

Enrollment of filter strips and recharge areas in the CRP and USDA easement programs

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ABSTRACT: Two related contingent valuation surveys were conducted in ten Cornbelt counties to estimate the potential enrollment in the Conservation Reserve Program (CRP) and a 30-year easement program of filter strips and cropland in areas vulnerable to groundwater contamination. It was found that potential CRP enrollment climbs dramatically in the range \$90-140/acre/year. Filter strip enrollments are greater than recharge area enrollments at any given rental rate. Thirty-year easements receive substantially less enrollment than CRP when a lump sum of 10 times the CRP rate is offered. Tree planting is a low percentage of CRP enrollments, but is a higher percentage of 30-year easement enrollments. Allowing enrollments to be used for set-aside requirements improves enrollments in the CRP by 32% for filter strips and by 6% for recharge areas; these differences are most marked at lower annual rental rates. Farmland owners who indicated they would not enroll gave primarily financial reasons for making that decision, further indicating that enrollment is very responsive to rental rates for the CRP and lump sums for easements. However, allowing variable time periods for contracts, adjusting rental rates for inflation or local cropland rental rates, publicizing maximum annual rental rates (MARRs), and simplifying the enrollment process could increase enrollments.

This two-part study investigates the potential of the Conservation Reserve Program (CRP), a 30-year easement program designed after the Wetland Reserve Program (WRP), and Swampbuster to significantly change uses of agricultural land in such a manner as to improve water quality in the Cornbelt region. In this article, the study area and methods of the overall project are presented, along with estimates of the potential enrollment of filter strips and groundwater recharge areas in the CRP and 30-year easements as a function of price, program rules, and vegetation cover (grass, trees). We also examine the reasons why

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some Cornbelt farmers and farmland owners are unwilling to enroll in these programs. The results are useful in estimating the costs of such a program and in identifying elements of program implementation that affect enrollment.

The focus of Part 2 is on wetlands. Here we again estimate the potential enrollment of farmed wetlands in the CRP and WRP and the constraints that Cornbelt farmers and farmland owners face in restoring wetlands within the context of those programs. We also examine farmers' and farmland owners' attitudes toward Swampbuster and the uses they would make of wetlands in the absence of that program.

Background

Current agricultural practices in the Cornbelt (Illinois, Indiana, Iowa, northern Missouri, and southern Wisconsin) have caused a widespread loss of aquatic habitat and decline in the quality of surface water due to excessive sedimentation and runoff of fertilizers and pesticides (Karr et al.; U.S. Department of Agriculture). Recent studies indicate that groundwater is also being contaminated from agricultural as well as nonagricultural sources (Bureau of National Affairs, Conner; Hallberg; Office of Technology, Olensius; U.S. House of Representatives). According to the U.S. Department of Agriculture (USDA), groundwater has been contaminated by agricultural fertilizers in 31 states and by pesticides in 37

states (Olensius), including each of the Cornbelt states (U.S. Department of Agriculture). In December, 1988, the U.S. Environmental Protection Agency (EPA) reported residues of 46 pesticides from normal agricultural use in the groundwater of 26 states (Bureau of National Affairs). Groundwater supplies drinking water to approximately 53% of the nation's population and to 97% of the population living in rural areas. Groundwater also provides about 55% of the water used by livestock (Feliciano; Olensius). The quality of the groundwater filling these needs is directly linked to land-use activities (Blatt).

Section 208 of the Clean Water Act Amendments of 1972, and Section 319 of the Clean Water Act Amendments of 1987, designed to control non-point source pollution, have been largely ineffective due to a reluctance by states to implement the land use regulations necessary to control agricultural nonpoint-source pollution. The 1990 Farm Bill directs that the continuation of the CRP be directed toward section 319 lands, among others (U.S. House of Representatives). However, the Clean Water Act is due for reauthorization this year (1995) and will likely contain a renewed emphasis on non-point source pollution control. The new act could thus dramatically affect activities in critical (impaired) watersheds throughout the United States.

Conservation practices critical to water quality control—potential retirement or change in chemical use on areas vulnerable to groundwater contamination and establishment of filter strips along surface waterways—have been only minimally achieved through existing USDA programs (U.S. Senate). A July 1990 General Accounting Office report stated that USDA is in a "unique position to potentially influence actions that can affect water quality," but that USDA has failed to develop and implement a coherent water resources policy (General Accounting Office). The Conservation Title of the 1985, and subsequently the 1990, Farm Bill contain provisions to address agricultural water pollution, including the Conservation Reserve Program (CRP) and related easement programs, such as the Wetland Reserve Program (WRP), that target environmentally-sensitive croplands for retirement in return for a USDA payment.

Together with policies to control soil erosion and chemical misuse, targeting new or replacement CRP enrollments to water quality-critical croplands would be a key step in developing a coordinated, cost-effective, and environmentally beneficial

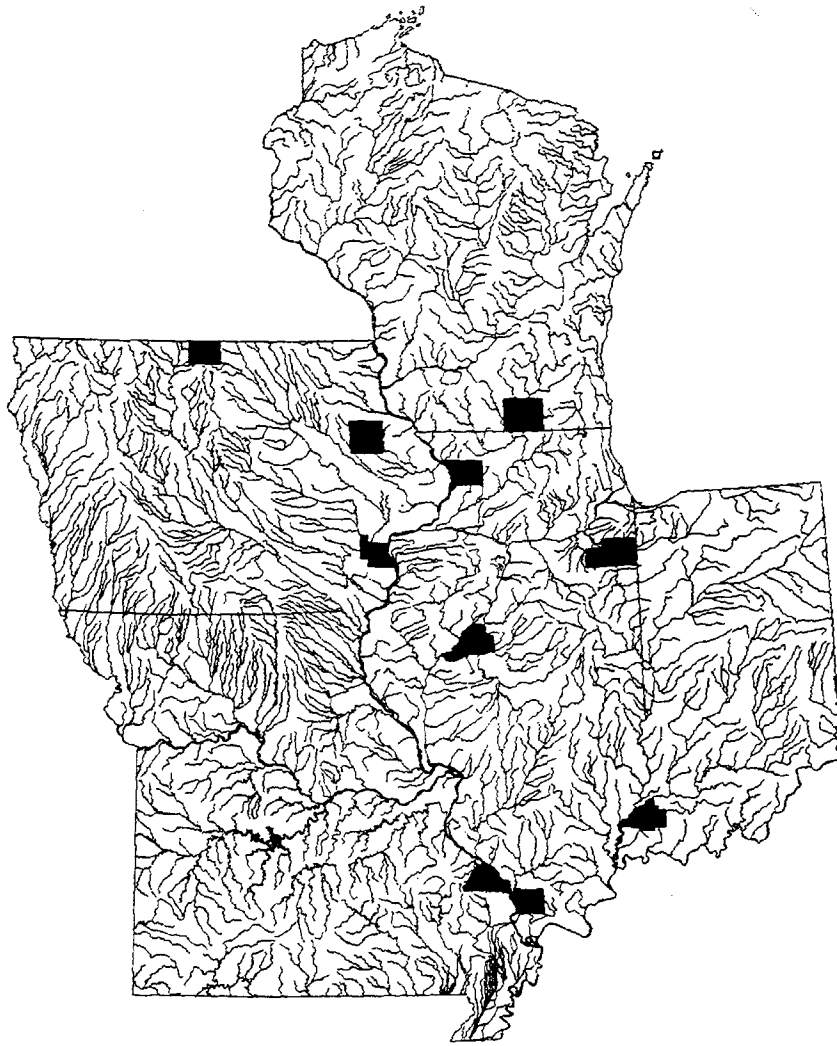


Figure 1. Cornbelt counties studied: Carroll, Kankakee, Mason, and Union in Illinois; Gibson in Indiana; Delaware, Louisa, and Winnebago in Iowa; Perry in Missouri; and Rock in Wisconsin

USDA policy on water quality (Barbarika; Osborn). At the regional scale, the Cornbelt is the U.S. region suffering most severely from water pollution derived from agricultural activities (Gianessi and Peskin). It can also be argued that, at the watershed scale, riparian lands and wetlands, rather than highly erodible lands, offer the greatest potential surface water quality benefits through cropland retirement. The delivery ratio for eroded sediment and nutrients is highest in streamside areas. Riparian buffer strips and wetlands can act as sediment sinks, filtering sediments and nutrients eroded further uphill or upstream (Cooper et al.; Peterjohn and Correll). Densely vegetated riparian areas can provide aquatic ecological benefits such as summer temperature control through shading, a beneficial flow of organic matter to stream ecosystems, and maintenance of coarse stream substrates (Karr and

Schlosser). Filter strips and riparian wetlands can also control flooding and maintain the alternating pattern of pools and riffles that serves as necessary habitat structure for higher aquatic organisms (Hynes). Moreover, Davie and Lant found that suspended sediment loads had not declined in two Southern Illinois streams with exceptionally high CRP enrollments of highly erodible croplands but with little enrollment of streamside lands. For groundwater resources, areas with high infiltration rates and shallow unconfined aquifers are most vulnerable to contamination.

Implementation of the CRP began in February 1986. Enrollments through the 12th signup in June 1992 totalled 36.5 million acres nationally from 377,000 separate contracts (Osborn). State average annual rental rates ranged from \$37.38 per acre in Montana to \$81.44 per acre in

Iowa with a national average of \$50.93 per acre (Osborn et al.). The CRP has been well-received among farmers, USDA county offices, and Congress, even though the congressional goal of 40 million acres enrolled by 1990 has not been reached.

The CRP has been attributed with eliminating 694 million tons of soil erosion per year, a reduction of 93% or 19.0 tons per acre on enrolled croplands (U.S. Department of Agriculture). Ribaldo et al. attribute present value benefits of an additional \$1.9-5.3 billion in surface water quality improvement to the CRP, but these benefits could be improved if the spatial pattern of enrollments better matched those regions where agricultural water pollution is most severe (Gianessi and Peskin) and those areas within watersheds that can best control sediment and nutrient delivery to streams (Karr and Schlosser; Peterjohn and Correll). Ribaldo et al. further conclude that "the CRP will not likely generate substantial improvements in groundwater quality, given current eligibility rules."

Until 1990, water quality enhancement was a secondary goal of the program (U.S. Department of Agriculture). However, since the 1990 farm bill, improvement in water quality has become a major goal of the CRP (PL 101-624). This change in goals is partly a response to estimates by Clark et al. of \$6.1 billion per year in widespread damage to aquatic habitats and to recreational and other uses of waterways in agricultural basins.

Beginning with the seventh signup in 1988, filter strips of 20-30 meters width have been eligible for CRP, but their enrollment has not been strong. Nationally, 4-4.9 million acres of cropland are eligible for CRP filter strips (based on filter strip width and the number of stream miles in contact with crop production), but only 51,701 acres, or just over 1%, have been enrolled (Ribaldo et al.; U.S. Department of Agriculture). This amounts to 0.14% of total enrollment in the CRP. Areas vulnerable to groundwater contamination are eligible for the CRP through section 319 of the Clean Water Act (PL 101-624), although they have not to date been a focus of the program.

Study area and methods

In this study we focused on 10 Cornbelt counties chosen for their availability of data, CRP enrollments, diversity of farm enterprises, potential for impacts on surface and groundwater quality, and potential for wetland restoration (Figure 1). Two separate but related surveys were

Table 1. Parameters of weighted, piecewise-linear regression of filter strip and recharge area enrollment on annual rental rates for the CRP and lump sum payments for 30-year easements (Data are from 770 mail surveys)

Price Range Estimated		Filter Strips	Recharge Areas
<u>10-year CRP</u>			
Intercept	Coefficient	-0.247	-0.152
	T-score	-0.97	-1.446
	Prob > T	0.335	0.150
\$50-90/ac/yr	Coefficient	0.00756	0.00325
	T-score	2.179	2.170
	Prob > T	0.0327	0.0317
\$90-140/ac/yr	Coefficient	0.00683	0.00881
	T-score	3.694	6.119
	Prob > T	0.0005	0.0001
\$140-400/ac/yr	Coefficient	-0.00006	0.00043
	T-score	-0.202	1.965
	Prob > T	0.840	0.051
<u>30-year easements</u>			
Intercept	Coefficient	0.234	-0.0909
	T-score	3.90	-2.135
	Prob > T	0.0001	0.0336
\$500-2,000/ac	Coefficient		0.0001975
	T-score		5.451
	Prob > T		0.0001
\$2000-4,000/ac	Coefficient		0.0000188
	T-score		0.618
	Prob > T		0.5378
\$500-4,000/ac	Coefficient	0.0000631	
	T-score	2.007	
	Prob > T	0.046	

more of these four categories. These assessments were based on the rules and regulations governing program implementation. Agricultural Conservation and Stabilization Service (ASCS) tract maps, U.S. Geological Survey topographic maps, Fish and Wildlife Service National Wetland Inventory maps, and state geological survey maps of groundwater vulnerability were used in identifying eligible acreages. Land that was deemed to be eligible was marked and, using USDA records, the landowner and/or farm operator was identified. Each survey contained a xerox copy of the corresponding ASCS tract map with filter strip, recharge area, farmed wetland, and wetland acreages measured and marked in different colors.

The first survey consisted of a questionnaire mailed to 2,067 farmers and farmland owners identified using the above process in the 10 counties selected. Seven-hundred seventy useful surveys were returned for an overall response rate of 37%. Two-hundred fifteen of these farms had a total of 2,030 acres of eligible filter strips; 389 farms had 57,588 acres of eligible recharge areas; 188 farms had 6,134 acres of eligible farmed wetlands; and 288 farms had 6,728 acres of wetlands subject to Swampbuster. The second survey was a personal interview survey with 157 different farmers and farmland owners in the same counties. Potential enrollments in the CRP and 30-year easements modelled on the WRP were estimated for filter strips, recharge zones, and farmed wetlands through data from both the mail and interview surveys.

The mail survey used a contingent choice framework where farmland owners were presented with annual rental

conducted to determine farmland owners' potential response to the CRP and 30-year easements for cropland retirement. Farms were selected that had substantial cropland acreages that met criteria for eli-

gibility or potential eligibility for the programs as applied to filter strips, recharge areas, and farmed wetlands or that were subject to Swampbuster. In most cases, farms were chosen that had land in two or

Table 2. Estimated percentage enrollment in the programs studied at selected annual rental rates and lump sum payments from the regression models and interview data

Cropland Type/ Source of Data	Estimated percentage enrollment														
	Annual Rental Rate (\$/Ac/Yr) for 10-Year CRP														
	50	60	70	80	90	100	120	140	160	180	200	250	300	350	400
Filter strips															
Mail survey	13	21	28	36	43	50	64	77	77	77	77	77	77	77	77
Interviews	1	1	4	5	10	41	55	72	84	84	86	86	88	88	88
Recharge areas															
Mail survey	1	4	8	11	14	23	40	58	59	60	61	63	65	67	69
Interviews	1	1	5	10	14	39	50	62	72	72	77	80	85	85	85
Cropland Type/ Source of Data	Lump Sum Payment for 30-Year Easement (\$/Acre)														
	500	750	1000	1250	1500	2000	2500	3000	4000						
Filter strips															
Mail survey	26	28	30	31	33	36	39	42	48						
Interviews	20	20	24	24	26	37	37	45	46						
Recharge areas															
Mail survey	1	6	11	16	21	30	30	30	30						
Interviews	2	2	6	6	8	14	14	18	22						

ESTIMATED ENROLLMENT OF FILTER STRIPS 10-Year CRP and 30-Year Easements

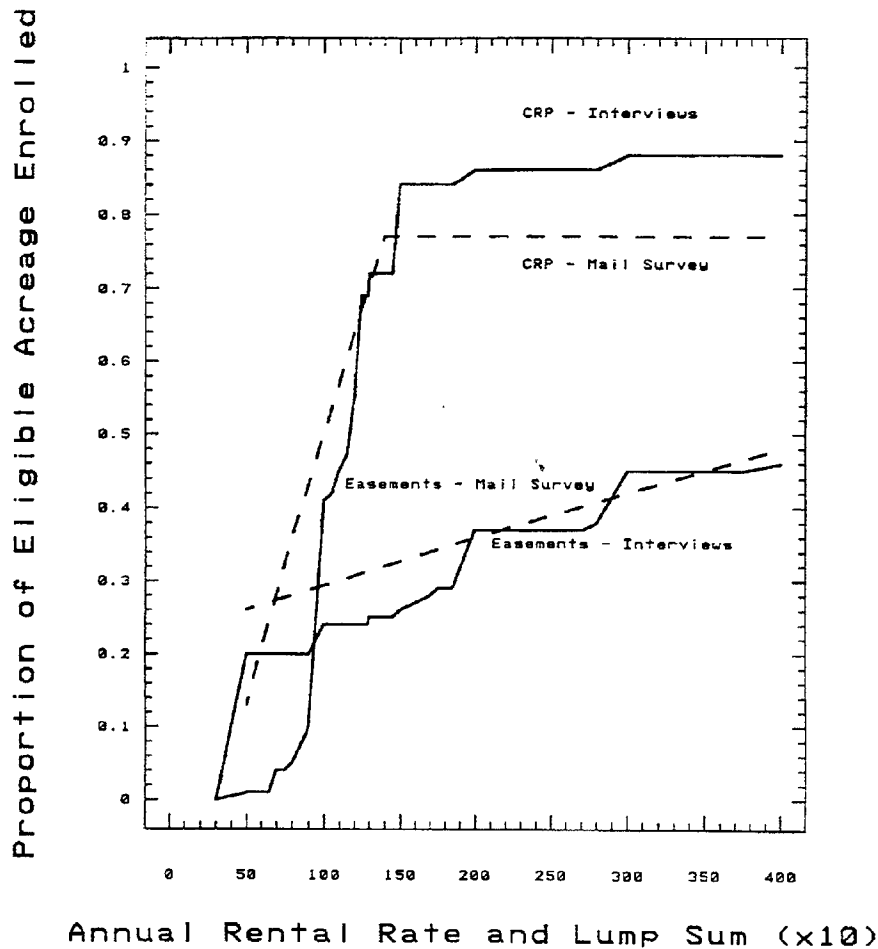


Figure 2. Potential enrollment as a function of price for filter strips in the CRP and 30-year easement programs estimated by personal interviews and weighted, piecewise-linear regression from the mail survey data

rates for the 10-year CRP of \$50, 60, 70, 80, 90, 100, 120, 140, 160, 180, 200, 250, 300, and 400 per acre per year. Corresponding lump sum offers were equal to ten times the CRP rate (resulting in an implicit discount rate of 9.3%). Landowners indicated the acreage they would enroll at the offered price from the areas marked as eligible. The relationship between price (rental rate or lump sum) and proportion of eligible acreage enrolled was modeled using weighted, piecewise-linear regression (Poirier) with each farm as an observation and eligible acreage as the basis for the weights. A variation of the CRP was also used wherein enrolled acreage could be used to meet the annual set-aside requirements for participation in the commodity programs.

The interview survey accepted open bids from the landowners of the mini-

mum annual rental rate and lump sum they would accept as compensation for enrolling the eligible areages under the 10-year CRP and 30-year easement scenarios. Results were analysed using a simple cumulative frequency distribution of the proportion of eligible acreage enrolled as price increased. Break points in the distributions were also used to identify the points at which slopes change in the piecewise linear regressions. The two surveys were designed to provide corroborating evidence of the response of enrollment to price using the two leading contingent valuation methodologies (Mitchell and Carson).

Results

Data from the personal interview surveys show a marked threshold for the CRP with filter strip enrollment increasing from 10% of eligible cropland at

\$90 to 84% at \$150 and recharge area enrollment increasing from 14% to 62% over the same range of annual rental rates. This threshold corresponds with the range of reported cropland rental rates in the study area. Consequently, we think that the threshold is reflective of Cornbelt realities. This threshold range was then applied in analyzing the mail survey data by delineating three price ranges (\$50-90, 90-140, 140-400/acre/year) that were hypothesized to have different price-enrollment relationships. The ranges provided the basis for "break points" in the piecewise regression analysis. Similarly, 30-year easement enrollments showed a smaller response at lump sum payments greater than \$2,000/acre in the interview data, although this relationship proved to hold only for recharge areas and not for filter strips in the mail survey. Weighted, piecewise-linear regression models were used to estimate these relationships with each farm as an observation and eligible acreage as the basis for the weights. Parameters of these regressions are shown in Table 1 with estimates of the proportion of eligible acreage enrolled in each program shown in Table 2 and in Figures 2 and 3 for filter strips and recharge areas, respectively.

Filter strips

Weighted, piecewise-linear regression of the mail survey data indicate that enrollment of filter strips in the 10-year CRP increases from 13% of eligible acreage at \$50/acre/year to 43% at \$90. The response to price is slightly less over the range \$90-140/acre/year in contrast to the interview data. Beyond \$140, enrollments are unresponsive to price and level off at 77% of eligible acreage. Interview data show a similar relationship, but with lower enrollment at low rental rates and a more marked threshold in the \$90-140 range (Figure 2).

For 30-year easements, both surveys indicate that enrollments respond less strongly to price. At \$500/acre the mail survey indicates 26% enrollment and the interview survey indicates 20% enrollment. But these rates rise to only 36% and 37% at \$2,000/acre and 48% and 46% at \$4,000/acre. The R-square for the regression was low (0.02), although significant (0.046) indicating that factors other than price discriminate between participating and non-participating farms.

Recharge areas

Weighted, piecewise-linear regression

Table 3. Reasons given for not enrolling in the CRP and easement programs

Reason for not enrolling	% of respondents indicating*
A. I expect to earn more producing on the eligible land than the amount proposed as a yearly payment.	56.8
B. The long-term nature of the programs reduces my flexibility to adjust land uses to changing economic circumstances.	52.8
C. I do not like the hassle of government programs.	49.9
D. I consider government control over the uses to which I put my land to be a violation of my property rights.	41.9
E. Too few acres would be eligible to make it worth my while.	40.3
F. Enrolling in the CRP would decrease the sale value of the farmland involved.	38.3
G. Enrolling in the CRP places too many restrictions on the operator who inherits the farm.	35.1
H. I would lose base acres for commodity programs.	33.1
I. Enrolling in the CRP would adversely affect the financial status of my farm.	26.8
J. I expect to earn more from renting out the eligible land than the amount proposed as a yearly payment.	20.8
K. Enrolling in the CRP would interfere with my relationship with the farm tenant.	16.7
N = 360	

* Respondents could show more than one reason; therefore, numbers add to greater than 100

Table 4. Respondents' attitudes toward suggested changes in the CRP

Suggested Change	Favor	No opinion	Do not favor
A. There should be more farmer input into the design and implementation of conservation programs.	74.2	20.7	5.1
B. Maximum annual rental rates for the county would be publicized.	64.9	22.3	12.8
C. Property taxes would be reduced on enrolled acreages.	62.6	13.9	23.5
D. An option to enroll lands for various time periods from 5 years to permanently would be offered.	58.3	29.3	12.4
E. Annual rental rates would be varied to reflect inflation.	55.9	22.4	21.7
F. Annual rental rates would be varied to reflect cropland rental rates.	53.3	23.5	23.2
G. An option to use CRP lands as pasture or hay would be offered with reduced rental rates.	45.0	24.1	30.9
N = 672			

of the mail survey data indicate that enrollment of recharge areas in the 10-year CRP increases from only 1% of eligible acreage at \$50/acre/year to 14% at \$90, far below enrollment rates for filter

strips. The response to price increases markedly, however, over the range \$90-140/acre/year, from 14%-58%, in close agreement with the interview data where the increase is from 14%-62% in

this threshold range. At rental rates greater than \$140, enrollments increase more gradually with price (although the relationship is marginally significant at 0.051) to reach a level of 69% in the mail survey and 85% in the interviews at \$400/acre/year (Figure 3).

For 30-year easements, both surveys indicate that enrollments are considerably lower than for the CRP and lower than for filter strips, but do respond to price over the \$500-2,000/acre range. At \$500/acre the mail and interview surveys indicate only 1% and 2% enrollment, respectively. But these rates rise steadily to 30% and 14% at \$2,000/acre. In the interview data, enrollment reaches 22% at \$4,000/acre. Response to price is insignificant, however, over the range \$2,000-4,000/acre in the mail survey data.

The set-aside option

The mail questionnaires also offered an option for farmland owners to use their CRP enrollment on filter strips or recharge areas to fulfill their ASCS set-aside requirements. To control the complexity of the survey, we did not consider the year-to-year variation in set-aside requirements set by ASCS. Results show that filter strip enrollments are 32% higher overall if enrollments can be so used. This difference is particularly great at the lower end of the price range; at \$50/acre/year, 16% more eligible acreage (13% vs. 29%) would be enrolled than if CRP acreage cannot be used as set-aside. At \$100/acre/year the difference is 18% (50% vs. 68%), but at \$200/acre/year there is no difference.

For recharge areas, the added attractiveness of allowing CRP enrollments to be used as set-aside is less pronounced. Overall, enrollments are 6% higher, with again a greater difference at lower rental rates. At \$50/acre/year, 2.1% more eligible acreage would be enrolled, 1.6% at \$100/acre/year, and only 0.5% at \$200/acre/year than if enrollments cannot be used as set-aside.

Tree planting

For filter strips, only 3.7% of all acres enrolled in the CRP would be planted to trees if farmland owners choose between grass and trees on an equal basis. For the 30-year easement program tree planting is 12.7% of enrollments, close to the original CRP goal of 12.5%. Results for recharge areas are similar. In the 10-year CRP, tree planting is 3.1% of enrollments; for 30-year easements, it is 7.9% of total enrollments.

ESTIMATED ENROLLMENT OF RECHARGE AREAS 10-Year CRP and 30-Year Easements

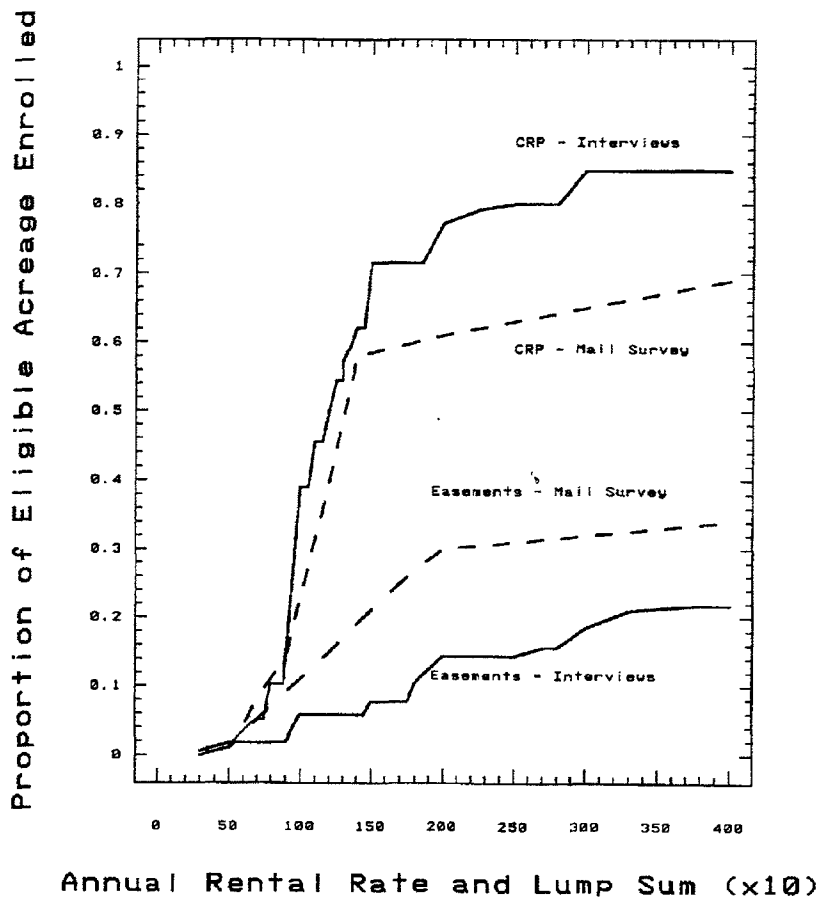


Figure 3. Potential enrollment as a function of price for recharge areas in the CRP and 30-year easement programs estimated by personal interviews and weighted, piecewise-linear regression from the mail survey data

Figure 4 displays a cumulative frequency distribution of bids for tree planting on filter strips and recharge areas obtained through the personal interviews. In the interviews, farmers could give separate bids for grass planting and tree planting; therefore these data represent potential enrollments if the CRP and 30-year easement programs provided greater incentives for planting trees than those for planting grass.

Enrollments are higher on recharge areas than on filter strips in both the 10-year CRP and the 30-year easement programs. This is probably due to filter strips running diagonally across fields or otherwise presenting an awkward placement for trees. Further, tile outlets are often found in potential filter strip areas and these outlets can be plugged by tree roots, thereby affecting the water regime of the whole field. Enrollments are also higher for the 10-year CRP than the 30-year easement program due to higher

total enrollments in the CRP. In the CRP, enrollment climbs rapidly in the range \$100-160/acre/year from 2% to 10% of eligible acreage for filter strips and from 2% to 17% of eligible acreage for recharge areas. Similarly in the 30-year easement program, enrollment climbs from 0% at \$800/acre to 7% at \$1,800/acre for filter strips and from 0% at \$800/acre to 13% at \$2,000/acre for recharge areas. While these proportions are fairly low, it should be anticipated that tree planting would not be as popular in prime Midwestern grain-growing areas as it is elsewhere, such as the southeastern states, where the bulk of tree planting has occurred during CRP sign-ups from 1986-1990 (U.S. House of Representatives 1990).

Barriers to enrollment

Table 3 provides results from 360 respondents to the mail survey who chose not to enroll indicating the reasons for

this decision. The primary reasons some farmland owners were not willing to enroll their eligible acreages are economic. Statements A and J, taken together, show that 77.4% of non-enrolling respondents made their decision at least partly on the basis of relative flows of income from the specified cropland for the CRP as compared to crop production (if they operate the farm) or renting it out (if they do not). Responses to statements H and I further indicate that other economic considerations, such as efficient utilization of purchased farm machinery and future eligibility for commodity programs, are also important to farmers and farmland owners. However, responses to statements C, D, and E indicate that at least 50% are opposed to getting involved in these programs either on ideological grounds (D) or due to an aversion to the administrative process (C,E). Finally, while less important in most instances, participation in the CRP or easement programs can interfere with relationships between the farmland owner and tenants (16.7%), inheritors (35.1%), or potential purchasers (38.3%) of the farmland.

In addition to the financial difficulties some farmers have with the decision to enroll in the CRP or easement program, they face additional barriers to planting trees. Planting trees, even more than planting grass (75.7% vs. 52.8%), reduces a farmer's flexibility to change land uses as economic conditions warrant. Trees can also divide up fields awkwardly or plug tiles. However, only 25.9% of respondents felt that they could not sell timber products profitably and less than 1% had a problem with the availability of tree seedlings.

Response to suggested changes in the CRP

Six (A-F) of seven suggested changes in the CRP were viewed favorably by a majority (53.3%-74.2%) of 672 respondents, with the last (G) favored by 45% (Table 4). None of the seven was viewed unfavorably by more than 30.9% of respondents, with only 5.1% against increased farmer input into conservation programs. These results indicate that farmland owners' attitudes toward the CRP would be improved if the maximum acceptable CRP rental rate (MARR) were publicized for each county, or if a range of contract periods were offered. While it adds to the expense of the program, periodic post-sign-up adjustments to the rental rates would encourage additional enrollment. Along the same lines, states or counties should consider adjusting property taxes on enrolled acreages,

ESTIMATED TREE PLANTING ON FILTER STRIPS AND RECHARGE AREAS

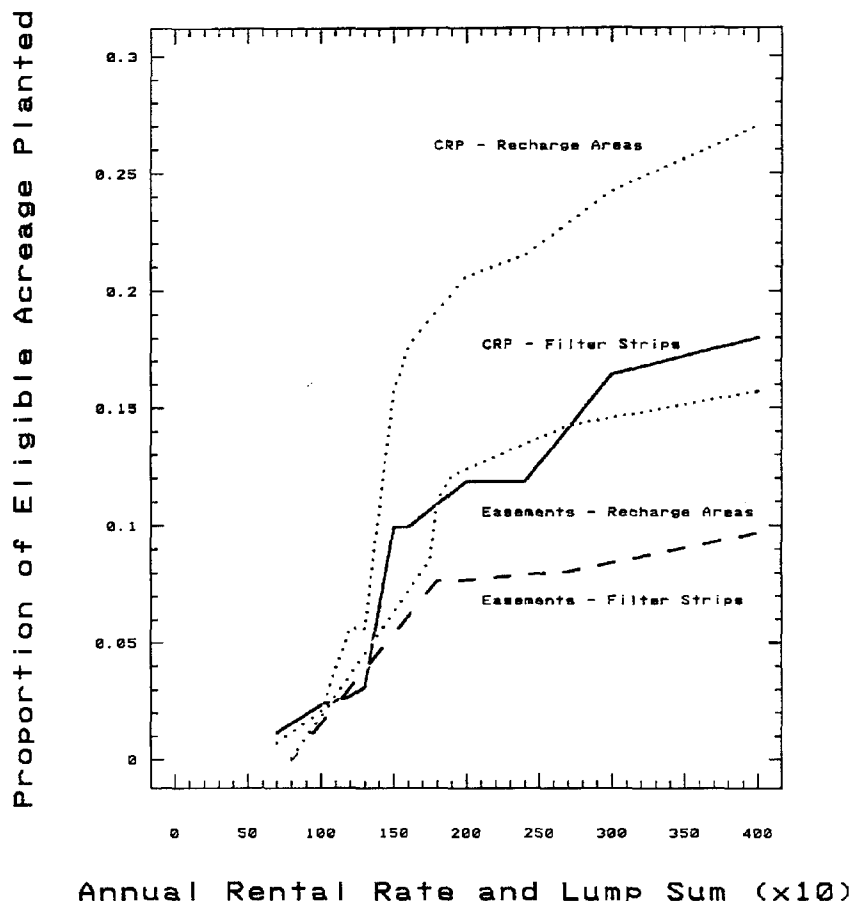


Figure 4. Cumulative frequency distribution of tree planting enrollments on filter strips and recharge areas in the CRP and 30-year easement programs from 157 personal interviews

or USDA could reimburse counties for either lower assessed valuations or lower tax rates on CRP land. An option to hay or pasture CRP lands at a reduced rental rate was least popular, but still favored by 14.1% more farmers than were against it. Additionally, 91% of farmers and farmland owners that expressed a preference preferred the annual rental payment format over the lump sum format used for easements for reasons of cash flow and the impact of income taxes. This indicates that enrollment in a 30-year easement program could be higher if payments were spread over several years or even the whole term of the contract. None of these suggested changes would change the fundamental nature or administration of the CRP or the WRP.

Conclusions and policy implications

The Conservation Reserve Program and related easement acquisition programs have a substantial potential to change

land uses on croplands critical to water quality control—if the public is willing to pay farmers somewhat higher rates than they have been receiving through the CRP to date. Enrollments are higher for filter strips than for recharge areas and higher for a 10-year CRP contract than for a 30-year easement with a corresponding lump sum equal to ten times the annual CRP payment. In fact, using the current CRP format of annual payments instead of, or along with, lump sum easement contracts may obtain greater enrollment even at contract periods of up to 30 years. Enrollments are higher if they can be used as ASCS set-asides, particularly for filter strips at lower rental rates. Overall, retirement of Cornbelt croplands critical to water quality control is considerably more expensive on a per acre basis than retirement of highly erodible croplands now in the CRP, because much of the land is more productive than the highly erodible cropland currently enrolled in

CRP. Mean corn yield was 129 bu/ac on cropland eligible as recharge areas and 136 bu/ac for filter strips, as compared to 100 bu/ac of program yield on current CRP enrollments in Illinois (Osborn et al.). But benefits are therefore also likely to be higher per acre in terms of reduction of surplus commodities, as well as in terms of water quality (Heimlich). A cumulative frequency distribution of interview bids shows a marked increase in enrollments over the range \$90-140/acre/year for both filter strips and recharge areas; this threshold also emerges strongly for recharge areas in the mail survey. It also corresponds closely with reported cropland rental rates in the counties studied. Thus, if high enrollments are desired, they can be achieved by pushing the acceptable rental rates up toward \$140/acre/year. At rates below \$90/acre/year, however, enrollments of recharge areas and filter strips would likely be low.

As CRP contracts begin to expire in 1995, Congress and the USDA may wish to consider replacing highly erodible acreages now in the program with filter strips and recharge areas studied here (Blatt). Areas vulnerable to groundwater contamination are also prime candidates for alternative forms of agricultural production with substantially reduced chemical use, rather than being removed from crop production entirely.

The primary barriers to enrollment are annual rental rates lower than the net return farmland owners make through crop production or cropland rentals, the 30-year term of easement contracts, and the transaction costs of participating in the program. For tree planting, land-use flexibility is an even greater impediment, as is interference of trees with farm operations and tile lines. Raising and publicizing annual rental rates, adjusting CRP rates for inflation or for changes in local cropland rental rates, adjusting property taxes on enrolled acreage, increasing flexibility in contract periods and terms, and simplifying enrollment procedures all have the potential to overcome some of the factors inhibiting farmers from participating in these programs.

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