Using Input-Output (I-O) Analysis in Evaluating Conservation Programs And Projects: Lessons Learned from Evaluation of the Conservation Reserve Program (CRP)[1]

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The prospect of changes in land use, such as those associated with conservation programs and projects, often leads to questions about the local and regional economic impacts likely to result from these changes. While alternative techniques for estimating the economic impacts of projects and programs are available, input-output models are being used increasingly for these types of evaluations (Leistritz). This paper describes the use of input-output modeling in estimating the economic impacts of the conservation reserve program (CRP) in North Dakota, discusses challenges faced in conducting the analysis, and examines lessons learned from the study.

CRP Study

The Conservation Reserve Program (CRP) was authorized by the 1985 Food Security Act (Public Law 99-198). Its major objective was to take highly erodible land out of agricultural production, thereby reducing wind and water erosion, protecting long-term food-producing capability, reducing sedimentation, improving water quality, creating wildlife habitat, curbing excess crop production, and providing income support for farmers. Landowners wishing to participate in CRP agreed to implement a conservation plan that provided for permanent vegetative cover on the land for ten years. In return, the federal government paid the landowner an annual contract payment determined by a bidding process (Mortensen et al. 1990).

Participation in CRP was high in North Dakota. Through the twelfth sign-up period (1992), North Dakota ranked second among all states with 3.2 million acres, or 11 percent of the state's cropland, under CRP contracts (Osborn et al.). Because of the high level of participation in CRP, as well as previous experience with the "Soil Bank" program of the 1950s, policymakers raised questions about the possible economic impacts of the CRP program. Potential impacts that were identified included those that could arise from (1) reductions in use of agricultural inputs such as fuel, fertilizer, and chemicals; (2) reduction in use of farm labor and machinery; and (3) long-term changes in land use if CRP land were not returned to crop production at the end of the contract period. The analysis reported here was undertaken to estimate the short-run economic impacts of the CRP program in North Dakota (i.e., those arising from reductions in use of agricultural inputs).

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Procedures

The study had two major phases. First, a statewide survey of CRP participants was conducted to determine selected characteristics of those individuals and their enrolled land that would be important for subsequent impact estimation. These characteristics included land attributes (such as comparison of costs and returns and soil productivity to those of non-CRP land in the area, comparison of CRP payments to local cash rents, cover option chosen, and cost of cover establishment) and landowner characteristics (such as age, residency, level of farm income, and use of CRP payments). A questionnaire was mailed to nearly 3,000 randomly selected landowners in North Dakota (approximately 40 percent of all participants through the fifth sign-up) in March 1988. Follow-up mailings resulted in 1,289 useable surveys for a response rate of 44 percent. Response rates were quite similar for each of the state's five pool groups (i.e., geographic groupings of counties based on similarity of soil and climatic conditions).

Key survey results were tabulated, then a regional input-output model, previously developed from primary data and consisting of 17 sectors, was used to estimate the indirect effects of the CRP program for each of the state's five pool groups. (For a detailed description of the model, see Coon et al.) An important prerequisite to providing these indirect effects was estimating the direct effects of program participation on farm expenditures and income. Sectors expected to experience direct effects were as follows:

1. The *retail trade* sector (fertilizer, fuel, oil, seed, chemicals, machinery, hardware);
2. The *finance, insurance, and real estate* sector (crop insurance, property insurance, borrowed capital);
3. *Business and personal services* (machinery repairs, custom farm operations, legal and accounting services); and
4. The *household* sector (net income from farm operations, payments to hired labor, CRP contract payments).

The procedures used to estimate these changes in expenditures are summarized in Figure 1. Three main sources of data were used to estimate expenditures changes: (1) county CRP survey data (Mortensen et al. 1988), (2) North Dakota agricultural statistics, and (3) county data from the state Agricultural Stabilization and Conservation Service (ASCS)(now Consolidated Farm Service Agency). Initially compiled on a county-by-county basis, the resulting estimates fall into three main categories: (1) reduced input expenditures, (2) reduced federal commodity payments, and (3) increased CRP contract payments and upkeep costs, all based on acres enrolled through the fifth sign-up (1.3 million acres, statewide). (For a more detailed discussion, see Mortensen et al. 1989.)

After the change in business activity resulting from the CRP program had been estimated for each sector, the resulting change in employment was estimated based on historic relationships between employment and gross business volume in each sector.

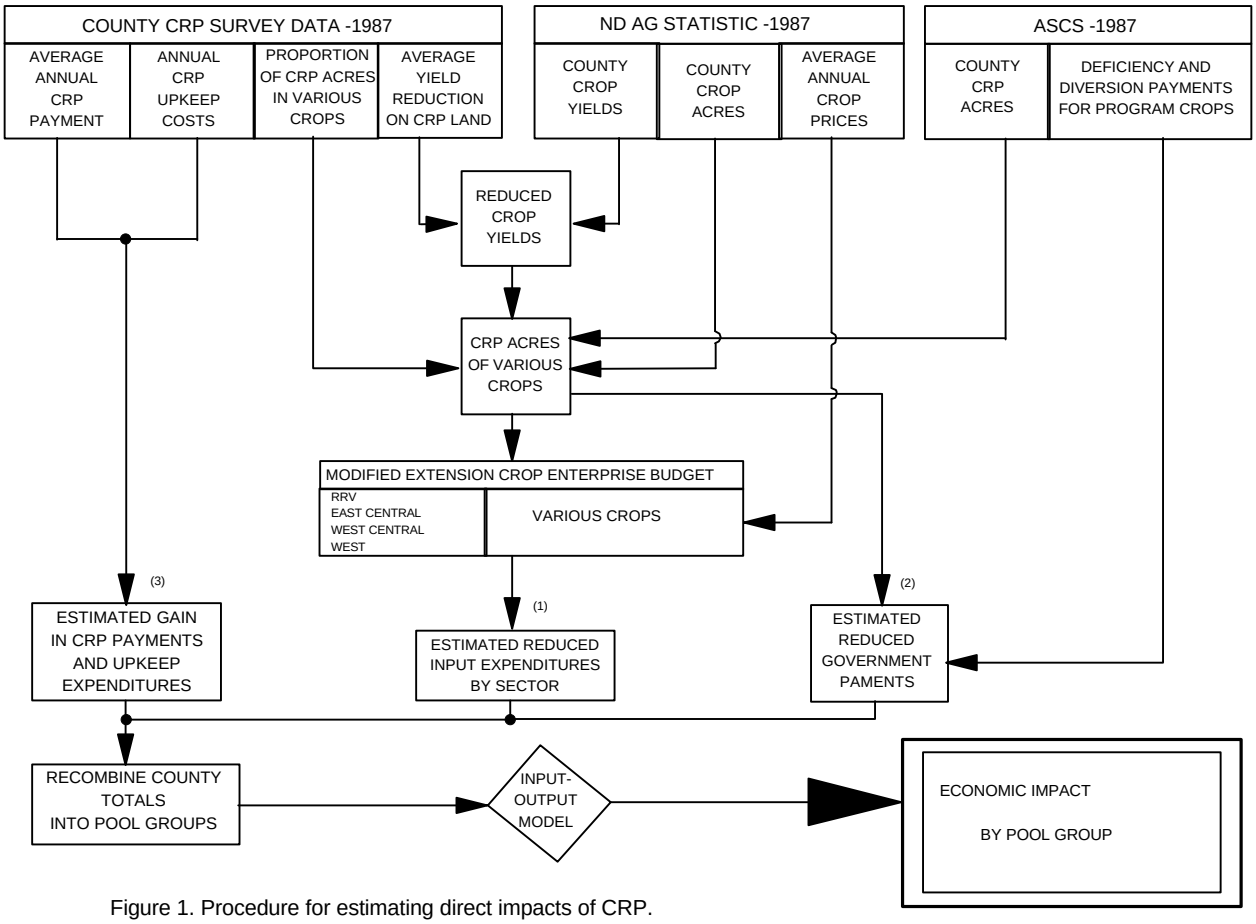


Figure 1. Procedure for estimating direct impacts of CRP.

Results

CRP participants generally felt their CRP land was less productive than other land in the area and that input costs were slightly higher (Table 1). (Unless otherwise noted, the values shown are the mean for all survey respondents.) CRP contract payments were felt to be 6.7 percent higher, on average, than prevailing cash rental rates in the area. The initial cost of establishing CRP cover averaged $37.20 per acre with more than 42.4 percent of responses falling between $30 and $40. Annual maintenance costs averaged $6.92 per acre, while annual contract payments averaged $36.98. More than 60 percent of all contracts had annual payments of $30 to $40.

The average age of CRP landowners was 57 years, and 90 percent lived in North Dakota (Table 1). About 73 percent of respondents had farmed either full- or part-time in 1987. For the farmers, the average gross farm income for 1987 was just over $94,000, or about 20 percent less than that reported for that year by a statewide longitudinal farm panel (Leistritz et al.). The average net cash farm income of $16,259 was about 22 percent less than that for the farm panel. For 41 percent of these producers, their CRP income exceeded their net cash farm income, and about 21 percent said that the program enabled them to continue farming.

The majority of survey participants (54.5%) intended to use their CRP payments for living expenses. Other uses of the CRP income were (1) paying CRP land debt (28%), (2) paying other debt (24.5%), and (3) savings or investment (22%). About 14 percent intended to use part or all of their annual payments to retire in North Dakota, whereas only 3.5 percent planned to use their payments to retire out of state. Likewise, about 10 percent and 3.5 percent intended to use their payments for leisure activities in-state and out-of-state, respectively.

Reduced direct expenditures caused by taking CRP land out of production totaled $55 million for the state with nearly 62 percent impacting the *retail* sector (Table 2). Pool groups two, four, and five had the highest net impact at about $12 million each. The *household* sector was positively affected in pool groups one, two, and three primarily because the CRP rental payments exceeded the farm income and government program payments that were foregone.

The direct effects were applied to the input-output model to estimate the total impact of the CRP program. Table 3 summarizes baseline business activity (i.e., estimated gross business volume or gross receipts of the respective sectors for the period 1980-87); the changes in business activity associated with CRP-related reductions in expenditures; increases in household incomes; and the net effect of the CRP program on business activity in each sector. The $55 million in direct effects resulting from the CRP result in about $141 million in reduced business activity for the state--an overall multiplier of 2.56. This total is spread among 13 sectors of the state's economy with the retail sector absorbing the greatest impact--about 40 percent of the state total.

Table 1. Selected Characteristics of CRP Land and Participants, North Dakota, 1988

Item	Units	Value
Yields--CRP land compared to land not in CRP	Percent	-9.5
Input costs--CRP land compared to land not in CRP	Percent	0.5
CRP contract payment compared to cash rent	Percent	6.7
Costs per acre to establish CRP cover	Dollars	37.20
Costs per acre to maintain CRP cover	Dollars	6.92
Annual CRP contract payment	Dollars	36.98
Type of CRP cover:		
Grass and/or legumes	Percent	91.0
Trees (on part of area)	Percent	9.0
Landowner age	Years	57.2
Landowner residence:		
North Dakota	Percent	90.0
Bordering states	Percent	4.2
Elsewhere	Percent	5.8
Landowner occupation:		
Farmer	Percent	73.0
Other	Percent	27.0
Gross farm income, 1987 (farmers only)(ave.)	Dollars	92,440
Net cash farm income, 1987 (farmers only)(ave.)	Dollars	16,259
CRP payment as a percent of net farm income:		
Over 100 percent or net farm income was negative	Percent	40.6
50 to 100 percent	Percent	13.2
26 to 50 percent	Percent	18.5
0 to 25 percent	Percent	27.8
Did the CRP program enable you to continue farming?		
Yes	Percent	20.6

Table 2. Acres Enrolled in CRP and the Associated Loss of Production Expenditures and Change in Income, by CRP Pool Group, 1987

Pool Group	Acres Through 5th Sign-up	Reduced Expenditures			Change in Income
		Retail	FIRE*	B&P Serv	Households
		----------Thousand Dollars----------			
1	244,518	-4,940	-1,787	-1,619	10
2	381,409	-8,539	-3,074	-2,649	2,033
3	260,548	-6,563	-2,406	-1,961	755
4	240,997	-7,986	-2,541	-1,950	-92
5	174,975	-7,262	-2,112	-1,772	-1,448
State	1,302,048	-35,291	-11,919	-9,951	1,258
State Total Percentage of Reduced Expenditures		61.7%	20.9%	17.4%	

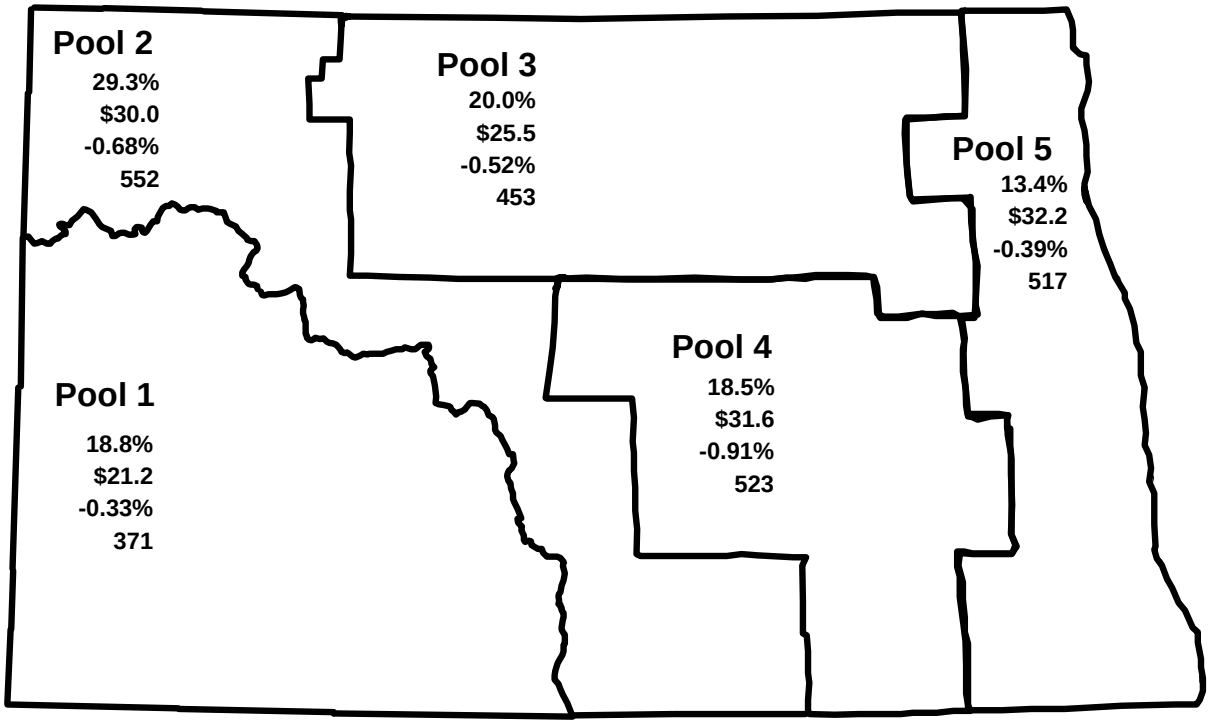
*Finance, Insurance, and Real Estate

Table 3. Average 1980-1987 Baseline Business Activity and Business Activity Associated with Reduced Production Expenditures and Income Change Resulting from CRP Acres by Economic Sector, North Dakota, 1987

Sector	Baseline Business Activity*	CRP Business Activity		
		Production Expenditures	Income Change	Net Change
	----------thousand dollars----------			
Ag. livestock	1,406,058	-4,254	85	-4,169
Ag. crops	3,662,184	-1,709	33	-1,676
Nonmetal mining	49,420	-186	7	-179
Construction	730,076	-2,650	113	-2,537
Transportation	91,330	-627	12	-615
Comm. & pub utilities	659,314	-4,540	133	-4,407
Ag proc & misc mfg	2,143,329	-2,670	52	-2,618
Retail trade	5,321,801	-57,505	937	-56,568
FIRE	1,110,927	-16,731	211	-16,520
Bus & pers services	488,715	-12,056	76	-11,980
Prof & soc services	521,151	-2,442	124	-2,318
Households	7,955,811	-35,685	1,953	-33,732
Government	679,028	-3,437	136	-3,301
Coal mining	134,774	0	0	0
Thermal elec generation	225,900	0	0	0
Petroleum exp/extraction	883,623	0	0	0
Petroleum refining	120,864	0	0	0
Total	26,247,305	-144,492	3,872	-140,620

*Baseline business activity is based on the 1980-1987 average sales for final demand in terms of 1987 = base dollars.

Among the county groupings, pool group five had the largest absolute impact from the CRP, reflecting the more intensive nature of agriculture in eastern North Dakota (Figure 2). Pool group four, on the other hand, had the greatest percentage impact. In no case, however, did the CRP impact exceed 1 percent of the area's baseline business volume. Employment effects of CRP were distributed somewhat differently than effects on gross business volume; pool group two had the largest total impact. Although the total CRP-related potential employment reduction was estimated to be only 2,416 jobs statewide, or about 0.77 percent of average annual employment in 1987, it should be noted that much of this employment loss may be concentrated in the state's most agriculturally dependent rural areas--areas already hard-hit by reductions in retail trade volume and employment stemming from the depressed state of the agricultural economy.



Key: **CRP acres as a percent of state total**
Total CRP impact in million dollars
CRP impact as a percentage of the pool's baseline
CRP-related employment change

Figure 2. Economic and employment impacts of CRP on various pool groups.

The results of this analysis indicated that the impacts of the Conservation Reserve Program on the North Dakota economy were relatively modest. Based on the 1.3 million acres removed from production through the fifth sign-up, total business activity was reduced by only 0.54 percent statewide and 0.91 percent for the most affected region. Assuming that the impacts would be proportional on a per acre basis, the additional acreage enrolled through the twelfth sign-up (3.2 million acres total) would result in a statewide impact of about 1.3 percent. However, it should be noted that the impacts were not distributed uniformly among sectors or communities. Rather, the retail sector accounted for more than 40 percent of the total impact of the program, and within the retail sector, businesses that relied on farm supplies or machinery for much of their volume were affected much more than others. Similarly, because CRP enrollment varied substantially among counties, those with higher percentages of their land enrolled obviously experienced greater impacts.

In addition to the negative effects resulting from initial reductions in agricultural activities, the program has a number of positive aspects. One very noticeable benefit of CRP in the Northern Great Plains region has been enhanced wildlife habitat, which has contributed to substantial increases in upland game bird and waterfowl populations (see, for example, *Grand Forks Herald*). Increased wildlife populations have in turn led to increases in hunting by both resident and nonresident sportsmen, which results in substantial recreation-related expenditures in rural areas (Lewis et al.). Another positive aspect of the program has been its contribution to income stability for the participating landowners. During a period when the region's farmers and landowners experienced adverse weather and market conditions, CRP income had a cushioning effect for both landowners' income and for the economic base of the region's rural communities.

Lessons Learned

In retrospect, the CRP study appears to have served its purpose in informing the region's decision makers regarding the short run economic implications of the program. While the initial effects of reduced agricultural production activities were negative, the analysis revealed that these effects were relatively modest. In particular, the extent to which CRP payments were being received by out-of-state landowners was found to be substantially less than had been commonly believed. At the same time, the study demonstrated the program's role in providing income stability for program participants, and thus indirectly enhancing the economic stability of rural communities.

While an input-output model was the analytical core of the study, much of the overall effort was directed toward defining the direct effects of the program. The survey of participants represented the majority of the total project cost, and the survey results provided insights that would otherwise have been unavailable. This experience would support the more general observation that analysts should allocate adequate resources to determining the direct effects of the project or program being evaluated.

In conclusion, input-output models are a valuable tool for estimating the economic impacts of conservation programs and projects. When used appropriately in conjunction with other social science research tools and techniques, I-O models can make a useful contribution to policy makers' understanding of program implications.

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