

## Grassland to Cropland Conversion in the Northern Plains: The Role of Markets and Policy

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## **Grassland to Cropland Conversion in the Northern Plains: The Role of Markets and Policy**

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Shifting land from grassland to cropland may result in the loss of wildlife habitat, increased soil erosion and sedimentation, and higher levels of nutrient loss to water. Environmentalists, wildlife groups, and some livestock interest groups have become particularly concerned about the loss of grasslands in the U.S. Northern Plains region (GAO). Located along the U.S. Central Flyway, grasslands in the Northern Plains provide excellent breeding for migratory birds.

Concerned groups have focused on the potential of federal programs to encourage grassland to cropland conversion (Morgan). While the majority of farm program payments have been “decoupled” from current production, marketing loan benefits, crop insurance, and disaster payments continue to depend on current prices and current production. These programs can help protect crop farmers from low prices and low yields. Producers can increase their eligibility for these programs by converting grassland to crop production.

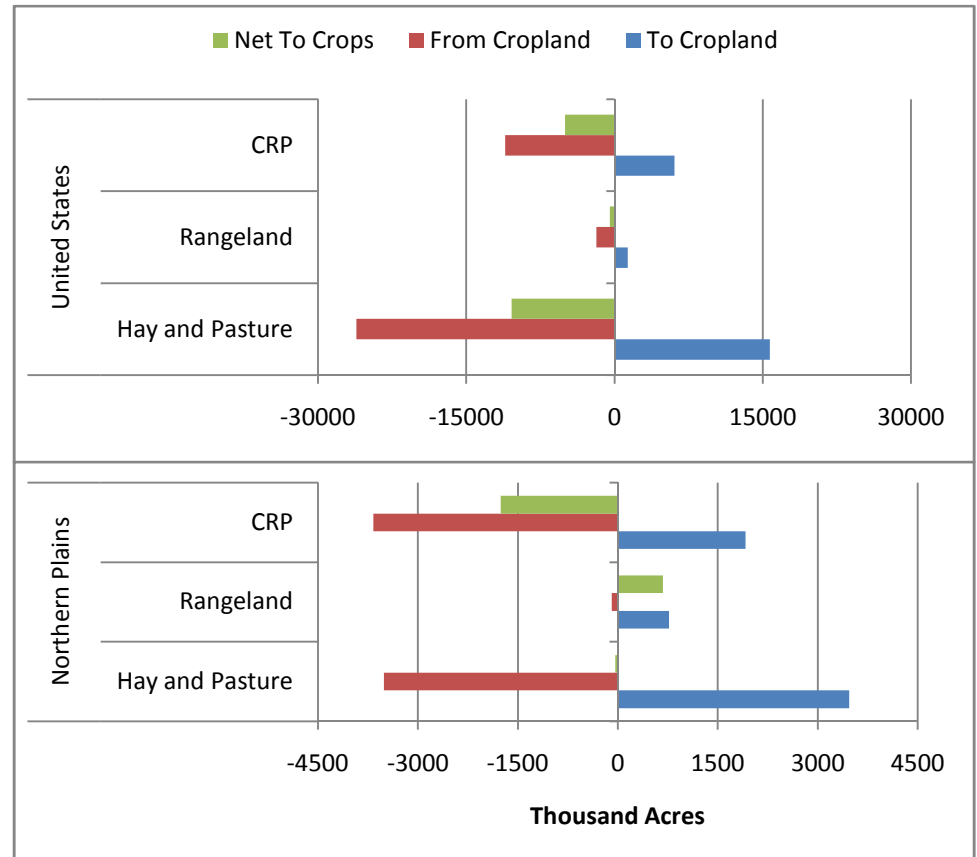
## Northern Plains Grass to Crop Conversion Exceeds U.S. Rate

Between 1997 and 2007 producers in the Northern Plains states converted 750,000 acres (0.9% ) of rangeland to cultivated cropland—57 percent of U.S. rangeland to cropland conversion. Net conversion of rangeland to cropland was 670,000 acres (0.8%). Gross rangeland conversion in the rest of the U.S. was less than 500,000 acres while net conversion was near zero.

In the U.S., overall, there was a large net movement from cropland to hay and pasture. In the Northern Plains, however, the net shift was zero as producers retained land in crop production or enrolled it in CRP.

While CRP acreage was about 32 million acres in 1997 and 2007, 11.1 million acres of cultivated cropland were enrolled for the first time while 6.1 million acres returned to crops and 5 million former CRP acres became hay or pasture. A similar shift occurred in the Northern Plains.

Land Use Change at the Grassland-Cropland Margin, 1997-2007



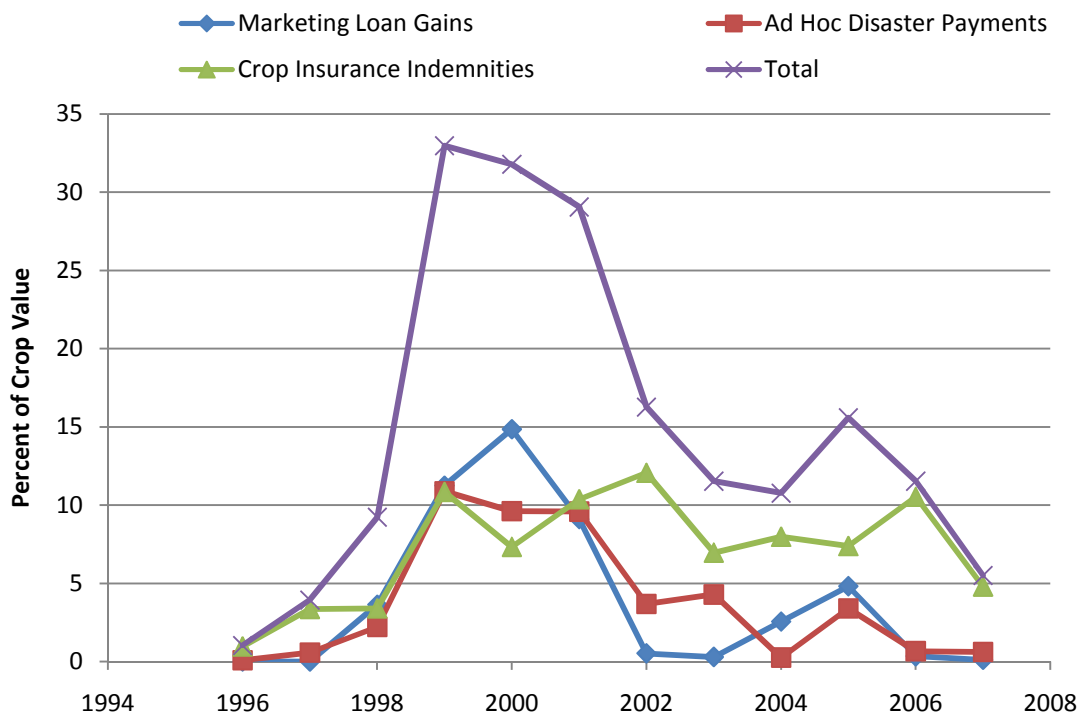
Source: 2007 National Resources Inventory

## Farm Program Payments Are Large When Compared to Crop Value

**Marketing Loan Gains** make up the difference when market price falls below a commodity-specific “loan rate”. High MLGs for 1999-2001 are largely associated with soybeans. The soybean loan rate was \$5.26 even though market prices hovered near \$4.50 during 1999-2001. The loan rate was lowered in the 2002 farm bill.

**Crop insurance** indemnities are paid when yields or revenue fall below predetermined levels. Indemnities (shown here) would be offset by premium costs which are heavily subsidized (more than 50 percent for the most popular levels of coverage is paid by the Federal government). Crop Insurance indemnities increased sharply in 1999 as a result of higher premium subsidies which encouraged broader participation and higher coverage levels.

## Farm Program Payments as a Percentage of Crop Value, Northern Plains 1996-2007



Source: Agriculture Resource Management Survey (ARMS) data for 1996-2007.

## **Multinomial Logit Model of Land Use**

We model cultivated crops, forages (hay, pasture, and range), and CRP. Hay, pasture, and range are grouped because returns are based on production of livestock feed. Land use data is from the National Resources Inventory (NRI). For 1997-2007, NRI includes annual land use observations for a “core” set of 110,771 points of land. We use core points in Nebraska, North Dakota, and South Dakota that were in cultivated crops, forages, or CRP during 1998-2007. Points in tracts under an ongoing CRP contract are removed as continuing CRP enrollment did not represent a land use choice. Our data contains a total of 67,849 land use choice events based on 7,430 NRI points.

Utility functions for cultivated crops, forages, and CRP are a function of market revenue, production cost, government payments, and land characteristics. The expected value and variance of crop revenue are based on (1) NASS county yield and acreage data for corn, soybeans, and wheat and (2) expected prices derived from futures market data. Crop costs are based on ERS cost and returns data. Marketing loan gains are simulated by truncating the price distribution at the applicable loan rate. Crop insurance returns are simulated using the joint distribution of crop prices and yields and crop insurance contract data.

Forage revenues and cost are based on ERS cost and returns data. Per animal-unit values are converted to per acre values using forage yield data obtained from NRCS Soil Survey data. Rainfall data are used to adjust forage yields to year-specific conditions following a method used by GAO.

CRP returns are based on the county-level Soil Rental Rates. The exogenous EBI is the Environmental Benefits Index score that is inherent to the land and cannot be changed by the producer or landowner. These variables are set to zero for land that does not meet CRP eligibility requirements.

The National Commodity Crop Productivity Index is used to control for variation in soil productivity and climate (USDA-NRCS). NRI data is also used to create indicators of irrigation, highly erodible land (HEL), and hydric soils (an indicator of potential wetness).

### Land Use Response to Economic Return is Inelastic

On average, marketing loan gains increased expected crop revenue by about 3 percent and reduce variance by about 8 percent (although the effect varied over time and across crops). At the mean of the data, these payments increase the probability of crop production by about 1.38 percent (1.01 percent for the increase in expected return and .37 for percent for the variance reduction). Overall, the probability of cultivated cropland is .531. Without marketing loan gains the probability of cultivated crops is reduced to .523, a difference of .008.

Variables representing the effect of crop insurance were not significantly different from zero in our estimation. The expected disaster payment was significantly different from zero, but yielded a very small land use response.

### Selected Elasticities

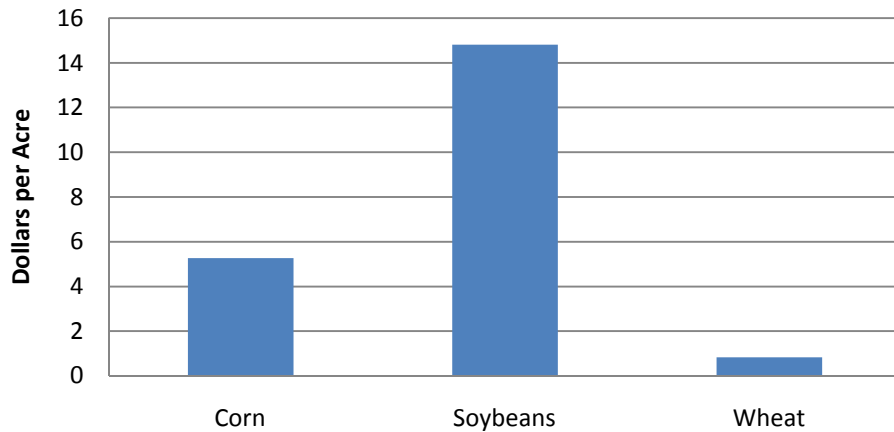
Cropland Alternative		"Own" Elasticity
Expected Crop Revenue (including MLB)		0.336
Variance of Crop Revenue (including MLB)		-0.046
Crop Production Cost		-0.301
Expected Net Crop Insurance Indemnity		-0.029†
Variance Reduction due to Crop Insurance		0.001
Expected Disaster Payment		0.000
Forage Alternative		
Expected Forage Revenue		0.200
Variance of Forage Revenue		-0.009
Forage Production Cost		-0.240
Conservation Reserve Program		
CRP Soil Rental Rate		0.207
Exogenous EBI Score		0.530
Land Characteristics		"Relative" Elasticity
Land Productivity	Crop	0.086
	Forage	-0.113

†Elasticities shown in grey are based on parameters estimates that were not significantly different from zero.

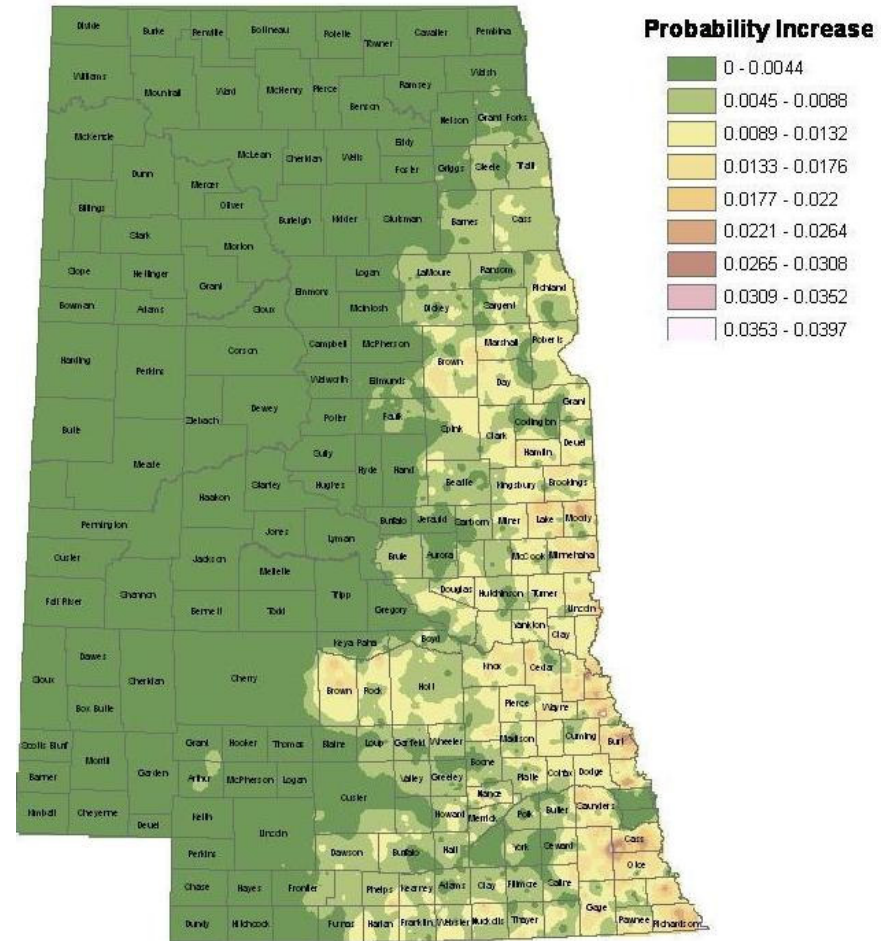
### Effect of Marketing Loan Benefit Varies Across Region

The effect of marketing loans gains varies widely across the Northern Plains. The largest changes are found along the eastern edge of Nebraska and South Dakota, an area where cultivated cropland accounts for a large majority of land and 90 percent of cropland is in corn or soybeans. The change is lowest on the western edge of the region, where rangeland is dominant and wheat is dominant crop on cultivated (non-irrigated) land. On average, marketing loan gains to wheat were small relative to corn and particularly soybeans.

**Average Estimated Marketing Loan Gains in the Northern Plains, by Crop, 1998-2007**



### Change in Probability of Cultivated Cropland Due to Marketing Loan Gains, Average over 1998-2007



## Summary and Conclusion

Our analysis suggests that, on average, marketing loan benefits increased the probability of cultivated crop production by 1.38 percent (an absolute change in probability of .008). While that is a modest response, it is of the same general magnitude as overall land use change during the study period. The elasticity estimates suggest that eliminating marketing loan gains may have reduced net grassland to cropland conversion.

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