 and preliminary data suggest hunter numbers in 2002 will be similar to 2001 levels. If 2001 and 2002 data were used instead of averages from 1996 to 2000, recreational effects of the CRP would be considerably higher than estimated in this report. If hunting levels continue to increase and foregone agricultural revenues remain similar, the ability of rural economies to offset agricultural losses stemming from the CRP will also increase.

## SUMMARY

Economic assessments of the Conservation Reserve Program have traditionally focused on the agricultural consequences associated with removing crop land from production. The goal of this study was to assess both economic losses and gains from the program in rural economies of North Dakota. The net economic effects of the program were measured by estimating agricultural revenues that would have occurred in the absence of the program (losses to the local economy) and estimating the recreational (hunter) expenditures associated with the program (gains to the local economy). The purpose of including both gains and losses to rural economies was to provide a more balanced assessment of the economic burden associated with the program.

Several counties in North Dakota, averaged from 1996 through 2000, had more than 100,000 acres enrolled in the CRP. Sixteen counties, grouped into six areas, which represent a cross section of geographical, agricultural, and natural resource characteristics in the state were selected for study. Each study county had relatively high CRP participation, measured both in total acreage and percentage of total crop land enrolled. A mail survey of 3,150 CRP participants in the 16 study counties provided information on crops grown and relative yields from CRP lands prior to enrollment, post-CRP land use intentions, and recreational activities associated with the CRP. Data on hunter participation, wildlife populations, and game harvest were gathered, along with interviews with wildlife biologists, in an attempt to determine the effects of the CRP on hunter expenditures in the study areas.

**Agriculture**

Revenues that would have likely occurred on CRP lands from 1996 through 2000 were estimated based on post-CRP land use intentions of contract holders, adjusted crop yields, anticipated crop prices, and estimated government farm program payments. Gross revenues for CRP land returning to crop production ranged from about $79 per acre in Burke and Divide Counties to $170 per acre in Ransom and Sargent Counties. Gross revenues for hay production from CRP lands ranged from $47 per acre in Adams, Bowman, and Hettinger Counties to $76 per acre in Ransom and Sargent Counties. CRP lands used for pasture were estimated to produce gross revenues ranging from $25 per acre in Burke and Divide Counties to $49 per acre in Ransom and Sargent Counties. Land left in permanent cover was assumed to generate revenues equal to farm program payments. Based on the ratios of crop, hay, grazing, and permanent cover use of post-CRP lands, average agricultural revenues per acre ranged from $65 in Burke and Divide Counties to $149 in Ransom and Sargent Counties. The average for all study areas was estimated at $91 per acre.

Agricultural revenues from post-CRP lands varied from $8.7 million per year in Burke and Divide Counties to $33.1 million per year in Kidder, Logan, and Stutsman Counties. Total gross agricultural revenues from post-CRP land use in the six study areas was estimated at $123.6 million. The difference between gross agricultural revenues and contract payments represent the net agricultural effects on post-CRP lands and was estimated at $76 million or about $56 per acre.

Without some other form of supply control, and assuming no additional changes in commodity supply and disappearance, returning CRP lands to agricultural production would have put downward pressure on commodity prices during the 1996 to 2000 period. A reduction in commodity prices not only affects revenues on CRP lands returning to agricultural production, but also affects revenues on non-CRP lands. Assuming no additional supply control provisions, commodity price reductions for wheat, non-oil sunflower, alfalfa, grass hay, and dry edible beans were estimated at 4.4 percent. Barley price was reduced by 9.9 percent, soybean, oil sunflower, and canola prices were each reduced by 5 percent, corn price was reduced by 10 percent, and oats price was reduced by 15.5 percent. Reduced commodity prices resulting from CRP

termination would have lowered agricultural revenues on non-CRP lands in the six study areas by $25.9 million.

In the absence of the Conservation Reserve Program, returning CRP lands to agricultural production would represent an economic gain to the local economy, but reduced commodity prices would produce an economic loss. Conversely, the agricultural effects of continuing the CRP would include an annual gain of $25.9 million in crop sales on non-CRP lands due to higher crop prices with the program and an annual decrease of $76 million in net agricultural revenues that would have occurred from agricultural use of CRP lands. The overall agricultural losses in the six study areas were estimated at $50.2 million annually from 1996 through 2000. Annual economy-wide agricultural losses ranged from $1.6 million in Burke and Divide Counties to $15.7 million in Kidder, Logan, and Stutsman Counties.

**Recreation**

The two forms of recreation most influenced by the CRP are hunting and wildlife viewing. Due to a lack of data on wildlife viewing, only hunting activities were included. Four types of hunting (i.e., pheasant, waterfowl, firearm-deer, archery-deer) were used to estimate the recreational impacts of the CRP. When averaged from 1982 to 1986 (pre-CRP period) and from 1996 to 2000 (post-CRP period), the statewide change in resident and nonresident hunters was estimated at 78,400. The relative weight or role the CRP has played in the change in hunting levels was estimated and then applied to the statewide change in hunter numbers. The statewide increase in resident and nonresident hunters attributable to the program was estimated at 54,500. Pheasant hunters comprised about 30 percent of the increase, waterfowl hunters represented about 44 percent of the increase, and deer hunters, both firearm and archery, accounted for 26 percent of the change in hunter numbers.

Using information on the hunting destinations of resident and nonresident hunters, the number of hunters in each category in each study was estimated. The 16 study counties were listed as the primary destination for about 37 percent of nonresident duck hunters and 43 percent of nonresident pheasant hunters. Residents indicated the study counties were the primary destination for 31 percent of waterfowl hunters and 28 percent of pheasant hunters. The study areas were allocated a percentage of the increase in statewide deer hunters based on the state share of tags in each study county.

Kidder, Logan, and Stutsman Counties were estimated to have the most additional resident hunters (as a result of the CRP), while Adams, Bowman, and Hettinger Counties were allocated the most additional nonresident hunters. Kidder, Logan, and Stutsman Counties were estimated to have the most overall hunters (resident and nonresident) as a result of the CRP, followed by McHenry, Pierce, and Sheridan Counties, and Adams, Bowman, and Hettinger Counties. Adams, Bowman, and Hettinger Counties had the most pheasant hunters as a result of the CRP, Kidder, Logan, and Stutsman Counties had the most waterfowl hunters, and Eddy, Griggs, and Nelson Counties had the most deer hunters. Ransom and Sargent Counties had the fewest hunters as result of the CRP.

Waterfowl hunting had the most additional resident and nonresident hunters (about 8,000) attributable to the CRP in the study areas. Pheasant hunting was second with about 6,000 additional resident and nonresident hunters. An estimated 4,100 additional resident and nonresident firearm-deer hunters were attributed to the CRP in the study areas. The least amount of resident and nonresident hunters attributable to the CRP was archery-deer with 300 individuals. The number of resident and nonresident hunters in the six study areas, as a result of the CRP, was estimated at 10,900 and 7,500, respectively. The total number of resident and nonresident hunters attributable to the CRP in the study areas was estimated at about 18,400. Hunters in the study areas represented about 34 percent of the total statewide change in resident and nonresident hunters as a result of the CRP.

Resident hunters, in each of the six study areas, were further subdivided by urban and rural residency for each hunting category. Urban resident hunters represented about 48 percent, 53 percent, 55 percent, and 57 percent of all resident firearm-deer, archery-deer, pheasant, and waterfowl hunters, respectively. Rural resident hunters were further subdivided between those living in the study area (i.e., local) and those living elsewhere in the state (i.e., nonlocal).

The number of hunters by residence and type of hunting were multiplied by average seasonal hunting expenditures. All of the rural spending by nonresident, urban resident, and rural nonlocal hunters were considered new wealth to the study areas; however, only 42 percent of rural local hunter expenditures were considered new money. Because Kidder, Logan, and Stutsman Counties (i.e., Jamestown) and McHenry, Pierce, and Sheridan Counties (i.e., Rugby) contain an urban trade center, 70 percent of urban expenditures by urban resident hunters, rural nonlocal hunters, and nonresident hunters, and 90 percent of urban expenditures by rural local hunters, was assumed to be captured by the study areas' major trade centers.

Total CRP-related hunter expenditures in Adams, Bowman, and Hettinger Counties were estimated at $1.9 million annually, with expenditures from nonresident hunters representing 61 percent of the total. Pheasant hunting accounted for 87 percent of all hunter expenditures (i.e., those due to the CRP).

Total CRP-related hunter expenditures in Burke and Divide Counties were estimated at $1.4 million annually, with expenditures from nonresident hunters accounting for 62 percent of the total. Over 62 percent of all hunter expenditures were from pheasant hunting. Waterfowl hunting accounted for 25 percent of hunter expenditures.

Total CRP-related hunter expenditures in Eddy, Griggs, and Nelson Counties were estimated at $1.5 million annually, of which, 82 percent was from resident hunters. Waterfowl and deer hunting accounted for 70 percent and 29 percent of all hunter expenditures, respectively.

Total CRP-related hunter expenditures in Kidder, Logan, and Stutsman Counties were estimated at $4.1 million annually, with about 67 percent of all expenditures coming from

resident hunters. Nearly 65 percent of the hunter expenditures was from waterfowl hunting. Pheasant hunting accounted for 19 percent of hunter expenditures.

Total CRP-related hunter expenditures in McHenry, Pierce, and Sheridan Counties were estimated at $2.6 million annually, with 61 percent of the total coming from resident hunters. Nearly 68 percent of the hunter expenditures in the study area was from waterfowl hunting. Deer hunting accounted for 17 percent of hunter expenditures.

Total CRP-related hunter expenditures in Ransom and Sargent Counties were estimated at $1.3 million annually, of which, 78 percent was from resident hunters. About 55 percent of the hunter expenditures in the study area was from waterfowl hunting. Pheasant hunting accounted for 27 percent of hunter expenditures.

Average CRP-related hunter expenditures in the six study areas were estimated at $12.8 million annually from 1996 through 2000. Expenditures from resident hunters represented 61 percent of the total. About 52 percent of the hunter expenditures was from waterfowl hunting. Pheasant hunting accounted for 32 percent of CRP-related expenditures. Firearm- and archery-deer hunting accounted for about 16 percent of all CRP-based hunter expenditures.

Resident waterfowl hunting represented the single largest category of spending with nearly 36 percent ($4.6 million) of all CRP-related hunting expenditures. Nonresident pheasant hunting was the second largest category with nearly 21 percent ($2.7 million). The remaining categories with substantial hunter expenditures were nonresident waterfowl ($2.1 million), resident deer ($1.9 million), and resident pheasant ($1.4 million).

**Combined Effects**

Rural economies in North Dakota are affected by the CRP primarily through loss of agricultural revenues and gains in recreational revenues. Revenues that would have likely occurred on CRP lands from 1996 through 2000 were based on post-CRP land use intentions of contract holders, adjusted crop yields, anticipated crop prices, and estimated government farm program payments. Total gross agricultural revenues from post-CRP land use in the six study areas were estimated at $123.6 million annually or $91 per acre. After subtracting contract payments, net agricultural revenues on CRP lands in the six study areas were estimated at $76 million or about $56 per acre. Using a crop-price scenario that represented about a 4 percent decrease in the prices for most major crops in the state, CRP termination would decrease agricultural revenues on non-CRP lands in the six study areas by $25.9 million. The overall effect, increased revenue from CRP lands returning to agricultural production and decreased revenues on non-CRP lands, was estimated at $50.2 million or about $37 per acre.

Four categories of hunting (i.e., pheasant, waterfowl, firearm-deer, archery-deer) were used to estimate the recreational impacts of the CRP. The statewide change in resident and nonresident hunters due to the CRP was estimated at 54,500. Additional resident and nonresident hunters attributable to the CRP in the study areas were estimated at about 18,400.

Hunter expenditures were adjusted to reflect 'new wealth' considerations, since not all local spending can be considered new money to a rural economy.

Total CRP-related hunter expenditures in the six study areas were estimated at $12.8 million annually. Expenditures from resident hunters represented 61 percent of the total or about $7.9 million. Nonresident expenditures were estimated at $5 million or 39 percent of all hunting expenditures.

The recreational impact from the program varied from $6 per CRP-acre in Eddy, Griggs, and Nelson Counties to nearly $12 per CRP-acre in Ransom and Sargent Counties. The overall average of recreational revenues for the six study areas was $9.45 per CRP-acre.

Average annual agricultural losses in the six study areas were estimated at $50.2 million. Average annual recreational revenues from hunting activities associated with the CRP in the six study areas were estimated at $12.8 million. Recreational revenues were estimated to cover 26 percent of the agricultural losses associated with the program.

Recreational revenues were estimated to offset about 28 percent of lost agricultural revenues in Adams, Bowman, and Hettinger Counties over the 1996 to 2000 period. Burke and Divide Counties were estimated to offset 88 percent of lost agricultural revenues with recreational expenditures. Recreational revenues from CRP-based hunting activity in Eddy, Griggs, and Nelson Counties were estimated to offset little (about 10 percent) of the agricultural losses. Recreational revenues in Kidder, Logan, and Stutsman Counties were estimated to offset about 26 percent of lost agricultural revenues, while 41 percent of the lost agricultural revenues in McHenry, Pierce, and Sheridan Counties was offset by recreational revenues. Recreational revenues from CRP-based hunting activity in Ransom and Sargent Counties were estimated to offset 22 percent of lost agricultural revenues.

The net effect of agricultural losses (foregone revenues) and recreational revenues (CRP-based hunting activities) differed greatly among the study areas. One study area was estimated to offset 88 percent of lost agricultural revenues with recreational activities. In three areas, a reasonable amount (26 percent to 41 percent) of lost agricultural revenues was offset by recreational revenues. In two areas, recreational activity offset little of the lost agricultural revenues. In Eddy, Griggs, and Nelson Counties, one of the areas where little of the lost revenues were offset, the amount of recreational revenues per CRP-acre were low and the foregone agricultural revenues in the region per CRP-acre were high. In Ransom and Sargent Counties, recreational expenditures per CRP-acre were high, but so too were the agricultural revenues. Although recreational expenditures per-CRP acre were highest in Ransom and Sargent Counties, the study area was projected to lose nearly $42 per CRP-acre, second highest among the study groups.

Estimates of the net effect of the CRP on local economies were based on data from 1996 through 2000 and only included revenues from selected hunting activities. Since hunter numbers increased in 2001 and preliminary indications suggest that hunter numbers will be high in 2002,

and the CRP has affected other wildlife and nonwildlife-based recreation, including more current hunter numbers and incorporating expenditures from all forms of CRP-based recreation would improve the net economic effects of the program in many areas of the state. The results presented in this study should be considered conservative.

## CONCLUSIONS

While long-term crop retirement programs generally produce, in varying degrees, negative effects on those businesses and sectors that provide agricultural inputs, those programs generate positive economic effects in other areas of the economy. The Conservation Reserve Program has greatly enhanced wildlife habitat in the northern Great Plains. Increased wildlife habitat has directly led to substantial increases in upland bird, waterfowl, and big game populations. Enhanced wildlife populations have in turn led to increases in wildlife-based recreation, primarily hunting, and to a lesser extent, wildlife viewing.

While several studies have estimated the loss of agricultural revenues associated with the CRP, few studies have attempted to include recreational revenues in the economic assessment of the program. Although this study examined the gains and losses in rural economic activity due to the CRP, the analysis should be viewed cautiously, as assessing the program's net economic effects remains sensitive to several key factors and a number of assumptions were incorporated due to a lack of data. In addition, the analysis was based on a single point in time, and the results may not accurately or precisely predict future economic effects of the program.

The future ability of rural areas to offset CRP-based agricultural losses with wildlife-related recreational expenditures will largely be dependent upon pheasant and waterfowl hunting. Pheasant and waterfowl hunting accounted for over 80 percent of all CRP-based hunting expenditures, and current data indicates that even major increases in deer hunting expenditures will likely only offset small reductions in pheasant and waterfowl hunting expenditures. Consequently, not all areas of North Dakota will be able to equally offset agricultural losses with recreational revenues. Future wildlife population levels, policies, and hunting trends which affect pheasant and waterfowl hunting will have the greatest affect on the level of recreational revenues captured in rural areas.

Collectively, resident hunter expenditures were a substantially higher source of new wealth than nonresident hunters. However, both resident and nonresident hunter expenditures are important sources of recreational revenues in most areas of the state. The future ability of rural areas to offset CRP-based agricultural losses will be dependent upon expenditures from both resident and nonresident hunters and factors which substantially affect either group will have implications on the amount of recreational spending captured in those rural economies.

The degree to which CRP-based hunting revenues in rural areas of the state are offsetting agricultural losses varied throughout the state. In several cases, hunting expenditures offset a substantial portion of the agricultural losses, while in other areas, the net economic loss from the program remains high. The net economic effects of the program in the western and central areas

of the state were the most favorable, since those areas had the highest levels of CRP-based hunting expenditures and had relatively lower amounts of lost agricultural revenues. However, the net effect of recreational and agricultural revenues in eastern areas of the state were not nearly as favorable. Those areas captured little additional hunting-related expenditures from the program and had relatively high levels of lost agricultural revenues. In North Dakota, the net economic effect of losses in agricultural revenues and gains in hunting-based recreational revenues indicated that several areas of the state are not as economically burdened by the CRP as previous research has suggested.

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# APPENDIX A

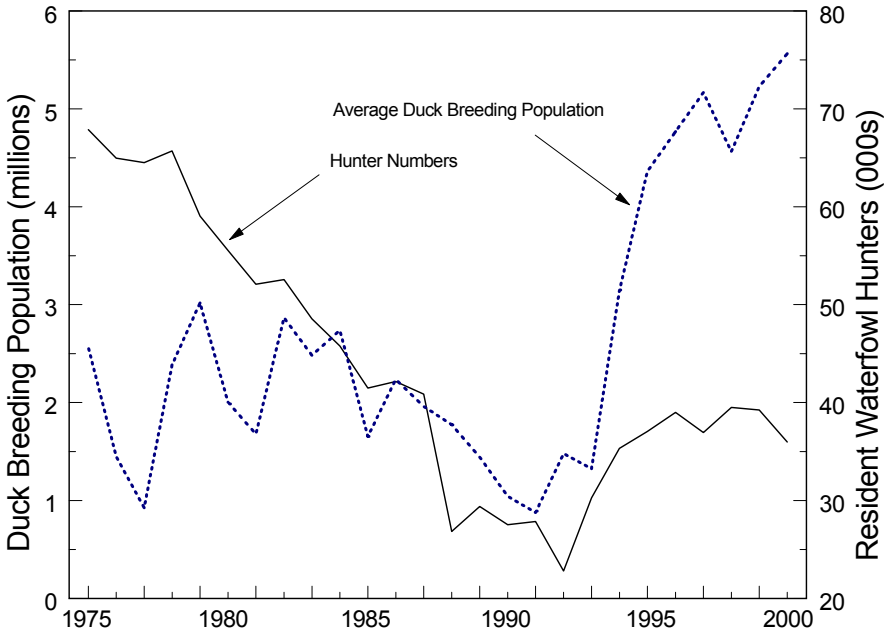
## Trends Associated with Resident Waterfowl Hunters

Analyzing the effects of the CRP on resident waterfowl hunter numbers presented some unique challenges. The primary problem was that the same methods used to estimate changes in the number of pheasant and deer hunters could not be applied to resident waterfowl hunters (RWH). From 1975 through 2000, resident pheasant and deer hunter numbers generally tracked changes in game populations and hunter numbers over the period generally were increasing, albeit at different rates at different times. The connection between increasing game populations and increasing hunter numbers was readily apparent with pheasant and deer hunting activities. Thus, when hunter numbers before CRP were compared to hunter numbers after CRP, changes in hunter numbers were positive, and some percentage of the change could be attributed to the program. In the case of RWH, a fundamental change in hunter numbers was occurring over a large portion of the period under study, and the change continued to occur for several years after the CRP was initiated. When RWH numbers before the CRP were compared to numbers after the CRP, the change was negative (i.e., there are fewer resident waterfowl hunters now than before the CRP was initiated). This phenomenon was in conflict with published literature on the effects of the CRP on waterfowl populations and hunting activity levels, and in conflict with information from interviews with biologists and game management personnel.

From 1975 through 1992, the change in RWH numbers was not consistent with changes in other hunting categories or consistent with duck breeding indexes. A thorough analysis of the cause of the decline in RWH numbers over the period is beyond the scope of this study, and the cause(s) were beyond the association between hunter numbers and game populations. The basic premise in this study was to associate the CRP-related wildlife habitat and corresponding influences on game populations to changes in hunter numbers. However, in the case of RWH, some other fundamental force(s) were causing a continued decline in hunter participation.

Without an in-depth analysis, the exact causes of the trend can not be determined. However, by comparing changes in pheasant and deer hunter numbers, some factors can probably be dismissed as the sole cause of the decline. Demographic changes within the state have been well documented (U.S. Department of Commerce *various years*). If the decrease in RWH was solely caused by population aging, rural out-migration, declining population, or other population-related measures, then some of the influence of those effects should have been evident in the trends associated with pheasant and deer hunter numbers. However, those hunter trends were increasing over the same period. Likewise, changes in pheasant and deer hunter numbers generally paralleled changes in wildlife population indexes. Decline in RWH numbers only partially paralleled changes in duck population indexes over the 1975 to 1992 period (Figure A1). However, since RWH numbers include goose hunting (i.e., dark and light geese), some of the change in overall waterfowl hunter numbers may be associated with changes in the number of goose hunters, and as a result, not necessarily directly tract changes in duck populations. Changes in the number of individuals who solely hunt geese would affect the number of RWH. The abundance and type of water habitat over the period, and how changes in those factors effect places to hunt waterfowl, may have played a role in the trend from 1975 to 1992. Other factors could include changes in bag limits, shot regulations, equipment costs, migration patterns, and hunter preferences. The scope of this study prevented an examination of all the possible factors for the sustained decrease in RWH numbers.

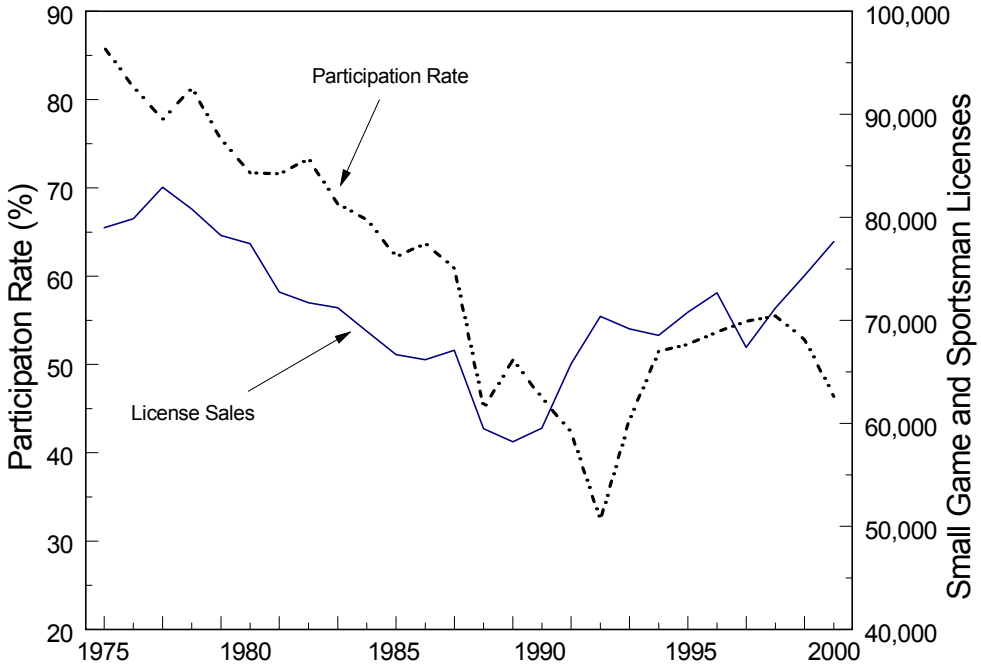
The number of RWH is a function of license sales and participation rates. Resident hunters are required to have a small game license to hunt waterfowl in the state. Although sales of small game licenses trended downward for much of the 1975 to 1992 period (Figure A2), license sales were not solely responsible for the decrease in hunter numbers. For example, a small game license was also required to hunt pheasants, and trends in pheasant hunting over the same period were increasing. Participation rates (i.e., the percentage of small game license holders who actually pursued waterfowl) also decreased over the period. Since the methodology used to estimate participation rates remained unchanged over the period (Schroeder 1976-1979, Johnson 1980-2001), procedures used to estimate RWH numbers can not credited with producing inconsistent estimates. Participation rates for RWH were very high (i.e., compared to current rates) in the mid 1970s (Figure A2). However, declining small game license sales and decreasing participation rates combined to produce a very consistent drop in RWH numbers from 1975 through 1992 (Figure A3). No apparent explanation was found for why the participation rate declined so rapidly over the period.




Appendix Figure A1. Average Duck Breeding Population Index and Resident Waterfowl Hunter Numbers, North Dakota, 1975 to 2000
Sources: ND Game and Fish Department (2001), Schroeder (1976-1979), and Johnson (1980-2001).

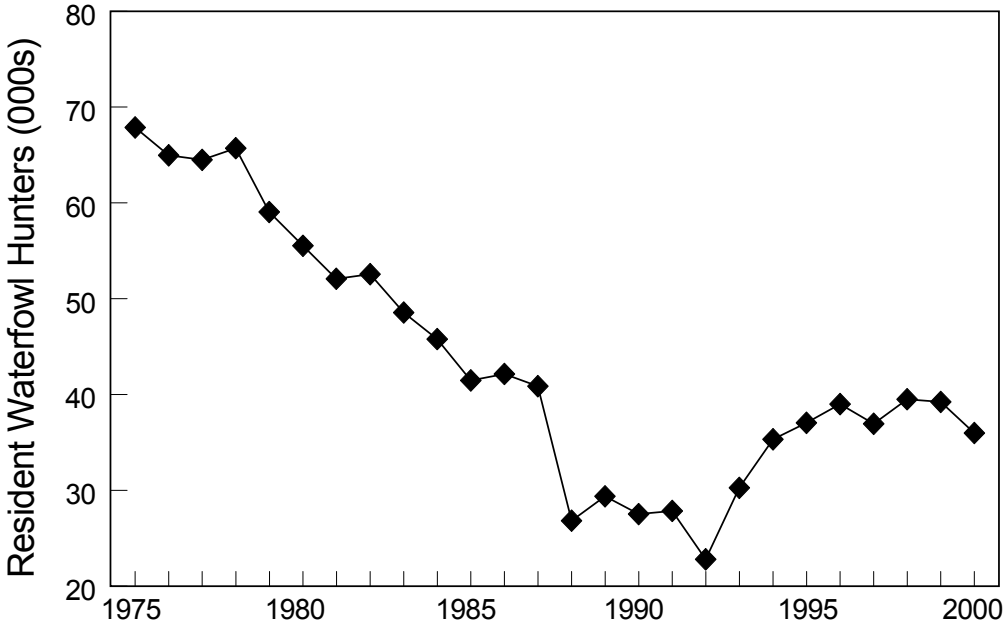
From 1975 through 1987, participation rates ranged from 61 to 86 percent. The average participation rate over the period was 73 percent. A major decrease in the participation rate was observed in 1988, and coincided with dry conditions in the state. In addition to a major drop in

the participation rate in 1988, rates continued downward from 1989 through 1992. Participation rates increased sharply after 1992. However, current participation rates remain well below historic averages. When evaluated from 1987 to 2000, the period corresponding with the CRP, participation rates show an increasing trend (Figure A4).

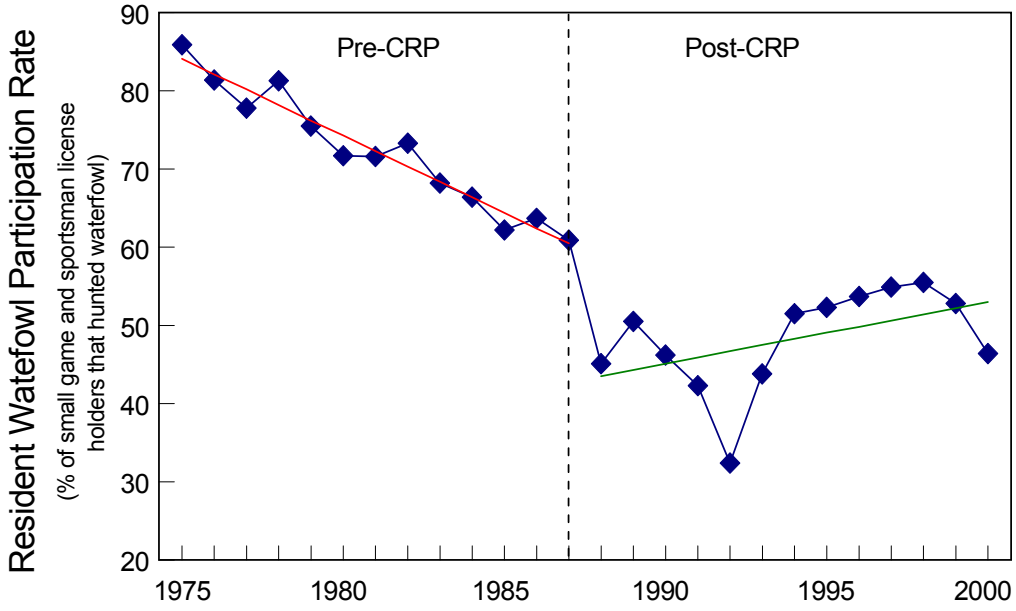



Appendix Figure A2. Resident Small Game and Sportsman License Sales, and Waterfowl Participation Rates, North Dakota, 1975 to 2000
Sources: ND Game and Fish Department (2001), Schroeder (1976-1979), and Johnson (1980-2001).

Small game license sales started to increase in the late 1980s. The turn around in license sales started shortly after the CRP was initiated. Although small game license sales increased in the late 1980s and early 1990s, participation rates continued to decline. Coinciding with the start of the state's wet cycle, participation rates started increasing. At the point when the CRP and the wet cycle coincided (i.e., circa 1993), a reversal occurred in the number of RWH. Had the CRP and the wet cycle not occurred over the same period, what would have happened to the number of RWH is difficult to predict. Thus, despite the cause for the sustained and rapid loss of RWH numbers from 1975 to 1992, the CRP and the wet cycle appear to coincide with a reversal of the trend.




Appendix Figure A3. Number of Resident Waterfowl Hunters, North Dakota, 1975 to 2000
Sources: Schroeder (1976-1979) and Johnson (1980-2001).




Appendix Figure A4. Resident Waterfowl Participation Rates, Pre-CRP and Post-CRP Trends, North Dakota, 1975 to 2000
Sources: Schroeder (1976-1979) and Johnson (1980-2001).

The trend in RWH numbers was evaluated over two periods, 1975-1987 (period of high participation rates) and 1975-1992 (entire period of sustained decline in hunter numbers). Change in RWH numbers were tested for both linear and nonlinear trends. Regression analysis of the number of RWH indicated the trend in both periods was linear and statistically significant (adjusted $R^2$ for 1975-1987 was 0.96 and adjusted $R^2$ for 1975-1992 was 0.97) ($P<0.0001$ F-test) (Figure A5). The trend in RWH numbers over the entire period (1975-2000) was found to be nonlinear and statistically significant (quadratic model had adjusted $R^2$ of 0.88) ($P<0.0001$ F-test) (Figure A6).

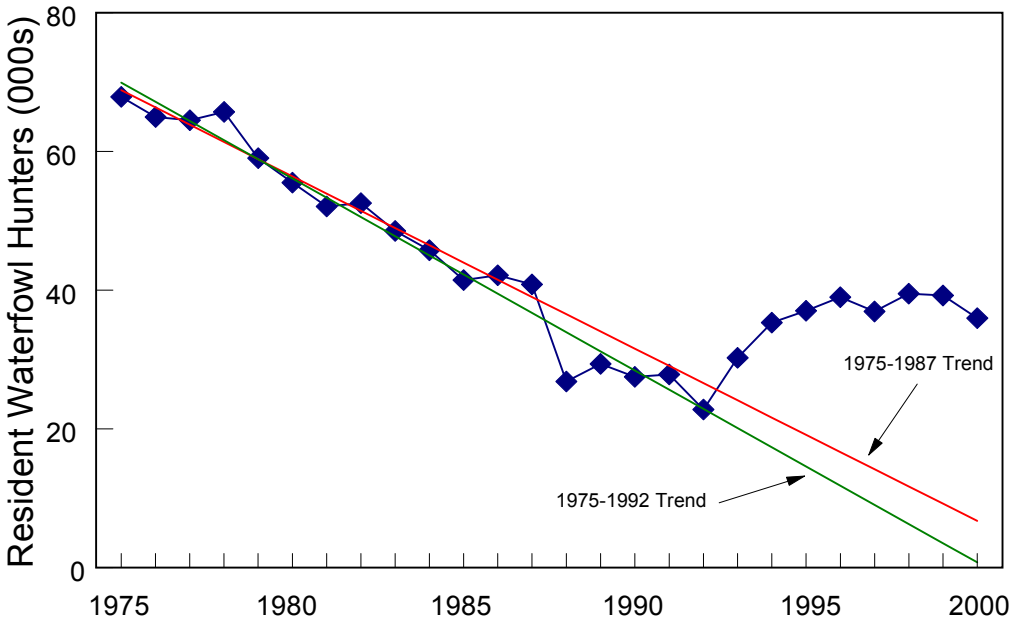
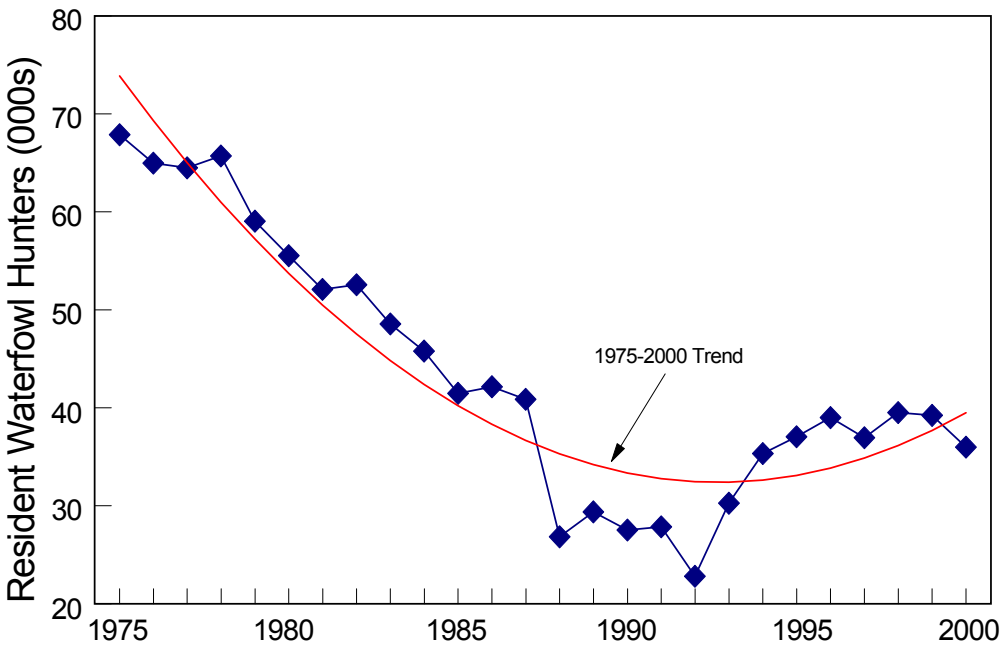
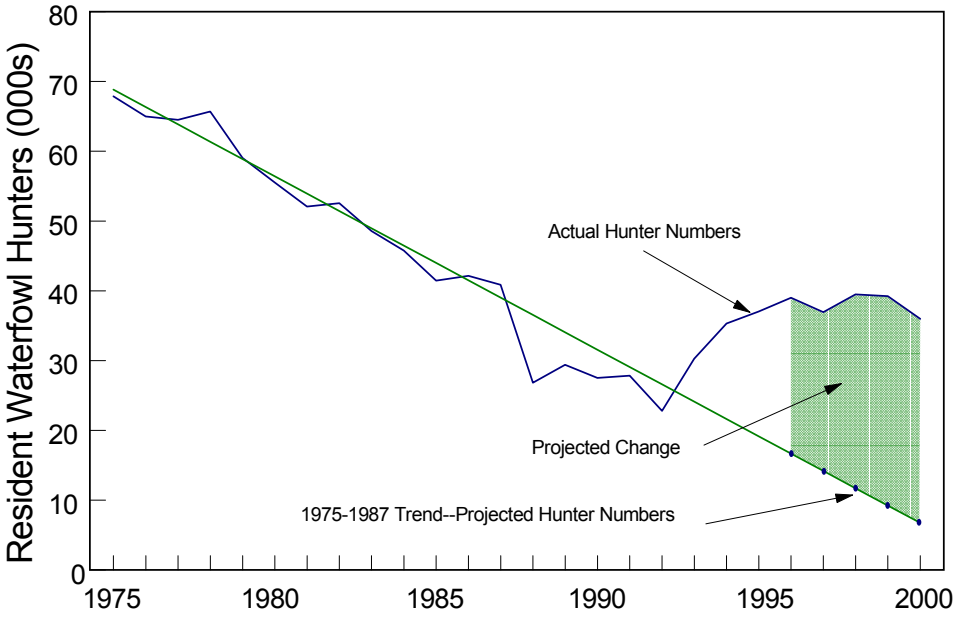



Figure A5. Number of Resident Waterfowl Hunters, Trends for 1975 to 1987 and 1975 to 1992, North Dakota
Sources: Schroeder (1976-1979) and Johnson (1980-2001).




Appendix Figure A6. Resident Waterfowl Hunters, Trend from 1975 to 2000, North Dakota
Sources: Schroeder (1976-1979) and Johnson (1980-2001).

Under the assumption that the CRP was not created and the wet cycle did not occur, and factors influencing the decrease in RWH numbers remained, it would be reasonable to expect that RWH numbers would have continued to decrease after 1992. Under that scenario, the number of RWH from 1993 to 2000 can be estimated using the trend models. Projections using the models indicate that under the above scenario, North Dakota would have had few RWH by 2000. Although the analysis can not confirm the causality of the CRP and the wet cycle, anecdotal evidence would suggest the presence of both factors influenced the long-term decrease in RWH numbers. For purposes of this study, the change in RWH numbers attributable to the CRP was based on comparing projected levels of hunter numbers to actual hunter numbers from 1996 through 2000 (Figure A7). The 1975-1987 model was used to project hunter numbers from 1996 to 2000, which resulted in more conservative projections than the 1975-1992 model. The projected number of RWH from 1996 through 2000 averaged about 11,717 individuals annually. The average actual number of RWH over the period was 38,142 annually. The average difference between projected and actual hunter numbers was 26,425 annually.




Appendix Figure A7. Projected and Actual Resident Waterfowl Hunter Numbers, North Dakota, 1975 to 2000

# APPENDIX B

## Agricultural Revenues

**Burke and Divide Counties**

| Crops | % of Land | Yield/Ac | Yld Adjust | Price | Sales | Gov Pmt | Total Rev |
|---|---|---|---|---|---|---|---|
| Spring Wheat | 14.0% | 24.5 | 7.1% | $3.11 | $9.90 | --- | --- |
| Durum | 53.6% | 26.9 | 7.1% | $3.34 | $44.80 | --- | --- |
| Barley | 4.7% | 41.3 | 7.1% | $1.79 | $3.21 | --- | --- |
| Alfalfa | 3.7% | 1.7 | 7.1% | $50.73 | $2.95 | --- | --- |
| Prevented Planted | 7.3% | --- | --- | $39.03 | $2.87 | --- | --- |
| Summerfallow | 16.7% | --- | --- | --- | --- | --- | --- |
| | 100.0% | | | | $63.73 | $15.64 | **$79.37** |

**McHenry, Pierce, and Sheridan Counties**

| Crops | % of Land | Yield/Ac | Yld Adjust | Price | Crop Sales | Gov Pmt | Total Rev |
|---|---|---|---|---|---|---|---|
| Spring Wheat | 39.5% | 25.2 | 7.7% | $3.14 | $28.89 | --- | --- |
| Durum | 8.5% | 23.3 | 7.7% | $3.24 | $5.96 | --- | --- |
| Barley | 13.8% | 45.8 | 7.7% | $1.69 | $9.81 | --- | --- |
| Oats | 4.1% | 33.2 | 7.7% | $1.00 | $1.24 | --- | --- |
| Oil Sunflower | 10.0% | 1,293.4 | 7.7% | $9.40 | $11.18 | --- | --- |
| Canola | 5.3% | 1,244.4 | 7.7% | $9.49 | $5.80 | --- | --- |
| Alfalfa | 9.8% | 1.9 | 7.7% | $51.46 | $8.77 | --- | --- |
| Prevented Planted | 9.1% | --- | --- | $29.25 | $2.65 | --- | --- |
| | 100.0% | | | | $74.31 | $21.76 | **$96.07** |

**Nelson, Eddy, and Griggs Counties**

| Crops | % of Land | Yield/Ac | Yld Adjust | Price | Crop Sales | Gov Pmt | Total Rev |
|---|---|---|---|---|---|---|---|
| Spring Wheat | 38.1% | 27.5 | 3.4% | $3.24 | $32.79 | --- | --- |
| Durum | 5.5% | 17.8 | 3.4% | $2.65 | $2.52 | --- | --- |
| Barley | 18.2% | 49.6 | 3.4% | $1.76 | $15.39 | --- | --- |
| Oil Sunflower | 11.6% | 1,384.2 | 3.4% | $9.70 | $15.01 | --- | --- |
| Nonoil Sunfolwer | 5.5% | 1,144.9 | 3.4% | $13.95 | $8.44 | --- | --- |
| Dry Edible Bean | 3.7% | 1,239.6 | 3.4% | $15.85 | $7.10 | --- | --- |
| Alfalfa | 5.1% | 2.1 | 3.4% | $50.26 | $5.21 | --- | --- |
| Canola | 3.9% | 1,200.9 | 3.4% | $9.23 | $4.15 | | |
| Soybeans | 3.6% | 24.9 | 3.4% | $5.18 | $4.42 | | |
| Prevented Planted | 4.8% | --- | --- | $36.30 | $1.74 | --- | --- |
| | 100.0% | | | | $96.77 | $31.59 | **$128.36** |

**Kidder, Logan, and Stutsman Counties**

| Crops | % of Land | Yield/Ac | Yld Adjust | Price | Crop Sales | Gov Pmt | Total Rev |
|---|---|---|---|---|---|---|---|
| Spring Wheat | 43.9% | 26.9 | 1.7% | $3.22 | $37.37 | --- | --- |
| Durum | 6.2% | 18.1 | 1.7% | $2.98 | $3.28 | --- | --- |
| Barley | 9.9% | 50.2 | 1.7% | $1.73 | $8.46 | --- | --- |
| Oats | 5.0% | 32.6 | 1.7% | $0.94 | $1.50 | --- | --- |
| Oil Sunflower | 12.5% | 1,348.9 | 1.7% | $9.43 | $15.59 | --- | --- |
| Alfalfa | 16.7% | 1.8 | 1.7% | $50.57 | $15.29 | --- | --- |
| Prevented Planted | 5.9% | --- | --- | $38.48 | $2.25 | --- | --- |
| | 100.0% | | | | $83.75 | $24.55 | **$108.30** |

**Adams, Bowman, and Hettinger Counties**

| Crops | % of Land | Yield/Ac | Yld Adjust | Price | Crop Sales | Gov Pmt | Total Rev |
|---|---|---|---|---|---|---|---|
| Spring Wheat | 55.3% | 28.5 | 7.2% | $2.97 | $43.54 | --- | --- |
| Durum | 9.8% | 30.2 | 7.2% | $3.02 | $8.33 | --- | --- |
| Barley | 4.0% | 40.1 | 7.2% | $1.69 | $2.53 | --- | --- |
| Oats | 3.8% | 24.6 | 7.2% | $0.86 | $0.74 | --- | --- |
| Alfalfa | 14.8% | 1.5 | 7.2% | $51.37 | $10.81 | --- | --- |
| Summerfallow | 12.2% | --- | --- | --- | --- | --- | --- |
| | 100.0% | | | | $65.94 | $20.18 | **$86.12** |

**Ransom and Sargent Counties**

| Crops | % of Land | Yield/Ac | Yld Adjust | Price | Crop Sales | Gov Pmt | Total Rev |
|---|---|---|---|---|---|---|---|
| Spring Wheat | 35.2% | 36.0 | 6.2% | $3.27 | $38.83 | --- | --- |
| Oil Sunflower | 6.6% | 1,396.4 | 6.2% | $10.15 | $8.81 | --- | --- |
| Dry Edible Bean | 4.3% | 1,383.7 | 6.2% | $16.21 | $9.01 | --- | --- |
| Corn | 18.3% | 88.2 | 6.2% | $2.03 | $30.70 | --- | --- |
| Soybeans | 25.5% | 32.5 | 6.2% | $5.15 | $40.00 | --- | --- |
| Alfalfa | 4.4% | 3.1 | 6.2% | $50.93 | $6.50 | --- | --- |
| Prevented Planted | 5.8% | --- | --- | $50.86 | $2.95 | | |
| | 100.0% | | | | $136.79 | $33.30 | **$170.10** |

## Hayland Revenues (post-CRP land use)

| | Adjusted 5-Year Avg Yield (tons) | $/ton | Per Acre Revenue |
|---|---|---|---|
| **Burke and Divide** | 1.27 | $30.84 | $39.22 |
| **McHenry, Pierce, and Sheridan** | 1.48 | $30.84 | $45.76 |
| **Nelson, Eddy, and Griggs** | 1.59 | $30.84 | $49.03 |
| **Kidder, Logan, and Stutsman** | 1.80 | $30.84 | $55.57 |
| **Adams, Bowman, and Hettinger** | 1.17 | $30.84 | $35.96 |
| **Ransom and Sargent** | 1.91 | $30.84 | $58.84 |

## Pasture Revenues (post-CRP land use)

| | AUMs per Acre | $/AUM | Per Acre Revenue |
|---|---|---|---|
| **Burke and Divide** | 0.97 | $14.53 | $14.09 |
| **McHenry, Pierce, and Sheridan** | 1.12 | $15.47 | $17.33 |
| **Nelson, Eddy, and Griggs** | 1.20 | $15.56 | $18.67 |
| **Kidder, Logan, and Stutsman** | 1.36 | $19.08 | $25.95 |
| **Adams, Bowman, and Hettinger** | 0.88 | $21.88 | $19.25 |
| **Ransom and Sargent** | 1.54 | $20.86 | $32.12 |