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CRP Entry Costs on Southern Minnesota Farms

by

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Introduction

The federal Conservation Reserve Program (CRP) pays farmers not to grow crops on highly erodible land. The program is voluntary: interested producers agree to plant soil-conserving cover crops on eligible land in exchange for an annual per-acre payment. The agreement--in effect a long-term rental of cropping rights--runs for ten years.

In this report, we use a simple farm-level partial budgeting model to examine the short-term financial effects of entering southern Minnesota farmland into the CRP. We focus on how required shifts in cropland allocation alter farm income. In doing so, we ignore other factors that might also be critical. For example, we do not take into account the release of labor resources that land retirement brings about. Presumably, less land in crops means more labor freed up for other farm enterprises, off-farm employment, or leisure. Nor do we account for the longer run possibility of capital freed from its current employment.

The analysis is on a one-year, net-cash-flow basis. We do not try to predict either the scale or the scope of federal farm programs in future years, nor do we suggest that current price conditions will continue unchanged.

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This is not a "What you should bid for the CRP" report. It is an examination of current-year costs and returns of the CRP entry decision, using southern Minnesota commercial farm data for illustration.

The Model

The economic impacts of CRP entry are quite sensitive to the particulars of individual farm operations. To examine entry costs on a set of hypothetical farms, we hold prices, yields, and planting costs fixed and vary only the crop mix and the size and composition of the commodity crop bases. We use a simple model of farm operation, one which calculates changes in net cash returns--the simple aggregate of individual crop and CRP revenues less associated production and land maintenance costs--brought about by CRP entry. Revenues come from market receipts and output-related government payments. Production costs are those avoided if an acre is not planted. We assume no change in machinery and equipment ownership, and we examine first-year net revenues only. We hold yields fixed as well. (Established ASCS yields are frozen under current law, and expected yields are unlikely to change significantly under plausible scenarios.) We show later the effects of relaxing some of these assumptions.

The model is only briefly described here. Its mathematical formulation is developed in the Appendix. A detailed spreadsheet version--which can be adapted for local price, crop, and cost conditions--is available at each county office of the Minnesota Extension Service.

The critical action of the model is the predictable manner in which CRP entry affects cropland allocation. Program crops, non-program crops, and idled land are the three important categories.

Changes in permitted plantings of program crops: Farmers participating in federal crop programs (80-90% of Minnesota farmers) are allowed to plant no more of a program crop than a particular proportion of their established base in that crop. (Commodity crop acreage bases are not geographic designations: they are accounting entities used to determine government payments and to limit program crop production.) By law, CRP entry reduces a farm's aggregate acreage base by the ratio of the number of CRP acres to the total number of cropland acres on the farm. We call this requied reduction the "base bite." For example, a 25 acre CRP entry reduces a 400-acre farm's aggregate base by 25/400, or 6.25%.

The base bite in turn reduces "permitted plantings," the legal maximum acreage planted to a program crop. This reduction in permitted plantings causes both government payments and crop marketings to decline as well, declines which are also part of the "cost" of CRP entry considered here.

The landowner is permitted to allocate the required base bite among any or all established bases on the farm. Since the bite reduces revenues proportional to the acres reduced and to foregone receipts (both government and market), it pays the farmer to allocate as much of the bite as is possible to bases which are the least lucrative. In the examples used here, wheat and oats bases return less per acre than does corn base; consequently, farmers are presumed to "bite" these bases first, if available.

Changes in amount of idled land: In our analysis, we assume that participating farmers plant to each program crop all they are legally permitted to--no more, no less. Under current (December 1987) law, land equivalent to 20% of the feed grain base and 27.5% of the wheat base must be idled, or "set aside." If any base is reduced through the base bite, therefore, the idle land requirement is also reduced. For example, if a 50 acre wheat base is reduced to 40 acres by the base bite, the idle land requirement associated with wheat base declines from 13.75 acres to 11.0 acres. This decline reduces the cost of CRP entry, because total set-aside maintenance costs thereby decline as well.

Changes in planting levels of other crops: Two factors combine to influence the amount of land available for non-program crops after CRP, program crop, and set-aside allocations have been made. The direct effect of CRP entry, of course, is to reduce the total amount of land available for cropping. However, as we showed above, the CRP through the base bite indirectly reduces the amount of land planted to program crops and also reduces the amount idled under set-aside requirements. This reduction acts to increase the proportion of land available for non-program crops. The net effect of these two forces, however, is always negative--each acre entered into the CRP reduces land available for non-program crops by a particular fraction of an acre. This associated decline in non-program crop revenue is also counted as a cost of CRP entry.

Total CRP entry costs: The overall cost of CRP entry, then, is the sum of reductions in receipts from program and non-program crops less the associated reductions in planting and maintenance costs on planted and idled lands. These must be compared against annual CRP payments less maintenance costs.

CRP Costs on Six Farms

To get an idea of the relative sizes of these costs and returns, we analyze CRP entry on the six representative southern Minnesota farms shown in Table 1. Acreage allocations are hypothetical; production costs and yields are drawn from the files of the South-East and South-West Minnesota farm records assocations. Prices are December 1987. Each farm has 400 acres in total cropland, all of which is assumed potentially eligible for CRP entry. (This is a simplifying assumption. On most farms, only some fields meet CRP eligibility criteria.) Each farm faces identical price and cost patterns for corn, wheat, and soybeans (Table 2). (Later we examine other crop mixes.) The farms vary only in the size and make-up of their commodity program crop bases. We consider both a relatively small (25 acres) and a relatively large (200 acres) CRP entry.

The change in net farm cash returns attributable to CRP entry on each farm is reported in Table 3. These are average costs for each CRP acre entered, so they can be compared to the flat per-acre payment that the government offers. For example, a 25 acre CRP entry on farm B reduces net cash returns by $171.58 for each CRP acre. A compensating CRP payment of $80/acre, say, would result in an effective cost of entry of $91.58 per CRP acre.

Two factors intermingle to yield the results in Table 3. The first is that each farm has a unique "base ratio," its total cropland divided by aggregate crop base. The base ratio affects the relative impact of the base bite on crop allocation--the higher the base ratio, the larger the base bite. Whether or not CRP costs increase with the bite depends upon

Table 1: Distribution of commodity acreage bases (acres). Six representative farms.

Farm	Total Cropland	Corn Base	Wheat Base	Aggregate Base
A	400	100	0	100
B	400	100	50	150
C	400	200	0	200
D	400	200	50	250
E	400	300	0	300
F	400	300	50	350

Table 2: Price, cost, and yield assumptions

<u>Prices</u> (dollars/bushel)

corn (market)	: 1.82
corn (target)	: 3.03
wheat (market)	: 2.28
wheat (target)	: 4.38
soybeans (market)	: 5.80

<u>Yields</u> (bushels/acre)

corn (expected)	: 120
corn (established)	: 100
wheat (expected)	: 42
wheat (established)	: 37
soybeans (expected)	: 40

<u>Production costs</u> (dollars/acre)

corn production	: 125
wheat production	: 60
soybean production	: 70
set-aside maintenance	: 11
CRP establishment and maintenance (annualized over 10 years)	: 7.75

the relative returns of program and non-program costs. Farmers are presumed to have incentives sufficient to plant all permitted acres, regardless of returns relative to non-program crops.) Examination of Table 3 shows that CRP costs on farms with only corn base (farms A, C, and E) increase as the base ratio increases, while the reverse is true on farms which can apply the bite to a wheat base (farms B, D, and F). What's happening here is that higher base ratios mean higher base bites and associated larger reductions in program crop plantings. The higher the ratio, the more CRP entry reduces plantings in program crops and the less in non-program crops. So if a program crop like wheat returns less per acre than beans, then CRP entry costs more for farmers with low base ratios. This is because soybean plantings are reduced proportionately more. The reverse is true if the program crop is corn, which returns more per acre than beans.

Table 4 shows how a 200 acre CRP reduces crop acreages on farm B,D, and F. The larger the base ratio, the more that plantings to program crops like corn and wheat are reduced. For example, the 200 acre CRP reduces soybean plantings by 125 acres on farm B, but only 25 acres on farm F. Taken alone, this ought to result in an average cost of CRP entry on farm F less than that for farm B. However, at the same time, corn acreage is reduced by 100 acres on F and only 20 on B, due to the base bite. The combined affect is a slight <u>increase</u> in cost for farm F over farm B.

The other factor at play here is the presence or absence of wheat base. This base is less lucrative than corn base in our examples, so it pays the farmer to allocate as much of the base bite as possible to the wheat base.

Table 3: Reduction in total farm net cash returns (dollars per CRP acre entered)

Farm	25 acre CRP	200 acre CRP
A	$171.58	$171.58
B	138.71	150.20
C	173.41	173.41
D	118.02	151.80
E	175.24	175.24
F	97.33	153.30

Table 4: Cropland allocations (acres). 200 acre CRP

Farm	B		D		F	
Corn Base	100		200		300	
Wheat Base	50		50		50	
	No CRP	CRP	No CRP	CRP	No CRP	CRP
Corn Plantings	80	60	160	100	240	140
Wheat Plantings	36	0	36	0	36	0
Soybean Plantings	250	125	150	75	50	25
Idled Land	34	15	54	25	74	35
CRP Land	0	200	0	200	0	200
TOTAL	400	400	400	400	400	400

Once the wheat base is used up in this manner, additional CRP acres will bite into the more lucrative corn base, and the average net cost of entry will rise.

This second factor can be demonstrated by examining marginal costs, the cost of one additional acre of CRP entry. We are most interested in any change in marginal costs when CRP entry increases past the "break point," the amount of CRP entry that just uses up the less lucrative base through the base bite. Each CRP acre after that bites into the corn base, so the cost of entry shifts significantly once past the break point. We show this, for the three farms that have both corn and wheat bases, in Table 5.

The combination of these factors--the influence of the base ratio, the importance of relative crop returns, and the shift in marginal costs--is shown in Table 6, which shows CRP costs for various CRP entries on farm D. As CRP entry levels increase past the break-point (80 acres), the overall average CRP cost also increase, due to the increasing bite on the corn base. Prior to that point, the average cost curve is flat. Note that the per-acre CRP cost shown for soybeans is unaffected by increasing CRP entry. This is because the calculated reduction in returns allocated to beans by the model is the same for each acre of CRP entry, even though the number of acres planted to soybeans is inversely proportional to CRP size.

Discussion

For current CRP payment levels to fully compensate a farmer for reduced income, the farm must return considerably less per acre than those in our illustrations. It is not enough to have some "marginal" land to put into the CRP: analysis of CRP entry must consider the financial effects on the farm operation as a whole.

It might be argued that retiring "marginal" CRP land will necessarily increase expected average yields on the remaining ("better") land. This would be true _if_ CRP land and set-aside land are both of lower quality than remaining planted land. It could be true for agronomic reasons, as well, if inputs freed by retired acres go instead to increase yields on remaining land. Expected yields, if allowed to increase in the model, will increase per-acre market revenues, as long as costs remain the same or increase at a slower rate. The extent to which this also dampens the cost of CRP entry depends upon the extent to which lower plantings after the base bite are countered by higher per-acre yields.

What about a different mix of crops? The corn-wheat-soybean farms of our examples are more representative of southwestern than of southeastern Minnesota. Table 7 looks at a 200 acre CRP entry on corn-oats-alfalfa farms with the same base configurations as farms B, D, and F, above. Results from Table 3 are repeated for comparison. (Revenues for oats do not include hay.) The cost of the CRP is over $140/ac. on all three farms.

So far, we have held fixed a great many prices and costs that could reasonably be expected to vary over time and across farms. We here examine variations in market or on-farm conditions. Table 8 shows how the total CRP cost would vary if our price and yield assumptions for farm D (corn-wheat-soybeans) were systematically altered. The cell "100%-100%" shows the current calculated CRP cost ($151.80). If prices for all crops were 10% higher and expected yields 10% higher than we assumed, for

Table 5: Costs of CRP entry below and above the point where wheat base is exhausted. (Reduction in net returns per CRP acre entered.)

		CRP cost	
Farm	Break Point	Below B.P.	Above B.P.
B	133 acres	$138.71	$278.32
D	80	118.02	237.82
F	57	97.33	197.32

Table 6: Effect of CRP size on CRP costs. Farm D. (Reduction in net returns per CRP acre entered.)

	CRP cost allocation (dollars/acre)			
CRP acres	Corn	Wheat	Beans	Total
25	$ 0	$57.27	$60.75	$118.02
75	0	57.27	60.75	118.02
125	40.89	36.65	60.75	138.29
175	61.65	26.18	60.75	148.59
225	73.19	20.36	60.75	154.31

example, the CRP cost would be $187.40. The calculated CRP cost is obviously sensitive to price and yield assumptions, as would be expected.

One could also use Table 8 to characterize farms that might find current CRP payment rates enticing. For example, farm D would break even at a CRP payment rate of $85/acre if expected yields were less than 90% <u>and</u> expected prices less than 85% of those assumed in this report.

This analysis has been conducted under the assumption that farmers would enter none, some, or all of the eligible land into the CRP, depending upon expected changes in net cash revenues. There might be cases, however, where the decision to enter is independent of CRP payment levels. For example, a farmer might enter an eligible field that is hard to crop and at the same time <u>rent</u> nearby land in order to maintain the same size operation but reduce average production costs per acre. The same number of acres would be rented as are reduced by CRP entry. (This is a critical assumption. In our example, net returns from soybeans are well beyond rental rates in most areas of southern Minnesota. The only farmer for which the present discussion might hold is one who wants to maintain the same size operation--no bigger, no smaller. Otherwise, the farmer would presumably <u>already</u> be renting additional land to grow beans at a profit.)

How much would the new land have to rent for in order for the CRP entry to have zero (or positive) net cash return effects? Consider a 25 acre CRP entry on farm D, where the total CRP cost was shown to be $118.02/acre entered. Wheat base was reduced by 15.6 acres and bean plantings by 9.4

Table 7: Effect of crop mix on calculated CRP cost. (Reduction in net return per CRP acre entered.)

		CRP costs	
Farm D	Base Configuration	corn/wheat/beans	corn/oats/alfalfa
B	100/50	150.20	142.22
D	200/50	151.80	142.05
F	300/50	153.80	141.88

Assumptions:	oats	alfalfa
expected yield	55 bu/ac.	5 T./ac.
ASCS yield	40 bu/ac.	--
market price	$1.60/bu.	$50/T.
target price	$1.60/bu.	--
production costs	$50/ac.	$80/ac.

Assumptions for wheat and beans as before.

Table 8: Effects of varying price and cost assumptions. Farm D. 200 acre CRP. (Reduction in net returns per CRP acre entered.)

YIELD (Proportion of current assumptions)		PRICE (Proportion of current assumptions) 70%	80%	90%	100%	110%	120%	130%
	75%	71.11	83.85	96.59	109.33	122.07	134.82	147.56
	80%	77.06	90.65	104.24	117.83	131.42	145.01	158.60
	85%	83.00	97.44	111.88	126.32	140.76	155.20	169.64
	90%	88.95	104.24	119.53	134.82	150.10	165.39	180.68
	95%	94.89	111.03	127.17	143.31	159.45	175.59	191.72
	100%	100.84	117.83	134.82	151.80	168.79	185.78	202.77
	105%	106.79	124.62	142.46	160.30	178.13	195.97	213.81
	110%	112.73	131.42	150.10	168.79	187.48	206.16	224.85
	115%	118.68	138.21	157.75	177.28	196.82	216.36	235.89
	120%	124.62	145.01	165.39	185.78	206.16	226.55	246.93
	125%	130.57	151.80	173.04	194.27	215.51	236.74	257.98

acres. If CRP payments in the area are $85/acre, each CRP acre effectively costs the farmer $33.02. With the costs given above, a base acre of wheat returns $79.23 and an acre of beans returns $162. To keep the same scale of operation with the same relative crop mix, therefore, the farmer would have to find 15.6 acres with wheat base renting at $46.21/acre or less and 9.4 acres for beans renting at $128.98/acre or less.

Summary

Landowner decisions regarding CRP entry will be made in part upon consideration of the reduction in whole-farm income resulting from associated reductions in program and non-program crop plantings. This report has focused on the importance to that decision of the relative size and make-up of the farm's commodity acreage bases.

Balanced against these calculated CRP costs must be the annual per-acre payment that the government will make for CRP entry. For farms in southern Minnesota similar to those examined here, this payment will clearly not cover current-year foregone income.

Nevertheless, the Conservation Reserve Program has a number of non-cash attributes that may encourage entry by farmers in particular career or ownership positions. For example, CRP payments are essentially guaranteed over ten years, whereas the deficiency payments that form a large part of the CRP cost calculated here are potentially more ephemeral, dependent upon Congressional renewal every few years. Furthermore, freed-up labor and capital resources, not considered in the present analysis, might be put to more profitable use elsewhere. This, too, would reduce the effective cost of CRP entry and could make current annual payments sufficiently attractive.

APPENDIX

The model used to calculate CRP entry costs in this report is based upon the following net returns function:

$$NR = \sum^{I} (1-j_i)(B_i-\alpha_i RB/C)(p_i^d Y_i^a + (p_i^m-c_i)Y_i^e)$$

$$+ \sum^{K}\delta_k(C-B-R(1-B/C))(p_k^m-c_k)Y_k^e$$

$$+ (p_r-c_r)R - \sum^{I} j_i(B_i-\alpha_i RB/C\ )c_i^s,$$

where

NR = net cash returns for the farm operation

$i = 1,\ldots,I$ -- program crops index

$k = 1,\ldots,K$ -- non-program crops index

B_i = crop acreage base

B = farm aggregate acreage base ($\Sigma B_i = B$)

α_i = proportion of base bite allocated to program crop i ($\Sigma\alpha_i = 1.0$)

δ_k = proportion of available land allocated to non-program crop k ($\Sigma\delta_k = 1.0$)

R = CRP acres

C = total cropland

p^d = per-bushel deficiency payments

p^m = market prices

c_i = per-unit production costs

Y^a = ASCS established costs

Y^e = expected yields

p_r = CRP payment per acre

c_r = annualized CRP cost per acre

j_i = set-aside requirement (percent of base)

c^s = per-acre set-aside maintenance costs

The base bite is therefore (R/C)B, and permitted plantings is $[(1-j_i)(B_i-\alpha_i RB/C)]$. In the report's tables, $p_r = 0$. To focus attention on land allocation, let per-acre net returns for each crop be

$$\pi_i = p_i^d Y_i^a + (p_i^m - c_i)Y_i^e$$

and

$$\pi_k = (P_k^m - c_k)Y_k^e.$$

The model becomes

$$NR = \sum^{J}[(1-j_i)(B_i-\alpha_i RB/C)]\pi_i \quad + \sum[\delta_k(C-B-R(1-B/C))]\pi_k$$

$$+ (p_r - c_r)R - \sum j_i(B_i - \delta_k RB/C)c_i^s.$$

We report reduction (from R=0 levels) in total farm net cash returns per CRP acre, allocated to each crop proportional to its acreage reduction. (CRP maintenance costs are allocated only to program crops, in the same proportion as is the base bite.) For example, the portion of the total CRP entry cost allocated to program crop i is

$$\sum^{I} \frac{(1-j_i)B_i\pi_i - \sum^{I}[(1-j_i)(B_i-\alpha_i RB/C)\pi_i - \alpha_i Rc_r]}{R}$$

$$= \sum^{I}[\alpha_i(1-j_i)(B/C)\pi_i + \alpha_i c_r],$$

and that for non-program crop k is

$$\frac{\sum^{K}\delta_k(C-B)\pi_k - \sum^{K}\delta_k(C-B-R(1-B/C))_{\pi k}}{R} \qquad = \sum^{K}\delta_k(1-B/C)\pi_k.$$

We do not include the CRP payment in these calculations, because we want to be able to keep separate the current-year costs and revenues associated with CRP entry.

The model is not placed in an optimizing framework, although it could lend itself to such treatment. In particular, one might consider R, $\underline{\alpha}$, and $\underline{\delta}$ as choice variables, given fixed price, yield, and cost data. We chose instead to restrict the determination of $\underline{\alpha}$ to a decision rule and to examine the effects of different levels of CRP entry on a range of farm types.