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Targeting Highly Erodible Cropland for Retirement:
A Program to Supplement
the Conservation Reserve Program
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Enrollment of highly erodible cropland in the Conservation Reserve Program (CRP) has lagged behind administrative targets in many regions of the country. Higher crop prices, unrealistic bid rates, and a hesitancy to take productive but eroding cropland out of production for ten years have led to poor participation rates. Within eastern Washington, such behavior has been the norm. Three CRP bid pools exist in the state, with the easternmost pool having a $60/acre bid rate. The pool covers five counties and over 2 million acres. Climate, topography, and crop productivity vary greatly, prompting CRP enrollment in only the very least productive regions of the pool. Only 5.1 percent of the total cropland, or 20 percent of the eligible cropland, has been enrolled after seven signup periods. Enrollment in Whitman county, one of five counties in the pool, has lagged even more. Only 1.7 percent of the total cropland, or 6.8 percent of the 276,539 acre target set by the ASCS, had been enrolled by late 1988. In many cases, as in other regions of the country, the most highly erodible lands have not been enrolled, reducing the cost effectiveness ($ spent/ton of soil saved) of CRP.

Policy changes to alter the CRP program have been proffered at both the local and national levels. Taff and Runge suggest a three-pronged set of changes consisting of 1) ridding CRP of the required reduction in base acreage; 2) removing the bid cap imposed by the USDA; and 3) targeting the CRP to the truly marginal crop lands. At the local level, individual conservation districts working with the Soil Conservation Service have some power in providing incentives to grass out the most highly erodible lands. Under provisions for management of land in permanent vegetative cover, producers may receive both cost sharing for establishment of such cover plus an incentive payment for three years. In exchange, producers agree to leave the land in appropriate cover for a period of five years. Only class 6e land is eligible. Within one Whitman county soil conservation district, the Rebel Flat Creek Watershed, the current incentive payment of $100/acre for three years plus a 65 percent of establishment cost payment has resulted in very little enrollment. The high productivity of the land and uncertainty of future government program regulations have discouraged participation.

The analysis presented here examines what payment would result in enrollment of the class 6e land in such a program in the Rebel Flat Creek watershed. Mixed-integer and separable programming techniques were used in a ten year decision framework to reflect the yes-no nature of the government farm programs and the nonlinear aspects of base reduction associated with use of CRP.

Policy Options

Enrollment in the soil district sponsored program, hereafter referred to as Grassout, was examined in conjunction with CRP. The Grassout option has an advantage over CRP in that Grassout acreage may be used as setaside in the Acreage Reduction Program (ARP). Other advantages are the government paid 65% versus 50% establishment cost shares and the fact that no base acreage is lost in the Grassout program. A drawback is the Grassout

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contract expires after five years. The producer may let the land go idle (stay in grass), break it out and farm the land subject to sodbuster provisions, or possibly enroll the grass in CRP if that program is assumed available at that point in time. Sodbuster regulations require that the land be farmed to meet a strict 1T soil loss tolerance level, and continuous spring barley is the only feasible option if the farmer plans to remain eligible for farm program benefits. Should the Grassout land be enrolled in CRP after the contract expires, a reduction in base acreage may also be required depending on the form of new CRP regulations. With these factors in mind, minimum acceptable payment rates for the grassout option were derived under three major scenarios: 1) NOCRP2 - CRP signup not possible in period 2; 2) YESCRP2 - CRP signup possible in period 2, with crop base reduction; and 3) NOBASRED2 - CRP signup possible in period 2, but no base reduction required. Scenario 3 was included to examine the impact of removing the currently required reduction in crop base due to CRP enrollment. Crop base in that scenario is reduced only in the first period. Setaside percentages also affect enrollment, prompting examination of the three scenarios assuming the current 10 percent rate as well as at a 20 percent rate.

Data Development

The Rebel Flat Creek watershed consists of 51,030 acres in the central portion of Whitman county in Washington State. Precipitation and soil types vary in three distinct zones which are usually referred to by their relative rainfall amounts (low, intermediate, and high). Rainfall declines from 14 to 21 inches per year as one travels eastwardly across the watershed. Detailed soil series data was collected for each zone within the watershed and aggregated by land class (i.e., 2e, 3e, etc.). A wheat/barley/fallow rotation using minimum tillage dominates in the low and intermediate zones and would meet conservation compliance criteria in most cases. Only 1.7 percent of the cropland in the high precipitation zone was class 6e, prompting exclusion of analysis for that zone. Crop yields, based on 1974 data by soil series, were adjusted via time dependent regressions (Kanjo) to reflect yield improvements due to technological change.

[1] wheat yld (bu/ac) = -1568.19 + .8265T - .0215A

[2] barley yld (bu/ac) = -1394.72 + .7335T - .0139A

where T is the calendar year and A is harvested acres in thousands. Base 1974 yields were adjusted to projected 1995 yields for each soil series. Weighted average yields by land class (Table 1) were then used in the analysis assuming a 1000 acre representative farm in each precipitation zone. Rotation based variable costs for the total number of acres per rotation (Table 2) were calculated based on area budgets (Bauscher, et. al., Caplan, et. al., and Hoag, et. al.). Values for the rotations represent the total variable cost of maintaining the rotation on the required number of acres. A breakout cost was also calculated to reflect the preparatory cost of farming the land once the five year contract had expired. No crop production was assumed in the year of breakout (year 6).

Model Formulation

A mixed-integer multi-period linear programming model was employed for a 1000 acre representative farm in both the low and intermediate precipitation zones. Two five-year periods were employed with the objective function consisting of maximizing the net present value of expected net returns. A six percent discount rate was assumed. Zero-one integer variables were used to reflect the option of participating in government programs or not. Producers could sell both wheat and barley in the market, sell both in the program, or sell one in the program and the other in the market. Deficiency payment rates and market prices (Table 3) were based on ten year average prices for the region (Young, et. al.). Current target prices and loan rates were assumed to continue to apply over the ten year period. Base acreages for wheat and barley were set at 400 acres each, yielding a total base of 800 acres.

Base acreage reduction in the first period due to CRP enrollment were calculated as

$$[3] \quad BASRED1 = (TOTBAS0/TOTAL\ CROPPED\ ACRES)*CRP1$$

where TOTBAS0 equals the total initial base acreage and CRP1 is the amount of land enrolled in CRP in the first period. In this case total initial base equals 800, total cropped acres are 1000, and equation [3] reduces to a linear function of first period CRP enrollment. The model allows either wheat or barley or both crop bases to be reduced, depending on the relative opportunity cost.

The base reduction calculation in period 2 posed an additional challenge due to the endogenous nature of total base after period 1. This value normally would be calculated as

$$[4] \quad BASRED2 = (TOTBAS1/TOTAL\ CROPPED\ ACRES)*CRP2$$

where TOTBAS1 equals the total base after period 1 and CRP2 is any new CRP enrollment in period 2. If CRP1 is non-zero, then TOTBAS1 is not equal to TOTBAS0 and equation [4] is nonlinear. Separable programming techniques using a logged approximation of the variables BASRED2, TOTBAS1, and CRP2 were employed to overcome the nonlinearity. In this form, equation [4] becomes

$$[5] \quad \ln(BASRED2) = \ln(TOTBAS1) + \ln(CRP2) - \ln(1000)$$

since total cropped acres equals 1000 acres. Approximations to each variable in equation [5] using a zero-one integer separable programming format (Taha) were derived. Individual formulations were then obtained for each precipitation zone and the YESCRP2, NOCRP2, and NOBASRED2 scenarios. Use of parametric programming techniques provided the Grassout payment rate, to be paid in each of the first 3 years, which would prompt enrollment of all class 6e land in the Grassout option.

Results

Analysis results (Table 4) indicate varying required Grassout payment rates across the two precipitation zones as well as by scenario. For the

low precipitation zone (10% setaside), payment rates decline from $153 to $86 if CRP is expected to be available. Rates for the NOBASRED2 scenario are the same, $86/acre. This implies that there is excess fallow ground in the rotation and no wheat or barley acreage is lost due to the low 10% setaside percentage or the reduction in crop base in period 2. Cropping results for these scenarios also indicate no CRP enrollment in period 1. For the NOCRP2 scenario, 40 of the 100 acres of class 6e land are left idle due to barley base restrictions. The remaining 60 acres of the Grassout land is broken out and farmed as continuous spring barley. If CRP is available in period 2, all 100 acres of the Grassout land of period 1 is enrolled in CRP. Producers use the greater cost-sharing percentage of the Grassout option in lieu of enrolling the land in CRP in period 1. Removing the base reduction accompanying CRP in period 2 resulted, as discussed previously, in no change in cropped acres since excess base exists.

Increasing the setaside percentage for barley and wheat to 20% resulted in few changes in required payment rates. Only the YESCRP2 scenario was affected with the payment rate increasing from $86 to $90/acre. Base restrictions in the YESCRP2 (20% setaside) scenario resulted in 37 acres of the 100 acres of class 6e land being idled while the remaining 63 acres were enrolled in CRP in period 2. Removal of the base reduction requirement resulted in all 100 acres being enrolled in CRP.

Results for the intermediate precipitation zone indicate lower payment rates than in the low zone for the NOCRP2 scenario. This is due to the higher spring barley yields (Table 1) on the class 6e land in the intermediate zone. If producers do break out the grassed land, they may expect higher barley returns than in the low precipitation zone. Thus a higher payment rate is required in the low precipitation zone for the NOCRP2 scenarios. For the four scenarios allowing CRP signup in period 2, required Grassout payment rates were slightly higher than in their counterpart scenarios in the low precipitation zone. This was due to a combination of factors. Producers could receive higher returns by enrolling a portion of their relatively low productive class 4e land in CRP and breaking out the class 6e land and farming it as continuous spring barley. Excess fallow existed in the strict 3 year rotation and producers could increase their overall net returns by enrolling some land in CRP and reducing the total proportion of fallow ground. In the NOCRP2 (10% setaside) scenario, this CRP enrollment occurred in period 1. Availability of CRP signup in period 2 shifted enrollment to the second period. Greater setaside requirements in the NOCRP2 (20% setaside) scenario, however, resulted in no CRP signup. The formerly excess fallow ground at the 10% rate was needed as setaside at the 20% rate. Removal of the crop base reduction requirement, coupled with a 20% setaside rate, resulted in 229 acres of class 4e land enrolled in the CRP. In all six scenarios, greater overall productivity in the intermediate zone resulted in all of the class 6e land being broken out and farmed in period 2.

As a policy alternative, the Grassout option warrants a mixed review. For the low precipitation zone, direct government payments in the YESCRP2, 10% setaside scenario total $60,058 (nominal) over the 10 year period. This includes only establishment cost shares plus incentive payments plus CRP payments. Deficiency payment savings due to base reduction have not been deducted from this total. Estimated soil savings during the 10 year period total 6,130 tons. This translates to a government cost of $9.80 per

ton. In the intermediate zone, no 6e land is still in grass at the end of the period. Five years of grassout on 95 acres cost $23,710, or $6.82 per ton of soil saved. These results reemphasize that some ongoing payment would be required to keep the 6e land in grass permanently. CRP is an obvious choice, but unfortunately, the Grassout payment rates are a poor indicator of what CRP bid rate would be required to grassout the 6e land. Those Grassout rates do indicate, however, that there would be some variability in the required CRP rate even within a county. Redesigning the CRP bid pools, based on productivity, plus making only the most highly erodible lands eligible for CRP enrollment, would certainly improve the cost effectiveness of the CRP program. As expected, removing the base reduction accompanying CRP generally results in greater enrollment, even with the current bid rate of $60 per acre. Use of the Grassout option appears tenable in the lower productivity areas, acting as an incentive to producers to ease their way into CRP.

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Table 1. Crop Yields and Composition of Representative Farms

Low Precipitation Zone

		Yields		Weighted Avg Yields	
Soil	Acres	Wheat (bu)	Barley (tons)	Wheat	Barley
2c	95	67	2.16	69	1.42
2e	46	76	1.40		
3e	642	76	1.40		
4e	117	62	1.24		
6e	100	32	1.09		

Intermediate Precipitation Zone

		Yields		Weighted Avg Yields	
Soil	Acres	Wheat (bu)	Barley (tons)	Wheat	Barley
2w	8	59	1.71	69	1.41
2c	16	84	2.02		
2e	74	129	2.33		
3e	692	64	1.23		
4e	111	75	1.73		
6e	95	54	1.54		
6w	3	67	1.17		

Table 2. Variable Costs of the Rotations and Breakout
          Activity

	Low and Intermediate Precipitation Zones
W/B/F-Min	$219.45
Cont. SB	60.57
Breakout	55.94

Table 3. Output Prices and Farm Program Payment Rates

	Wheat ($/bu)	Barley ($/ton)
Whitman County Price	3.50	92.50
National Average Price	3.28	91.25
Target Price	4.10	101.25
Deficiency Payment Rate	.82	10.00

Table 4. Required Grassout Payment Rates and Acreage Summary

Low Precipitation Zone

Scenario[1]	Setaside %	Payment Rate ($/ac)	NPV ($1000)	Period 1 Acres Cropped	CRP	Grassout	Period 2 Acres Cropped[2]	CRP	Idle	Breakout
NOCRP2	10%	153	584	900	0	100	900	0	40	60
YESCRP2	10%	86	573	900	0	100	900	100	0	0
NOBASRED2	10%	86	573	900	0	100	900	100	0	0
NOCRP2	20%	153	577	900	0	100	900	0	80	20
YESCRP2	20%	90	568	900	0	100	900	63	37	0
NOBASRED2	20%	86	573	900	0	100	900	100	0	0

Intermediate Precipitation Zone

Scenario	Setaside %	Payment Rate ($/ac)	NPV ($1000)	Period 1 Acres Cropped	CRP	Grassout	Period 2 Acres Cropped	CRP	Idle	Breakout
NOCRP2	10%	138	560	796	109	95	796	109	0	95
YESCRP2	10%	96	554	905	0	95	796	109	0	95
NOBASRED2	10%	96	554	905	0	95	796	109	0	95
NOCRP2	20%	104	543	905	0	95	905	0	0	95
YESCRP2	20%	104	543	905	0	95	905	0	0	957
NOBASRED2	20%	96	550	905	0	95	676	229	0	95

[1]Scenarios: NOCRP2 - CRP enrollment not available in period 2

YESCRP2 - CRP enrollment in period 2 possible but crop base acreage reduced proportionately

NOBASRED2 - CRP enrollment in period 2 possible, but no crop base acreage reduction

[2]Cropped acreages shown for period 2 do not include breakout acreage