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Renewing CRP: Results from a Study of Alternative Targeting Criteria

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RENEWING CRP: RESULTS FROM A STUDY OF ALTERNATIVE TARGETING CRITERIA

Determining the best way to achieve the benefits from a renewal of the Conservation Reserve Program (CRP) is one of the most pressing policy issues that Congress will resolve in this 1995 farm bill year. Support for a renewal is widespread because both farmers and the environment benefit from CRP. Environmental benefits include reductions in soil erosion, enhanced water quality, and enhanced wildlife habitat. Farmers benefit from supply reductions and direct CRP payments.

The difficulty in simply renewing existing contracts is that CRP will now be competing with other agricultural programs for funding. This competition has focused increased attention on the efficiency with which the benefits of CRP are obtained. To what extent can a significant portion of the environmental benefits offered by CRP be maintained if CRP outlays are significantly reduced? Recent research conducted at the Center for Agricultural and Rural Development at Iowa State University addresses this issue. The research is reported in *The Economic, Environmental, and Fiscal Impacts of a Targeted Renewal of Conservation Reserve Program Contracts* (CARD Working Paper 95-WP 129) by Bruce A. Babcock, P.G. Lakshminarayan, and JunJie Wu. Please refer to this document for a more detailed analysis of the research. This briefing paper summarizes the results of that research and discusses its policy implications.

Efficiency Gains from Environmental Targeting

The first question to be addressed is exactly how can the efficiency of the CRP program be increased? What criteria should

be used to judge whether a contract should be renewed? Intuition tells us that we should maximize the benefits of CRP for a given level of federal expenditure. This maximization is accomplished by ranking CRP land in ascending order according to the ratio of per acre CRP rental rate to per acre environmental benefit offered. That is, land with the lowest cost per unit of environmental benefit is renewed first. Land with higher ratios are then renewed until the CRP budget is exhausted.

Two alternative renewal criteria that will not maximize environmental benefits are to renew CRP contracts according to the level of environmental benefit offered and to renew CRP contracts based on per acre rental rates. The first criterion will enroll the most environmentally sensitive lands first without regard to cost while the second criterion will maximize the number of acres renewed.

There are potentially large trade-offs involved when choosing a renewal criterion between the number of acres that can be enrolled and the level of environmental benefits achieved. The magnitude of the trade-offs depends on how the cost of renewing individual CRP contracts and the corresponding level of environmental benefit offered are distributed across current CRP land. If environmental benefits are concentrated on a small percentage of CRP land, then the only way to obtain environmental benefits is to renew contracts that offer high levels of the benefit. In addition, a high degree of concentration implies that a large proportion of the environmental benefits offered by current CRP land can be obtained by a partial

renewal, thus increasing the efficiency with which the benefits of CRP are obtained. Conversely, if environmental benefits are more uniformly distributed across current CRP land then maximizing the size of CRP will be largely consistent with an objective of maximizing the total level of environmental benefits offered by CRP. As a result, the efficiency gains from environmental targeting will not be large.

The other important aspect of the joint relationship between cost and environmental benefit is whether they are negatively correlated. If low-cost land offers large environmental benefits, then the three renewal criteria will result in similar outcomes because land with low cost to benefit ratios will also have lower than average costs and offer greater than average benefits. Thus, a given expenditure can purchase both relatively large amounts of land and large amounts of environmental benefits. However, if cost and benefits are positively correlated, that is, low-cost land offers, on average, few environmental benefits, then the alternative renewal criteria will likely lead to vastly different outcomes. In this case, a given expenditure can purchase either large amounts of land or environmental benefits, but not both.

The degree of concentration and correlation of environmental benefits with costs varies with the type of benefit considered. Available data that can be used to measure the environmental benefits of CRP is extremely limited. But the National Resources Inventory (NRI) survey data do allow construction of a limited number of indicators. These indicators provide measures of wind and water erosion, contribution to groundwater contamination, wildlife habitat, and surface water quality. In addition, a measure of multiple environmental benefits can be obtained by

simply summing up the individual indicators.

Concentration and Cost of Environmental Benefits

Figure 1 presents the degree to which the various environmental indicators are concentrated. As discussed above, the more concentrated are environmental benefits, the greater will be the efficiency gains from targeting and the greater will be the conflicts between the alternative renewal criteria. For each indicator in Figure 1, CRP land is ranked according to the level of benefit offered. The curves in Figure 1 show the proportion of total environmental benefit obtained as the proportion of total land is enrolled. A steeper curve represents greater concentration.

The most concentrated indicator is surface water quality: more than 98 percent of total surface water quality benefits on current CRP land are obtained by enrolling less than 27 percent of CRP land. Wind erosion and groundwater vulnerability are also fairly concentrated: enrollment of 32 percent of CRP land achieves about 90 percent of the total benefits from the two indicators. Water erosion is slightly less concentrated. To achieve 90 percent of the total water erosion benefits, nearly 43 percent of current CRP land has to be renewed. The wildlife habitat and the multiple index are the most uniformly distributed.

The other important factor affecting the magnitude of efficiency gains from targeting is the correlation between cost and environmental benefits on CRP. Figure 2 shows how the correlation varies across the various environmental indicators. The vertical axis measures the county-average CRP bid through the eleventh sign-up. The horizontal axis measures the number of acres enrolled in a CRP renewal. (100

percent renewal is only 33.3 million acres, which is the size of CRP through the eleventh sign-up. NRI data are not available for the twelfth sign-up.) For each of the environmental indicators, CRP contracts have been ranked according to the level of benefit offered. The curves in Figure 2 show how the average CRP rental rate varies as CRP is expanded by enrolling land according to the level of environmental amenity offered. If the curve slopes up for a given indicator, then the land that offers the highest environmental benefit as measured by that indicator costs less than average to enroll, indicating a negative correlation. If the curve slopes down, then the land that offers the highest benefits costs more than average, indicating a positive correlation.

Wind erosion is the only indicator that is negatively correlated with cost. This implies that targeting wind erosive lands should result in many contracts being renewed. Conversely, water erosive lands are the most positively correlated with cost, which implies that a targeting policy of enrolling inexpensive lands first will not result in large reductions in water erosion benefits. For acreage levels less than 14 million acres, the other indicators—surface water quality, wildlife habitat, groundwater vulnerability, and the multiple indicator—are all positively correlated. The positive correlations for the wildlife habitat and surface water quality indicators are partly explained by the large weight that both indicators assign to land close to surface water bodies. This type of land is, on average, more productive so it is more expensive than other land. The groundwater vulnerability index gives a large weight to land planted to chemically intensive crops. The results in Figure 2 indicates that this cropland is relatively expensive. For enrollments greater than 14 million acres, there is no clear relationship between the

various indicators and cost, other than the average cost is equal for all indicators at complete renewal.

Combining the correlation and concentration estimates, one would expect that moving away from a targeting criterion of enrolling least cost lands would have the largest effects on surface water quality and water erosion because these indicators are positively correlated with cost and are highly concentrated. That is, the efficiency gains from environmental targeting are likely large for these two indicators. Because wind erosion is negatively correlated with cost and is also highly concentrated, one would expect that enrolling the least cost land does a fairly good job of achieving wind erosion benefits. Targeting wildlife habitat will not likely result in large efficiency gains because wildlife benefits are more uniformly distributed. But this uniformity allows greater choice in which CRP land to renew to capture wildlife benefits.

Environmental Benefits from a Partial CRP Renewal

A better understanding of the magnitude of the trade-offs between the number of acres in CRP and environmental benefits and determining the extent to which environmental and economic gains can be obtained from targeting requires an examination of the overall cost and environmental implications of targeted renewal of current CRP land under alternative budget scenarios. In the absence of policy guidelines for the future of the CRP program, four different scenarios are analyzed. CRP fiscal spending limits of \$250 million, \$500 million, \$750 million, and \$1 billion are considered for each target indicator. These limits translate into 15, 30, 45, and 60 percent renewal of CRP contracts entered through the eleventh sign-up.

Tables 1 and 2 present the empirical results for the three targeting schemes: maximization of acreage; maximization of environmental benefits; and enrollment of land based solely on environmental benefits. Reported are estimates of the number of acres enrolled, the proportion of CRP land renewed, the average rental rate paid for the enrolled acreage, and the total budget exposure under the three schemes. Table 1 presents the results when the multiple environmental index is targeted and for acreage maximization. Table 2 presents the results when individual environmental attributes are targeted.

The results in Table 1 illustrate how moving away from acreage maximization towards environmental targeting can increase the efficiency of environmental purchases. At \$500 million, acreage targeting achieves only 21.5 percent of potential water erosion benefits of CRP, 37.6 percent of groundwater vulnerability benefits, 16 percent of surface water quality and wildlife habitat benefits, and about 31 percent of multiple environmental benefits. In contrast, targeting the multiple index almost doubles each of the indicators, except for wind erosion benefits. The trade-off for greater environmental benefits is a 10 percent reduction in CRP size. There is little difference in wind erosion benefits among the three targeting schemes because of the negative correlation between cost and wind erosion. Almost 69 percent of wind erosion benefits at the \$500 million level are obtained by simply maximizing the size of CRP. Maximizing environmental benefits, as measured by the multiple benefit index, achieves 58 percent of the total amenity while enrolling just 32 percent of CRP land.

Results from targeting the five environmental indicators independently are presented in Table 2. The environmental efficiency of these targeting schemes is

estimated both by the levels of the target indicator achieved and the level of multiple benefit index. The correlation between the environmental attribute and cost plays an important role in determining the number of acres that can be enrolled under the different options. For example, under a \$500 million program, selecting land based solely on water erosion benefits, which is positively correlated with cost, will reduce CRP size from 13 million acres under acreage maximization to about 9.3 million acres. But when negatively correlated wind erosion is targeted, program size is reduced by only one million acres, despite the greater concentration of wind erosive lands relative to water erosive lands.

The column in Table 2 titled “Target Indicator Level” reports the percentage of total benefits achieved by targeting a given indicator. What is striking is that a criterion of renewing contracts according to the ratio of cost to benefit leads to essentially the same total level of environmental benefits as does enrolling land according to environmental benefit alone. Perhaps this should not be too surprising given the degree of concentration of many of the indicators: if one wants to purchase environmental quality, one needs to seek land with significant environmental amenities. The largest difference between the two targeting schemes is for the wildlife habitat indicator. As shown in Figure 1, this indicator is the most uniformly distributed. Using the cost-benefit ratio to select land allows more choice of where to purchase the wildlife habitat.

The Table 2 results support the notion that the more the environmental attribute is concentrated and negatively correlated with cost, the greater the proportion of the total attribute obtained at the various funding levels. For example, 80.4 percent of potential water erosion on CRP land can be

eliminated at just 30 percent of current expenditures (\$500 million). But, for the negatively correlated wind erosion, 94.2 percent of wind erosion can be eliminated at 30 percent of current cost. Almost 100 percent of benefits from the surface water quality index and 91 percent of the groundwater vulnerable land can be purchased with \$500 million funding. But if wildlife habitat is targeted, \$500 million buys just 43 to 50 percent of total wildlife benefits.

The last two columns of Table 2 show the percentage of the multiple index that can be obtained by targeting individual environmental attributes. The more the individual targets are positively correlated with the multiple index, the greater the percentage of multiple index. Surface water quality and wildlife habitat indexes are most correlated with the multiple index: the correlation coefficients are 0.89 and 0.92. At the \$500 million budget constraint, 32 percent of potential multiple benefits are achieved if surface water quality and wildlife habitat benefits are maximized.

Supply of Environmental Benefits in CRP

The preceding results illustrate the trade-offs involved from targeting different environmental objectives for land that is currently enrolled in CRP. One important point that the focus on current CRP land neglects is the proportion of environmentally sensitive land that is currently enrolled in CRP. For example, if only a small fraction of land vulnerable to groundwater contamination is currently enrolled in CRP, does it make sense to target this environmental indicator at the expense of others? Perhaps so, if the marginal benefits from enrolling this land are extremely high. Otherwise, the total payoff from enrolling this land is likely to be quite low. If, on the other hand, a large portion of

environmentally sensitive land is already enrolled in CRP, then it is more justifiable to target such land because a significant portion of the total environmental benefit offered by cropland can be obtained.

For this paper's indicators, the proportion of groundwater sensitive land and land that offers wildlife benefits currently in CRP is quite low because of the way that these two indexes are defined. Groundwater vulnerability is highest on land that grows crops using a lot of fertilizer and pesticides, such as corn, soybeans, wheat, and cotton. CRP does not, and never will, enroll a significant proportion of land that grows these crops. Furthermore, there is no reason to believe that marginal benefits are extraordinarily large from enrolling a small proportion of groundwater vulnerable land. The wildlife index is constructed so that all nonriparian land west of the Mississippi provides equally valuable wildlife habitat. Thus, a small proportion of total available wildlife habitat will ever be enrolled in CRP. But it still might make sense to target wildlife habitat because the marginal returns might be fairly large. That is, there are likely very large payoffs from converting riparian land and some grassland from agricultural uses. But beyond some point, enrolling additional grassland is likely to have significantly lower values. U.S. society has indicated a large willingness to pay to save species, but a much lower willingness to pay to expand populations of nonthreatened species.

Overall, USDA did a surprisingly good job of enrolling land subject to high water erosion rates through the eleventh sign-up. CRP contains 68 percent of total U.S. cropland that has water erosion rates 20 tons or greater. In the Northern and Southern Great Plains, fully 90 percent of cropland with erosion rates greater than 20 tons is enrolled in CRP. But in the Corn

Belt, only 40 percent of cropland with this erosion rate is enrolled. Thus, if reducing water erosion is a top priority, then targeting existing CRP land will achieve significant national benefits.

Currently, CRP land contains 25 percent of the nation's cropland that has wind erosion rates greater than 20 tons per acre and only about 4 percent of cropland within 100 feet of a surface water body. The wind erosion estimate suggests that targeting wind erosive cropland would achieve significant national benefits. But new land must be obtained if CRP is to be used to retire significant amounts of riparian land.

Policy Implications

The results clearly indicate that a partial renewal of CRP contracts can preserve a significant portion of the environmental benefits offered by current CRP land if contract renewal is targeted. The most efficient method to purchase environmental benefits is to renew contracts that offer the lowest cost per unit of environmental benefit offered. If reduced water erosion continues to be a primary target, then a 15 million acre renewal would capture approximately 90 percent of the total reductions in water erosion available from current CRP land. If wind erosion is to be targeted, then 75 percent of the wind erosion reductions could be obtained with a 6.2 million acre CRP. The significant water quality and wildlife benefits that accrue from taking riparian land out of crop production cannot be obtained by renewing CRP contracts because of the relatively small amount of riparian land offered by current CRP land.

Table 3 presents estimates of what it would cost to renew CRP contracts and to bring new cropland into CRP that offers significant environmental benefits. The first cost estimate is obtained from county-

average CRP bid rates. The second cost estimate is obtained from crop reporting district cash rent data for 1994. As shown, to renew all current CRP land and the new non-CRP cropland that meets at least one of the three criteria would cost between \$1.6 and \$1.8 billion annually.

As shown, the average cost of cropland in areas with large amounts of riparian land is significantly higher than in areas that have high wind and water erosion. But the per acre benefits from riparian land might justify the high cost. Benefits from converting of riparian land include providing critical wildlife habitat, improving surface water quality by reducing chemical and sediment loads, reducing the severity and frequency of floods, and improving recreational benefits for landowners and others.

Concluding Remarks

The results of this analysis provide policymakers with estimates of the trade-offs involved when choosing a renewal criteria. Too often policymakers must make political decisions without adequate information about the costs and benefits of alternative actions. As demonstrated here, there are significant trade-offs involved in choosing the course of action for CRP. These results should increase the ability of Congress to make better decisions.