

Crop Insurance and the Environment: A Brief Review of Agricultural Economics Literature on the Land Use Effects of Crop Insurance

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Issue: The 2012 Farm Bill discussion has raised questions about the effect of public support for crop insurance on the environment, particularly land use. This note reviews agricultural economics literature (listed at the end) regarding land use effects of the crop insurance (CI) program.

Perspective: Claassen et al. (2011) provide comprehensive information on land shift patterns based on the USDA's Natural Resources Conservation Service's 2007 National Resources Inventory. Between 1997 and 2007, 39 million acres of U.S. cropland were converted to grassland (pasture, hay, range or Conservation Reserve Program (CRP)); meanwhile 23.7 million acres of grassland were converted to cropland, which resulted in net total of 16.5 million acres of cropland returning to grassland over the period.

In contrast with the overall U.S. pattern, the Northern Plains region (Kansas, Nebraska, North Dakota, and South Dakota) had a net conversion of grassland to cropland during this time period. Particularly, a net total of 680,000 acres (about 0.8 percent of 1997 range acres) was converted from rangeland to cropland, which accounted for 57 percent of overall U.S. rangeland-to-cropland conversion. Despite about 3 percent of U.S. cropland (about 10 million acres) in 1997 being moved to hay and pasture, the net change in the Northern Plains was about zero (i.e., the movement from hay and pasture land to cropland and vice versa offset each other). In terms of CRP activities, Northern Plains states were in line with the national trend and moved a net total of 1.8 million acres from cropland to the CRP.

Key Literature: Walters et al. (2012), Claassen et al. (2011) and Miao, Feng and Hennessy (2011) are the most comprehensive and recent studies looking into crop insurance and land use issues. Previous studies include Young, Vandever, Schnepf (2001); Goodwin, Vandever, Deal (2004), Lubowski et al. (2006); Stubbs (2007); GAO (2007); and Carrizo, Claassen, Cooper (2009). Claassen et al. (2011) and Miao, Feng and Hennessy (2011) use a combination of econometric and simulation techniques and improve upon previous literature by focusing on marginal land (a critical portion of the Northern Plains which includes a large share of the Prairie Pothole Region) by distinguishing among converted grassland types, and by using field-level data rather than county-level data. Walters et al. (2012) use an econometric analysis and based on farm-level data in two regions with homogenous land (Iowa and North Dakota) and two regions with relatively more heterogeneous land (Eastern Washington and Eastern Colorado). Their findings are in line with the previous literature, which is that the effect of subsidized crop insurance in bringing the marginal land into cultivation is statistically significant but small, less than 1 percent. Furthermore, Walters et al. (2012) find that crop insurance is as often beneficial as adverse depending on crop and location.

The aforementioned studies also point out that crop insurance is only one of a number of factors that have contributed to expanded plantings. These factors include the growing need to feed the U.S. and world populations, whose rising incomes and growing numbers have expanded the

demand for food; increased use of crops for energy production, which has required more land in production to maintain food production; record-high prices of major crops, which is the dominant incentive to expand production; technology changes, which have resulted in varieties of major field crops that are better suited to production in more western and southern areas; technology changes that have facilitated planting and cultural practices, including larger and more powerful equipment, GPS systems, etc. In particular, Miao, Feng and Hennessy (2011) estimate the effect of crop prices to be much greater than crop insurance subsidies on the conversion of marginal land. They find a 5-percent decrease in the premium subsidy rate for crop insurance results in 0.6 percent of insured cropland being converted to non-crop land. Whereas a 5-percent decrease in crop prices results in 1.01 percent of insured cropland being converted to non-crop land.

Beyond the small expansionary effect on grassland-to-cropland conversions, CI has offsetting effects on cultivated land in the form of lower use of other risk reduction strategies, such as intense chemical use. Empirical results in the Great Plains suggest farmers purchasing crop insurance use less chemical inputs (Smith and Goodwin, 1996). Similar results were obtained in Babcock and Hennessy (1996) for Iowa corn. Smith and Goodwin (1996) and Babcock and Hennessy (1996) refuted the counter results in the earlier study by Horowitz and Lichtenberg (1993). Smith and Goodwin (1996) concluded that environmental consequences should not be the basis for efforts to persuade lawmakers to end the CI program. Another study by Wu (1999) focused on the Central Nebraska Basin in 1991. This study recognized the findings in Babcock and Hennessy (1996) and Smith and Goodwin (1996) and yet finds farmers change crop mix, switching to corn from hay and pasture, concluding the net effect of CI would be increased soil erosion and chemical use. However, the claim of soil erosion is refuted later by Goodwin and Smith (2003) who find that crop insurance has almost no effect on soil erosion. Moreover, Mishra, Nimon and El-Osta (2003) find that revenue insurance (similar to earlier findings on yield insurance) reduces the fertilizer applications in winter wheat production. Finally, Sumner, Alston and Glauber (2011) mention the crop mix effect found in Wu (1999) and yet point out that designing and implementing government crop insurance without potential production distortions would be very difficult.

Conclusion: Studies of the effect of crop insurance on the environment suggest that the risk reduction provided by crop insurance is associated with increased planted acreage of some crops in some areas but that the effect on the conversion of grassland to cropland is generally fairly small. In addition, crop insurance substitutes for other risk reduction strategies, such as fertilizer and pesticide use which have been associated with environmental degradation. While studies suggest the overall effects on land and input use are small, they may be more significant in local areas. Further, the role of crop insurance using premium discounts to incentivize the use of biotech crops, which may substitute for land expansion and chemical use, has not been explored. As coverage of crop insurance has expanded and crop prices have set new record highs in recent years, more research is merited on the relative roles of crop insurance, market prices and other factors in explaining land and input use in agriculture.

One should expect that the effect of insurance would be to help maintain, expand, and increase the efficiency of the farm production infrastructure by improving access to credit and promoting on-farm investment. In addition to keeping farms in business and resilient in the aftermath of

natural disasters (and that alone may mean higher production than otherwise), increased production is a desirable effect of insurance—an outcome that is good for U.S. and global food consumers and low-income people. In contrast to the minimal land use effects attributable to crop insurance, it is much more likely the case that the record-high prices of major crops remain the dominant incentive in expanding agricultural production.

References:

Babcock, B.A. and D.A. Hennessy. Input Demand under Yield and Revenue Insurance. *American Journal of Agricultural Economics* 78(2): 416-427.

Carriazo, F., R. Claassen, and J. Cooper. 2009. Crop Insurance, Disaster Payments, and Incentives for Land Use Change in Agriculture: A Preliminary Assessment. Paper Presented at the Annual Meeting of the American Agricultural Economics Association, Milwaukee, WI, July 26-28.

Claassen, R., F. Carriazo, J.C. Cooper, D. Hellerstein, and K. Ueda. 2011. Grassland to Cropland Conversion in the Northern Plains: The Role of Crop Insurance, Commodity, and Disaster Programs. USDA, Economic Research Service, Economic Research Report 120, June. Available online at: www.ers.usda.gov/publications/err120/.

Goodwin, B.K. and V. Smith. 2003. An Ex Post Evaluation of the Conservation Reserve, Federal Crop Insurance, and Other Government Programs: Program Participation and Soil Erosion. *Journal of Agricultural and Resource Economics* 28(2):201-216.

Goodwin, B.K., M.L. Vandever, and J.L. Deal. 2004. An Empirical Analysis of Acreage Effects of Participation in the Federal Crop Insurance Program. *American Journal of Agricultural Economics* 86(4): 1058-1077.

Horowitz, J.K. and E. Lichtenberg. 1993. Insurance, Moral Hazard, and Chemical Use in Agriculture. *American Journal of Agricultural Economics* 75(4): 926-935.

Lubowski, R.N., S. Bucholtz, R. Claassen, M. J. Roberts, J.C. Cooper, A. Gueorguieva, and R. Johansson. 2006. Environmental Effects of Agricultural Land-Use Change -- The Role of Economics and Policy. USDA Economic Research Service, Economic Research Report 25.

Miao, R., H. Feng and D.A. Hennessy. 2011. Land Use Consequences of Crop Insurance Subsidies. Paper Presented at the Annual Meeting of the Agricultural and Applied Economics Association, Pittsburgh, PA, July 24-26.

Mishra, A.K., R.W. Nimon, H.S. El-Osta. 2005. Is Moral Hazard Good for the Environment? Revenue Insurance and Chemical Input Use. *Journal of Environmental Management* 74: 11-20.

Smith, V.H. and B.K. Goodwin. 1996. Crop Insurance, Moral Hazard, and Agricultural Chemical Use. *American Journal of Agricultural Economics* 78(2): 428-438, May.

Stubbs, M. 2007. Land Conversion in the Northern Plains. Congressional Research Service Report for Congress, RL33950.

Sumner, D.A., J.M. Alston, and J.W. Glauber. 2010. Evolution of the Economics of Agricultural Policy. *American Journal of Agricultural Economics* 92(2): 403-423.

U.S. Government Accountability Office. 2007. Agricultural Conservation: Farm Program Payments are an Important Factor in Landowners' Decisions to Convert Grassland to Cropland. Report to Congressional Requesters GAO-07-1054, September.

Young, C.E., M.L. Vandever, R.D. Schnepf. 2001. Production and Price Impacts of U.S. Crop Insurance Programs. *American Journal of Agricultural Economics* 83(5): 1196-1203.

Walters, C.G., C.R. Shumway, H.H. Chouinard, and P.R. Wandschneider. 2012. Crop Insurance, Land Allocation, and the Environment. *Journal of Agricultural and Resource Economics* 37(2): 301-320.

Wu, J. 1999. Crop Insurance, Acreage Decisions, and Nonpoint-Source Pollution. *American Journal of Agricultural Economics* 81(2); 305-320.