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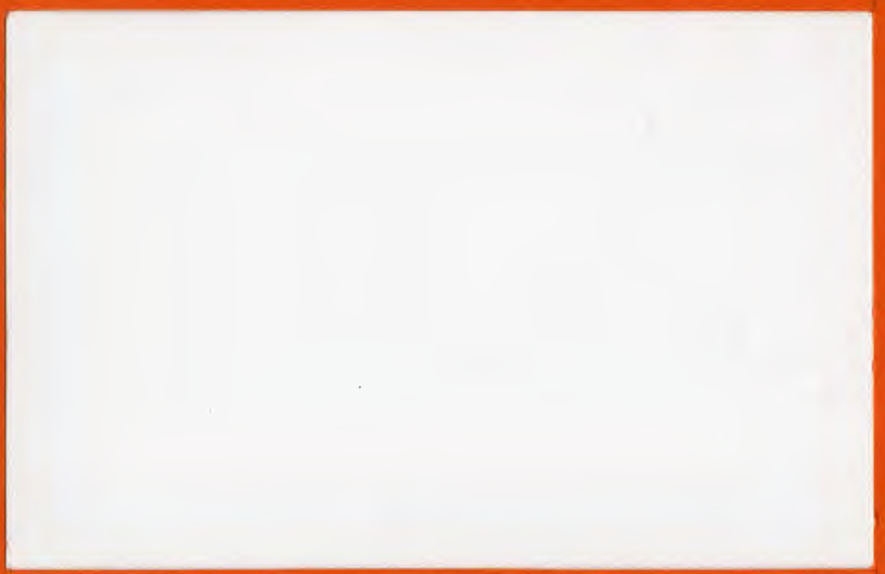

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RECREATIONAL IMPACTS of the CONSERVATION RESERVE PROGRAM: A BREAK-EVEN APPROACH

by

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ABSTRACT:

RECREATIONAL IMPACTS of the CONSERVATION RESERVE PROGRAM:

A BREAK-EVEN APPROACH

The Conservation Reserve Program (CRP) achieves supply control, income and improved environmental quality by paying farmers to substitute vegetative cover for crops on highly erodible land. The CRP has important economic impacts from the perspective of farmers and from the perspective of the regional economy. This study evaluates the CRP from each perspective.

Previous studies of the CRP estimated the negative effects of reductions in crop production and the partially offsetting positive effects of payments to farmers and expenditures on vegetative cover. This study analyzes the additional positive economic impacts of increases in recreational activity stemming from improved environmental quality. A break-even approach was used to analyze the impacts of recreational activities which are anticipated, but whose precise magnitude is unknown. It was found that break-even levels for regional employment and income could be achieved if farmers received break-even payments of $65/acre and if CRP-induced increases in recreational spending were $5-10/acre.

Previous studies treat compensation paid to farmers in different manners, resulting in large variations in estimates of the program's impacts. This study presents a consistent method of dealing with the economic impacts of environmental and social programs, such as the CRP, whose objectives include decreased output with compensation for producers.

This study is based on the CRP in Virginia, but the analysis of economic impacts of the CRP is also applicable to other regions, with appropriate adjustments for local conditions.

RECREATIONAL IMPACTS of the CONSERVATION RESERVE PROGRAM: A BREAK-EVEN APPROACH

INTRODUCTION

The Conservation Reserve Program (CRP), was established under the Food Security Act of 1985. [1] The CRP has as its objectives supply control, farmer income support and improvements in environmental quality. These objectives are achieved by providing compensation to farmers for substituting permanent vegetative cover (cover) for row crops on highly erodible land. [2] Cover on former cropland, and consequent reductions in erosion-related pollution, should lead to on- and off-farm improvements in wildlife habitat and water quality. In turn, improved environmental quality will potentially enhance wildlife-based and water-based recreational opportunities and lead to increased expenditures on recreational activities.

While the CRP was not designed to achieve specific regional economic objectives, there has been a great deal of interest in the economic impacts of the CRP on rural communities. These impacts include the negative effects of CRP-induced reductions in crop production and the partially offsetting positive effects of payments to farmers and the economic activity generated by establishment, maintenance and harvest (in the case of trees) of cover. Previous studies of the economic impacts of the CRP by Broomhall and Johnson, Martin et al., Mortensen et al., and USDA (1989) have, however, ignored the positive regional economic impacts of CRP-induced increases in recreational activity. These increases in recreational activity have the potential to offset some of the economic disadvantages caused by reduced crop production (Harmon).

It is important to explore the economic trade-offs between agricultural production and environmental quality-based amenities like recreation. Due to their higher income elasticity, the demand for environmental quality-based amenities is growing faster than the demand for agricultural products in the U.S. (Runge; Crosson). This differential rate of growth will have important implications for future land-use patterns and property rights arrangements.

Furthermore, previous economic impact studies of the CRP have treated the compensation paid to farmers inconsistently, resulting in over- or under-estimation of the program's impacts. Given the great deal of interest in economic impacts of the CRP, it is important that accurate and consistent bases for analysis be established.

CRP-induced increases in recreational activity are anticipated but, to date, their precise magnitude is unknown. The critical issue in such cases is whether it is reasonable to expect the beneficial impacts to offset the negative impacts and leave the regional economy no worse off. A break-even approach is used in this study to quantify the level of beneficial activity needed to exactly offset the reductions in economic activity due to the program.

The specific objectives of this study are to:

(a) develop an accurate and consistent basis for treating the compensation paid to farmers for reduced production,

(b) demonstrate the use of a break-even approach when the relevant policy issue is the level of activity necessary to offset negative economic effects of the program,

(c) analyze differences in break-even levels from the perspective of the farming sector, and the regional economy, and

(d) estimate the level of increased recreational activity needed to exactly offset the otherwise negative economic impacts of the CRP.

This study is based on the CRP in Virginia, but the analysis is also applicable to other regions, with appropriate adjustments for local conditions. The break-even analysis is also applicable to other programs with environmental and social objectives that entail the reduction of existing levels of output and the provision of compensation to producers (e.g., the proposed Clean Air Act).

THE CRP AND ENVIRONMENTAL QUALITY

The basic strategy of the CRP is to provide farmers with additional incentives to substitute cover for crop production on highly erodible soils. Farmers voluntarily enter into a bidding process with the U.S. Department of Agriculture (USDA) requesting an annual "rental" payment as compensation for losses related to reduced crop production and the maintenance costs of cover.[3] If the USDA accepts the bid, farmers are provided with half the expenses for establishing cover and annual payments for the duration of the ten-year contract. Acceptable cover practices include introduced or native grasses and legumes, grass filter strips, trees, and wildlife habitats. To limit negative economic impacts on rural communities, only 25% of a county's cropland may be enrolled in the CRP (unless the USDA grants a waiver).

Harvesting, grazing or any other commercial use of the cover is, in general, not permitted during the CRP contract period. However, consumptive (hunting and fishing) and non-consumptive (birdwatching, wildlife photography, hiking and picnicking) recreation is permitted on retired CRP land. Retired CRP land tends to enhance wildlife habitat and recreational opportunities on

adjacent meadows, wooded areas and waterways. [4] Therefore, farmers might be able to supplement their income by renting land for recreational activities.

In addition to on-farm benefits, cover also reduces erosion-related pollution that impairs water-based recreation (swimming, fishing, boating and waterfowl hunting). Where CRP enrollments of erodible cropland are high, the downstream quality of streams, estuaries, lakes, bays and wetlands should be enhanced. This should, in turn, lead to increases in recreational activity on waterways and surrounding areas.

Ribaudo (1989a, 1989b); Langner; Ribaudo et al. (1989); and Ribaudo et al. (1990) predict significant increases in wildlife-based and water-based recreational activity resulting from the CRP. Ribaudo et al. (1989) estimated that a fully implemented 45-million acre CRP should generate about $10 billion in natural resource benefits in the U.S. About forty percent should come from improved wildlife habitat (not including non-consumptive recreation) and about forty percent from improved surface water quality (including recreational fishing and other non-recreational categories related to damage from sedimentation, but not including recreational boating and swimming or commercial fishing). According to Ribaudo et al. (1989), and Ribaudo et al. (1990) there should also be CRP-induced environmental benefits from increased soil productivity, improved air quality and improved groundwater quality.

VIRGINIA AND THE CRP

A major concern of the Commonwealth of Virginia is water quality in the Chesapeake Bay, one of the most important ecosystems in the U.S. The Chesapeake Bay supports numerous recreational activities and its adjoining wetlands are important habitats for migratory birds and waterfowl (Phillips

and Shabman). Cropland contributes about two-fifths of the nitrogen and about one-tenth of the phosphorous non-point pollution in the Chesapeake Bay (Ligon et al.). Virginia has used the federally funded CRP to complement existing state programs designed to improve water quality in the Chesapeake Bay. However, CRP enrollment levels have been low in areas that are major contributors of cropland-based pollution to the Chesapeake Bay.

To encourage increased enrollment in targeted areas, Virginia instituted changes in the CRP bidding process. In 1988 Virginia's CRP bid pool was broken down into three sub-state pools with maximum acceptable rental rates of $70 and $60 per acre, respectively, for two areas in the Chesapeake Bay watershed targeted for intensive control of erosion-related pollution from cropland, and $55 per acre elsewhere in the state. In addition, beginning in 1989, the Virginia Division of Soil and Water Conservation offered enrollment bonuses to farmers in the Chesapeake Bay watershed.

In Virginia a total of 910,000 acres are eligible for the CRP (740,000 acres if the 25% enrollment limit per county is imposed). Through the ninth CRP sign-up which took place in 1989, only 76,200 acres had been enrolled, at an average annual payment of about $52/acre. The average CRP payment for the first six CRP sign-ups was about $49/acre. In the ninth sign-up the average payment increased to about $60/acre and 10,500 acres were enrolled, with a high proportion in targeted areas of the Chesapeake Bay watershed.

ECONOMIC IMPACT ANALYSIS OF THE CRP

Enhanced recreational opportunities resulting from the CRP will have both economic value and economic impacts. Analysis of the CRP by Ribaudo (1989a, 1989b); Langner; Ribaudo et al. (1989); and Ribaudo et al. (1990)

provide estimates of the economic value to primary users of recreation (recreationists), but do not consider the market value of the economic activity that is generated. This activity includes the supply of goods and services to recreationists. These are known as the economic impacts of recreational activity.

Even though non-market benefits and costs are assigned dollar values in the analysis of economic value (e.g., benefit/cost analysis), they are not included in economic impact analysis. Economic impact analysis measures only the changes in economic activity actually transacted in the marketplace. Input-output (I-O) models are the most frequently used analytical framework for economic impact analysis.[5] There have been several economic impact studies of the CRP including studies by Broomhall and Johnson, Martin et al., Mortensen et al., and USDA (1989).

None of these studies devoted sufficient attention to the unique features of the CRP -- a program designed to reduce existing output levels by providing compensation to producers for their losses. This paper proposes the following principles when analyzing the economic impacts in such cases. Given these principles, the adequacy and consistency of other analyses can be assessed.

(1) since certain economic agents in the target sector (in this case farmers) are compensated by the program for their reduced level of employment, the measurement of change in relevant regional employment should exclude induced reductions in their employment,

(2) since other economic agents in the target sector (in this case hired labor) are not compensated for their reduced level of employment, this employment loss should be included in the measurement of relevant employment

change,

(3) since compensated economic agents receive a transfer payment which they spend, the measurement of change in regional income should include the transfer payment and ensuing expenditures in the regional economy, and

(4) since the objective of the program is to reduce output in one sector, criteria related to changes in regional output should exclude the consequent reductions in the target sector output.

When introducing a scenario in I-O analysis, one can either change the demand for outputs in the target (producing) sector, or change demand for inputs from backward-linked input-supply sectors. The latter approach essentially excludes direct effects of the scenario on output, employment, and income in the target sector. The study by USDA (1989) used the former approach, thereby focusing on the directly impacted crop sectors. By choosing this approach the USDA (1989) study overestimated negative employment impacts by including employment losses of compensated farmers, a violation of principle (1) above. In contrast, by focusing on economic impacts in input-supply sectors, the studies by Broomhall and Johnson, and by Mortensen et al. excluded employment losses of farmers, but underestimated the negative employment impacts of the CRP by also excluding the impacts on hired farm labor, a violation of principle (2).

The income impact of the CRP includes both the payment to farm households and the income generated by subsequent consumption expenditures of farm households. USDA (1989) overestimated the negative income impacts by ignoring the initial income impact of CRP transfer payments from the USDA to farm households, a violation of principle (3). In contrast, Martin et al. correctly included the economic impacts of income being both received and then

being spent as household expenditures.

The studies by Broomhall and Johnson, Mortensen et al., and USDA (1989) each violated principle (4) by interpreting the negative impacts of the CRP on total gross output as a measure of regional economic well-being. Total gross output should not be the focus when assessing regional economic impacts of the CRP because farmers are being paid to reduce output.

The analysis in this study presents a consistent means of measuring the economic impacts of the CRP, and other environmental and social programs whose objectives include decreased output with compensation provided for selected economic agents. Figure 1 compares the framework of analysis used in this and other economic impact studies of the CRP.

METHODS

This section on methods begins with a sub-section on the assumptions used for the I-O analysis and is followed by a sub-section describing the break-even approach.

Assumptions Used for the I-O Analysis

Like Broomhall and Johnson, Martin et al., and USDA (1989), the U.S. Forest Service's I-O model, IMPLAN Version 2.0 (Alward; Palmer and Siverts) was used for the economic impact analysis. The IMPLAN I-O model's database consists of a national technology matrix, disaggregated to the county level, based on the economic interrelationships of 528 sectors in 1982. [6] For this study, the IMPLAN I-O model was aggregated into 38 sectors. Sectoral aggregation was based on the allocation of changes in final demand, sectors directly affected by CRP-induced changes in final demand were left disaggregated. For the analysis, Virginia's counties were aggregated into a

single state-wide unit.

Using Type II multipliers, economic impacts of the CRP -- changes in final demand -- were calculated in terms of total gross output, total income (divided into property income and employee income) and employment. [7]

The analysis is based on a representative year of the CRP, and the following economic impacts were considered: [8]

(a) Reduced crop production. Like USDA (1989), gross revenues per acre were used to introduce changes in final demand directly into the respective crop production sectors. [9] To date, Virginia CRP participants have retired acreage producing at about 90% of the state-wide average (USDA, 1989). [10] Following Shoemaker, it was assumed that farmers continue to enroll acreage with below average yields, although high erodibility does not necessarily imply low productivity (Heimlich).[11] It was assumed that there was no "slippage" (no intra-farm or inter-farm transfer of resources that may offset the reduced economic activity) although, in practice, there might be some diversion of resources to other economic activities.

Due to the low level of participation in USDA commodity programs by Virginia farmers, especially in the Chesapeake Bay watershed (Ligon, et al.), it was assumed that producer prices (not deficiency payments) reflected prices received by farmers. Possible CRP-induced forfeiture of income from other government support programs were not considered. [12]

(b) Maintenance of Vegetative Cover. It was assumed that annual maintenance costs of cover were $5/acre (Virginia ASCS). Changes in final demand for cover were introduced via an aggregated sector consisting of the hay and pasture, and grass seeds sectors.

(c) CRP payments (household expenditures). Losses in net farm income

resulting from reduced crop production are implicitly part of (a) above. CRP payments are an income transfer from the USDA to households designed to compensate farmers for these income losses, and are introduced into the I-O model as changes in consumption final demand by farm households. [13] IMPLAN's breakdown of household consumption expenditures was used to allocate changes in final demand. For the baseline analysis the annual CRP payment was assumed to be $60/acre (the state average in the most recent CRP sign-up). The net increase in household expenditures was assumed to be $55/acre ($60 minus $5 spent on cover maintenance).

The economic impacts (a), (b) and (c) were all considered in previous economic impact studies of the CRP. This analysis also considers economic impacts related to CRP-induced increases in recreational activity. Two sources of recreational expenditures were considered, rental payments by recreationists to farmers, and expenditures on goods and services by recreationists in the regional economy. In both cases the level of economic activity is unknown, necessitating the use of a break-even approach.

(d) Rental payments by recreationists to farmers. Farmers might be able to supplement their income by renting their land for recreational activities. There has been an apparent rise in the amount of hunting activity in several southern states and numerous annual hunting leases have been contracted for $10 and more per acre (Doane's). Miller and Bromley surveyed about half of the Virginia farmers enrolled in the CRP in 1988, and three-fourths of the respondents indicated they would like to improve wildlife habitat on CRP-enrolled land. One-tenth of the respondents indicated they would lease their land if their price were met (half of which would lease for $5 or less per acre). Respondents that did lease their land for cash, charged

an average of $2/acre/year. It was assumed that farmers spend income from rental payments according to the same expenditures patterns as income from crop production and CRP payments.

(e) Recreationists' expenditures on goods and services. Another source of recreational expenditures is money spent by recreationists on goods and services. IMPLAN (and most other I-O models) does not include an economic sector called recreation or tourism because these sectors are not defined in the Standard Industrial Classification (SIC) or in the national I-O accounts on which most I-O models are based. The recreation and tourism sector is, instead, a composite of a number of sectors. A recreationist typically purchases goods and services from the six broad categories presented in Table 1. The shares in Table 1 are the assumed expenditure pattern of a "representative" recreationist in Virginia. These categories and shares are similar to recreation-specific expenditure patterns cited by Walsh.

Increases in recreational expenditures in a large area such as a state do not necessarily indicate new infusions of economic activity. They might merely represent the substitution of one economic activity within the state for another. For I-O analysis the important distinction is whether or not the spending is "new spending" in Virginia. Therefore, this analysis only considers expenditures from non-Virginia residents, or from Virginia residents who had previously purchased recreational activities elsewhere.

Figure 2 summarizes the direct economic impacts of the CRP. Figure 2a shows economic flows without the CRP (the loss of which are negative impacts of the CRP), while Figure 2b shows the economic impacts with the CRP (the CRP's positive impacts). Note losses (gains) to agricultural supply sectors from crops (cover), the countervailing effects on consumption sectors and the

introduction of recreation-based sectors and the government in Figure 2b.

Description of the Break-even Approach

To perform traditional economic impact analysis, an I-O model requires data on anticipated changes in final demand. Occasionally, the level of anticipated economic activity is not known. Break-even analysis enables us to measure the level of one type of economic activity needed to offset the negative economic impacts from another economic activity. The break-even analysis used in this study is a relatively simple procedure that can be used when there is a lack of data on anticipated changes in final demand.

The standard formulation of an I-O model is:

$$X = AX + Y \qquad (1)$$

where X is an nx1 vector of sector gross output, A is an nxn matrix of technical coefficients, Y is an nx1 vector of final demand, and n is the number of sectors. The solution to this system of equations is:

$$X = (I - A)^{-1} Y \ . \qquad (2)$$

This allows us to calculate sectoral output if sectoral final demand is known. The term $(I - A)^{-1}$ is the matrix of multipliers (Leontief coefficients). We can denote the multiplier matrix as M, therefore:

$$M = (I - A)^{-1} \ , \text{ and} \qquad (3)$$

substituting equation (3) into equation (2) gives:

$$X = M Y \ . \qquad (4)$$

If the objective is to calculate the break-even value of a particular sector's final demand, that is, to calculate a value y_{i*} which will generate a total gross output $\bar{X}^*$ (where * indicates the break-even levels, lower case indicates a scalar and bar indicates the sum of a vector), then proceed as follows.

Premultiplying both sides of equation (4) by the unit vector gives:

$$\bar{X} = \bar{M}\, Y \ , \qquad (5)$$

where $\bar{M}$ is the vector of total gross output multipliers and $\bar{X}$ (a scalar) is the value of total gross output. If the ith element of Y is set equal to y_{i*} and all other elements set to zero, then:

$$\bar{X}^* = \bar{M}\, Y^* \ , \qquad (6)$$

or:

$$\bar{X}^* = \bar{M}_i\, y_i^* \ , \qquad (7)$$

where $\bar{M}_i$ is the total gross output multiplier for sector i. Since $\bar{M}_i$ is a scalar, the break-even level of final demand for the ith sector is:

$$y_{i*} = \bar{X}^* \ / \ \bar{M}_i \ . \qquad (8)$$

Similarly, break-even values of income and employment in sector i can be calculated by multiplying y_{i*} by the respective ratios of income and employment to output in sector i. This is equivalent to dividing $\bar{X}^*$ in equation (8) by the income coefficient or employment multiplier.

The break-even procedure used in this study is, in essence, the reverse of the standard formulation of the I-O model. In this alternative formulation we solve for the necessary changes in Y required to achieve a given level of X. [16]

RESULTS

The following section on results begins with a sub-section on the baseline analysis, and is followed by sub-sections on the break-even analysis from the farmer's perspective, and the break-even analysis from a regional perspective.

Baseline Analysis

The baseline analysis assumes a $60/acre CRP payment and does not include the economic impacts from increased recreational activity. Type II total gross output (TGO) and employment multipliers, and total income coefficients were derived for each CRP-induced economic activity (see Table 2). The TGO and employment multipliers, and total income coefficient for recreational expenditures are larger than for crop production. This is due, in part, to the larger local labor component in consumption-oriented sectors (with a high proportion of services), compared to the larger proportion of "leakages" for inputs in goods-producing sectors.

Economic impacts were calculated by combining the TGO and employment multipliers, and total income coefficients with the CRP-induced changes in final demand. The regional economic impacts of enrolling 1,000 acres in the CRP in Virginia were estimated to be the following: TGO decreased by $206,650; employment decreased by 0.35 jobs, and total income decreased by $12,970. Results of the baseline analysis are presented in Table 3.

The calculation of total economic impacts in Table 3 represents the major difference between this study and previous economic impact studies of the CRP. The findings in USDA (1989), for example, are comparable to the sub-total economic impacts in Table 3. The sub-total economic impact on employment was a decrease of 1.9 jobs per 1,000 acres enrolled in the CRP. However, this decline in employment includes on-farm labor (the -2.9 jobs in row A, column 4). Since farmers enrolled in the CRP are being paid not to work, their employment is appropriately deducted when calculating employment impacts. On the other hand, since there is no compensation paid to hired farm labor and input-supply sectors, their employment losses are negative impacts

of the CRP.

In the last column of Table 3, the total income impact is adjusted to reflect the transfer payment to farm households in compensation for income losses due to reduced crop production. The total income impact includes both the initial transfer payment to farm households ($60,000 in row D) and the income impact generated by the subsequent consumption expenditures of farm households ($41,415 in row C).

Break-even Analysis: Farmer's Perspective

The baseline analysis was based on the approximate existing conditions. The following analysis focuses attention on the farmer's break-even perspective. Here the analysis will search for the level of CRP payments and/or rental payments by recreationists to farmers needed to offset the negative income impacts from reduced crop production.

Because of the lack of information on the specific crop budgets of potential participants in the CRP, the IMPLAN I-O model's database was used to conduct this break-even analysis. IMPLAN's input-output coefficients distinguish between property income and employee income. IMPLAN's property income coefficients in the crop production and cover sectors are defined as returns to farmers for labor, management and capital, while the employee income coefficients are defined as payments to hired farm labor.

According to the coefficients in the IMPLAN model, an average farmer enrolling in the CRP for an annual $60/acre rental payment would not receive full compensation for income foregone from reduced crop production (Table 4). This conclusion is consistent with the low level of CRP enrollment in Virginia. CRP enrollment in Virginia was extremely low prior to the implementation of separate bid pools that targeted areas in the Chesapeake Bay

watershed with increased maximum allowable rental rates to $60-70/acre.

The break-even CRP payment, in terms of farmer income, is calculated in Table 4 to be almost $65/acre ($64.3). In theory, a farmer should be indifferent between earning property income from crop production, from CRP payments, and from rental payments by recreationists. The $65/acre break-even point for farmers could be achieved, for example, by a $60/acre CRP payment and $5/acre hunting lease, or other pecuniary combinations adding up to $65/acre. In addition, farmers might consider non-pecuniary benefits such as the utility from personal wildlife-based recreation benefits and utility from off-farm improvements in recreational opportunities. Therefore, CRP-induced recreational opportunities could effectively lower the break-even point of CRP payments to farmers.

Break-even Analysis: Regional Perspective

Although the farmer's break-even payment for income compensation was calculated to be $65/acre, from a regional perspective there are still negative economic impacts in terms of TGO, employment and income (Table 5). When farmers receive a $65/acre payment (from any combination of CRP payments and rental payments from recreationists), how much "new spending" on recreational expenditures must be generated to offset the negative regional economic impacts of each acre enrolled in the CRP? The break-even levels in Table 5 are: $118/acre for TGO, $9.6/acre for employment and $5.6/acre for income.

The break-even for TGO is considerably higher than the respective break-even levels for employment and income. The TGO break-even is only presented for the sake of comparison, because as noted previously, for this analysis the TGO break-even should not be an accepted measure of regional economic well-

being. On the other hand, the break-even points for employment and income are important indicators of regional economic well-being. As indicated in Table 5, the break-even for employment and income will be achieved if farmers receive $65/acre and CRP-induced environmental quality improvements can generate an extra $5-10/acre of new final demand for recreation. [15]

Of course, there are many ways to achieve break-even levels of employment and income. One way is to further increase the level of CRP payments to farmers. The regional break-even points of employment and income were calculated to be CRP payments of about $80/acre and $70/acre respectively. [16] Alternatively, any combination of CRP payments and rental payments by recreationists to farmers that totalled $70-80 would allow the region to break-even. Also, other combinations of CRP payments, rental payments by recreationists, and expenditures by recreationists could achieve regional break-even levels of employment and income. However, this break-even analysis does not consider the distributional impacts on firms or individuals. For example, some retailers might lose business from reductions in certain economic activities, whereas other retailers might gain from increases in other economic activities.

CONCLUSIONS

This paper quantifies the amount of increased recreational activity resulting from CRP-induced improvements in environmental quality necessary to offset the negative economic impacts of the CRP in Virginia. According to the analysis, the break-even for employment and income can be achieved if farmers receive $65/acre and CRP-induced environmental quality improvements can generate an additional $5-10/acre of "new spending" on recreation.

Alternatively, any combination of CRP payments, rental payments by recreationists, and expenditures by recreationists that totalled $70-80/acre could achieve regional break-even levels of employment and income. Levels of this magnitude seem highly feasible and in many parts of the state quite likely.

The economic impacts of the CRP were assessed from the perspective of farmers and from the perspective of the regional economy. The income-generating potential from recreation on farmers' land might make enrollment in the CRP more attractive and could thereby lower the required level of USDA payments to CRP participants. From a regional perspective, if increased CRP enrollment is accompanied by increased on-farm and/or off-farm recreational activity, then there is a potential to offset negative regional economic impacts from decreased crop production.

This paper highlights the need for special attention to the interpretation of results when using an I-O model to analyze the economic impacts of an income transfer program that pays producers not to produce. Employment impacts should exclude employment losses of compensated producers (and include employment losses of hired farm labor) and income impacts should include the initial income impact of the income transfer, and total gross output impacts should not be the focus of attention.

Surveys by Ligon et al., and by Miller and Bromley have found that many Virginia farmers lack adequate information on the CRP, including its existence, eligibility requirements and benefits. Furthermore, many farmers were not aware of potential recreation-based benefits from the CRP. Lack of information is a major obstacle to increased farmer participation in the CRP in Virginia and probably throughout the country. In order to increase

enrollment in the CRP, farmers should be provided with information on the pecuniary and non-pecuniary benefits from enhanced recreational opportunities.

Since the magnitude of anticipated CRP-induced recreational activity was unknown, this paper used a break-even approach. A break-even approach can provide policymakers with important information on the feasibility of offsetting negative economic impacts of one activity or program with another.

This paper points to the need for additional research on the multiple environmental and economic impacts of the CRP. It is crucial to determine the levels of additional recreational expenditures generated by land enrolled in the CRP. The relationship between the location of land enrolled in the CRP and the location of areas benefitting from increased environmental quality and enhanced recreational opportunities needs more attention. Better data on the breakdown of recreational expenditures is also required to improve the accuracy of the economic impact estimates.

For a comprehensive analysis of the potential environmental and economic impacts of the CRP, the impacts of improvements in soil productivity, air quality, groundwater quality, and commercial fisheries need to be considered. These additional environmental and economic impacts could also be analyzed using a break-even approach.

It is suggested that this type of economic impact analysis, preferably at a more disaggregated sectoral and county level, be applied to assist states target the CRP towards environmental and economic objectives.

ENDNOTES:

1 Sources of general information on the CRP and Virginia-specific data were: USDA (1989); USDA (1990); Virginia ASCS; and Ligon et al.

2 "Farmer" is the person who controls property rights for the income generating capacity of the land, and has decision-making authority with respect to enrollment in the CRP.

3 See Shoemaker for details on the bidding process which is administered by the Agricultural Stabilization and Conservation Service (ASCS) of the USDA.

4 According to Langner, wildlife potential varies regionally and is determined by the type of cover and land-use practices on adjacent areas. Wildlife habitats usually consist of a mixture of native grasses and herbaceous species that provide wildlife with cover and food. Wildlife populations associated with farmland include pheasant, quail, rabbit, deer, along with other small mammals and ground-nesting birds.

5 Input-output (I-O) analysis is a general equilibrium approach based on an accounting system of intersectoral purchases and sales. I-O analysis assumes: fixed proportion (Leontief) production functions, no input substitution, homogeneous sector output, and no resource constraints. Economic impacts can be divided into: (i) direct economic impacts- the gross revenues received by producers for final purchases of goods and services by consumers, government and exports, (ii) indirect economic impacts- the expenditures on factors of production, "backward-linkages" to input supply sectors affected by the direct economic impacts, and (iii) induced economic impacts- the subsequent impacts resulting from income received by economic agents during the direct and indirect impacts which are, in turn, spent on other goods and service. Type I multipliers measure direct plus indirect

economic impacts and Type II multipliers measure direct plus indirect plus induced impacts.

6 IMPLAN Version 2.0 is based on input-output ratios from 1982, and when applying the model all prices must be in 1982 prices. In the text, prices are given in 1989 prices using the CPI, with 1982=1.00 and 1989=1.275.

7 Type II multipliers were used because they appropriately assume that some portion of new income received by households is spent, thereby creating induced impacts in the economy. All of the previously mentioned economic impact studies of the CRP also used Type II multipliers.

8 This analysis addresses the annual recurring economic impacts of the CRP and, does not include the establishment or termination costs of the CRP. According to Ribaudo (1989a), enhanced recreational opportunities resulting from the CRP-induced improvements in environmental quality might lag behind cover establishment.

9 Corn, soybeans and wheat accounted for about nine-tenths of Virginia's row crop acreage in 1987, and about two-thirds of Virginia's CRP eligible acres were planted to these crops in 1982. It was assumed that cropland with these crops were enrolled in the CRP, in proportion to their respective shares of CRP eligible acres. Average gross revenues per acre were calculated using average yields and average real producer prices for the 1982 to 1987 period (Virginia Agricultural Statistics). Based on crop budgets, it was assumed that 80% of the employment in crop production (and cover maintenance) was by farmers, 20% by hired labor.

10 CRP data sets in USDA (1989) are ASCS established yields attached to each farm's crop acreage bases for commodity programs, and not a precise characterization of either the crops or the productivity of the lands actually

retired.

11 According to Shoemaker, the bidding process of the CRP reflects a pattern of enrollment in which lower quality land with the lowest opportunity cost goes into the program.

12 Shoemaker noted that as an alternative, it can be assumed that any CRP-induced forfeiture of income from other government support programs was compensated for by increased commodity prices resulting from the supply control objectives of the CRP.

13 Farmers receiving CRP payments were assumed not to change their expenditure patterns nor take their CRP payments and migrate from Virginia. Martin et al., and Broomhall and Johnson address the potential economic impacts of out-migration by CRP participants.

14 Johnson and Kulshreshtha addressed a similar issue of calculating final demand when a sector's output is constrained or otherwise predetermined.

15 The lower break-even point for income relative to employment indicates that recreational expenditures have higher returns to employee and property income (wages plus profits) per person employed than expenditures for the combined CRP-induced changes in crop production, cover maintenance and household expenditures.

16 Break-even levels of final demand were calculated using the benchmark values of TGO, employment and income for $65/acre, and the TGO and employment multipliers and total income coefficient for household expenditures (Table 2). The break-even calculations were:

Employment $80.6 = \$65 + [(0.25)/(\$1/.0204)] \times 1.275(CPI)$, and

Income $70.6 = \$65 + [(\$4.2/0.753)]$.

REFERENCES

Alward, G.A. "IMPLAN Version 2.0: Methods Used to Construct the 1982 Regional Economic Data Base." U.S. Forest Service. Fort Collins, CO. Draft.

Broomhall, D.E. and T.G. Johnson. "The Impact of the Conservation Reserve Program on a Region in Rural Eastern Georgia." Review of Regional Studies. Forthcoming, 1990.

Crosson, P.R. "Supplying the Environmental Values of Agriculture". Resources. Resources for the Future. Number 98:4-8. Winter 1990.

Doane's Agricultural Report, February 3, 1989. cited in Capsules (a periodic publication of the Southern Rural Development Center), March 1989.

Harmon, K.W. "History and Economics of Farm Bill Legislation and the Impacts on Wildlife Management and Policies". Impacts of the Conservation Reserve Program in the Great Plains. Symposium Proceedings, September 16-18, 1987. USDA Forest Service. General Technical Report RM-158. pp. 105-108. April 1988.

Heimlich. R.E. Productivity and Erodibility of U.S. Cropland. Economic Research Service. Washington, D.C. Agr. Econ. Report No. 604. January 1989.

Johnson, T.G. and A.N. Kulshreshtha. Exogenizing Agriculture in an Input-Output Model to Estimate Relative Impacts of Different Farm Types". Western Journal of Agricultural Economics. 7(2):187-198. December 1982.

Langner, L.L. "Land Use Changes and Hunter Participation: The Case of the Conservation Reserve Program." Paper presented at the 54th North American Wildlife and Natural Resources Conference, Washington D.C., March 21 1989.

Ligon, P.C., S.S. Batie, W.R. Kerns, D.B. Taylor, and P.B. Siegel. "Chesapeake Bay Farmers' Participation in the Conservation Reserve Program." Dept. of Agr. Econ., Virginia Polytechnic Institute and State University. SP-88-10. May 1988.

Martin, M., H. Radtke, B. Eleveld, and S.D. Nofziger. "The Impacts of the Conservation Reserve Program on Rural Communities: The Case of Three Oregon Counties." Western Journal of Agricultural Economics. 13(2):225-232. December 1988.

Miller, E.J. and P.T. Bromley. "Wildlife Management on Conservation Reserve Program Land: The Farmers' View." Journal of Soil and Water Conservation. 44(5):438-440. Sept.-Oct. 1989.

Mortensen, T.L., R.C. Coon, F.L. Leistritz, J.A. Leitch and B.L. Ekstrom. "Regional Economic Impact of the Conservation Reserve Program: An Application of Input-Output Analysis." North Dakota Agricultural Experiment Station. AE89003. January 1989.

Palmer, C. and E. Siverts. IMPLAN User Guide, Version 1.1. U.S. Forest Service. Fort Collins, CO. July 1985.

Phillips, S. and L. Shabman. "Modelling Agricultural Pesticide Application and Risk for the Chesapeake Bay Region of Virginia: Current Estimates, Future Trends and Research Needs." Dept. of Agr. Econ., Virginia Polytechnic Institute and State University. SP-89-14. May 1989.

Ribaudo, M.O. Water Quality Benefits from the Conservation Reserve Program. USDA. Economic Research Service. Washington, D.C. Agr. Econ. Report No. 606. February 1989. (a)

Ribaudo, M.O. "Targeting the Conservation Reserve Program to Maximize Water Quality Benefits." Land Economics. 65(4):320-332. November 1989. (b)

Ribaudo, M.O., S. Piper, G.D. Schaible, L.L. Langner, and D. Colacicco. "CRP: What Economic Benefits?" Journal of Soil and Water Conservation. 44(5):421-424. Sept.-Oct. 1989.

Ribaudo, M.O., D. Colacicco, L. Langner, S. Piper and G.L. Schaible. Natural Resources and Users Benefit from the Conservation Reserve Program. USDA. Economic Research Service. Washington, D.C. Agr. Econ. Report No. 627. January 1990.

Runge, C.F. "Induced Agricultural Innovation and Environmental Quality". Land Economics. 63(3):249-258. August 1987.

Shoemaker, R. "Agricultural Land Values and Rents Under the Conservation Reserve Program". Land Economics. 65(2):131-137. May 1989.

U.S. Department of Agriculture, Agricultural Stabilization and Conservation Service (ASCS). "Conservation Reserve Program, Logo-Package: Includes Ninth Signup Results." Washington, D.C. January 1990.

U.S. Department of Agriculture. Conservation Reserve Program: Progress Report and Preliminary Evaluation of the First Two Years. Washington, D.C. January 1989.

Virginia Agricultural Stabilization and Conservation Service (ASCS). Richmond, VA. Written communication from Carolyn V. Felts, Program Specialist, Conservation. February 1, 1990.

Virginia Agricultural Statistics. Virginia Agricultural Statistics Service. Richmond, VA. various editions.

Virginia Statistical Abstract, 1987. Center for Public Service. University of Virginia. 1988.

Walsh, R.G. Recreation Economic Decisions: Comparing Benefits and Costs. Venture Publishing, Inc. State College, PA. 1986.

Figure 1. Comparison of the Framework Used in This Study and Other Studies Analyzing Economic Impacts of the CRP

Study	Scenarios Introduced	Criteria for Analysis	Exclude Compensated Farmer Employment Losses (Principle 1)	Include Uncompensated Hired Farm Labor Employment Losses (Principle 2)	Include Income Received as Transfer Payment (Principle 3)	Exclude Compensation for Reductions in TBO (Principle 4)	Include Economic Impacts of Improved Environmental Quality
Broomhall and Johnson	change in input sectors	TBO employment	yes	no	yes	no	no
Martin et al.	change in input sectors	income	not applicable	not applicable	yes	yes	no
Mortensen et al.	change in input sectors	TBO employment	yes	no	yes	no	no
USDA (1989)	change in crop sectors	TBO employment income	no	yes	no	no	no
The authors	change in crop sectors and recreation purchases	TBO employment income	yes	yes	yes	yes	yes (partially)

Figure 2. Flow of Regional Economic Impacts of CRP

Figure 2a Negative Regional Economic Impacts from Reduced Crop Production

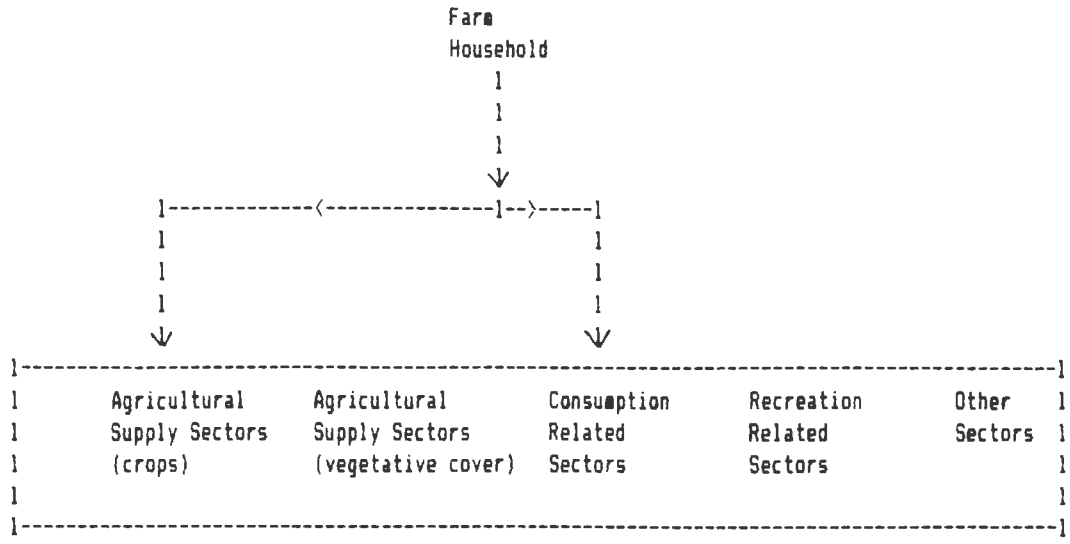

Figure 2b Positive Regional Economic Impacts from CRP Payments, Cover Maintenance and Recreation

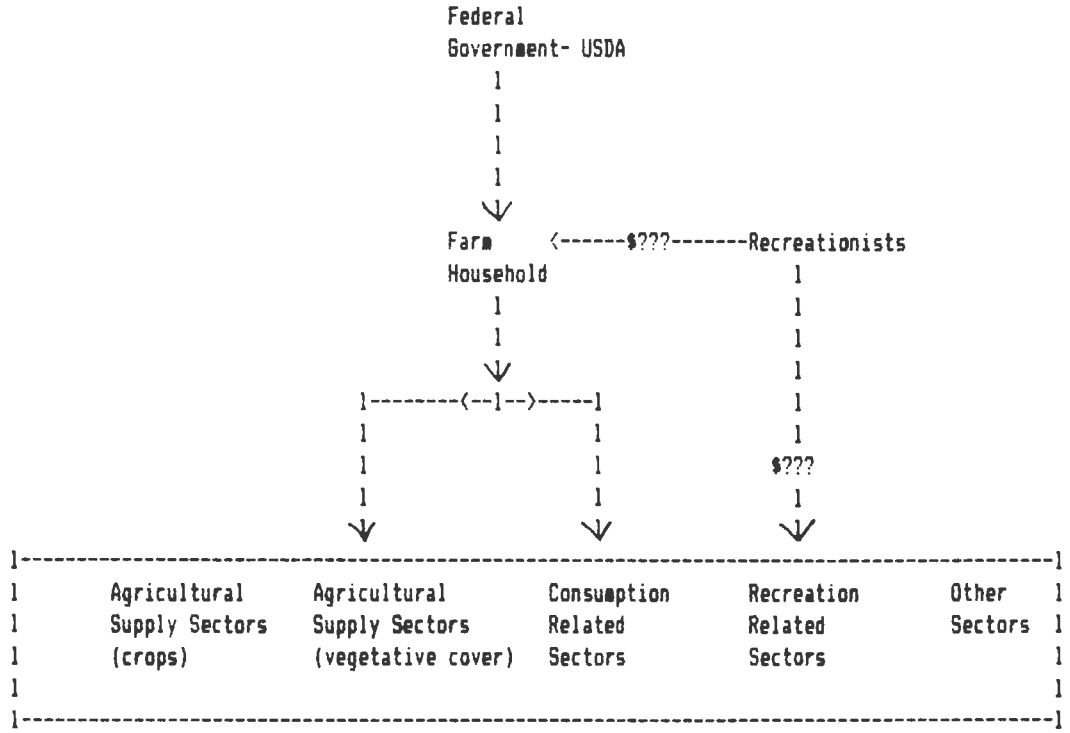

Table 1. Travel Industry Generated Receipts in Virginia, 1985

Recreation and Tourism Related Sector	Share of Receipts
Food Services	32%
Lodging Places	24%
Automobile Transportation	16%
Public Transportation	11%
Entertainment/Recreation	9%
Misc. Retail Stores	8%

Source: Virginia Statistical Abstract, 1987.

Table 2. TYPE II Total Gross Output (TGO) and Employment Multipliers, and Total Income Coefficient per $1 Change in Final Demand (FD)

Economic Activity	TGO Multiplier ($ of TGO per $1 FD)	Employment Multiplier (# of jobs per $1,000,000 FD)	Total Income Coefficient ($ of income per $1 FD)
Crop Production	1.55	19.6	0.617
Maint. of Vegetative Cover	1.51	16.2	0.569
Household Expenditures	1.46	20.4	0.753
Recreational Expenditures	1.69	33.4	0.751

Table 3. Economic Impacts of the CRP in Virginia: Baseline Analysis

Program Component	Economic Impacts Calculated per 1,000 Acres in 1989 Prices			
	Final Demand (FD)	TGO	Employment	Total Income
	$	$	# of jobs	$
(1)	(2)	(3)	(4)	(5)
A. Reduced Crop Production	-190,000	-294,500	-2.9	-117,230
B. Maint. of Vegetative Cover	+5,000	+7,550	+0.1	+2,845
C. Household Expenditures	+55,000	+80,300	+0.9	+41,415
SUB-TOTAL (A+B+C)	-130,000	-206,650	-1.9	-72,970
D. Income Transfer				+60,000
E. Compensated Farm Employment Losses			+1.55	
TOTAL ECONOMIC IMPACTS $60/acre CRP Payment (A+B+C+D+E)	-130,000	-206,650	-0.35	-12,970

Notes:
1. TGO, Employment and Total Income calculated by multiplying FD by respective multipliers and coefficient (Table 2).
2. Compensated Farm Employment Losses calculated as: [(13)x(0.8)/19.6]x(2.9), where 13 jobs out of 19.6 jobs per $1,000,000 of Final Demand for crop production are on-farm, assume 80% operator labor, multiplied by 2.9 from row (A).

Table 4. Break-even Analysis of CRP in Virginia: Farmer's Perspective

Program Component	Economic Impacts per Acre Calculated in 1989 Prices	
	Final Demand (FD)	Farmer Income
	$	$
(1)	(2)	(3)
A. Reduced Crop Production	-190	-60.8
B. Maint. of Vegetative Cover	+5	+1.5
D. Income Transfer (Baseline)	+55	+55
TOTAL ECONOMIC IMPACTS (baseline) $60/acre CRP Payment (A+B+D)	-130	-4.3
BREAK-EVEN for FARMER INCOME		
F. Income Transfer (Break-even)	+59.3	+59.3
TOTAL ECONOMIC IMPACTS (Break-even) $64.3/acre CRP Payment (A+B+F)	-125.7	0

Notes:
1. Property Income for (A) and (B) calculated by multiplying FD by their property income multipliers, 0.32 and 0.30.
2. Income Transfer for property income calculated as CRP payment minus $5/acre cost of maintaining vegetative cover.

Table 5. Break-even Analysis of CRP in Virginia: Regional Perspective with Recreational Activity

Economic Impacts per Acre Calculated in 1989 Prices

Economic Parameter that is Basis for Break-even Analysis (1)	Break-even Final Demand (FD) $ (2)	Total Gross Output (TGO) $ (3)	Employment # of jobs (4)	Total Income $ (5)
BENCHMARK VALUES Based on $65/acre CRP Payment	-125	-199.4	-0.25	-4.2
Total Gross Output Break-even (*)	+118.0	+199.4		
Employment Break-even (**)	+9.6		+0.25	
Total Income Break-even (***)	+5.6			+4.2

BREAK-EVEN ALGORITHMS: TGO and employment multipliers, and income coefficient from Table 2.

(*) Total Gross Output (TGO):

$$\text{Break-even Value for Change in Final Demand for Recreational Expenditures} = \frac{\text{Benchmark Value of TGO from CRP}}{\text{TGO Multiplier for Recreational Expenditures}}$$

(**) Employment:

$$\text{Break-even Value for Change in Final Demand for Recreational Expenditures} = \frac{\text{Benchmark Value of Employment from CRP}}{\text{Employment Multiplier for Recreational Expenditures}} \times 1{,}000 \times 1.275 \text{ (CPI)}.$$

(***) Total Income:

$$\text{Break-even Value for Change in Final Demand for Recreational Expenditures} = \frac{\text{Benchmark Value of Total Income from CRP}}{\text{Total Income Coefficient for Recreational Expenditures}}$$

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