Accepted for publication 16 February 2007. Published 14 June 2007.

Estimating Economic Impact of Conservation Field Borders on Farm Revenue

Philip J. Barbour, Department of Wildlife and Fisheries, 259 Thompson Hall, Mississippi State University, Mississippi State 39762; **Steven W. Martin,** Delta Research and Extension Center, P. O. Box 69, Stoneville, MS 38776; and **Wes Burger,** Department of Wildlife and Fisheries, 259 Thompson Hall, Mississippi State University, Mississippi State 39762

Corresponding author: Steven W. Martin. smartin@ext.msstate.edu

Barbour, P. J., Martin, S. W., and Burger, W. 2007. Estimating economic impact of conservation field borders on farm revenue. Online. Crop Management doi:10.1094/CM-2007-0614-01-RS.

Abstract

Potential opportunity costs of conservation buffer practices were examined to determine the effects of proximity to field edge and adjacent plant community (APC) type (crop, herbaceous, and wooded) on crop yields, relative to field interiors for corn (*Zea mays*) and soybean (*Glycine max*) systems on 150 fields in Mississippi. Yield data were obtained from combines equipped with a yield monitor and Global Position System (GPS) for years 1999-2003 for three counties in central Mississippi. A partial budget format was used to develop net change in profit analyses on corn and soybean crops with and without conservation practice CP-33: Habitat Buffers for Upland Birds. Yield reductions averaged across three APC types at swath 1 (defined as one 7.32-m-wide combine header pass) were -2,963 kg/ha and -230 kg/ha compared to mean interior yields of 9,828 kg/ha and 2,498 kg/ha for corn and soybeans, respectively. Partial budget analyses for corn showed that on average, enrollment of a 7.32-m (36-ft) CP-33 border would increase net returns when next to APC-type crop, herbaceous, and wood.

Introduction

As part of a larger investigation studying wildlife benefits of field border management practices (13), agronomic impacts on crop yields associated with four swathes (passes) of a combine in relation to plant community types and relative to field interiors were examined. Of particular interest was how mean yields changed spatially from crop edge to field interior and what effect three plant community types (crop, herbaceous, or wood) had on mean yields along the edge (swath 1) and on subsequent swathes (swaths 2, 3, and 4) further into the field. If crop yields were consistently less along edges due to edge effect, plant community type, or both, a higher economic return along field perimeters might occur with the implementation of a conservation practice such as habitat buffers for upland birds (CP-33). This study provides insight into costs and benefits of replacing lower-yielding field edges with conservation buffers.

Generally, crop yields are reduced near edges relative to field interiors and thus field edges are agronomically less valuable (5), and yields are generally presumed to be lower near edges or "headlands" than in the main body of the field (16). Several studies have shown headlands to yield significantly less than the rest of the field in cereals (1,6,16) and root crops (7). Lower crop yields on headlands have been attributed to soil compaction, poor seedbed preparation, greater weed abundance, shading by tall field boundary vegetation, and competition from tree roots (1). Fully sprayed (herbicide) headlands yield on average 18% less grain per hectare than midfield, although differences varied from a 67% reduction to a 24.9% increase in yield (1). Differences between yields from headlands and the main body of a field may be greater where soil type is more prone to compaction, and/or where the field is bordered by trees or a competitive hedge (16). Crop inputs (fertilizer) and protection (fungicide, herbicide, and insecticide) begin and end on field edges that may result in over-and under-applications (*personal observation*). Irrigation may begin and end along edges resulting in over- or under-watering of crops. Additionally, crops adjacent to wood plant communities are frequently lower yielding than field interiors. Semple et al. (12) found that shading of field plants adversely affected crop growth and yields and the net effect of shelter and shade resulted in a 50% reduction in yield. Presence of trees at the field edge has been shown to have the greatest effect on adjacent crop yields: areas shaded by trees produced 4.4 tons/ha wheat versus areas not shaded which produced 8.1 tons/ha (15). Thus, headlands or field edges are frequently lower yielding due to stresses that field interiors lack.

A salient consideration in replacement of low-yielding field margins with buffer strips or similar practices is whether edge effects (i.e., lesser yields due to aforementioned factors) move to field interiors. In an experiment on yield of sugar beet and winter wheat, Sparkes et al. (15) reported that headland effects did not move to field interiors when field margins were planted in grass (and not used for turning), and there were no significant effects on adjacent crop yield.

US agricultural policies and programs continue to evolve towards greater consideration of wildlife as well as maintaining historical priorities such as soil erosion and water quality. The first specific farm policy title devoted to conservation was in the 1985 Farm Bill (4). The 2002 Farm Security and Rural Investment Act (Farm Bill) continued the emphasis with environmental enhancements taking priority over other benefits, such as productivity and supply control (4). Stull et al. (17) examined use of GPS yield monitor maps in combination with economic analyses to optimize strategic decisions to identify areas of fields that were best suited for enrollment in Conservation Reserve Program (CRP) grass filter strips. Their analyses revealed that historical GPS yield monitor data could be used to select areas for enrollment that would increase overall net returns with economically superior results from either enrolling all eligible land in the CRP or not participating in CRP (17).

On 1 October, 2004, the United States Department of Agriculture (USDA) Farm Service Agency (FSA) introduced a new conservation practice under the Continuous Conservation Reserve Program (CCRP) intended to create 250,000 acres of habitat for northern bobwhite in 35 states (2). This new practice, CP-33: Habitat Buffers for Upland Birds, is applied around field edges of eligible cropland. Eligible cropland must be suitably located and adaptable to establishment of northern bobwhite. The cropland does not need to be classified as highly erodible, but must have been cropped at least four out of six years (1996-2001) (2). Other conservation practices (e.g., CP-22: grass filter strips or CP-22: riparian buffers) required eligible land to be classified as highly erodible (HEL) or adjacent to streams or waterways, respectively. Although many acres of farmland are HEL or adjacent to waterways, many more thousands are not, and as such, until creation of CP-33, were not eligible for enrollment in buffer conservation practices. This study supports the Stull et. al (17) findings on use of historical yield monitor maps to economically optimize enrollment of field edges in conservation practices.

Study Area

The study area consisted of 150 row crop fields (2,742.2 ha total area with a mean field size of 17.5 ha) on privately-owned farms in Clay, Lowndes, and Noxubee counties, Mississippi, located within the Gulf Coast Plain physiographic province (88°44'W, 33°40'N to 88°31'W, 33°05'N) (Fig. 1) with a mean elevation of 62.4 m. The mean corn field size was 19.0 ha (n = 104, range = 0.3 ha to 211.4 ha) and total area in corn fields was 1,993.5 ha. Mean soybean field size was 16.2 ha (n = 46, range = 1.4 ha to 82.9 ha) and total area in soybean fields was 748.7 ha.

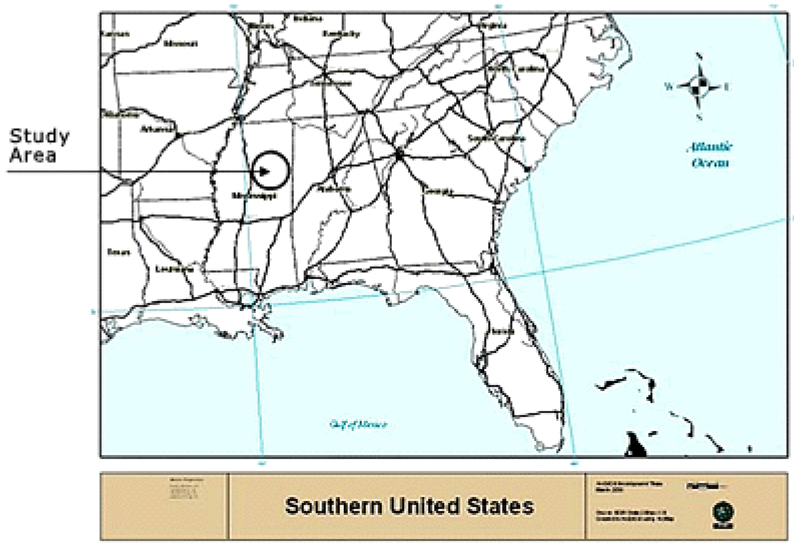

Fig. 1. Study area in Mississippi, Southern United States.

Of the fields, 20.0% (n = 30) had crop, 41.0% (n = 62) herbaceous, and 39.0% (n = 58) wood adjacent plant community (APC) type present. Of the 104 corn fields, 22.0% (n = 23) had crop, 40.0% (n = 41) herbaceous, and 38.0% (n = 40) wood APC present. Of the 46 soybean fields, 13.0% (n = 6) had crop, 45.0% (n = 21) herbaceous, and 42.0% (n = 19) wood APC present. Of the 104 corn fields, 16.0% of edge (field perimeter) was crop APC type, 37.0% herbaceous, and 47.0% wood. Of the 46 soybean fields, 9.0% of edge was crop APC type, 40.0% herbaceous, and 51.0% wood.

For all corn and soybean fields in the study area, field border segments that had a crop APC type present, always had the same crop type as the field itself (e.g., if a corn field had all three APC types present – crop, herbaceous, and wood – the crop type adjacent to the field was always corn).

Mean annual precipitation for Clay, Lowndes, and Noxubee counties was 161.60, 159.87, 161.07, and 158.83 cm, respectively, for years 2000-2003. Mean temperatures for the three counties over the four years were least in January (-1.6°C) and greatest in August (33.9°C) (18).

Yield Data Collection

GPS yield monitor crop data were obtained from combine operators in Clay, Lowndes, and Noxubee counties, Mississippi for 2000-2003. Confidentiality of all data was maintained and protected through anonymity. Data for 150 fields were downloaded from memory cards [John Deere Green Star and Ag Leader, (producers' chosen equipment)] onto a personal computer and converted to shape files. Yield data were imported into Microsoft Excel with John Deere JD Office and Ag Leader desktop computer software. Yield data were cleaned in ArcMAP 8.3 through a two-step filtering process that used query builder to eliminate erroneous points originating from various sources of errors common to GPS equipped combine yield monitors [e.g., rapid speed changes, full header width not cut, header position was up versus down, lost signal, erroneous position information, and improperly calibrated sensor, (3)].

This observational study was an incomplete block design with two factors. Factor 1 was APC type with three levels (crop, herbaceous, wood) and factor 2 was combine swath number with four levels [1st (nearest field edge), 2nd, 3rd, and 4th]. Thus, 12 treatment combinations as a 3 × 4 factorial experiment were possible. Not all fields had all three community types present but always had at least two. Swath and adjacent community type were considered fixed main effects while field was a random block effect. Grain yield (kg/ha) was the response variable. Normality of residuals was tested with Shapiro-Wilk test and residuals were typically non-normally distributed. The distribution of residuals was examined visually. Non-normality was attributed to a leptokurtic probability curve (14). Since the distribution of residuals were symmetrical and

ANOVA tests of fixed effects are relatively robust to deviations from normality, the mixed model ANOVA on untransformed values was used. Homoscedasticity was checked by covariance modeled with a group effect in SAS with TYPE=CS (covariance structure), and TYPE=VC (variance components). The PROC MEANS procedure (SAS Institute Inc., Cary, NC) was used to obtain mean yields for each swath and associated APC type and field interior, the ratio of mean yield for each swath to mean yield interior, and the difference between mean yield for each swath and mean yield interior. The PROC MIXED procedure (SAS Institute Inc., Cary, NC) was used to test for main effects of swath and adjacent plant community type and swath × community type interactions for the response variable yield. The LSMEANS SLICE option was used to test simple effects of APC type (crop, herbaceous, wood) within swath and effect of swathes 1 to 4 within adjacent community type on mean yield estimates. The LSMEANS PDIFF option was used for multiple comparisons of least square mean estimates and standard error for yield (kg/ha) by pairwise comparisons of swath by APC type (9).

A partial budget format (8) was used to develop net change in profit analyses on corn/soybean row crop rotations with and without conservation practice CP-33: Habitat Buffers for Upland Birds. Justification for use of a partial budget (versus an enterprise budget) originates from the need to analyze a partial change being made to the overall farming operation. Partial budgets provide formal and consistent methods for calculating expected changes in profit from a proposed change in the operation, thus it compares profitability of status quo, with a new alternative (8). Additional and reduced revenue and cost components of the partial budget are identified in Table 1. A break-even equation may be specified from the table components that require that the advantages of the proposed changes be set equal to the disadvantages as follows:

$$\Sigma\, CRP_{cij} + \Sigma\, VC_{cij} =$$

$$\Sigma\, GR_{cij} + \Sigma\, GOV_{cij} + \Sigma\, EST_{ciji} + \Sigma\, MNT_{ciji} + \Sigma\, COC_{ciji}\,, \forall_c \qquad [1]$$

where CRP = CP-33 payments, VC = variable costs of crop production associated with implementing CP-33 independent of yield, GR = gross revenue from crop, GOV = government payments associated with leaving land in agricultural production, EST = prorated establishment cost of CP-33, MNT = maintenance costs of CP-33, and COC = cost of capital invested in CP-33.

In order to determine which swath and APC type combination or which swath irrespective of the APC type in which CP-33 is either an economic advantage or disadvantage, net change in profit (NCP) gross revenue was obtained by solving Equation 1 for NPC as follows:

$$\Sigma NPC_{cij} =$$

$$\Sigma CRP_{cij} + \Sigma VC_{cij} - (\Sigma GR_{cij} + \Sigma GOV_{cij} + \Sigma EST_{cij} + \Sigma MNT_{cij} + \Sigma COC_{cij}), \forall_c \quad [2]$$

The net change in profit was used to identify which swathes and APC type combinations had sufficient net returns to economically outperform the alternative of implementing CP-33. Typically, CRP payments are made to the landowner, which may or may not be the producer. For this study, we assumed that the operator owned the land in production and received the CRP payments similar to Stull et al. (17). Ten-year (1995-2004) average prices for corn and soybeans were used to calculate revenues (10).

Table 1. Partial budget for calculating net change in profit analysis equation.
Proposed change: enroll field margins in CP-33 Habitat buffers for upland birds.

Advantages	**Disadvantages**
Increased revenue CRP[s]	**Decreased revenue** GR[u] GOV[v]
Decreased costs VC[t]	**Increased costs** EST[w] MNT[x] COC[y]
Totals CRP + VC	**Totals** GR + GOV + EST+MNT+COC
[z]NPC = (CRP+VC) – (GR + GOV + EST+MNT+COC)	

[s] CRP = CP-33 average payments received from enrolling field margins in the CRP.

[t] VC = sum of variable costs of grain production removed from operation.

[u] GR = sum of gross revenues of grain production removed from operation.

[v] GOV = sum of government payments received by the producer for crop grown.

[w] EST = establishment costs for CP-33 spread out over life of the buffer.

[x] MNT = maintenance costs of the buffer per year.

[y] COC = cost of capital invested in the buffer per year using average investment times interest rate of 6%.

[z] NPC = net change in profit gross revenue.

Variable production costs for corn and soybeans were obtained from the Mississippi State University, Department of Agricultural Economics, Blackbelt and Coastal Plain 2005 planning budgets. Specified expenses were $694.07/ha for corn and $290.57/ha for soybeans. Incentive payments for CP-33 included a signing incentive payment (SIP) of up to $247.10/ha. This value amortized over 10 years (length of contract) at 6% interest provided an annual SIP payment of $45.02/ha/year. Also included was an annual rental payment of $80.91/ha/year for the length of the contract (10 years). The annual rental payment ($80.91/ha) was a weighted average of county specific CRP rental rates for comparable land paid annually. Annual rental rates for CRP in Clay county ranged from $46.95/ha to $108.73/ha on 8,049.88 ha, for Lowndes county from $56.83/ha to $108.73/ha on 8,442.83 ha, and for Noxubee from $46.95 to $116.14 on 13,988.74 ha (Farm Service Agency, *personal communication*). The non-weighted average specific rental rate for Clay county was $77.84/ha, for Lowndes was $82.78/ha, and for Noxubee was $81.54/ha. An annual maintenance fee (mowing, disking; required by CP-33 guidelines) of $12.36/ha/year was included. Additional CP-33 incentive payments were cost-share assistance of up to 50% of the eligible reimbursable practice costs and a practice incentive payment (PIP) of up to 40% of the eligible establishment cost (2). For the CP-33 in this study, a native grass and legume mix (without lime) was used, which allowed up to a $395.20/ha establishment cost (11). A request through the Freedom of Information Act to the national office of the Farm Service Agency (FSA), Kansas City, KS was required to obtain county specific information on government payments made to Clay, Lowndes, and Noxubee counties, MS. The calendar year final payments tables and final direct countercyclical payment tables provided by FSA for participating corn and soybean farms were used to calculate a four-year (2000-2003) average government payment paid per commodity per county per hectare per farm.

Corn

For 104 corn fields, mean actual yield of first combine swath for three APC types (crop, herbaceous, and wood) was 30% less than mean actual yield (9,827.9 kg/ha) of field interior (Table 2). Mean yield estimates differed significantly among swath and adjacent community type and mean yield estimates had a significant swath × adjacent community interaction. The test of slice effect of adjacent community type (crop, herbaceous, wood) within swath on mean yield estimates was significant for swath 1, but not for swath 2, swath 3, or swath 4. The test of slice effect of swathes 1 to 4 within adjacent community type on mean yield estimates was significant for crop, herbaceous, and wood. Least square means estimates and standard error (SE) on yield reduction relative to field interior by swath and adjacent community type had greatest yield reductions at swath 1, followed by swath 2, swath 3, and then swath 4 (Fig. 2).

Table 2. Mean corn yield (ME) (kg/ha) and standard error (SE) by swath (1-4, n = segments*) and adjacent plant community type (crop, herbaceous, wood), and percent yield reduction (PYR) for 104 corn fields compared to rest of field in Clay, Lowndes, and Noxubee counties, Mississippi, 2000-2003.

	Crop				Herbaceous				Wood			
Swath	**n**	**ME**	**SE**	**PYR**	**n**	**ME**	**SE**	**PYR**	**n**	**ME**	**SE**	**PYR**
1	52	7683	362	23.0	94	6842	198	30.0	90	6014	222	38.0
2	51	8704	357	13.0	94	8319	228	15.0	90	8086	246	17.0
3	51	9353	338	05.0	94	9291	223	05.0	90	9057	245	07.0
4	50	9587	349	03.0	94	9663	220	01.0	89	9521	249	01.6

* The 104 corn fields had n segments of adjacent plant community type per swath.

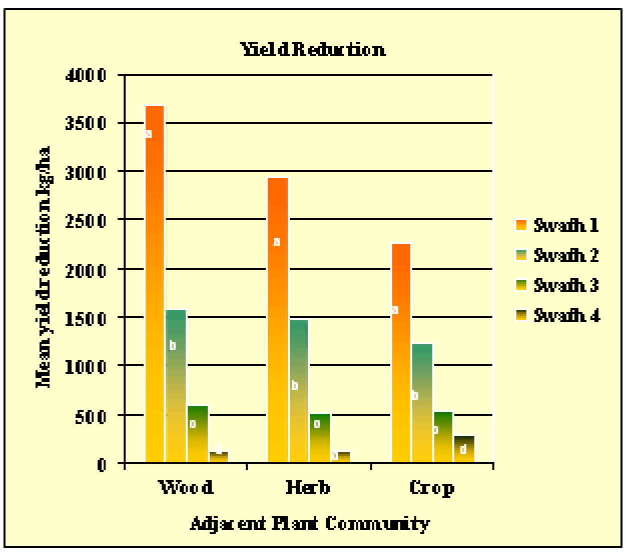

Fig. 2. Mean corn yield reduction (kg/ha) for adjacent plant community types wood, crop, and herbaceous.

The partial budget analyses for corn showed that by enrolling the field margin in CP-33 at least as wide as the first swath of a combine header (7.32 m) would increase net revenue compared to not using CP-33 (Tables 3 and 4). The difference in economic advantage (+ $/ha) at swath 1 adjacent to crop compared to swath 1 adjacent to herbaceous was nearly 2 × greater in magnitude. The same comparison from swath 1 herbaceous to swath 1 wood was 1.5 × greater. Again, the same comparison from swath 1 crop to swath 1 wood was nearly 3 × greater in magnitude. Clearly, traditional corn production at swath 1 next to these three APC types was an economic loss with the largest loss next to wood. A slight economic advantage was also found at swath 2 next to herbaceous and wood APC type and for whole field (combination of crop, herbaceous and wood field edges or irrespective of APC). In a related study that examined lower yielding field edge segments through precision agriculture, over years 1997-1999 in corn, soybeans, and wheat, conservation strips resulted in a net economic gain of $373.25/ha (17). Economic returns decreased from swath 1 out to swath 4 and whole field. Economic returns increased from APC type crop, herbaceous, and wood, respectively. Irrespective of adjacent community type, CP-33 was economically advantageous at swath 1 (Fig. 4).

Table 3. Partial budget results and net profit change (NPC) for adjacent plant community types, from 104 corn fields in Clay, Lowndes, and Noxubee counties, Mississippi, from 2000 to 2003.

	Swath	**Total advantage** ($/ha)	**Total disadvantage** ($/ha)	**NPC** ($/ha)
Crop	1	$832.36	$747.20	$85.14
	2	$832.36	$843.74	-$11.34
	3	$832.36	$905.02	-$72.66
	4	$832.36	$927.17	-$94.77
Herbaceous	1	$832.36	$667.76	$164.60
	2	$832.36	$807.32	$25.04
	3	$832.36	$899.16	-$66.80
	4	$832.36	$934.31	-$101.95
Wood	1	$832.36	$589.52	$242.84
	2	$832.36	$785.30	$47.07
	3	$832.36	$877.05	-$44.69
	4	$832.36	$920.89	-$88.53

Table 4. Total advantage (+) or disadvantage (-) ($/ha) of CP-33 and corn by swath, adjacent plant community type and whole field*.

	Adjacent Plant Community			
Swath	**Crop**	**Herbaceous**	**Wood**	**Whole field**
1	$85.14	$164.60	$242.84	$176.98
2	-$11.34	$25.04	$47.07	$25.52
3	-$72.66	-$66.80	-$44.69	-$59.62
4	-$94.77	-$101.95	-$88.53	-$95.24

* Whole field is all swathes irrespective of plant community type

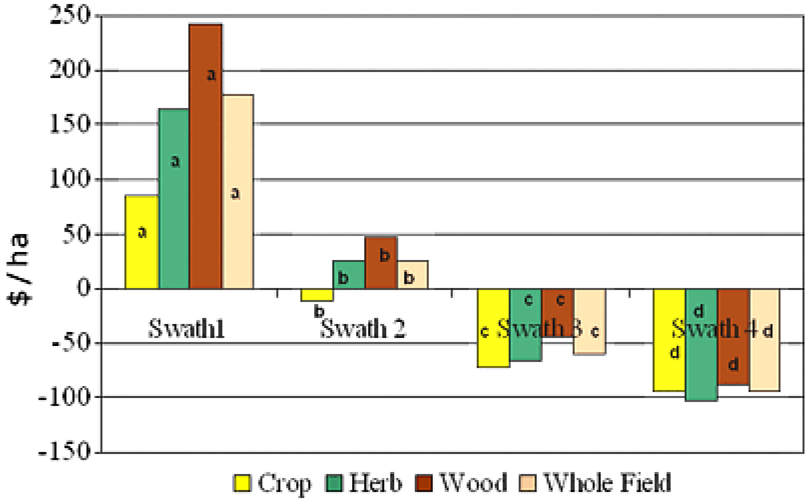

Fig. 3. Advantage (+) or Disadvantage (-) ($/ha) of CP-33 and corn by swath and adjacent plant community and whole field (irrespective of APC) from 104 fields in Clay, Lowndes, and Noxubee counties Mississippi, 2000-2003.

Soybeans

For 46 soybeans fields mean yield of first combine swath for three adjacent community types (crop, herbaceous, and wood) was 10.0% less than mean yield (2,497 kg/ha) of field interior (Table 5). Mean yield estimates differed significantly by swath, but not by adjacent community. Swath × adjacent community interaction was not found to be significant. The test of slice effect of adjacent community type (crop, herbaceous, wood) within swath on mean yield estimates and within adjacent community type on mean yield estimates was not significant for crop, herbaceous, and wood.

Table 5. Mean soybean yield (ME) (kg/ha) and standard error (SE) by swath (1 to 4, n = segments*) and adjacent plant community type (crop, herbaceous, wood), and percent yield reduction (PYR) compared to rest of field for 46 soybean fields in Clay, Lowndes, and Noxubee counties, Mississippi, 2000-2003.

	Crop				Herbaceous				Wood			
Swath	n	ME	SE	PYR	n	ME	SE	PYR	n	ME	SE	PYR
1	12	2496	212	08.0	42	2203	112	07.0	39	2041	115	14.0
2	12	2501	184	08.0	42	2156	107	09.0	37	2188	112	06.0
3	12	2604	172	04.0	42	2229	107	06.0	38	2273	119	04.0
4	12	2612	194	03.0	42	2310	108	03.0	38	2346	124	01.0

* The 46 soybean fields had n segments of adjacent plant community type per swath.

Least square means estimates (ME) and standard error (SE) on yield reduction relative to field interior by swath and adjacent community type resulted in adjacent community crop, swath 1 with the greatest yield reduction, followed by swath 2, swath 3, and swath 4. Within adjacent community herbaceous, swath 2 had greatest yield reduction, followed by swath 1, swath 3, and swath 4. Within adjacent community wood, swath 1 had greatest yield reduction, followed by swath 2, swath 3, and swath 4 (Fig. 3).

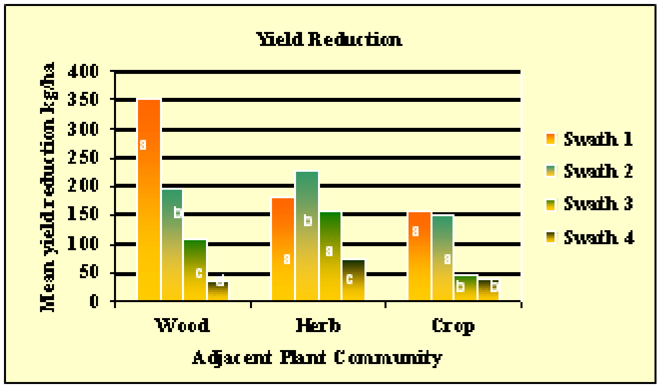

Fig. 4. Mean soybean yield reduction (kg/ha) for adjacent plant community types crop, herbaceous, and wood.

The partial budget analyses for soybeans showed that for any APC type and swath combination and for the whole field consideration (irrespective of APC type), enrolling in CP-33 would be not be economically advantageous (Tables 6 and 7). Similar to corn, a trend of decreasing economic returns occurred from swath 1 out to swath 4 and the whole field. As well, a trend of increasing economic returns occurred from APC type crop, then herbaceous, and then wood and the whole field overall (Fig. 5).

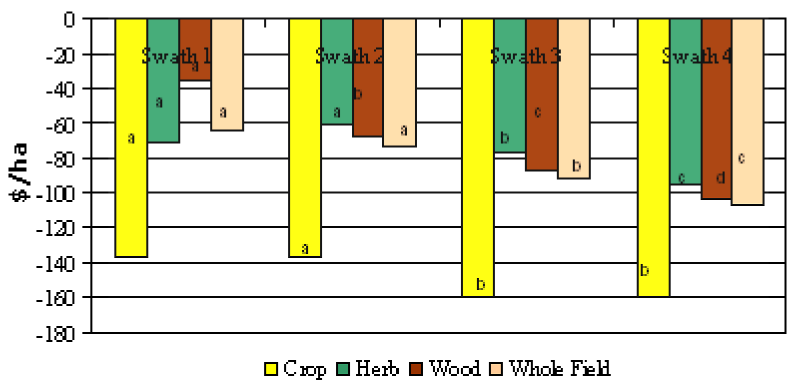

Fig. 5. Disadvantage (-) ($/ha) of CP-33 and soybeans by swath and adjacent plant community and whole field (irrespective of APC) from 46 fields in Clay, Lowndes, and Noxubee counties Mississippi, 2000-2003.

Table 6. Partial budget results and net profit change (NPC) for adjacent plant community type, from 46 soybean fields in Clay, Lowndes, and Noxubee counties, Mississippi, from 2000-2003.

	Swath	**Total advantage** ($/ha)	**Total disadvantage** ($/ha)	**NPC** ($/ha)
Crop	1	$428.86	$565.18	-$136.32
	2	$428.86	$566.29	-$137.43
	3	$428.86	$589.15	-$160.29
	4	$428.86	$590.82	-$162.06
Herbaceous	1	$428.86	$500.17	-$71.31
	2	$428.86	$489.74	-$60.88
	3	$428.86	$505.94	-$77.08
	4	$428.86	$523.91	-$95.05
Wood	1	$428.86	$464.22	-$35.36
	2	$428.86	$496.84	-$67.98
	3	$428.86	$515.70	-$86.84
	4	$428.86	$531.90	-$103.04

Table 7. Total disadvantage (-) ($/ha) of CP-33 and soybeans by swath, adjacent plant community type and whole field[x].

	Adjacent Plant Community			
Swath	**Crop**	**Herbaceous**	**Wood**	**Whole field**
1	-$136.32	-$71.31	-$35.36	-$64.65
2	-$137.43	-$60.88	-$67.98	-$73.97
3	-$160.29	-$77.08	-$86.84	-$91.94
4	-$160.06	-$95.05	-$103.04	-$107.03

[x] Whole field is all swathes irrespective of plant community type.

Conclusions

Mean corn yields at combine swath 1 next to wood APC were significantly less that the mean yields of the field interior. Although a significant corn yield reduction relative to the field interior was always present within any field segment regardless of APC type at swath 1 (field edge), it was greatest adjacent to wood, followed by herbaceous then crop. Swathes 2 through 4 also had associated yield reductions but were less so and not significantly different from the interior yield.

Mean soybeans yields at swath 1 were significantly less than mean interior yield but not for swathes 2 to 4 nor of the same magnitude as for corn yield (9.6% mean yield reduction for soybeans and 30.3% for corn). Soybeans typically are grown on clays, which in some years can be advantageous from an available soil moisture standpoint. Like corn, soybean yields were significantly less next to wood adjacent community. Both corn and soybean crops could have had reduced yields at the field edge due to depredation by herbivores [e.g., eastern cottontail rabbit (*Sylvilagus floridanus*), eastern whitetail deer (*Odocoileus virginianus*), raccoon (*Procyon lotor*)] as well as possibly birds and insects. A wood community adjacent to the crop would potentially harbor more species of herbivores and individuals of those species than either crop or herbaceous adjacent community. Yield reduction differences between corn and soybean may be related to differences in photosynthetic abilities among C3 and C4 plants as wooded APC would limit sunlight avalibilty.

For corn, implementation of CP-33 was economically advantageous at swath 1 for crop (+ $85.14/ha), herbaceous (+ $164.60/ha), wood (+ $242.84/ha), and whole field (+ $176.98/ha) and at swath 2 for herbaceous (+ $25.04/ha), wood (+ $47.07/ha), and whole field (+ $25.52/ha). For any other swath and APC combination, CP-33 was not economically advantageous. For soybeans, implementation of CP-33 was not economically advantageous for any swath or APC combination. Less yield reduction at field edges as well as low relative crop production costs contributed to the economic disadvantages of CP-33 for soybeans.

Results and conclusions are based on "averages," individual fields might have different results. Additionally, fields were mono-culturally farmed, thus fields enrolled in a crop rotation might have different outcomes. Also, the added value of upland birds and other wildlife specifies might provide incentives economic or non-economic not considered in this analysis.

Literature Cited

1. Boatman, N. D., and Sotherton, N. 1988. The agronomic consequences and costs of managing field margins for game and wildlife conservation. Aspects Appl. Biol. 17:47-56.
2. Burger, L. W., Jr., Hamrick, R., and Brasher, K. 2004. Restoring bobwhite quail habitat: A conservation practice for agricultural producers. Forest and Wildlife Res. Center Misc. Pub. WF418, Mississippi State Univ., Mississippi State, Mississippi.
3. Carlson, C. G., Kleinjan, J., Chang., J., Wilson, J., Humburg, D., Clay, D., and Long, D. 2002. Cleaning yield data. In review for PPI site specific guideline paper. Mississippi Agric. Stat. Serv., NASS, USDA, Washington, DC.
4. Cain, S., and Lovejoy, S. 2004. History and outlook for farm bill conservation programs. Am. Agric. Econ. Assoc. Choices: The Magazine of Food, Farm, and Resource Issues, 4th quarter: 37-42.
5. De Snoo, G. R. 1994. Cost-benefits of unsprayed crop edges in winter wheat, sugar beet and potatoes. Brit. Crop Prot. Counc. Monog. 58:197-202.
6. Fisher, N. M., Davies, D. H. K., and Richards, M. C. 1988. Weed severity and crop losses in conservation headlands in southeast Scotland. Aspects Appl. Biol. 18:37-46.
7. Jaggard, K. W., Gummerson, B., and Clark, C. J. A. 1987. Management of headlands on beet fields. Brit. Sugar Beet Rev. 55:18-20.
8. Kay, R. D., and Edwards, W. M. 1994. Farm Management, 4th Ed. McGraw Hill, Boston, MA.
9. Little, R. C., Milliken, G. A., Stroup, W. W., and Wolfinger, R. D. 1996. SAS System for mixed models, SAS Institute Inc., Cary, North Carolina, USA.
10. Mississippi Agricultural Statistics Service. 2005. Crop prices received by farmers: market year average prices. Mississippi Agric. Stat. Serv., NASS, USDA, Washington, DC.
11. National FSA2-CRP (Revision 4) Handbook. 2005. United States Department of Agriculture, Farm Service Agency, Washington, DC.
12. Semple, D. A., Bishop, E. C., and Morris, J. 1994. An economic analysis of farm hedgerow management. Brit. Crop Prot. Counc. Monog. 58:161-166.
13. Smith, M. D. 2004. Wildlife habitat benefits of field border management practices in Mississippi. Ph. D. diss., Mississippi State Univ., Mississippi State, Mississippi.
14. Sokal, R. R., and Rohlf, F. J. 1994. Biometry: The Principles and Practice of Statistics in Biological Research, 3rd Ed. W. H. Freeman and Company, New York, NY.
15. Sparkes, D. L., Jaggard, K. W., Ramsden, S. J., and Scott R. K. 1998. The effect of field margins on the yield of sugar beets and cereal crops. Annals Appl. Biol. 132:129-142.
16. Speller, C. S., Cleal, R. A. E., and Runham, S. R. 1992. A comparison of winter wheat yields from headlands with other positions in five fen peat fields. Brit. Crop Prot. Counc. Monog. 50:47-50.
17. Stull, J., Dillon, C., Shearer, S., and Isaacs, S. 2004. Using precision agriculture technology for economically optimal strategic decisions: the case of CRP filter strip enrollment. J. Sustain. Agric. 24:79-96.
18. U.S. Department of Commerce. 2000-2003. Climatological Data Annual Summary, Mississippi. NOAA, National Climatic Data Center, Ashville, North Carolina, USA.