Analysis and Cost Projections of the Integrated Farm Revenue Program

A Report for American Farmland Trust

by

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February 23, 2007

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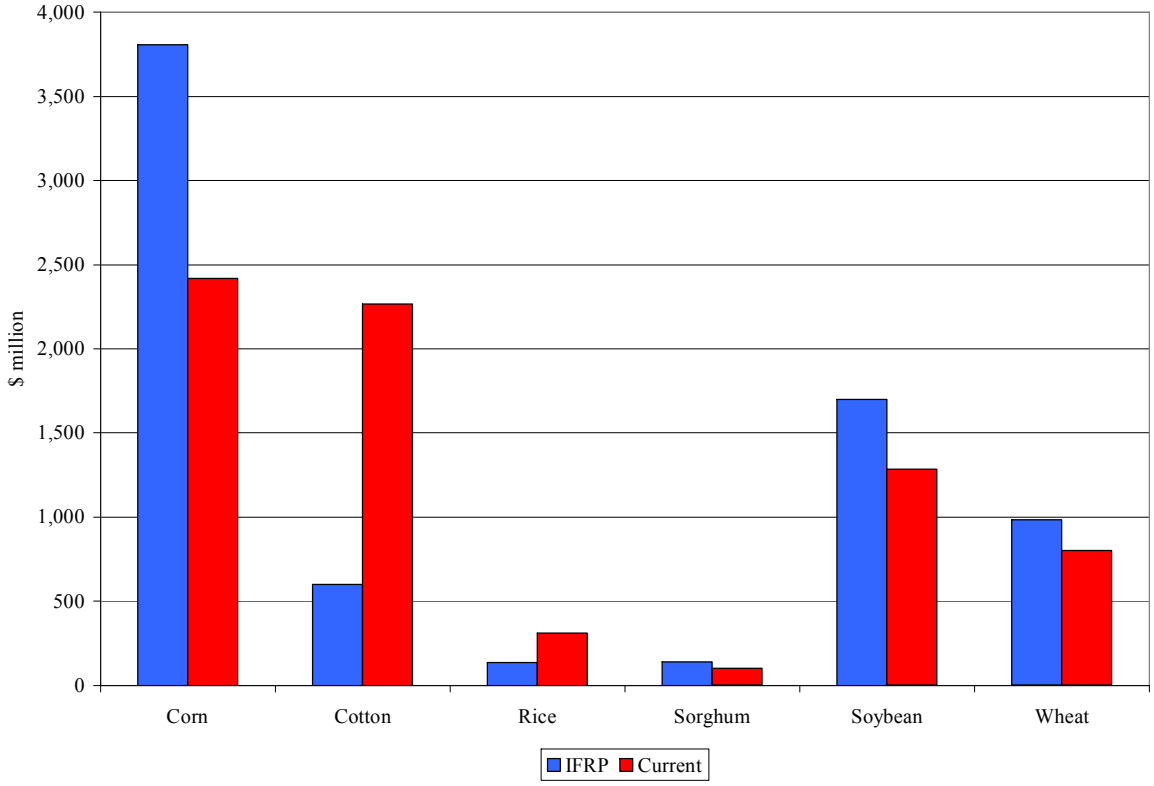
Executive Summary

In response to a request from American Farmland Trust (AFT), AgRisk Management has conducted a cost analysis of AFT's Integrated Farm Revenue Program assuming that it is implemented in the 2007 Farm Bill. As initially conceived by Professor Carl Zulauf (Ohio State University), this program would replace marketing loans, countercyclical payments and would result in reduced crop insurance premiums and associated costs. The program's main component is the National Revenue Deficiency Payment, which would make payments to eligible producers of a crop whenever national revenue falls below a trigger revenue level. The crop insurance program would be integrated with the new program by reducing crop insurance indemnities by the amount of a farm's National Revenue Deficiency Payment. This integration eliminates overlapping coverage between crop insurance and commodity programs and reduces the need for ad hoc disaster assistance.

The projected net budget cost of the Integrated Farm Revenue Program (IFRP) over the assumed five-year life of the 2007 Farm Bill includes the projected cost of the National Revenue Deficiency Payment less the projected cost of marketing loans and countercyclical payments less the cost savings that would accrue from the crop insurance program. Costs for the Integrated Farm Revenue Program, the current farm programs, and the crop insurance program were estimated for six program crops: corn, soybeans, wheat, cotton, rice and grain sorghum. Projected costs vary with the coverage level that determines the trigger revenue levels. As shown in the table below, the projected average annual net cost of the IFRP at the 90 percent coverage level is $182 million, assuming farmers choose the 75 percent coverage level for their crop insurance coverage. The net cost of the IFRP at the 100 percent coverage level is $2.48 billion per year. At the 95 percent coverage level, the net cost falls to $1.224 billion. At the 85 percent coverage level, there is a net savings of $659 million, in comparison to current programs.

Annual Average Net Cost of the Integrated Farm Revenue Program at the 90% Coverage Level	
Projected Cost of IFRP	$4,494 million
Less Projected Cost of Counter-cyclical and Marketing Loan Programs	$2,748 million
Less Savings from Crop Insurance	$1,564 million
Projected Net Cost of IFRP	$ 182 million

The Integrated Farm Revenue Program guarantees are based on market prices rather than current target prices. Hence the distribution of payments differs under this program as compared to current programs, as shown in the crop-specific chart below. In the chart, projected annual average total costs for the IFRP are shown, along with the projected annual average total costs for the current farm programs. Current program payments include payments from the counter-cyclical, marketing loan, and crop insurance programs.



Projected Average Annual Costs of Current Programs and the Integrated Farm Revenue Program at the 90% Coverage Level

The National Revenue Deficiency Payment program would significantly reduce average indemnity payments from the crop insurance program. The amount of the reduction varies by region, by crop, and by the coverage level that determines trigger revenue. At the 90 percent coverage level, average indemnities for farmers insured at the 75 percent coverage level would be reduced by 19 percent for cotton, 22 percent for wheat, 27 percent for sorghum, 29 percent for soybeans, 45 percent for rice, and 46 percent for corn. At the 100 percent coverage level, average indemnities would be reduced by 29 percent for cotton, 32 percent for wheat, 38 percent for sorghum, 41 percent for soybeans, 59 percent for rice, and 57 percent for corn. Regions that have yields that are highly correlated with national yields would experience larger reductions than these average reductions. These reductions in expected indemnities would translate into similar sized reductions in crop insurance premiums. The reaction of farmers to this reduction in risk and crop insurance premiums is not accounted for in this analysis and thus this analysis assumes a 75 percent coverage level which corresponds most closely to the current situation in the crop insurance program.

Cost Projections of the Integrated Farm Revenue Program

I. Introduction

In response to a request from American Farmland Trust (AFT), AgRisk Management has conducted a cost analysis of AFT's Integrated Farm Revenue Program assuming that it is implemented in the 2007 Farm Bill. This program would replace marketing loans, countercyclical payments and would result in reduced crop insurance premiums and associated costs. The program's main component is the National Revenue Deficiency Payment (NRDP), which would make payments to eligible producers of a crop whenever national revenue falls below a trigger revenue level. The crop insurance program would be integrated with the new program by reducing crop insurance indemnities by the amount of a farm's National Revenue Deficiency Payment. This integration eliminates overlapping coverage between crop insurance and commodity programs.

Stochastic scoring methods were used to estimate program costs because payments are triggered when revenue is low, and revenue depends on random prices and random yields. Projected costs are estimated by taking the average payment over a wide range of prices and yields. Average prices for each year of the 2007 Farm Bill follow the price projections from the preliminary baseline developed in December 2006 by the Food and Agricultural Policy Research Institute (FAPRI). The FAPRI preliminary price projections are similar to current Congressional Budget Office (CBO) price projections.

Adoption of the NRDP program would reduce payments from the crop insurance program. Some farmers would likely increase their crop insurance coverage because of the resulting reduction in premiums. Other farmers would likely drop out of the program because they feel their risks are sufficiently covered by the NRDP program. This analysis does not estimate how participation in the crop insurance program would be changed under the proposed program. Rather, it is assumed that current projected participation rates and coverage levels are unchanged after program implementation. The percent reduction in expected indemnities from Revenue Assurance (without the Harvest Price Option) due to implementation of the NRDP multiplied by the preliminary FAPRI projections for crop insurance costs is taken as the measure of savings that would accrue from crop insurance.

The remainder of the report is organized as follows. The next section outlines the method used to make cost projections. Section III presents results, including maps that illustrate the impact of the program on crop insurance.

II. Method of Analysis

The National Revenue Deficiency Payment would pay all eligible producers whenever national revenue fell below the national target revenue level. The amount of payment would vary across farms because expected yields vary by farm. Thus, to calculate the cost of this program requires estimating the magnitude and probability of national revenue losses and the distribution of yields across farms for each crop considered. Part of the cost of this program would be offset by a reduction in the cost of running the crop insurance program because a farm's crop insurance indemnity would be reduced by the amount of a farm's NRDP. To calculate this cost savings requires estimation of projected crop insurance indemnities for eligible

farms across the United States and the degree to which payments from the national program would reduce these indemnities. Thus this component requires data that measures farm-level average yields and yield variability across the United States. The methods and data used to estimate the cost of the program draw heavily on the data and rating methods used to determine premium rates for two popular crop insurance programs: Revenue Assurance (RA) and Group Risk Income Protection (GRIP). Because of the importance in maintaining proper correlations between farm yields and national yields, a commonly used decomposition of farm yield into systemic and poolable (idiosyncratic) components was employed.

The key to determining the likelihood and magnitude of payments is to determine the distribution of payments paid under NRDP for each crop (corn, soybeans, wheat, cotton, grain sorghum, and rice). Some definitions will help illustrate how this distribution was estimated.

$$\text{National Percent Loss} = \text{Max}[(\text{National Revenue Guarantee} - \text{Actual Revenue}), 0] / \text{National Revenue Guarantee} \quad (1)$$

$$\text{National Revenue Guarantee} = \text{National Coverage Level} * \text{Insurance Price} * \text{Expected National Yield} \quad (2)$$

$$\text{Insurance Price} = \text{FAPRI Projected Price} + \text{Basis} \quad (3)$$

$$\text{Actual Revenue} = \text{Actual Yield per Planted Acre} \times \text{Actual Price} \quad (4)$$

Insurance Price in equation (3) is the price that is used to set revenue guarantees in the crop insurance program for revenue insurance products. These prices are taken directly from commodity exchanges. Because the objective of this cost-estimation analysis is to approximate what the CBO would estimate the costs to be, we based this analysis on baseline prices. Major baseline price projections are made by USDA, FAPRI, and CBO. The most current set of price projections are those presented by FAPRI in their December baseline review. Hence we base this analysis on that baseline. FAPRI baseline prices represent projections of the NASS season average price. Season average prices are typically lower than the prices used to set insurance guarantees because NASS prices represent the average price received by farmers rather than prices at delivery points specified by the exchanges. Hence the first step of this analysis is to estimate Insurance Price by adding the average difference between NASS season average prices and the prices used to set revenue guarantees. Dr. Chad Hart is the FAPRI economist responsible for reconciling crop insurance expenditures with FAPRI baseline projections. His estimates of the basis used in this reconciliation are used to adjust the FAPRI projected prices. The resulting prices by projection year are reported in Table 1.

Table 1. FAPRI Acreage, Projected Prices, Basis Values, and Insurance Prices

	Crop Year				
	2008	2009	2010	2011	2012
Planted Acreage			(million acres)		
Corn	88.7	88.9	90.1	90.7	91.3
Soybeans	70.6	71.7	71.2	71.1	70.6
Wheat	59.0	58.2	58.2	58.1	58.1
Cotton	13.4	13.5	13.5	13.5	13.5
Rice	2.8	2.9	3.0	3.0	3.0
Grain Sorghum	6.6	6.5	6.5	6.5	6.5
Projected Prices					
Corn ($/bu)	3.02	3.07	3.08	3.09	3.07
Soybeans ($/bu)	6.70	6.69	6.64	6.53	6.49
Wheat ($/bu)	4.11	4.18	4.22	4.27	4.31
Cotton ($/lb)	0.519	0.519	0.52	0.521	0.531
Rice ($/cwt)	8.18	8.55	8.59	8.61	8.78
Grain Sorghum ($/bu)	2.82	2.88	2.89	2.92	2.92
Price Basis					
Corn ($/bu)	0.39	0.39	0.39	0.39	0.39
Soybeans ($/bu)	0.39	0.39	0.39	0.39	0.39
Wheat ($/bu)	0.36	0.36	0.36	0.36	0.36
Cotton ($/lb)	0.09	0.09	0.09	0.09	0.09
Rice ($/cwt)	1.08	1.08	1.08	1.08	1.08
Grain Sorghum ($/bu)	0.22	0.22	0.22	0.22	0.22
Insurance Prices					
Corn ($/bu)	3.41	3.46	3.47	3.48	3.46
Soybeans ($/bu)	7.09	7.08	7.03	6.92	6.88
Wheat ($/bu)	4.47	4.54	4.58	4.63	4.67
Cotton ($/lb)	0.609	0.609	0.61	0.611	0.621
Rice ($/cwt)	9.26	9.63	9.67	9.69	9.86
Grain Sorghum ($/bu)	3.04	3.10	3.11	3.14	3.14

Expected National Yield in equation (2) is estimated from simple linear trends based on yield per planted acre data for each crop from 1980 to 2005. The estimated yield trends are extended through the 2008 to 2012 projection period and are shown in Table 2. National Coverage Level in equation (2) is varied from 90 to 100 percent by increments of 5 percent.

Table 2. Expected National Yields

	Crop Year				
	2008	2009	2010	2011	2012
Expected Nat. Yields per Planted Acre					
Corn (bu/acre)	142.2	144.2	146.3	148.4	150.5
Soybeans (bu/acre)	41.1	41.5	42.0	42.4	42.9
Wheat (bu/acre)	36.1	36.4	36.6	36.9	37.1
Cotton (lb/acre)	710.2	716.3	723.2	729.7	736.3
Rice (lb/acre)	6,980.5	7,043.9	7,099.1	7,158.0	7,224.4
Grain Sorghum (bu/acre)	54.2	54.3	54.4	54.6	54.7

Actual Revenue is simulated in the following manner. NASS national yield data were detrended to put them on a 2005 technology basis using the linear trends estimated from 1980 to 2005. The price draws have a mean equal to each year's insurance price. The price-yield and price-price correlations between national yields and prices were set equal to empirical rank order correlations from 1980 to 2005 using the Iman and Conover[1] method. We take 500 price draws for each national yield draw, thereby creating 13,000 national revenue draws for each crop. (See Paulson and Babcock[2] for more details about how these revenue draws were created.) The price draws are drawn according to the correlations previously discussed and price volatilities based on the average volatility used to determine RA and GRIP premium rates over the last five years. National yield draws for each crop are taken directly from their empirical distribution. Yields are drawn so that the same year is drawn for each crop, thereby using the actual relationship between national crop yields that is reflected in the data from 1980 to 2005. This method imposes the empirical correlations between national yields. Price draws are indexed by yield year (1980 to 2005) and iteration number (1 to 500). We then calculate the National Percent Loss for each of the 13,000 draws for each crop. This method thereby maintains a reasonable degree of correlation between crops for each draw. Therefore the percent losses are correlated across crops.

The advantage of maintaining this correlation is that it allows for a natural method for correlating farm yields to national yields. Obtaining a good measure of correlation between farm and national yields is crucial for this analysis because the savings from the crop insurance program depend crucially on this correlation. If the correlation is high, then the savings are high. In contrast, in regions where there is low correlation, then the savings will be relatively low because a low national yield does not imply anything about the level of farm yields. Because the same insurance price and actual price is used for both the farm and nation when calculating the national revenue deficiency payment, the key feature in this analysis is to maintain a proper degree of correlation between farm yields and national yields. A common decomposition of farm yields into a systemic component and a poolable component accomplishes this.

Following Miranda[3], decompose farm yield as follows:

[1] Iman, R. and W. Conover. 1982. "A Distribution-Free Approach to Inducing Rank Correlation Among Input Variables." *Communications in Statistics* B11 3: 311-334.

[2] Paulson, Nick and B.A. Babcock. "Get A GRIP: Should Area Revenue Coverage Be Offered through the Farm Bill or as a Crop Insurance Program." Working paper 07-WP 440. Center for Agricultural and Rural Development, Iowa State University, January 2007.

[3] Miranda, M. J. 1991. "Area-Yield Crop Insurance Reconsidered." *American Journal of Agricultural Economics* 73(2, May): 233-42.

$$\text{Farm Yield} = \text{Expected Farm Yield} + \text{beta} * (\text{Actual County Yield} - \text{Expected County Yield}) + \text{Random Noise} \quad (5)$$

In this decomposition farm yields are determined by a systemic component that affects all farms in a county (Actual County Yield – Expected County Yield) and a component that only affects an individual farm (Random Noise). Random Noise is a mean zero random variable that is uncorrelated across farms. Because Random Noise, by definition, is uncorrelated across farms, it is poolable risk. Thus, farm yield consists of a systemic component that affects all farms in a county and a poolable or idiosyncratic component. The farm's "beta" measures the sensitivity of a farm's yield to the systemic component that is measured by changes in county yields. In years where the county yield is high, farms with a beta greater than one will tend to have great years, whereas the same farm will have quite poor yields when the county yield is down. The average farm beta in all counties equals one because the average farm yield in a county by definition equals the county average yield. In addition, by definition, the average (across farms) Expected Farm Yield in a county equals the Expected County Yield.

The objective of this cost analysis is to estimate the degree to which the national payment program offsets crop insurance indemnities on individual farms. To keep the analysis tractable and interpretable some simplifying assumptions about the terms in equation (5) were made. All farm betas in a county were set equal to 1.0. All Expected Farm Yields were set equal to Expected County Yields. And the variance of Random Noise terms was set equal on all farms in a county. Thus equation (5) reduces to

$$\text{Farm Yield}_{cjit} = \text{Actual County Yield}_{ct} + \text{Random Noise}_{jit} \quad j = 1, \ldots, 25;\ t = 1980 \text{ to } 2005,\ i = 1, \ldots, 500 \quad (6)$$

The added subscripts in (6) denote that 25 farm yields were simulated for each county, 26 years of county yield data were used, and 500 random price and idiosyncratic risk draws were used to obtain 13,000 farm yield draws per farm. Note that by drawing farm yields in the same order as the national yields ensures that the correlation of farm yield with national yield is determined by the degree to which the county in which a farm resides has yields that moved in tandem with national yields from 1980 to 2005 and the magnitude of the variance of Random Noise in each county. A higher variance increases the relative importance of poolable risk, thereby lowering the correlation between farm yield and national yield.

The variance of poolable risk for farm yields in a county was set so that the implied amount of yield variability from both systemic and poolable risk together in equation (6) was consistent with the Risk Management Agency's (RMA) rates for 65 percent yield insurance coverage on an enterprise unit. That is, the amount of farm-level yield variability was calibrated so that it is consistent with the rates actually used by RMA. Enterprise unit rates were set at 76.5 percent of optional unit rates, which is consistent with recent rating work conducted by RMA. For each crop-county combination, RMA's Actuarial Data Master allows for calculation of this 65 percent rate. Then for each county, we solved for the county- and crop- specific variance of poolable risk that resulted in the desired rate using Monte Carlo analysis.

The weakness of this approach to estimating the offset is that it makes no account for how farmers' crop insurance decisions would change after the National Revenue Deficiency Payment was implemented. Some farmers would likely increase coverage because their premium would decrease. Other farmers would likely find that they would not need to buy crop insurance at all. In the results section, we calculate the aggregate crop insurance offset for various revenue insurance coverage levels assuming that every farmer buys this coverage level both before and after implementation of the new program.

III. Projected Costs of the Integrated Farm Revenue Program

In this program Congress will only choose the coverage level for the NRDP. Farmers will continue to choose the farm-level insurance coverage level. Detailed results are presented for four NRDP coverage levels and for an individual farm coverage level of 75 percent. The current average coverage level in the crop insurance program for program crops is approximately 70 percent. But this includes many Crop Revenue Coverage policies and RA-HPO policies that have higher premium rates. Thus, the 75 percent coverage level results correspond most closely to the current situation in the crop insurance program.

Table 3 contains the summary results for three NRDP coverage levels, 85, 90, 95, and 100 percent, and three farm level percent coverage level, 65, 75, and 85 percent. The estimation at 3 farm-level coverage levels shows the interaction between the NRDP and crop insurance. The results for individual farm coverage at 75 percent are highlighted here, as that represents the closest case to current crop insurance participation. The Table 3 results are average annual 2008-12 average total program costs for the NRDP. The third column of the table shows the average government cost of NRDP without accounting for any offsets from crop insurance, marketing loans, or counter-cyclical expenditures. This cost is strictly the additional cost of the NRDP. Average program costs range from $3.4 billion at the 85 percent NRDP coverage level to $7.3 billion at the 100 percent NRDP coverage level.

Part of this cost will be offset by a reduction in crop insurance expenditures. These offsets vary by NRDP and farm coverage level. The reduction in crop insurance expenditures is directly related to the NRDP coverage level and inversely related to the farm coverage level. After accounting for the crop insurance offsets, average total costs for the Integrated Farm Revenue Program range from $1.9 billion at the 85% national coverage level to $5.4 billion at the 100% national coverage level. However, because the Integrated Farm Revenue Program would replace marketing loans and countercyclical payments, there is an additional budget offset. The last column of Table 3 shows the net costs of the Integrated Farm Revenue Program after accounting for all of the offsets from crop insurance, marketing loans, and countercyclical payments. Net costs range from a $821 million savings to $2.7 billion cost. At a farm coverage level of 75 percent, the average annual net cost of the program ranges from $659 million in savings to $2.48 billion in costs. At the 90 percent coverage level, the Integrated Farm Revenue Program has minimal costs. At the 85 percent coverage level, the IFRP actually has cost savings in comparison to current farm programs and crop insurance.

Table 3. 2008-12 Average Total Program Cost for Integrated Farm Revenue Program

NRDP Cov. Level	Farm Cov. Level	Program Cost without Offsets	Program Cost with Crop Insurance Offset	Program Cost with LDP, CCP, and Crop Insurance Offset
%	%		($ million)	
100	65	7,310	5,077	2,329
100	75	7,310	5,228	2,480
100	85	7,310	5,415	2,667
95	65	5,796	3,814	1,066
95	75	5,796	3,972	1,224
95	85	5,796	4,162	1,414
90	65	4,494	2,768	20
90	75	4,494	2,930	182
90	85	4,494	3,118	370
85	65	3,397	1,927	-821
85	75	3,397	2,089	-659
85	85	3,397	2,270	-478

Tables 4 – 15 provide a more detailed examination of the costs for a farm coverage level of 75 percent and NRDP coverage levels of 100 percent (Tables 4 – 6), 95 percent (Tables 7 – 9), 90 percent (Tables 10 – 12), and 85 percent (Tables 13-15). These results show how NRDP payments would be distributed across crops and projection year. Tables, 4, 7, 10, and 13 present the crop- and year-specific projected NRDP payments for the three NRDP coverage levels. The projected high corn and soybean prices and large planted acreage result in these two crops receiving by far the most payments. Tables 5, 8, 11, and 14 present projected average annual revenue insurance payments by crop and year. These payments overestimate the cost of the crop insurance program because they assume that all acres planted are insured. The reason for presenting these results is that they are used in conjunction with the net crop insurance indemnities reported in Tables 6, 9, 12, and 15 to estimate the extent to which NRDP would reduce crop insurance indemnities. A comparison of the gross indemnities to the net indemnities shows that NRDP would have a significant impact on crop insurance indemnities on those acres that were actually insured.

Table 4. National Revenue Deficiency Payments

NRDP Coverage Level = 100%, Farm Coverage Level = 75%					
Crop	2008	2009	2010	2011	2012
			($ million)		
Wheat	708	715	725	737	748
Rice	184	196	206	210	217
Cotton	489	498	517	523	536
Corn	3,797	3,914	4,030	4,122	4,181
Sorghum	112	113	113	115	115
Soybean	1,720	1,764	1,758	1,747	1,742

Table 5. Average Gross Indemnities from Revenue Insurance

NRDP Coverage Level = 100%, Farm Coverage Level = 75%					
Crop	2008	2009	2010	2011	2012
			($ million)		
Wheat	853	854	861	869	876
Rice	107	112	116	116	119
Cotton	618	623	650	649	658
Corn	2,576	2,624	2,671	2,701	2,707
Sorghum	127	128	128	128	128
Soybean	1,539	1,558	1,534	1,505	1,483

Table 6. Average Net Average Indemnities from Revenue Insurance

NRDP Coverage Level = 100%, Farm Coverage Level = 75%					
Crop	2008	2009	2010	2011	2012
			($ million)		
Wheat	581	580	584	587	591
Rice	45	46	47	46	47
Cotton	440	441	458	456	460
Corn	1,124	1,131	1,137	1,135	1,123
Sorghum	80	80	80	80	79
Soybean	920	925	904	881	863

Table 7. National Revenue Deficiency Payments

National Coverage Level = 95%, Farm Coverage Level = 75%					
Crop	2008	2009	2010	2011	2012
			($ million)		
Wheat	548	553	561	570	579
Rice	146	155	164	166	172
Cotton	374	381	396	400	410
Corn	3,070	3,165	3,259	3,334	3,381
Sorghum	91	92	92	94	94
Soybean	1,326	1,360	1,356	1,347	1,344

Table 8. Average Gross Revenue Insurance Indemnities

National Coverage Level = 95%, Farm Coverage Level = 75%					
Crop	2008	2009	2010	2011	2012
			($ million)		
Wheat	853	854	861	869	876
Rice	107	112	116	116	119
Cotton	618	623	650	649	658
Corn	2,576	2,624	2,671	2,701	2,707
Sorghum	127	128	128	128	128
Soybean	1,539	1,558	1,534	1,505	1,483

Table 9. Average Net Revenue Insurance Indemnities

National Coverage Level = 95%, Farm Coverage Level = 75%					
Crop	2008	2009	2010	2011	2012
			($ million)		
Wheat	627	626	630	634	638
Rice	52	54	55	54	55
Cotton	472	475	493	491	496
Corn	1,275	1,284	1,293	1,293	1,282
Sorghum	86	86	86	86	86
Soybean	1,015	1,022	1,000	976	956

Table 10. National Revenue Deficiency Payments

National Coverage Level = 90%, Farm Coverage Level = 75%					
Crop	2008	2009	2010	2011	2012
			($ million)		
Wheat	412	415	422	428	435
Rice	111	118	125	127	132
Cotton	274	279	290	292	300
Corn	2,447	2,523	2,599	2,659	2,696
Sorghum	72	73	73	74	74
Soybean	989	1,014	1,011	1,005	1,002

Table 11. Average Gross Revenue Insurance Indemnities

National Coverage Level = 90%, Farm Coverage Level = 75%					
Crop	2008	2009	2010	2011	2012
			($ million)		
Wheat	853	854	861	869	876
Rice	107	112	116	116	119
Cotton	618	623	650	649	658
Corn	2,576	2,624	2,671	2,701	2,707
Sorghum	127	128	128	128	128
Soybean	1,539	1,558	1,534	1,505	1,483

Table 12. Average Net Revenue Insurance Indemnities

National Coverage Level = 90%, Farm Coverage Level = 75%					
Crop	2008	2009	2010	2011	2012
			($ million)		
Wheat	670	670	674	679	683
Rice	60	62	64	63	64
Cotton	504	507	527	525	531
Corn	1,430	1,443	1,455	1,457	1,448
Sorghum	93	93	93	93	92
Soybean	1,110	1,118	1,096	1,070	1,050

Table 13. National Revenue Deficiency Payments

National Coverage Level = 85%, Farm Coverage Level = 75%					
Crop	2008	2009	2010	2011	2012
			($ million)		
Wheat	298	301	305	310	315
Rice	81	86	91	92	96
Cotton	189	192	200	201	206
Corn	1,925	1,985	2,044	2,091	2,121
Sorghum	55	56	56	57	57
Soybean	704	722	719	715	714

Table 14. Average Gross Revenue Insurance Indemnities

National Coverage Level = 85%, Farm Coverage Level = 75%					
Crop	2008	2009	2010	2011	2012
			($ million)		
Wheat	853	854	861	869	876
Rice	107	112	116	116	119
Cotton	618	623	650	649	658
Corn	2,576	2,624	2,671	2,701	2,707
Sorghum	127	128	128	128	128
Soybean	1,539	1,558	1,534	1,505	1,483

Table 15. Average Net Revenue Insurance Indemnities

National Coverage Level = 85%, Farm Coverage Level = 75%					
Crop	2008	2009	2010	2011	2012
			($ million)		
Wheat	711	711	715	721	725
Rice	68	71	73	73	73
Cotton	534	537	559	557	564
Corn	1,586	1,602	1,619	1,624	1,615
Sorghum	99	99	99	100	99
Soybean	1,202	1,213	1,190	1,163	1,142

Table 15 compares the costs of the NRDP to the counter-cyclical and marketing loan programs. The higher prices projected for most crops results in lower counter-cyclical and marketing loan costs. Cotton is the only crop with significant counter-cyclical and marketing loan costs as projected prices are still below the cotton target price. The NRDP uses market prices to establish revenue guarantees. Thus, the cotton price used to create the NRDP revenue guarantee is below the current cotton target price, while for most of the other crops the price used to set the guarantee is above the current target price. This comparison highlights some of the differences between the NRDP and current programs, but it ignores the impacts on crop insurance due to the integration of NRDP payments in crop insurance indemnities.

Table 16 accounts for the impact of crop insurance for both the Integrated Farm Revenue Program and the current farm programs. As shown in Table 16, cotton payments would be reduced by about $1.6 billion over five years from adoption of the IFRP at the 90% coverage level. Corn payments would increase by $1.4 billion over five years. Soybean payments would increase by $400 million and wheat payments would increase by $181 million. Rice payments would decrease by $176 million. Much of the shift in payment flows among the crops is due to projected price levels as explained earlier.

Table 16. Farm Program Costs by Crop and Year (Excluding Crop Insurance)

Year	2008	2009	2010	2011	2012	Average
			($ million)			
NRDP (Coverage level = 90%)						
Corn	2,447	2,523	2,599	2,659	2,696	2,585
Cotton	274	279	290	292	300	287
Rice	111	118	125	127	132	123
Sorghum	72	73	73	74	74	73
Soybean	989	1,014	1,011	1,005	1,002	1,004
Wheat	412	415	422	428	435	422
Total	4,306	4,423	4,519	4,586	4,638	4,494
Counter-cyclical and Marketing Loan Programs						
Corn	209	168	167	160	174	176
Cotton	1,896	1,903	1,913	1,903	1,796	1,882
Rice	328	278	281	280	261	286
Sorghum	12	10	8	8	8	9
Soybean	259	270	295	354	377	311
Wheat	114	92	82	70	63	84
Total	2,818	2,721	2,746	2,775	2,679	2,748

Table 17. Total Government Costs by Crop and Year (Including Crop Insurance)

Year	2008	2009	2010	2011	2012	Average
			($ million)			
IFRP (NRDP coverage level = 90%, farm coverage level = 75%)						
Corn	3,603	3,733	3,834	3,910	3,952	3,806
Cotton	577	590	603	608	618	599
Rice	126	132	139	142	146	137
Sorghum	137	139	139	141	141	140
Soybean	1,665	1,718	1,720	1,703	1,690	1,699
Wheat	971	968	978	990	1,005	982
Total	7,079	7,279	7,413	7,493	7,551	7,363
Current Programs (LDP, CCP, and current crop insurance)						
Corn	2,291	2,368	2,436	2,478	2,524	2,419
Cotton	2,268	2,285	2,299	2,293	2,189	2,267
Rice	353	302	307	307	288	312
Sorghum	102	101	99	100	101	100
Soybean	1,196	1,250	1,287	1,336	1,348	1,283
Wheat	826	797	792	789	793	800
Total	7,036	7,104	7,220	7,302	7,244	7,181

IV. Effect on Farm Level Insurance Premiums

To examine the amount of protection NRDP provides at the farm level, the percentage reduction in the farm insurance indemnity due to NRDP is mapped for each crop and county for the NRDP coverage level of 90 percent and a farm coverage level of 75 percent. That is we mapped

$$\frac{\left(\text{Total farm indemnity} - \text{Net farm indemnity}\right)}{\text{Total farm indemnity}}$$

Figures 1 – 6 show the distribution of the percentage reduction in the farm insurance indemnities by crop for the 2008 crop year. To make comparisons across the maps easier, we have standardized the maps so that counties with reductions between 0 and 20 percent are in red, 20 to 40 percent reductions are shown in orange, 40 to 60 percent reductions are shown in light green, 60 to 80 percent reductions are light blue, and 80 to 100 reductions are dark blue.

As Figure 1 shows, for corn, the percentage reduction is the strongest in the major corn-producing regions. Some counties in Iowa have percentage reductions exceeding 80 percent. Most Corn Belt counties have percentage reductions above 40 percent. Counties in the western Great Plains, the South, and the Northeast have smaller percentage reductions, less than 20 percent. These results are expected. The NRDP triggers payments when national actual revenue falls below the NRDP coverage level times expected national revenue. Given a 90 percent national coverage level, the combination of national yield and national price has to fall 10 percent to trigger a payment. Such a large fall will likely be linked with events in the major producing region for the crop. The key here is the correlation between farm revenues and national revenues. Just as national corn revenues are more correlated with Iowa state-level corn revenues than Arizona state-level corn revenues, national corn revenues are more correlated with Iowa farm-level corn revenues than Arizona farm-level corn revenues. The strength of the correlation between farm revenues and national revenues is directly related to the percentage reduction in farm-level insurance indemnities resulting from the integration of the national program. This pattern occurs across all crops to varying degrees.

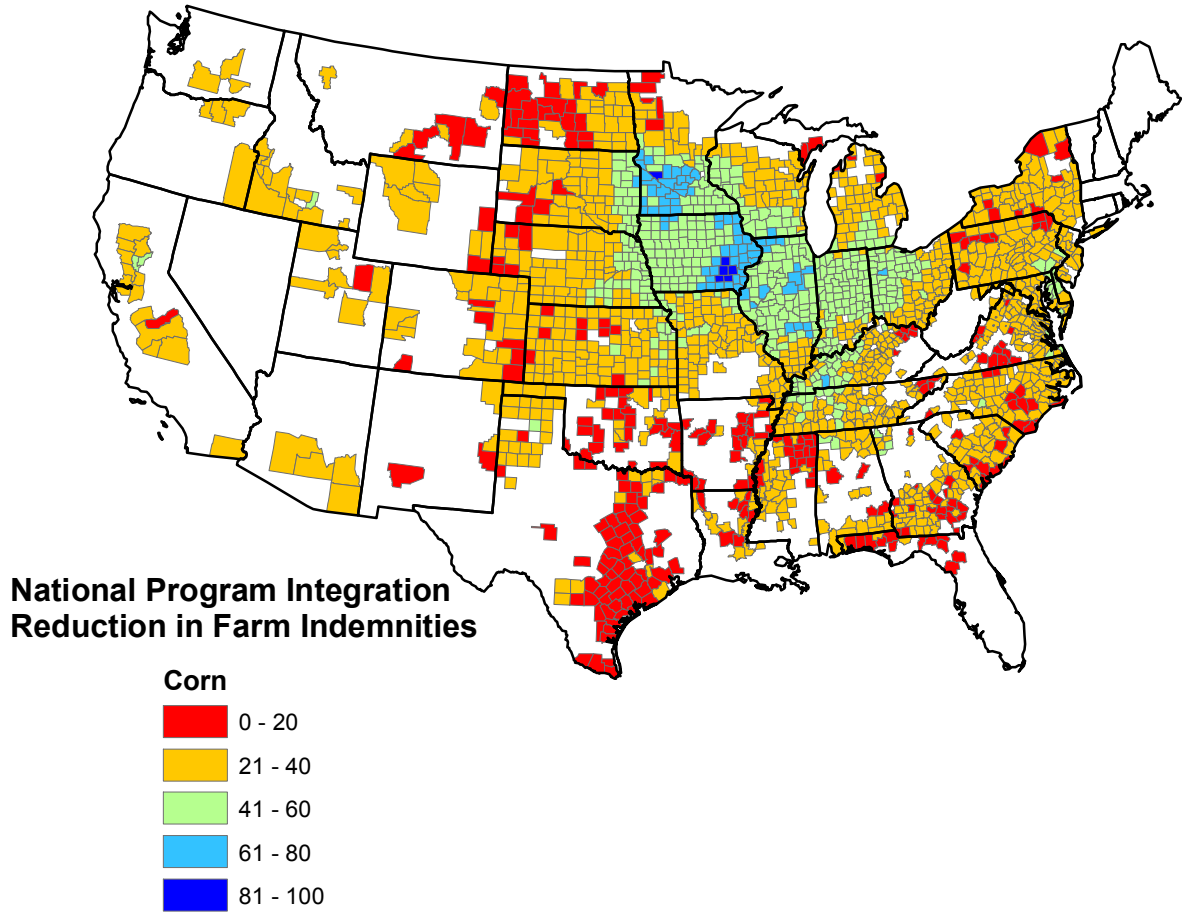


Figure 1. Percentage Reduction in Farm Indemnities for Corn Under 90% National Coverage

Figure 2 shows the map for cotton. Overall, the percentage reductions are significantly less than those for corn. All counties have percentage reductions less than 40 percent. This is due to the sizable amount of yield risk at the farm level that is not accounted for by yield variations at the national level. Cotton revenue farm insurance premium rates are significantly higher than corn revenue farm insurance premium rates on a per dollar of coverage basis. This indicates much higher farm-level revenue risk for cotton than for corn. This also suggests that the correlation between cotton farm-level revenues and cotton national-level revenues is less than the correlation between corn farm-level and national-level revenues. Again, the higher the correlation is, the larger the percentage reduction in farm indemnities from the national program payment.

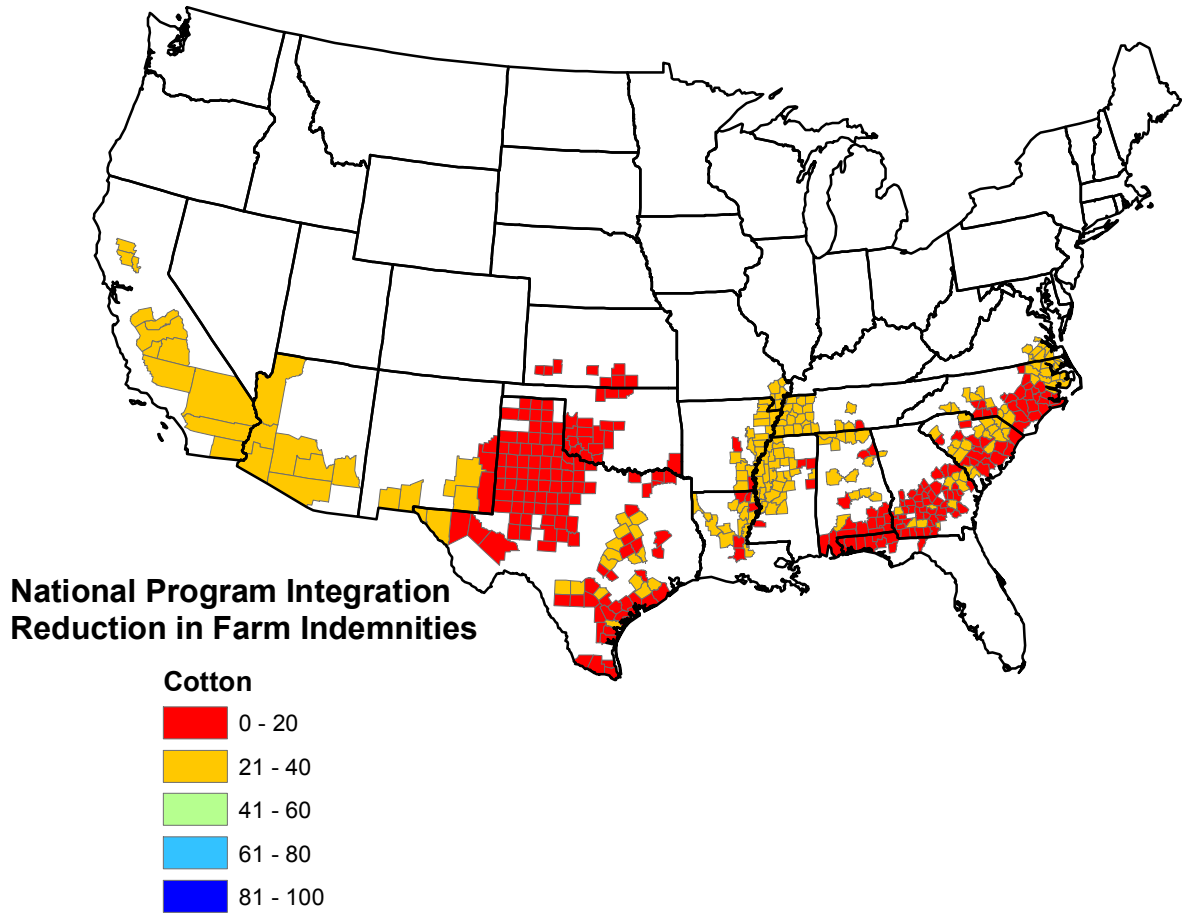


Figure 2. Percentage Reduction in Farm Indemnities for Cotton Under 90% National Coverage

Figure 3 is the map for rice. All counties see a 20 to 60 percent reduction in farm indemnities due to the national program payment. Rice areas in California, Texas, western Louisiana, Mississippi, and Arkansas show the largest reductions in farm indemnities. The average reduction in farm indemnities for rice is nearly the same as for corn.

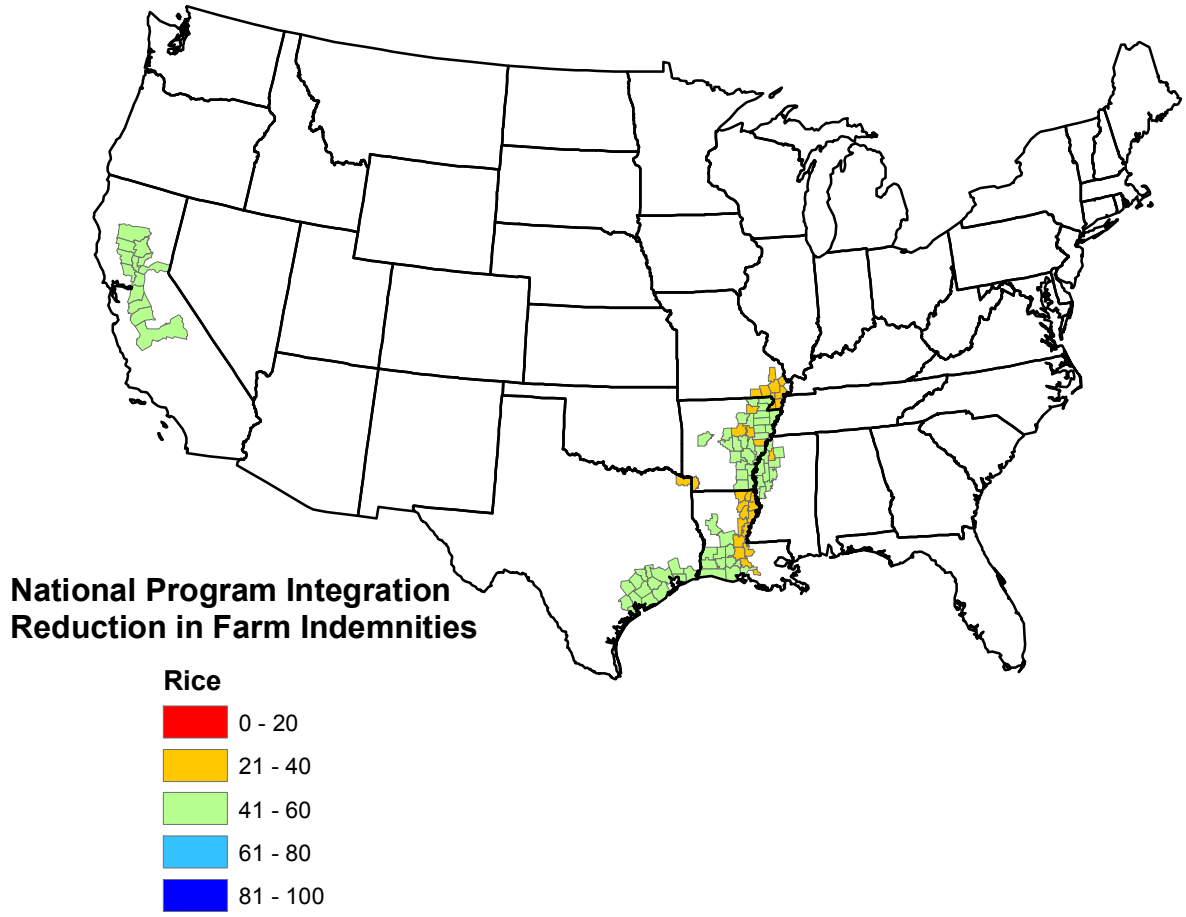


Figure 3. Percentage Reduction in Farm Indemnities for Rice Under 90% National Coverage

The sorghum map in Figure 4 shows that Kansas and Nebraska counties would experience the largest percent reductions, on the order of 20 to 60 percent. Most other sorghum producing counties would have percentage reductions below 20 percent. The California county showing a large reduction in farm indemnities is due to a short historical data set for sorghum in that county; it is likely the county's actual reduction in farm indemnities will be in line with the other California counties.

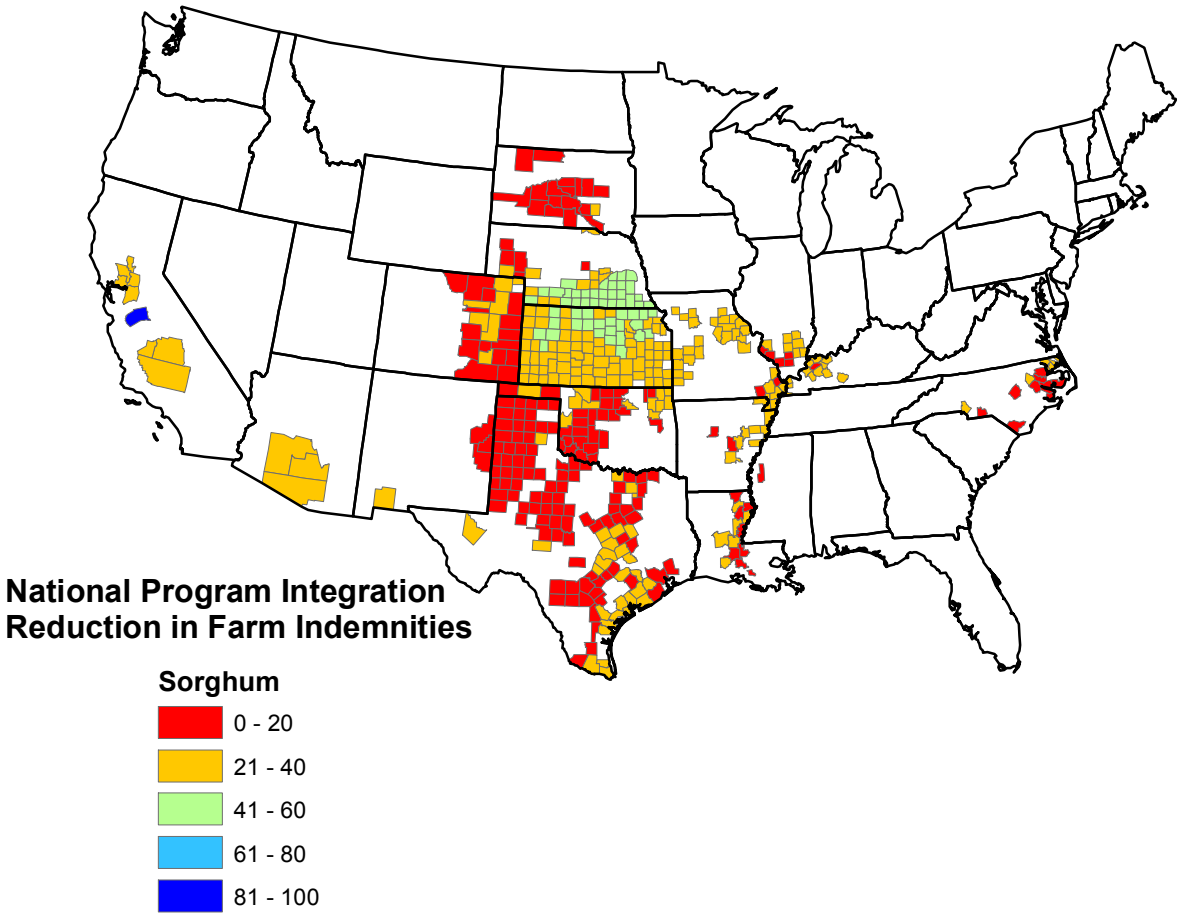


Figure 4. Percentage Reduction in Farm Indemnities for Sorghum Under 90% National Coverage

The results for soybeans strongly parallel those for corn. Corn Belt farms would experience a significant reduction in farm-level insurance indemnities whereas counties outside the Corn Belt would not. Soybean producers in southern Minnesota, Iowa, southwestern Wisconsin, and Illinois would experience reductions in expected insurance indemnities of between 40 and 60 percent.

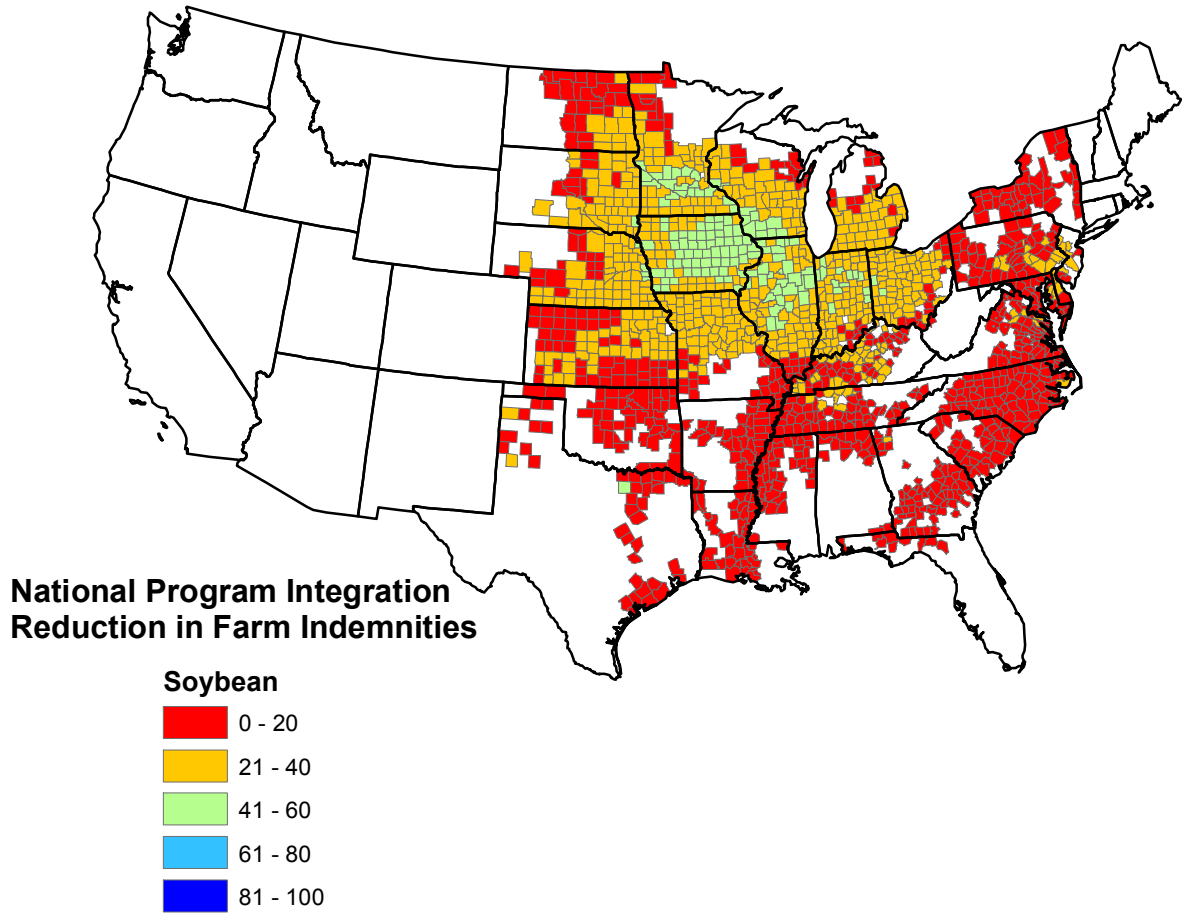


Figure 5. Percentage Reduction in Farm Indemnities for Soybeans Under 90% National Coverage

For wheat, with the exception of one Texas county (probably due to a short historical wheat data set for that county), the percentage reductions in farm indemnities are below 40 percent. There are four areas where the reduction in farm indemnities exceeds 20 percent; those are the Pacific Northwest, the Northern and Central Great Plains, and the Mid-Atlantic. This shows that even in the major producing regions for wheat, there would be sizable revenue risk at the farm-level after accounting for NRDP payments. With wheat, there is a possibility of structuring the NRDP by type (such as spring and winter wheat), but we have not analyzed such an implementation.

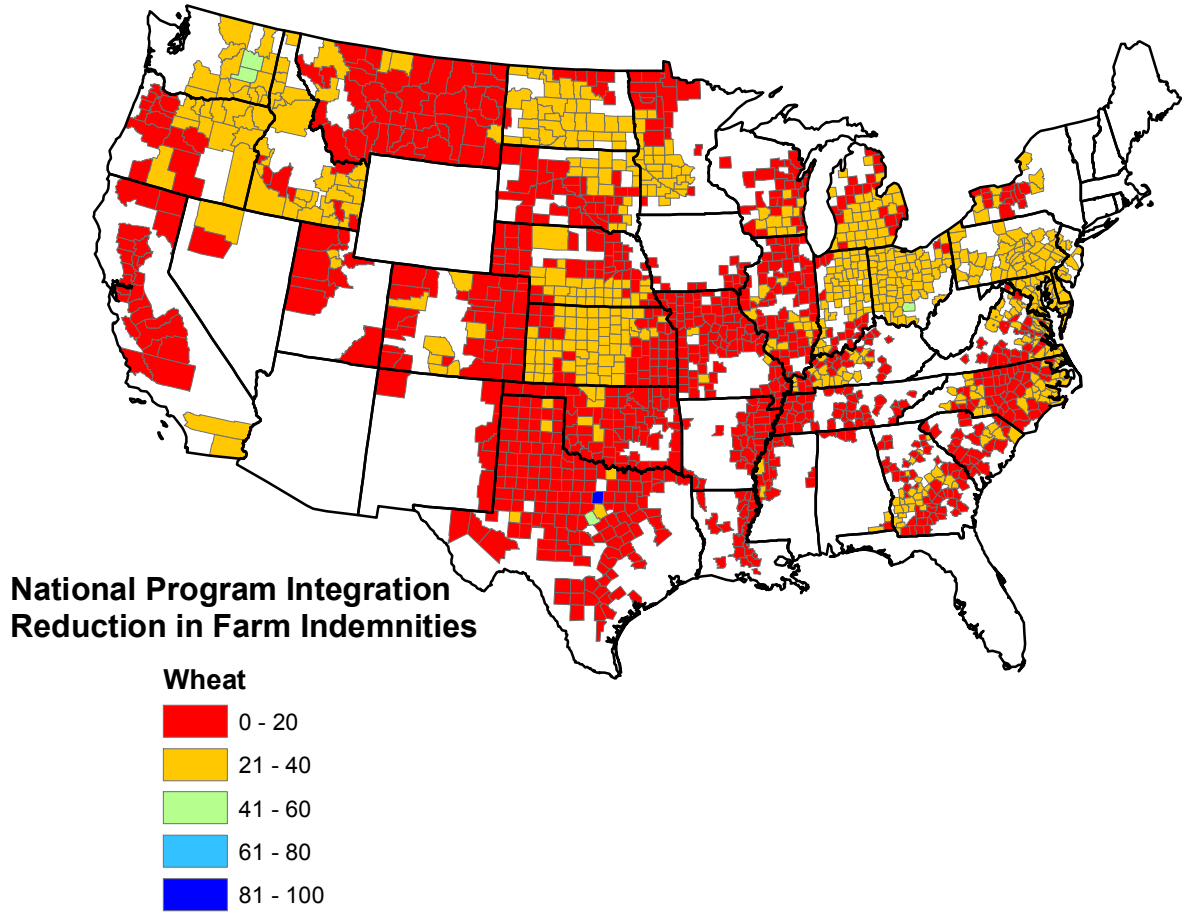


Figure 6. Percentage Reduction in Farm Indemnities for Wheat Under 90% National Coverage

A final comparison shows how the payments would be distributed across states. Table 18 shows the average annual budget cost by state across the five year farm bill period of the Integrated Farm Revenue Program at 90% national coverage and the current marketing loan, counter-cyclical, and crop insurance programs.

Table 18. 2008-12 Average Total Cost Comparison by Crop and State.

State	Wheat			Rice			Cotton		
	IFRP	Current	Difference	IFRP	Current	Difference	IFRP	Current	Difference
		($ million)			($ million)			($ million)	
Alabama	0.49	0.54	-0.05	0.00	0.00	0.00	20.97	85.90	-64.93
Alaska	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Arizona	0.00	0.21	-0.21	0.00	0.00	0.00	19.34	92.33	-73.00
Arkansas	4.64	4.60	0.04	66.64	142.96	-76.31	63.19	199.71	-136.52
California	13.87	11.67	2.20	25.48	58.27	-32.79	37.29	194.26	-156.97
Colorado	34.40	28.09	6.32	0.00	0.00	0.00	0.00	0.00	0.00
Connecticut	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Delaware	1.74	1.37	0.37	0.00	0.00	0.00	0.00	0.00	0.00
Florida	0.00	0.02	-0.02	0.00	0.33	-0.33	2.74	12.76	-10.02
Georgia	4.27	3.59	0.67	0.00	0.00	0.00	54.36	205.10	-150.74
Idaho	51.25	41.04	10.21	0.00	0.00	0.00	0.00	0.00	0.00
Illinois	17.84	14.76	3.08	0.00	0.01	-0.01	0.00	0.00	0.00
Indiana	10.91	8.94	1.96	0.00	0.00	0.00	0.00	0.00	0.00
Iowa	0.20	0.20	-0.01	0.00	0.00	0.00	0.00	0.00	0.00
Kansas	193.68	155.38	38.30	0.00	0.00	0.00	1.57	3.96	-2.39
Kentucky	9.73	7.84	1.88	0.00	0.00	0.00	0.00	0.01	-0.01
Louisiana	2.32	1.93	0.39	17.42	42.03	-24.61	28.85	129.51	-100.65
Maine	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Maryland	4.78	3.78	1.00	0.00	0.00	0.00	0.00	0.01	-0.01
Massachusetts	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Michigan	20.60	16.17	4.43	0.00	0.00	0.00	0.00	0.00	0.00
Minnesota	39.11	31.85	7.26	0.00	0.00	0.00	0.00	0.00	0.00
Mississippi	1.22	1.23	-0.01	10.76	24.25	-13.49	61.12	241.02	-179.90
Missouri	14.51	12.73	1.78	8.22	17.42	-9.20	24.62	74.66	-50.04
Montana	79.62	64.31	15.31	0.00	0.00	0.00	0.00	0.00	0.00
Nebraska	34.66	28.13	6.54	0.00	0.00	0.00	0.00	0.00	0.00
Nevada	0.32	0.28	0.04	0.00	0.00	0.00	0.00	0.00	0.00
New Hampshire	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
New Jersey	0.65	0.51	0.14	0.00	0.00	0.00	0.00	0.00	0.00
New Mexico	2.82	2.39	0.43	0.00	0.00	0.00	2.96	12.87	-9.91
New York	2.75	2.20	0.55	0.00	0.00	0.00	0.00	0.00	0.00
North Carolina	11.15	8.88	2.28	0.00	0.00	0.00	39.03	131.66	-92.63
North Dakota	112.95	93.44	19.52	0.00	0.00	0.00	0.00	0.00	0.00
Ohio	30.07	23.92	6.15	0.00	0.00	0.00	0.00	0.00	0.00
Oklahoma	64.85	53.88	10.97	0.00	0.04	-0.04	7.61	36.66	-29.05
Oregon	25.54	20.63	4.91	0.00	0.00	0.00	0.00	0.00	0.00
Pennsylvania	4.06	3.16	0.90	0.00	0.00	0.00	0.00	0.00	0.00
Rhode Island	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
South Carolina	3.67	3.00	0.68	0.00	0.00	0.00	10.95	44.48	-33.52
South Dakota	55.13	44.08	11.05	0.00	0.00	0.00	0.00	0.00	0.00
Tennessee	3.89	3.39	0.50	0.00	0.05	-0.05	31.81	104.99	-73.18
Texas	40.93	34.33	6.60	8.34	26.21	-17.86	187.95	680.80	-492.85
Utah	3.31	2.70	0.60	0.00	0.00	0.00	0.00	0.00	0.00
Vermont	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Virginia	4.88	3.92	0.96	0.00	0.00	0.00	4.72	16.18	-11.46
Washington	69.81	55.85	13.96	0.00	0.00	0.00	0.00	0.00	0.00
West Virginia	0.12	0.10	0.02	0.00	0.00	0.00	0.00	0.00	0.00
Wisconsin	5.67	4.42	1.25	0.00	0.00	0.00	0.00	0.00	0.00
Wyoming	0.00	0.18	-0.18	0.00	0.00	0.00	0.00	0.00	0.00

Table 18. Average Total Cost Comparison by Crop and State (continued).

State	Corn			Sorghum			Soybeans		
	IFRP	Current	Difference	IFRP	Current	Difference	IFRP	Current	Difference
	($ million)			($ million)			($ million)		
Alabama	7.13	4.52	2.62	0.00	0.02	-0.02	1.75	1.34	0.41
Alaska	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Arizona	1.34	0.86	0.47	0.18	0.13	0.05	0.00	0.00	0.00
Arkansas	11.39	7.02	4.38	1.28	1.03	0.25	62.58	47.00	15.58
California	6.80	4.79	2.01	0.32	0.23	0.10	0.00	0.00	0.00
Colorado	45.19	29.02	16.17	1.67	1.22	0.45	0.00	0.00	0.00
Connecticut	0.00	0.04	-0.04	0.00	0.00	0.00	0.00	0.00	0.00
Delaware	7.31	4.63	2.68	0.00	0.00	0.00	3.79	2.90	0.88
Florida	0.73	0.51	0.21	0.00	0.00	0.00	0.13	0.10	0.03
Georgia	9.42	6.10	3.32	0.00	0.02	-0.02	2.55	1.90	0.65
Idaho	2.93	1.97	0.95	0.00	0.00	0.00	0.00	0.00	0.00
Illinois	656.04	415.03	241.00	2.23	1.60	0.63	253.11	192.91	60.20
Indiana	301.35	191.60	109.74	0.00	0.01	-0.01	147.21	111.38	35.83
Iowa	712.40	452.12	260.28	0.00	0.00	0.00	276.23	208.98	67.26
Kansas	158.01	99.59	58.42	72.40	51.05	21.34	53.41	39.82	13.59
Kentucky	56.15	35.91	20.24	0.73	0.51	0.22	29.62	22.19	7.43
Louisiana	16.49	10.26	6.23	2.92	2.06	0.86	15.65	11.70	3.95
Maine	0.00	0.04	-0.04	0.00	0.00	0.00	0.00	0.00	0.00
Maryland	18.06	11.53	6.53	0.00	0.00	0.00	10.01	7.61	2.40
Massachusetts	0.00	0.03	-0.03	0.00	0.00	0.00	0.00	0.00	0.00
Michigan	89.42	57.43	31.99	0.00	0.00	0.00	43.30	32.49	10.82
Minnesota	375.09	237.83	137.26	0.00	0.00	0.00	159.96	121.78	38.19
Mississippi	17.43	10.76	6.67	0.22	0.21	0.01	31.23	23.25	7.99
Missouri	137.35	86.79	50.56	4.31	3.34	0.97	108.62	81.82	26.80
Montana	0.74	0.52	0.22	0.00	0.00	0.00	0.00	0.00	0.00
Nebraska	423.23	269.18	154.05	7.19	5.82	1.37	125.35	93.53	31.81
Nevada	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
New Hampshire	0.00	0.02	-0.02	0.00	0.00	0.00	0.00	0.00	0.00
New Jersey	2.46	1.57	0.89	0.00	0.00	0.00	1.68	1.25	0.42
New Mexico	2.42	1.73	0.69	1.03	0.82	0.21	0.00	0.00	0.00
New York	18.52	12.45	6.07	0.00	0.00	0.00	4.72	3.48	1.24
North Carolina	25.23	16.17	9.06	0.21	0.15	0.06	25.38	19.04	6.34
North Dakota	48.18	30.37	17.81	0.00	0.00	0.00	56.32	41.95	14.37
Ohio	159.44	102.17	57.27	0.00	0.00	0.00	109.95	83.33	26.62
Oklahoma	11.39	7.16	4.23	4.66	3.30	1.36	4.28	3.16	1.13
Oregon	1.66	1.08	0.59	0.00	0.00	0.00	0.00	0.00	0.00
Pennsylvania	33.60	21.38	12.22	0.00	0.00	0.00	9.73	7.22	2.51
Rhode Island	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
South Carolina	8.56	5.49	3.06	0.00	0.00	0.00	5.63	4.21	1.42
South Dakota	173.04	109.80	63.24	1.84	1.38	0.47	80.89	62.30	18.59
Tennessee	27.43	17.41	10.01	0.00	0.04	-0.04	23.81	17.78	6.03
Texas	76.34	48.77	27.57	38.35	27.55	10.80	3.69	2.73	0.96
Utah	0.69	0.48	0.21	0.00	0.00	0.00	0.00	0.00	0.00
Vermont	0.00	0.11	-0.11	0.00	0.00	0.00	0.00	0.00	0.00
Virginia	14.21	9.12	5.10	0.00	0.01	-0.01	9.74	7.33	2.42
Washington	3.98	2.60	1.37	0.00	0.00	0.00	0.00	0.00	0.00
West Virginia	0.78	0.55	0.23	0.00	0.00	0.00	0.28	0.22	0.07
Wisconsin	142.30	91.33	50.96	0.00	0.00	0.00	38.27	28.71	9.56
Wyoming	2.16	1.42	0.74	0.00	0.00	0.00	0.00	0.00	0.00

Appendix I. Methods

Calculation of Program Costs

Farm-level payments under the National Revenue Deficiency Payment Program occur if National Percent Loss is greater than zero. Thus the first step is to use the 500 price draws for each national yield draw for each crop and each projection year to simulate Actual Revenue. For a given crop and projection year

$$\text{Actual Revenue}_{it} = \text{Price}_{it} * \text{National Yield}_t \quad i = 1, \ldots, 500, \; t = 1, \ldots, 26. \tag{7}$$

The next step is to calculate the corresponding National Percent Loss for each crop and projection year and coverage level:

$$\text{National Percent Loss}_{it} = \text{Max}[\text{National Revenue Guarantee} - \text{Actual Revenue}_{it}, 0] / \text{National Revenue Guarantee} \tag{8}$$

National Revenue Guarantee remains constant across all price and yield draws. The level of a payment at the farm depends on the farm's expected revenue which equals the product of expected farm yield and Insurance Price. By assumption, each farm has the same expected yield which equals the expected county yield (see equation (6)). Thus farm level payments in county c, year t, and iteration i are given by:

$$\text{National Revenue Deficiency Payment}_{itc} = \text{National Percent Loss}_{it} * \text{Expected County Yield}_c * \text{Insurance Price} \tag{9}$$

Expected County Yield varies by county and projection year (not subscripted), but not by price draw or national yield draw. Insurance Price varies by projection year, but not by price draw or national yield draw. The unit of the National Farm Payment is dollars per acre. Total Farm Payment for the county equals the National Farm Payment multiplied by planted acreage in a county. Planted acreage for each county was based on FAPRI aggregate acreage projections for each crop in each projection year. County acreage in any projection year equals a county's share of national crop acreage in 2005 multiplied by FAPRI's projection of total planted acreage. The aggregate average payment equals

$$\text{Aggregate National Revenue Deficiency Payment}_{itc} = \frac{1}{13{,}000} \sum_c \sum_i \sum_t \text{National Revenue Deficiency Payment}_{cit} * \text{County Acreage}_c . \tag{10}$$

To determine the impact on crop insurance indemnities requires estimation of farm-level revenue insurance indemnities. The form of the revenue insurance contract is identical to RA without the harvest price option. Farm-level guarantee on farm j in county c are defined as:

$$\text{Farm Revenue Guarantee}_{jc} = \text{Coverage Level} * \text{Insurance Price} * \text{Expected Farm Yield}_c \quad \text{for all j} \tag{11}$$

Actual farm revenue is defined as:

$$\text{Actual Farm Revenue}_{jcit} = \text{Price}_{it} * \text{Farm Yield}_{jcit} \quad (12)$$

Farm level gross indemnity is defined:

$$\text{Gross Farm Indemnity}_{jcit} = \text{Max}[\text{Farm Revenue Guarantee}_{c} - \text{Actual Farm Revenue}_{jcit}, 0] \quad (13)$$

And finally, National Farm Payment is netted out from Gross Farm Indemnity to obtain:

$$\text{Net Farm Indemnity}_{jcit} = \text{Max}[\text{Gross Farm Indemnity}_{jcit} - \text{National Revenue Deficiency Payment}_{cit}, 0]. \quad (14)$$

These two indemnities are then averaged across 25 farms in each county for each price draw and farm yield draw and then aggregated across counties:

$$\text{Aggregate Gross Farm Indemnity} = \frac{1}{13,000}\sum_{c}\sum_{i}\sum_{t}\text{Average Gross Farm Indemnity}_{cit} * \text{County Acreage}_{c} \quad (15)$$

$$\text{Aggregate Net Farm Indemnity} = \frac{1}{13,000}\sum_{c}\sum_{i}\sum_{t}\text{Average Net Farm Indemnity}_{cit} * \text{County Acreage}_{c} \quad (16)$$

The total cost of the program then equals Aggregate National Revenue Deficiency Payment less the offset from the crop insurance program. The projected cost of the crop insurance program equals expected indemnity less producer paid premium plus expected net underwriting gains plus A&O expenses. If premium rates are set at actuarially fair levels then total premium equals expected indemnity and projected crop insurance costs equal:

$$\text{Total Crop Insurance Cost} = \text{Expected Indemnity} * (\text{Percent Premium Subsidy} + \text{Percent A\&O} + \text{Percent Net Underwriting Gain}) \quad (17)$$

This formulation of cost allows for easy calculation of the offset from the NRDP. Multiplying Expected Indemnity by the ratio of Aggregate Net Farm Indemnity to Aggregate Gross Farm Indemnity provides a measure of how CBO would score the impact of the National Revenue Deficiency Payment program on total indemnities paid out. If it is assumed that adoption of this new program would induce RMA to reduce premiums on a county by county basis to reflect Net Farm Indemnity rather than Gross Farm Indemnity, then the cost of the crop insurance program would equal:

Total Crop Insurance Cost New = (Aggregate Net Farm Indemnity/Aggregate Gross Farm Indemnity) * Expected Indemnity *(Percent Premium Subsidy + Percent A&O + Percent Net Underwriting Gain) (18)

and the net savings equal:

Aggregate Crop Insurance Offset = Total Crop Insurance Cost – Total Crop Insurance Cost New (19)

Total Cost = Aggregate National Revenue Deficiency Payment – Aggregate Crop Insurance Offset (20)