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FEFO 06-15

**Future Increase in Corn Acres Will Vary Across the Corn-Belt**

Shifts in acres from soybeans to corn likely are needed to meet future corn demand for ethanol production. For acreage shifts to occur, corn prices must increase relative to soybean prices so that some farmers find corn production more profitable than soybean production. Since yields impact profitability and yields vary geographically, acreage adjustments are likely to be regional in nature. Potential for shifts are examined in this paper by computing break-even soybean-corn price ratios for counties in the greater corn-belt. These breakeven ratios are compared to projected soybean-corn ratios, as described in the following section. Overall, current futures prices suggest that many farmers over much of the corn-belt will likely find corn production more profitable than soybean production in 2007 and 2008.

**Projected soybean-corn price ratios**

Current prices of Chicago Board of Trade (CBOT) futures contracts serve as good indicators of prices on futures contracts at the time of their expiration. Table 1 shows September 11, 2006 settlement prices for December corn and November soybean contracts for 2006, 2007, and 2008. The December 2009 corn contract price also is reported. These prices serve as indicators of harvest-time futures prices in their respective years. Cash price projections can be made by adjusting futures prices for basis.

Futures prices in Table 1 suggest that prices in both 2007 and 2008 will be above 2006 prices. Corn prices are projected to be \$.45 per bu. higher in 2007 than in 2006 (\$2.88 - \$2.43) and \$.16 per bu. higher in 2008 than in 2007. Similarly, soybean prices are projected \$.61 per bu. higher in 2007 than in 2006 and \$.37 higher in 2008 than in 2007. Futures prices suggesting rising prices like those shown in Table 1 are unusual and likely account for much of the hope for higher grain farm incomes over the next two years.

**Table 1. Settlement Prices on Chicago Board of Trade Contracts, Sptember 11, 2006**

Year	December Corn	November Soybeans
2006	\$2.43	\$5.44
2007	2.88	6.05
2008	3.04	6.42
2009	3.18	

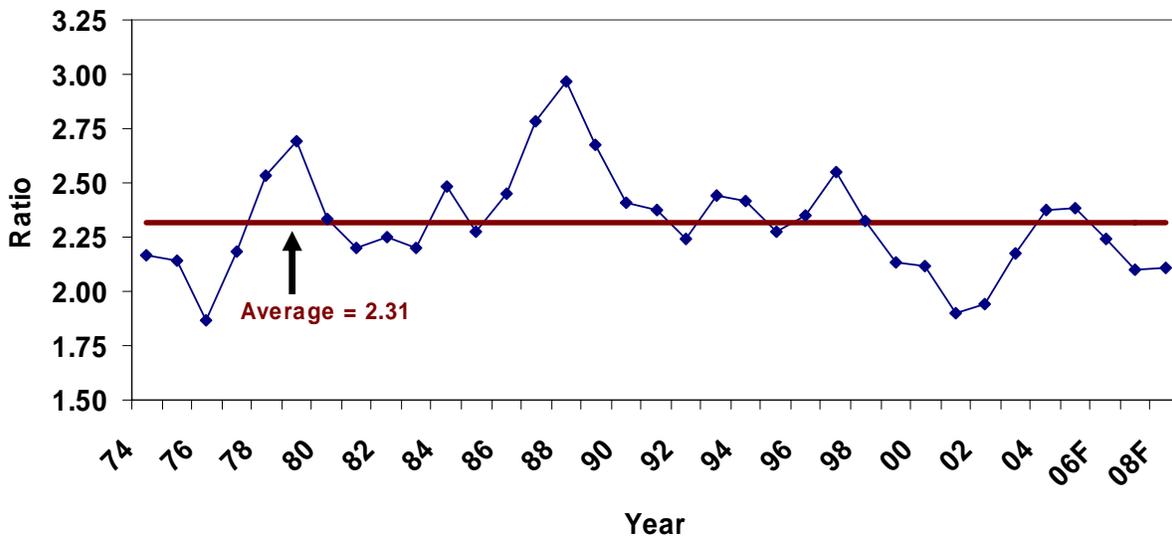
Besides rising, the 2007 and 2008 futures prices for corn are above historical averages. Between 1974 and 2005, settlement prices on the December corn contract during the month of February averaged \$2.63. Hence, the corn futures prices shown in Table 1 are \$.25 per bu. above the average in 2007 (\$2.88 settlement price for 2007 - \$2.63 average) and \$.38 above average in 2008.

Only the 2008 settlement price is above average for soybeans. Between 1974 and 2005, settlement prices on the November soybean contract during the month of February averaged \$6.11 per bu. The 2007 future contract price is \$.06 per bu. below the long run average and the 2008 price is \$.31 above average.

Comparison to averages suggest that corn prices are expected to rise relatively more than soybean prices. A direct way of evaluating relative prices is to construct ratios of soybean prices to corn prices (i.e., soybean price divided by corn price). Figure 1 shows soybean-corn price ratios from 1974 through 2005. Average of settlement prices during February of the November soybean contract and the December corn contract are used in calculating the historical soybean-corn price ratios. Projected ratios for 2006, 2007, and 2008 are based on futures prices shown in Table 1.

The historical average soybean-corn price ratio is 2.31, indicating that soybean prices have averaged 2.31 times corn prices. Futures prices result in projected prices ratios of 2.10 in 2007 and 2.11 in 2008, significantly below the historical average. This suggests that there may be incentives to switch from soybeans to corn.

**Figure 1. Soybean-to-Corn Price Ratio Based on Harvest Time Futures Contracts, 1972 - 2008F.**



Besides being below average, the projected ratios for 2007 and 2008 are also below the price ratio implied by loan rates. Since 1998, loan rates often have been the effective planning prices as market prices often have been projected below loan rates. The 2002 Farm Bill set the national loan rates at \$1.95 per bu. for corn and \$5.00 for soybeans, resulting in a soybean-corn ratio of 2.55. The 2007 and 2008 future prices imply cash prices above loan rates, resulting no loan deficiency payments or marketing loan gains and in market-driven soybean-corn price ratios. This market driven price ratios of 2.11 (2007) and 2.11 (2008) are significantly below the 2.5 price ratio implied by loan rates, again favoring corn production over soybean production.

### Determining breakeven soybean-corn price ratios across counties

Besides prices, yields and costs also impact profitability. The impacts of these factors can be stated mathematically in the following formula:

$$\text{breakeven corn price} = (\text{cost difference} + \text{soybean price} \times \text{soybean yield}) / \text{corn yield}$$

where the breakeven corn price gives the price at which corn and soybeans have the same profits and the

“cost difference” is the additional cost of producing corn-following-corn rather than soybeans (see the Sept 17 *Illinois Farm Economics: Facts and Opinions* article titled “Breakeven Corn Prices for More Corn in 2007” for more detail). This equation serves as the basis for determining breakeven soybean-corn price ratios. The above equation is rearranged to calculate ratios for each county in the greater corn-belt using expected yields for each county.

In each county, historical corn and soybean yields were obtained from the National Agricultural Statistical Service, an agency of the U.S. Department of Agriculture. Counties that did not have sufficiently long yield series were not included in the analysis. Trends were fit to each county yield series and the trended yields were used to estimate 2007 expected yields. The 2007 expected corn and soybean yields then were used to calculate breakeven price ratios.

The cost difference was set at \$110 per acre. This indicates that corn production costs are \$110 per acre higher than soybean production costs. More detail on this estimate is provided in the *Illinois Farm Economics: Facts and Opinions* entitled “Breakeven Corn Prices for More Corn in 2007”.

The above procedure results in a breakeven price ratio for each county. If soybean and corn prices result in a ratio less than the breakeven ratio, corn production is forecast to be more profitable than soybean production. If the actual price ratio is above the breakeven ratio, soybean production is more profitable than corn production. Take, for example a breakeven ratio of 2.4, a forecast corn price of \$2.80 per bu. and a forecast soybean price of \$6.00 per bu. The forecast prices result in a ratio of 2.14 ( $\$6.00 \text{ soybean price} / \$2.80 \text{ corn price}$ ). Corn production is more profitable than soybean production because the forecast price ratio of 2.14 is below the 2.4 breakeven ratio.

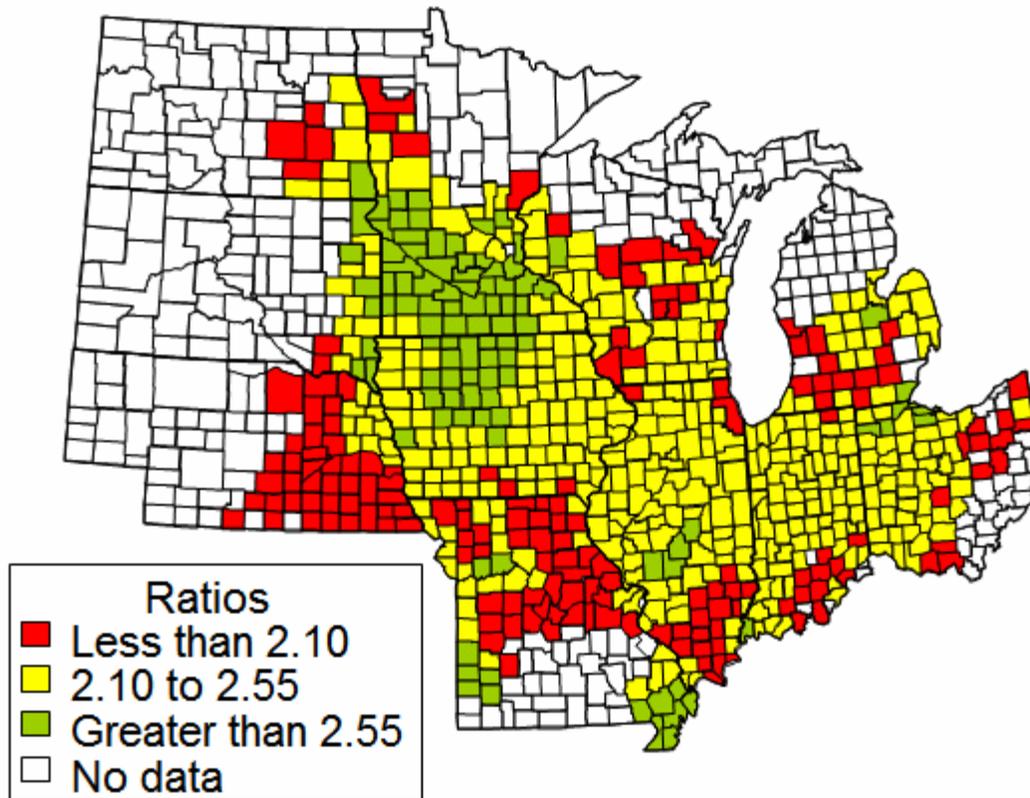
The county breakeven ratios are calculated using county average yields. Individual farms would have breakeven ratios that are different from the county as farm yields will not be the same as county yields. Farmers should conduct their own budgeting analyses to evaluate profitable. Farmers in counties with lower breakeven ratios are likely to find corn to be more profitable than soybean than farmers in counties with higher breakeven ratios.

### **Breakeven soybean-corn price ratios**

Figure 2 shows a map of breakeven price ratios across the greater corn-belt. Counties are shaded with one of three colors based on the breakeven ratios. Counties in green have breakeven ratios above 2.55. The 2.55 represents the price ratio resulting from loan rates. Farmers in these counties likely were finding corn production to be more profitable than soybean production even prior to price increases projected for 2007 and 2008. Counties in yellow have price ratios between 2.1 and 2.55. The 2.1 was selected because it roughly matches the expected price ratios for 2007 and 2008. Farms in these counties may not have found corn production to be more profitable than soybean production under loan rate pricing but may now find corn production more profitable given higher price projections for 2007 and 2008. Counties shaded in red have breakeven ratios below 2.10. Farms in these counties likely will find soybean production more profitable than corn production.

Under loan rate prices, there were several counties where corn production appeared to be more profitable than soybean production (see the green areas in Figure 2). These areas predominately were in southern Minnesota and north-central Iowa, central Illinois, southeast Missouri, and southwest Missouri. Counties with breakeven ratios above 2.55 tend to have the highest expected corn yields (see Appendix Figure 1 for a map of expected corn yields). The one area that is an exception to this generalization is central Illinois. Central Illinois has many counties with high expected corn yields that do not have breakeven ratios above 2.55. This occurs because central Illinois has higher soybean yields than most other areas in the corn-belt.

**Figure 2. Breakeven Soybean-to-Corn Price Ratios.  
Calculated Using Expected County Yields.**



A projected price ratio of 2.1 causes corn production to be more profitable than soybean production in most counties of the corn-belt (shaded yellow in Figure 2). If price projections hold, farmers over a much larger geographical area may consider planting more corn.

Those are counties that have breakeven price ratios below 2.1 tend to be on the fringes of the corn-belt (shaded red in Figure 2). Switches to corn likely will not be profitable for many farmers in these counties.

### **Summary**

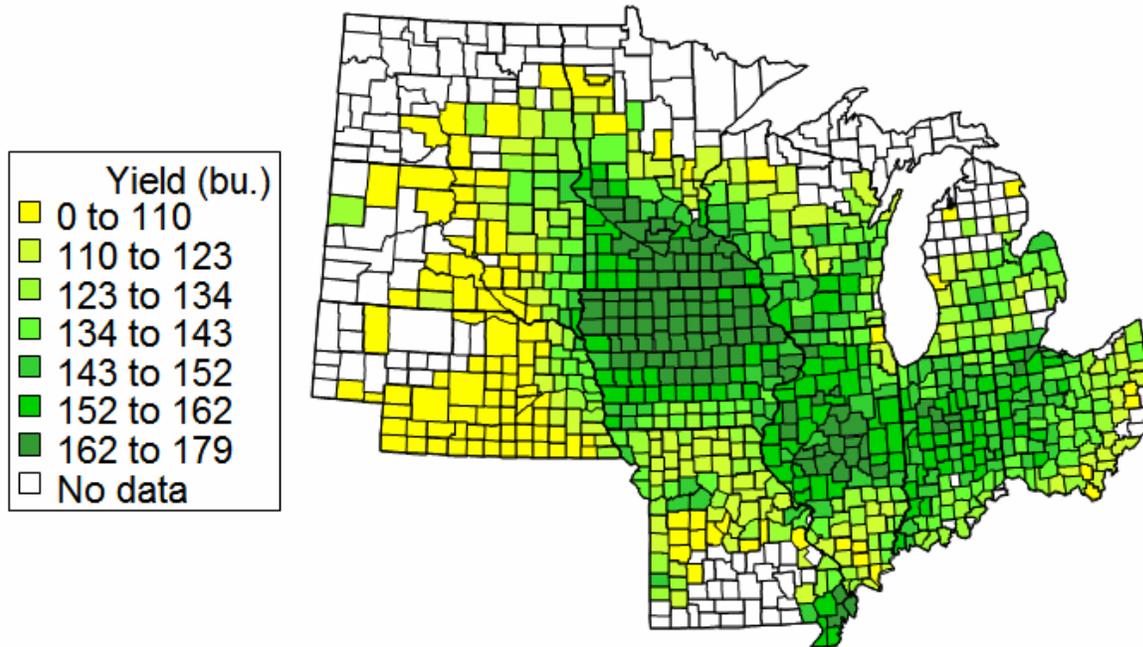
Projected corn and soybean prices for 2007 and 2008 based on futures contracts result in soybean-corn price ratios below historical averages and below the price ratio implied by loan rates. As a result, corn production may be more profitable than soybean production over much of the corn-belt. Therefore, there may be shifting from soybeans to corn in much of the corn-belt in the next several years.

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## Appendix

This appendix shows maps containing data that were used to calculate breakeven price ratios or are useful in describing corn and soybean production in the greater corn-belt.

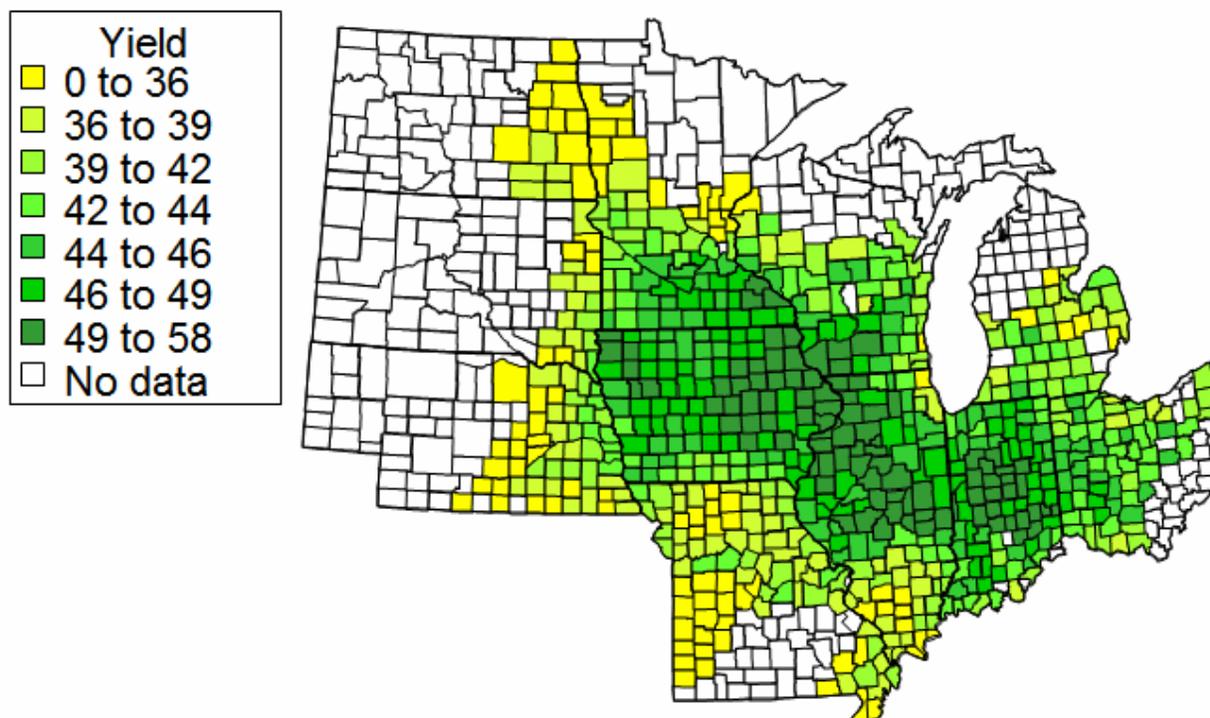
**Appendix Figure 1. 2007 Expected Corn Yields.**



Appendix Figure 1 shows 2007 expected county corn yields. These yields were calculated using historical county yields as reported by the National Agricultural Statistical Service for non-irrigated farmland. Historical yields were used to calculate trend-line projected yields. The trend-line projected yields then were used to calculate expected yields for 2007.

Areas of high yields are located in southern Minnesota, northern and central Iowa, and central Illinois.

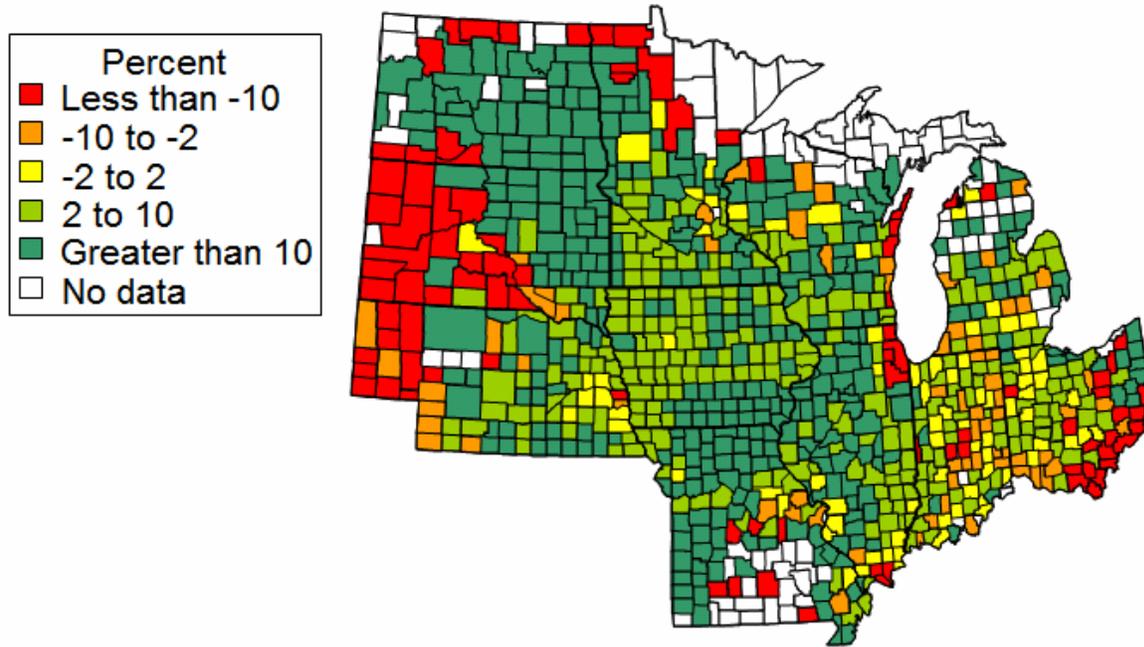
## Appendix Figure 2. 2007 Expected Soybean Yields.



Appendix Figure 2 shows 2007 expected county soybean yields. These yields were calculated using historical county yields as reported by the National Agricultural Statistical Service for non-irrigated farmland. Historical yields were used to calculate trend-line projected yields. The trend-line projected yields then were used to calculate expected yields for 2007.

Areas of high yields are located in eastern Iowa, western Wisconsin, northern and central Illinois, and west-central Indiana.

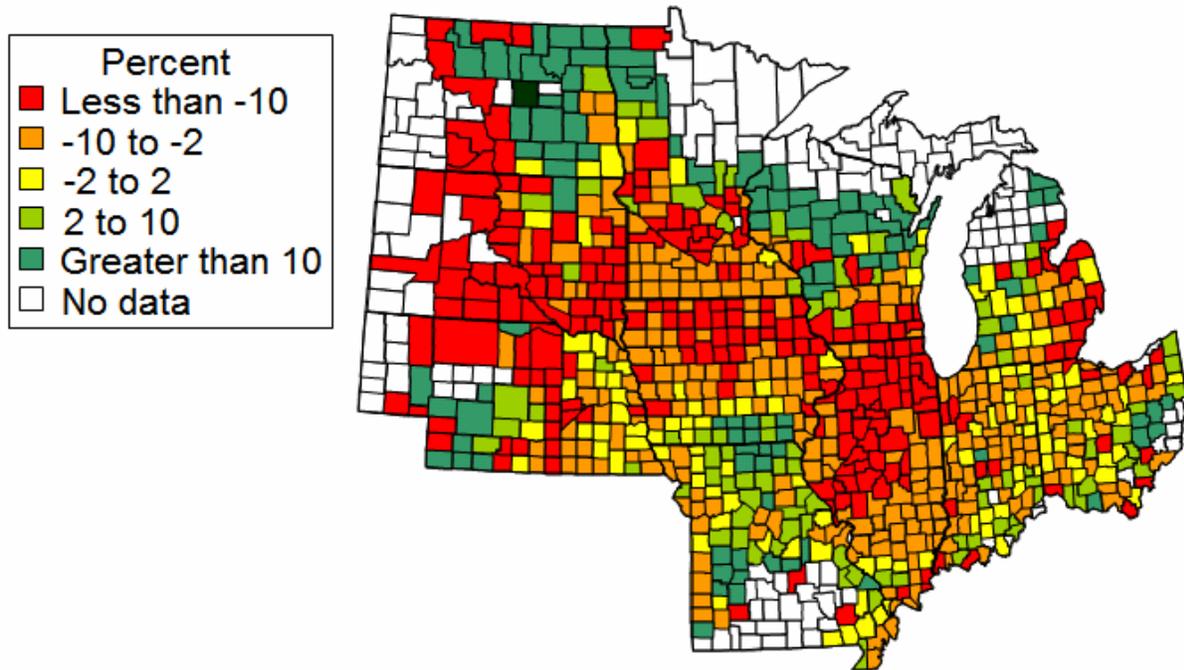
### Appendix Figure 3. Change in Corn Acres From 2001 to 2005.



Appendix Figure 3 shows change in corn acres by county from 2001 to 2005. Data on county corn acres were obtained from the National Agricultural Statistical Service. Changes are stated as percentages (i.e.,  $((2005 \text{ acres} - 2001 \text{ acres}) / 2001 \text{ acre}) - 1) \times 100$ ).

Most counties in the corn-belt increased acres. Many counties in Illinois, Iowa, North Dakota, and South Dakota increased corn acres by more than 10 percent. Counties that lost acres were located in extreme northern Minnesota and North Dakota, western South Dakota and Nebraska, and south eastern Ohio.

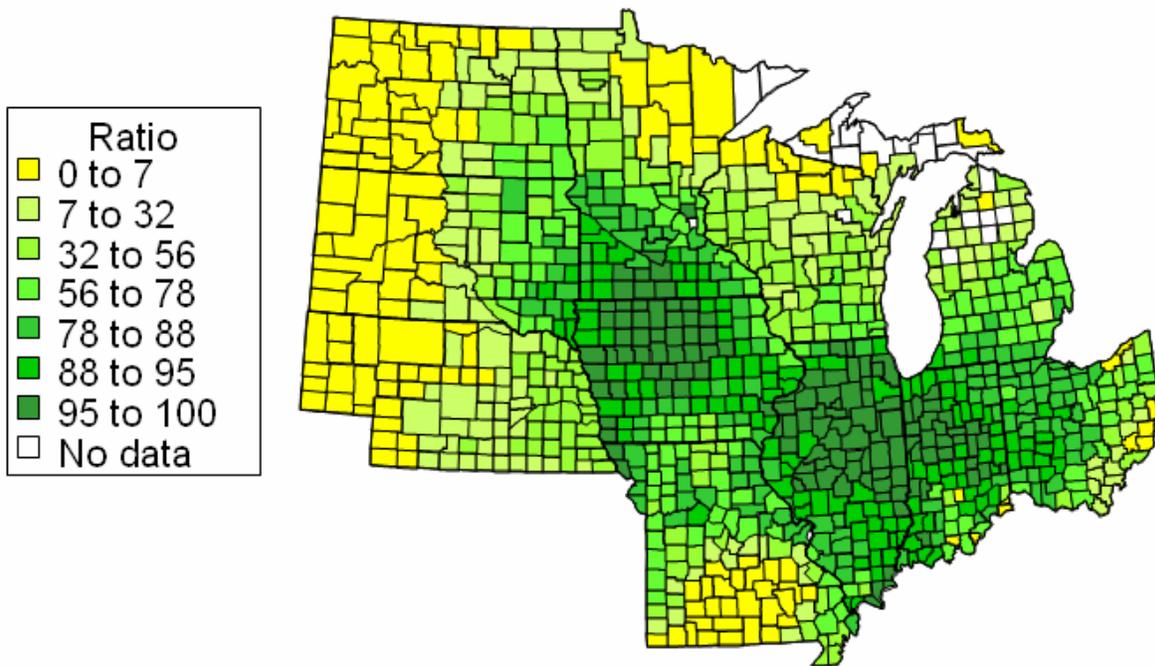
## Appendix Figure 4. Change in Soybean Acres From 2001 to 2005.



Appendix Figure 4 shows changes in soybean acres by county from 2001 to 2005. Data on county acres were obtained from the National Agricultural Statistical Service. Changes are stated as percentages (i.e.,  $\frac{((2005 \text{ acres} - 2001 \text{ acres}) / 2001 \text{ acre}) - 1}{1} \times 100$ ).

Most counties in the corn-belt decreased soybean acres. Many counties in Illinois and Iowa decreased soybean acres by more than 10 percent. Counties that gained acres were located in northern Wisconsin, North Dakota, southern Iowa and Missouri.

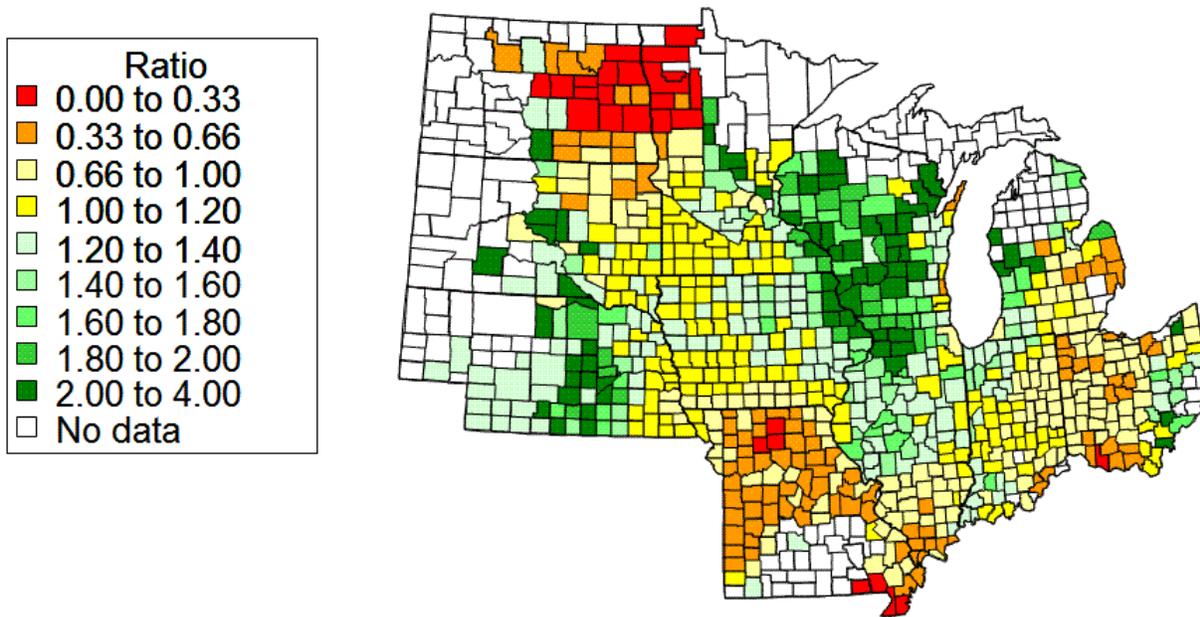
## Appendix Figure 5. Corn and Soybean Acres as a Percent of Harvested Acres, 2005.



Appendix Figure 5 shows corn and soybean as a percent of total harvested acres. A percent of 100 means that corn and soybean account for 100% of harvested acres in a county. Data were obtained from National Agricultural Statistical Service and are for 2005.

Many counties in Illinois and Iowa have corn and soybeans acreage that account for over 95% of harvested acres. In these counties, switches to corn must come at the expense of soybeans.

## Appendix Figure 6. Corn Acres Divided by Soybean Acres, 2005



Appendix Figure 6 shows corn acres divided by soybean acres. Values in this figure proxy how many acres have been produced as corn-following-corn. Ratios above 1 generally mean that corn is being raised on farmland previously planted in corn in area where corn and soybeans make up a very large portion of total harvested acres (Southern Minnesota, Iowa, Illinois, and Indiana (see Appendix Figure 5)).

The highest ratios occur in northern Illinois and southern Wisconsin. Many Illinois counties have ratios exceeding 1.2.