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**UPDATE**

A Farm-level Economic  
Analysis of Wildlife Habitat Buffers  
in Missouri

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## Update of Farm-level Economic Analysis of Wildlife Habitat Buffers in Missouri

This document updates analysis released as FAPRI–MU Report #23-07 in August 2007; *A Farm-level Economic Analysis of Wildlife Habitat Buffers in Missouri*. The first report presented an approach to evaluate the economic benefits over time of idling acres on crop field edges, in exchange for government program assistance through the CP-33 conservation practice, Habitat Buffers for Upland Wildlife. The general conclusion was that on the three representative farms tested the buffer alternative yielded positive economic benefits to the user over the life of the contract.

This analysis uses the same basic approach, but incorporates new data to include significant changes that have occurred in both markets and program payments:

- **Market dynamics.** Virtually all relevant price projections have made dramatic moves in the past year. Commodity prices, crop input prices and land values have all increased rapidly. This report is based on the latest FAPRI–MU stochastic modeling results of the agricultural sector, dated January 2008.
- **Program payments.** In August 2007, the rates for determining CP-33 program payments (soil rental rates) were adjusted upward to reflect higher average cash rental rates. For the representative farms in this study, the rates increased an average of 20 percent. Also, in April 2008 the annual maintenance incentive payment was reduced from \$4 per acre to \$2 per acre for CP-33 buffers. These changes are included in the analysis.

For this update, a CP-33 buffer scenario was evaluated against a baseline for three representative farms, with costs and returns projected forward 10 years—the life of a CRP contract. This implicitly assumes only two land management alternatives.

As in the previous study, yield loss occurs on the margin of fields of a particular size, called flex fields. Crops are rotated through the flex fields to estimate the impacts with different crop enterprises while maintaining the average crop mix across the farm. For example, a tract with 10 acres of tree-lined margin is managed as a 60 acre block for rotation purposes. The crop rotation cycle is three years for each farm. Rotations and field-to-margin size relationships are grounded on consensus of actual field sizes, geometry, plantings and management as obtained via the representative farm process.

- In the baseline farm, yields on flex field edges suffer relative to the field potential due to tree-line encroachment. Yields on these field margins are discounted 65 percent for corn, 60 percent for soybeans and 10 percent for wheat.
- In the CP-33 alternative, buffer strips are installed on the flex field edges. Thus, fewer acres are planted and average farm yields increase. Buffer establishment costs are estimated at \$200 cash outlay per acre with 90 percent cost share. The farm receives a signing incentive payment of \$100 per buffer acre, an annual rental payment unique to the farm and a maintenance incentive payment. Annual maintenance costs to the land user are \$4.50 the first year of simulation.

Key variables of the three representative farms in this study are shown in table 1. All three farms derive the majority of receipts from crop enterprises, but two have forage-beef enterprises. The Carroll farm is the smallest of the three with 500 cropped acres, plus 200 acres enrolled in general Conservation Reserve Program (CRP). The Bates and Ralls farms are very similar in terms of size, land tenure, types of enterprises and operating costs. However, the Bates farm has lower average yields, more yield risk (variation), and generates more income from double-cropped acres. Although the farms are identified by a county name, one should not conclude that location has anything to do with the success or failure of an alternative.

**Table 1. Comparison of representative farms**

Farm identification	Carroll	Ralls	Bates
Baseline avg. returns to family living	\$63,240	\$119,590	\$134,140
Baseline row-cropped acres	500	1460	1400
Double cropped acres	60	56	310
Forage acres	0	400	440
General CRP acres	200	0	0
Total crop and forage acres	700	1860	1840
Crop acres owned by operator, %	62	49	43
Flex field acres for crop rotation	60	120	120
CP-33 buffer acres	10	20	20
CP-33 payment per buffer acre	\$103.28	\$90.21	\$82.80
Corn, acres / yield*	190 / 149	536 / 128	485 / 123
Soybean acres / yield	190 / 44	684 / 43	310 / 37
Wheat acres / yield	60 / 59	120 / 69	485 / 60
Double soybean acres / yield	60 / 21	56 / 21	310 / 25

\* All yields shown are a five year average, 2003-2007 in bushels.

Crop acres are the average over the 3 year rotation cycle.

Simulation results are summarized in table 2. The net economic benefits are positive for two farms, but negative for one. Thus, CP-33 has the potential to pay even under higher crop prices in the outlook, given the parameters and assumptions of this analysis. However, there are some situations where there is not an economic incentive such as the Bates farm. The underlying reasons for this are more clearly shown in the detailed tables discussed below.

**Table 2. Summary of CP-33 versus baseline farm**

Average annual gain (loss) over 10 year year period, \$ per buffer acre.

Farm identification	Carroll	Ralls	Bates
Net cash farm income	\$24.50	\$42.45	(\$39.25)
Returns to family living	\$30.70	\$65.10	(\$8.25)
Ending cash reserves	\$23.70	\$34.00	(\$8.25)

The magnitude of the gains or losses is also important to those making a decision. The economic benefits should be weighed against other goals, such as the land user's preference for wildlife cover. Benefits should also be considered relative to the total financial picture for the farm. For example, if the Bates farm decides to install a buffer the decision will reduce accumulated wealth at the end of ten years by just \$1,650 or 0.26 percent.

## Detailed Tables

Tables 3 through 5 show key financial variables for each farm under the baseline and CP-33 buffer alternative. A brief explanation of the financials follow based on the numbers reported in table 3 for the Carroll farm.

### *Government payments*

With no buffer, the farm receives government payments from general CRP and the provisions of the commodity title of the farm bill. With the CP-33 buffer, the change in government payments is greatest in the year of installation (2007) due to the signing incentive payment and cost-share for buffer establishment. The total change in government payments at the end of the ten year period is \$12,700, for an annual average change of \$127 per buffer acre per year.

### *Gross market revenue*

Market revenue declines in each year due to fewer acres of production. The greatest change occurs in years when the flex acres are double cropped (2008, 2011, 2014). Over the contract life, the value of farm sales declines by \$26,600. On average, the farm foregoes \$266 of gross market revenue per buffer acre per year.

### *Total farm receipts*

This is simply the sum of government payments and farm receipts. The additional government payments partially offset the market losses—48 percent in the case of the Carroll farm. Total farm receipts decline \$13,900, or \$139 per buffer acre per year.

### *Cash operating costs*

Production costs are higher in the first year due to establishment costs, but decline with fewer acres being planted. Specific line item changes are for seed, fertilizer, chemicals, fuel, repairs, drying, check-off costs, and operating interest. Over the contract life, the farm spends \$16,400 less in operating costs, a savings of \$164 per buffer acre per year.

### *Net cash farm income*

The net result of all of the above metrics is shown in net cash farm income, which increases in each year of the contract except the double crop years. The impact is positive, but relatively small at \$2,500 for the whole farm at the end of ten years, or \$25 per buffer acre per year.

### *Returns to family living*

This metric measures the income kept by the operator, after debt reduction and income taxes. It follows a similar pattern as net cash farm income. The farmer “feels” an increase of \$3,100 over ten years, or \$31 per buffer acre per year.

### *Ending cash reserves*

This measures the contribution of the alternative to farm business wealth as a cash asset. At the end of 2016, the farm has accumulated \$2,370 more than it would have if it continued to farm with a yield penalty on the field edges. On average, this is an annual increase of \$24 per buffer acre per year.

### *Probability of cash deficit*

There is some, but little change in the chance that the farm will not generate sufficient cash to meet current year obligations due to the relatively small acreage impacted.

## Comparison of Farms

Return to the case of the Bates farm for an example of why a particular farm may not realize positive economic benefits from CP-33. What factors make it less appealing to install a CP-33 practice, particularly compared to the Ralls farm, that is similar in so many respects? Tables 4 and 5 can be compared for each of the metrics. The Bates farm receives less of a payment, gives up more in market revenue and has less of a cost savings advantage.

- With respect to the program payment, the impact is \$11 per acre. This illustrates an obvious point: payment rates are a key factor in the financial incentive. It is well known that cash rental rate markets tend to be localized.
- With respect to market returns, the Bates farm has lower yields, but more than offsets this with higher commodity prices received particularly for wheat. Thus, the difference is most apparent in the wheat-double crop bean flex years. This is a function of marketing skills and opportunities. The impact of lost revenue is \$49 per acre greater for the Ralls farm.
- With respect to operating costs, the Bates farm has lower crop cost of production (and lower yields). Thus, it would save \$21 less per buffer acre by reducing planted acres.

The sum of the differences is an \$81 advantage for the Ralls farm versus the Bates farm—enough to have a net gain for the Ralls farm and a net loss for the Bates farm.

**Table 3. Carroll crop farm, CP-33 alternative:**  
 Financial implications of enrolling 10 acres of field edge buffers in the CP-33 practice.

Calendar year	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	Farm Annual average	Annual avg. change per buffer acre
<b>Government payments, (\$1,000)</b>	<i>(Payments for all government programs, including DCP, LDP, general CRP, CP-33 cost-share, SIP, SRR, and MIP)</i>											This column is dollars
No buffer, poor yield on edge	21.68	27.08	27.43	27.85	27.83	28.02	28.09	27.59	28.30	28.09	27.20	
With CP-33 buffer	25.53	28.07	28.44	28.83	28.81	29.00	29.07	28.58	29.28	29.07	28.47	
Change	3.85	0.99	1.01	0.98	0.98	0.98	0.98	0.99	0.98	0.98	1.27	\$127
<b>Gross market revenue, (\$1,000)</b>	<i>(Value of sales from all crops and beef sold)</i>											
No buffer, poor yield on edge	214.79	214.27	211.51	206.95	214.56	220.44	220.04	231.14	235.51	229.88	219.91	
With CP-33 buffer	212.78	210.45	209.50	204.95	210.69	218.08	217.91	227.06	233.32	227.74	217.25	
Change	-2.01	-3.82	-2.01	-2.00	-3.87	-2.36	-2.13	-4.08	-2.19	-2.14	-2.66	(\$266)
<b>Total farm receipts, (\$1,000)</b>	<i>(Government payments + market revenue)</i>											
No buffer, poor yield on edge	236.47	241.35	238.94	234.80	242.39	248.46	248.13	258.73	263.81	257.97	247.11	
With CP-33 buffer	238.31	238.52	237.94	233.78	239.50	247.08	246.98	255.64	262.60	256.81	245.72	
Change	1.84	-2.83	-1.00	-1.02	-2.89	-1.38	-1.15	-3.09	-1.21	-1.16	-1.39	(\$139)
<b>Cash operating costs, (\$1,000)</b>	<i>(All cash costs except debt reduction, income tax, capital purchase, and owner withdrawal. Includes initial establishment costs)</i>											
No buffer, poor yield on edge	118.25	123.15	121.69	113.66	117.60	118.33	120.37	123.31	124.08	119.00	119.94	
With CP-33 buffer	119.19	121.21	119.44	112.29	115.50	115.95	118.93	121.23	121.73	117.59	118.31	
Change	0.94	-1.94	-2.25	-1.37	-2.10	-2.38	-1.44	-2.08	-2.35	-1.41	-1.64	(\$164)
<b>Net cash farm income, (\$1,000)</b>	<i>(Total farm receipts less cash operating costs)</i>											
No buffer, poor yield on edge	118.23	118.20	117.25	121.14	124.80	130.13	127.76	135.42	139.73	138.98	127.16	
With CP-33 buffer	119.12	117.31	118.50	121.49	124.00	131.13	128.05	134.41	140.86	139.22	127.41	
Change	0.89	-0.89	1.25	0.35	-0.80	1.00	0.29	-1.01	1.13	0.24	0.25	\$25
<b>Returns to family living, (\$1,000)</b>	<i>(Cash available for owner withdrawal from current year earnings--after taxes, capital purchases and debt reduction)</i>											
No buffer, poor yield on edge	75.02	67.10	55.15	77.93	66.31	70.65	54.51	58.75	59.11	47.88	63.24	
With CP-33 buffer	75.73	66.41	56.18	78.40	65.83	71.50	54.78	58.19	60.13	48.33	63.55	
Change	0.71	-0.69	1.03	0.47	-0.48	0.85	0.27	-0.56	1.02	0.45	0.31	\$31
<b>Ending cash reserves, (\$1,000)<sup>a</sup></b>	<i>(Accumulated cash and interest over simulation period after all cash expenses with the assumed owner withdrawals)</i>											
No buffer, poor yield on edge	30.02	51.27	59.45	90.66	109.89	133.13	140.06	151.18	162.85	163.05		
With CP-33 buffer	30.73	51.29	60.49	91.99	110.67	134.68	141.87	152.33	164.93	165.42		
Change	0.71	0.02	1.04	1.33	0.78	1.55	1.81	1.15	2.08	2.37		\$24
<b>Probability of a cash deficit, (%)</b>	<i>(Chance that farm will not generate enough cash to meet current year obligations)</i>											
No buffer, poor yield on edge		23.6	44.4	15.2	27.4	27.4	48.6	44.2	42.6	57.4		
With CP-33 buffer		25.4	41.4	14.0	28.2	25.4	48.8	45.2	43.0	57.6		
Change		1.8	-3.0	-1.2	0.8	-2.0	0.2	1.0	0.4	0.2		

<sup>a</sup> Ending cash reserve is a "dummy account" to store accumulated wealth under the assumption of no business growth.

**Table 4. Ralls crop-beef farm, CP-33 alternative:**

Financial implications of enrolling 20 acres of field edge buffers in the CP-33 practice.

Calendar year	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	Farm Annual average	Annual avg. change per buffer acre
<b>Government payments, (\$1,000)</b>	<i>(Payments for all government programs, including DCP, LDP, general CRP, CP-33 cost-share, SIP, SRR, and MIP)</i>											This column is dollars
No buffer, poor yield on edge	22.79	38.46	40.21	40.13	40.59	41.52	40.98	41.37	42.91	41.04	39.00	
With CP-33 buffer	30.28	40.27	42.00	41.91	42.39	43.30	42.76	43.17	44.70	42.81	41.36	
Change	7.49	1.81	1.79	1.78	1.80	1.78	1.78	1.80	1.79	1.77	2.36	\$118
<b>Gross market revenue, (\$1,000)</b>	<i>(Value of sales from all crops and beef sold)</i>											
No buffer, poor yield on edge	673.16	674.95	664.81	660.88	669.51	689.18	701.06	711.81	729.43	732.37	690.72	
With CP-33 buffer	669.23	668.79	660.88	657.10	663.09	685.14	697.04	704.98	725.19	728.16	685.96	
Change	-3.93	-6.16	-3.93	-3.78	-6.42	-4.04	-4.02	-6.83	-4.24	-4.21	-4.76	(\$238)
<b>Total farm receipts, (\$1,000)</b>	<i>(Government payments + market revenue)</i>											
No buffer, poor yield on edge	695.95	713.41	705.02	701.01	710.10	730.70	742.04	753.18	772.34	773.41	729.72	
With CP-33 buffer	699.51	709.06	702.88	699.01	705.48	728.44	739.80	748.15	769.89	770.97	727.32	
Change	3.56	-4.35	-2.14	-2.00	-4.62	-2.26	-2.24	-5.03	-2.45	-2.44	-2.40	(\$120)
<b>Cash operating costs, (\$1,000)</b>	<i>(All cash costs except debt reduction, income tax, capital purchase, and owner withdrawal. Includes initial establishment costs)</i>											
No buffer, poor yield on edge	427.28	445.47	458.95	443.84	440.00	458.38	429.85	426.22	439.29	424.12	439.34	
With CP-33 buffer	429.16	442.94	453.36	441.15	437.15	452.46	427.02	423.35	433.17	421.21	436.10	
Change	1.88	-2.53	-5.59	-2.69	-2.85	-5.92	-2.83	-2.87	-6.12	-2.91	-3.24	(\$162)
<b>Net cash farm income, (\$1,000)</b>	<i>(Total farm receipts less cash operating costs)</i>											
No buffer, poor yield on edge	268.67	267.94	246.07	257.17	270.10	272.32	312.18	326.96	333.05	349.29	290.38	
With CP-33 buffer	270.35	266.12	249.52	257.86	268.34	275.98	312.78	324.81	336.72	349.76	291.22	
Change	1.68	-1.82	3.45	0.69	-1.76	3.66	0.60	-2.15	3.67	0.47	0.85	\$42
<b>Returns to family living, (\$1,000)</b>	<i>(Cash available for owner withdrawal from current year earnings--after taxes, capital purchases and debt reduction)</i>											
No buffer, poor yield on edge	167.06	136.48	97.26	108.52	94.47	79.62	112.67	119.35	136.46	143.98	119.59	
With CP-33 buffer	168.22	135.48	100.09	109.59	94.17	82.70	114.07	119.41	139.61	145.55	120.89	
Change	1.16	-1.00	2.83	1.07	-0.30	3.08	1.40	0.06	3.15	1.57	1.30	\$65
<b>Ending cash reserves, (\$1,000)<sup>a</sup></b>	<i>(Accumulated cash and interest over simulation period after all cash expenses with the assumed owner withdrawals)</i>											
No buffer, poor yield on edge	97.06	162.82	190.46	235.01	268.31	286.18	339.34	400.50	479.55	568.90		
With CP-33 buffer	98.22	162.99	193.20	238.21	270.42	290.77	344.35	404.41	485.83	575.70		
Change	1.16	0.17	2.74	3.20	2.11	4.59	5.01	3.91	6.28	6.80		\$34
<b>Probability of a cash deficit, (%)</b>	<i>(Chance that farm will not generate enough cash to meet current year obligations)</i>											
No buffer, poor yield on edge		27.2	36.8	35.0	39.8	44.4	33.0	30.8	27.2	27.6		
With CP-33 buffer		27.0	35.4	34.6	39.8	43.8	32.8	30.6	26.4	26.8		
Change		-0.2	-1.4	-0.4	0.0	-0.6	-0.2	-0.2	-0.8	-0.8		

<sup>a</sup> Ending cash reserve is a "dummy account" to store accumulated wealth under the assumption of no business growth.



**Table 5. Bates crop-beef farm, CP-33 alternative:**  
Financial implications of enrolling 20 acres of field edge buffers in the CP-33 practice.

Calendar year	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	Farm Annual average	Annual avg. change per buffer acre
<b>Government payments, (\$1,000)</b>	<i>(Payments for all government programs, including DCP, LDP, general CRP, CP-33 cost-share, SIP, SRR, and MIP)</i>											This column is dollars
No buffer, poor yield on edge	24.03	38.15	39.27	40.06	40.23	40.27	40.13	40.23	42.44	40.55	38.54	
With CP-33 buffer	31.33	39.79	40.88	41.62	41.72	41.90	41.79	41.92	43.96	41.96	40.68	
Change	7.30	1.64	1.61	1.56	1.49	1.63	1.66	1.69	1.52	1.41	2.15	\$107
<b>Gross market revenue, (\$1,000)</b>	<i>(Value of sales from all crops and beef sold)</i>											
No buffer, poor yield on edge	701.32	693.06	666.97	653.50	687.41	689.64	692.41	735.19	734.49	729.36	698.34	
With CP-33 buffer	697.93	685.11	662.13	649.50	678.94	684.24	688.90	724.84	729.09	725.14	692.59	
Change	-3.39	-7.95	-4.84	-4.00	-8.47	-5.40	-3.51	-10.35	-5.40	-4.22	-5.75	(\$287)
<b>Total farm receipts, (\$1,000)</b>	<i>(Government payments + market revenue)</i>											
No buffer, poor yield on edge	725.35	731.21	706.24	693.56	727.64	729.91	732.54	775.42	776.93	769.91	736.87	
With CP-33 buffer	729.26	724.90	703.01	691.12	720.66	726.14	730.69	766.76	773.05	767.10	733.27	
Change	3.91	-6.31	-3.23	-2.44	-6.98	-3.77	-1.85	-8.66	-3.88	-2.81	-3.60	(\$180)
<b>Cash operating costs, (\$1,000)</b>	<i>(All cash costs except debt reduction, income tax, capital purchase, and owner withdrawal. Includes initial establishment costs)</i>											
No buffer, poor yield on edge	409.78	432.89	433.67	415.24	425.85	440.16	427.87	445.10	451.01	464.02	434.56	
With CP-33 buffer	412.04	429.31	430.27	413.39	421.68	435.61	425.71	441.04	446.39	461.97	431.74	
Change	2.26	-3.58	-3.40	-1.85	-4.17	-4.55	-2.16	-4.06	-4.62	-2.05	-2.82	(\$141)
<b>Net cash farm income, (\$1,000)</b>	<i>(Total farm receipts less cash operating costs)</i>											
No buffer, poor yield on edge	315.57	298.32	272.57	278.32	301.79	289.75	304.67	330.31	325.92	305.90	302.31	
With CP-33 buffer	317.22	295.59	272.73	277.74	298.98	290.53	304.98	325.71	326.66	305.13	301.53	
Change	1.65	-2.73	0.16	-0.58	-2.81	0.78	0.31	-4.60	0.74	-0.77	-0.78	(\$39)
<b>Returns to family living, (\$1,000)</b>	<i>(Cash available for owner withdrawal from current year earnings--after taxes, capital purchases and debt reduction)</i>											
No buffer, poor yield on edge	200.28	167.30	138.51	176.00	156.84	89.89	122.26	103.78	132.19	54.32	134.14	
With CP-33 buffer	201.33	165.81	138.95	175.93	155.53	90.77	122.74	101.58	132.87	54.21	133.97	
Change	1.05	-1.49	0.44	-0.07	-1.31	0.88	0.48	-2.20	0.68	-0.11	-0.17	(\$8)
<b>Ending cash reserves, (\$1,000)<sup>a</sup></b>	<i>(Accumulated cash and interest over simulation period after all cash expenses with the assumed owner withdrawals)</i>											
No buffer, poor yield on edge	130.28	227.41	294.76	399.04	485.10	504.86	556.36	589.33	650.42	633.87		
With CP-33 buffer	131.33	226.99	294.78	398.98	483.73	504.39	556.34	587.13	648.91	632.22		
Change	1.05	-0.42	0.02	-0.06	-1.37	-0.47	-0.02	-2.20	-1.51	-1.65		(\$8)
<b>Probability of a cash deficit, (%)</b>	<i>(Chance that farm will not generate enough cash to meet current year obligations)</i>											
No buffer, poor yield on edge		8.0	17.8	8.0	10.4	42.2	25.0	34.0	26.2	63.0		
With CP-33 buffer		8.4	18.2	8.2	11.4	42.6	24.0	34.2	24.8	64.0		
Change		0.4	0.4	0.2	1.0	0.4	-1.0	0.2	-1.4	1.0		

<sup>a</sup> Ending cash reserve is a "dummy account" to store accumulated wealth under the assumption of no business growth.

## Appendix

A number of assumptions are used to facilitate this analysis.

- Federal commodity programs are unchanged over the projection period.
- Since relatively few acres are enrolled in the CP-33 practice, no changes occur in capital or labor requirements and no changes occur in land values.
- Other than program payments, no income is received on buffer acres, such as hunting fees.
- For the CP-33 alternative, 100 percent of the buffer establishment costs and the cost share reimbursement is made in the first year, 2007.
- Buffer acres are modeled as flex acres in the crop-mix rotation. In 2007, each farm plants soybeans, followed by wheat/double-crop soybeans, followed by corn, followed by soybeans. This procedure is used to reduce skewing the results due to the cost-price relationships for a particular crop.
- Buffer acres are treated as land owned by the operator. The operator enjoys all benefits and incurs all costs on the flex acres.

Recall that, for the stochastic farm analysis, 500 different price and yield combinations are randomly drawn each year to estimate the future stream of revenue. Selected price charts from the January 2008 baseline are shown.

Figure 1. US corn price

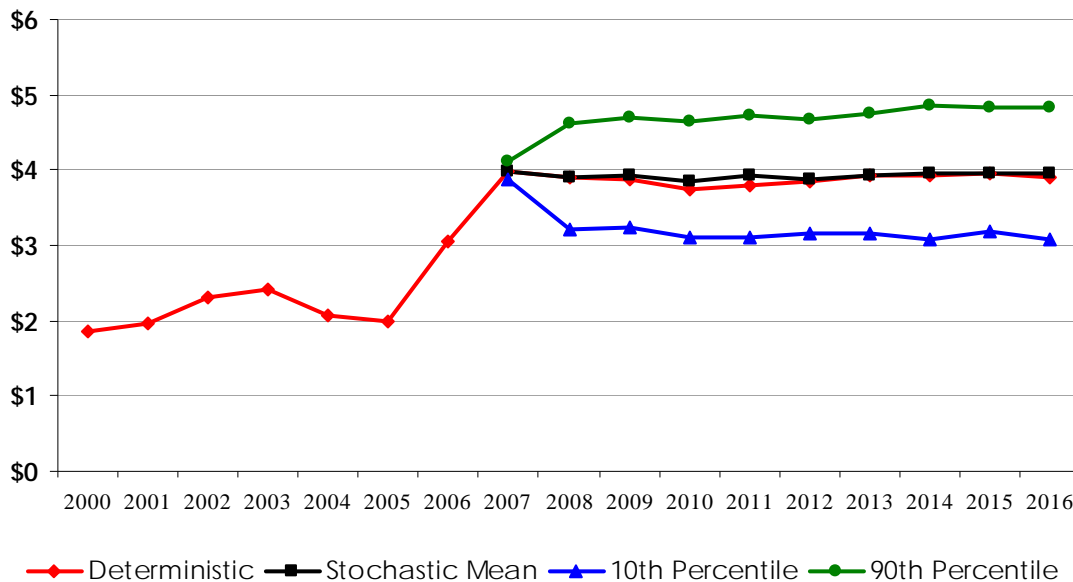


Figure 2. US soybean price

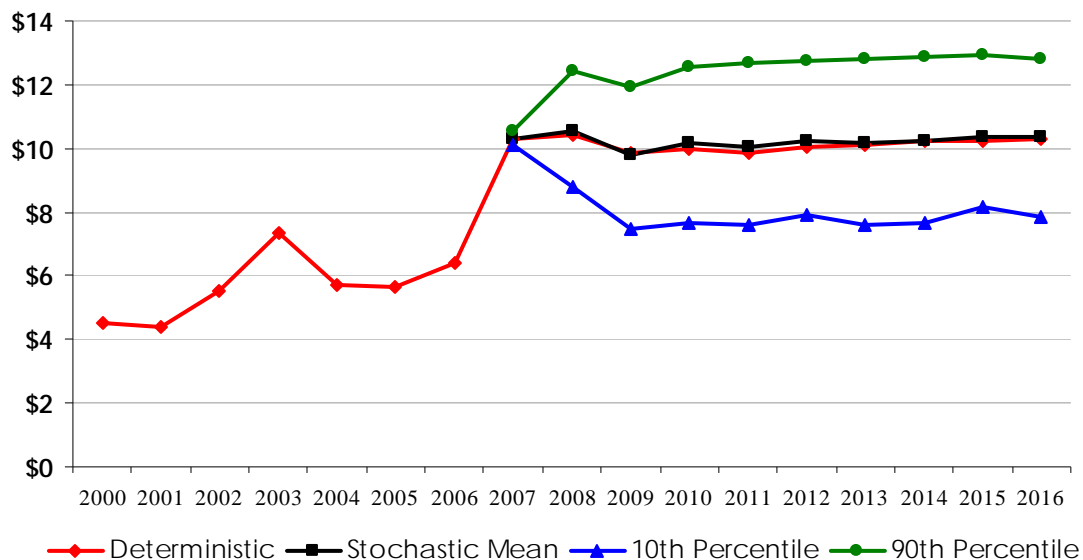


Figure 3. US wheat price

