returns to grassland, which put pressure on cattle grazing opportunities and wildlife habitat, decreasing populations of both. Despite these forces, a different land ethic exists for some producers who consciously make the choice to retain grassland. However, with increasing farm costs, support programs that favor producing certain commodities and few incentives to support bringing young people back to production agriculture- conversion of grassland for farming is likely to continue to the detriment of alternative landscapes and the rural community.

Conclusion

The array of factors identified highlight the enormous complexity underlying land use decisions. Themes constructed describe some of the feedback processes contributing to land use decisions and grassland conversion. Mental models were described that highlight the diverse perspectives of stakeholders who view production and conservation quite differently. Future work includes modeling work incorporating these factors, feedbacks, and preferences to forecast future land use scenarios.

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Risk Management Subsidies, Production System Switching Costs, and Native Grassland Conversion

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Native and unimproved grasslands are critical habitat for many North American duck, shorebird and songbird species, and also for some increasingly rare insects. These habitats coexist with agriculture and the agricultural production environment is changing. A variety of evidence suggests that the rate of native sod conversion to cropland in the United States has increased since the 1990s, and especially in the Dakotas. There may be many reasons for cropland expansion in a historically marginal and yield risky area. Growing demand for commodities in international markets and for fuel has made crop farming more attractive. Innovations in seed technology have reduced non-seed costs, relieved farmers from some environmental compliance constraints, and made crops more drought tolerant. Our concern is with the role of crop insurance subsidies, where subsidy amount varies directly with production riskiness.

A few studies have examined the impacts of Federal risk intervention policies on land-use decisions. Goodwin, Vandeveer, and Deal [Amer. J. Agric. Econ., 86(4), 2004] represent the consensus that while crop insurance subsidies do incentivize cropping, the effect is not large. These works referred to an environment in which lower subsidies were provided than since 2000. More recently Claassen, Cooper, and Carriazo [J. Agric. & Appl. Econ., 43(2), 2011] has sought to provide farm-level analysis of a wide suite of farm programs. Their findings were similar: insurance subsidy impacts occurred, but were not large.

We too seek to understand how risk market subsidies affect incentives to convert native grassland. Unlike all of the current literature, however, we take a dynamic perspective and explore a very different and hitherto unmentioned channel through which risk interventions can affect land-use choices. The Dakotas have seen cropping booms and busts over the past century. Fixed conversion costs can be large and are not recoverable. Land owners will need to be confident that high returns to cropping are not transient before making the conversion decision. Government risk management policies that increase expected future returns to cropping and reduce variability in returns, relative to grazing, will provide assurances to growers, to their bankers, and to input suppliers that production in the area will continue to be viable in the long run.

We developed a real option model of the irreversible native grassland conversion decision. Upon plowing,

native grassland can be followed by either a permanent cropping system or a system in which land is put under cropping (respectively, grazing) whenever crop prices are high (respectively, low). Switching costs are incurred upon alternating between cropping and grazing. The effects of risk intervention in the form of crop insurance subsidies are studied, as are the effects of cropping innovations that reduce switching costs. We calibrate the model by using cropping return data for South Central North Dakota over 1989-2012. Simulations show that a risk intervention that offsets 20% of a cropping return shortfall increases the sod-busting cost threshold, below which native sod will be busted, by 41% (or $43.7/acre). Omitting cropping return risk across time underestimates this sod-busting cost threshold by 23% (or $24.35/acre) and hence may substantially underestimate native sod conversion caused by Federal risk management subsidies. This work is preliminary. We expect to publish a clearly explained, more developed paper on the topic at a later date.

Using Predictive Models to Understand the Changing Landscape of the Northern Great Plains and Potential Implications for Wildlife and Human Communities

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The landscape of the Northern Great Plains has changed dramatically over the past decade. The conversion of native grasslands for food and fuel is increasing across the region and with it come potential wide-ranging impacts to wildlife, ecosystem services and human communities. Understanding past trends and being able to predict future ones will assist us in prioritizing conservation actions across the Northern Great Plains Ecoregion.

In this presentation, I described work that World Wildlife Fund (WWF) and partners, including The Nature Conservancy (TNC) and University of Wyoming, have been developing regarding predictive models that describe the potential for converting grassland to cropland and developing oil and gas resources across the Northern Great Plains. I began by presenting historical trends in conversion of grassland to cropland in the U.S. portion of the Northern Great Plains. Based on results from a new study, between 1978 and 2008, the average annual increase in crop acreage within the Northern Great Plains was 0.9%, which is about 1.1 million acres (445,154 ha) over the 30-year period. Growth in acreage of soybeans, corn and wheat accounted for the majority of the increase in crop acreage, with corn and soybeans playing a larger role in the last decade (1998-2008; Rashford, 2012).

Preliminary results from our predictive models suggest that, holding all else steady, an increase in crop prices will lead to an increase in the number of parcels that are converted to cropland on all but those areas with the poorest soil quality. Specifically, an increase in crop prices by 10% will lead to an average increase in probability of converting from grassland to cropland by 0.3%, while a 25% increase in crop prices will lead to a 0.9% increase in the probability of conversion. This 0.9% increase translates to a little over a million acres converted across the US portion of the NGP ecoregion. However, in areas that have high soil quality, an increase in crop prices of 10% leads to an increase in the probability of conversion of 4% to 10% depending on the soil quality (areas with higher soil quality have a higher probability of conversion). These changes largely occur along the eastern edge of the ecoregion in North and South Dakota, while many areas in Montana, Wyoming and Nebraska have poor soils that are not able to support cultivation using current crop types and cropping techniques (Rashford, 2012). Changes in the amount of government payments (e.g., crop insurance, disaster payments) can also substantially change the probability of converting grassland to cropland. Currently, government payments vary across the ecoregion from $0 to $32.47 per acre (0.4 ha), with an average of $8.31 per acre (0.4 ha). Removal of all government payments reduces the probability of converting grassland to cropland by 3% on average, but leads to a reduction of almost 30% in some areas, particularly those that have more marginal soils, specifically in the western portions of North and South Dakota and eastern portions of Montana and Wyoming. In total, the elimination of all government payments translates to an increase and/or reclamation of 5.5 million acres (2.2 million ha) of grassland (Rashford, 2012).