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LONG-TERM AGRICULTURAL LAND-USE TRENDS IN NEBRASKA, 1866–2007

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ABSTRACT—Although landscape changes from anthropogenic causes occur at much faster rates than those from natural processes (e.g., geological, vegetation succession), human perception of such changes is often subjective, inaccurate, or nonexistent. Given the large-scale land-use changes that have occurred throughout the Great Plains, the potential impacts of land-use changes on ecological systems, and the insight gained from knowledge of land-use trends (e.g., to compare to wildlife population trends), we synthesized information related to land-use trends in Nebraska during 1866–2007. We discussed and interpreted known and potential causes of short- and long-term land-use trends based on agricultural and weather data; farm policies and programs; and local, state, and global events. During the study period, mean farm size steadily increased, whereas number of farms rapidly increased until about 1900, remained stable until about 1930, then rapidly decreased. Total area of cropland in Nebraska increased until the 1930s, but then showed long-term stability with large short-term fluctuations. Crop diversity was highest during 1955–1965, then slowly decreased; corn was always a dominant crop, but sorghum and oats were increasingly replaced by soybeans after the 1960s. Land-use changes were affected by farm policies and programs attempting to stabilize commodity supply and demand, reduce erosion, and reduce impacts to wildlife and ecological systems; direct and indirect effects of war (e.g., food demand, pesticides, fertilizers); technological advances (e.g., mechanization); and human population growth and redistribution. Although these causes of change will continue to affect Nebraska’s landscape, as well as that of other Great Plains states, new large-scale trends such as increasing energy demands (e.g., biofuels) may contribute to an already highly modified landscape.

Key Words: agriculture, biofuels, Conservation Reserve Program, farm policy, farm programs, land use, Nebraska, wildlife

INTRODUCTION

The effects of natural processes (e.g., geological, vegetation succession) on landscape change are normally slow with punctuations caused by cataclysmic events, such as meteor strikes, volcanic activity, or fire. Anthropogenic changes occur at higher rates of speed (Antrop 1998, 2000). However, change is usually incremental and the rate of change may be slower than most people can perceive, which can lead to subjectivity when interpreting

landscape changes (Antrop 2000). Human perceptions of landscape directly influence future landscape conditions (Nassauer 1995); thus, inaccurate or misinformed perceptions by the public have the potential to increase difficulty in policy, planning, or management decision-making processes. In our field of study, wildlife ecology and management, the public may perceive lower populations of wildlife during relatively short time periods. They have opportunities to observe wildlife during the year, and short-term population trend data is published in local newspapers each fall, designed to provide forecasts of

hunting opportunities. However, people may not perceive trajectories in landscape change that may be the cause of wildlife population fluctuations.

The ecological function affected by decisions that cause landscape change may be hidden (Nassauer 1992). Ecological systems are both complex and dynamic, often making perception of change by landscape inhabitants difficult (Nassauer 1992). Biologists often simplify systems during landscape studies by concentrating on very finite units of time and space. Limits of human understanding of such complex systems, among other constraints, necessitate this simplicity. However, descriptive studies that are broad in both space and time have the potential to be insightful to landscape inhabitants, as well as to decision-makers.

“Nebraska’s growth and development are directly related to an abundance of soils of high natural fertility” (Elder 1969:1), but certainly other factors have been involved given the complexity of agricultural, economic, and ecological systems. For example, within the Great Plains, changes in agriculture have largely been the result of multiple factors, such as weather patterns, agricultural commodity prices, and technology (Parton et al. 2007). Nebraska’s population has increased by an average of 5% each year since 1960 (U.S. Census Bureau 2008), so it is no surprise that some level of land-use change has been occurring. However, the impact of human population growth on agriculture seems more prevalent as spatial scale increases from local to national to global perspective (Parton et al. 2007).

Although historical land-use trends for much of the United States and Canada have been described (Turner and Ruscher 1988; Warner 1994; Medley et al. 1995; Igl and Johnson 1997; Boren et al. 1999; Pan et al. 1999; Ramankutty and Foley 1999), there has been no descriptive synthesis for the state of Nebraska. Such a description of land use, based on scientific data as opposed to human perception, could improve understanding of the functioning of Nebraska’s ecological systems and could prove instrumental in future decisions made in agricultural systems (Goklany 2002). Also lacking is a description of events related to land-use changes in Nebraska. Such a description could promote new research hypotheses and serve as a basis for research in many disciplines, including agriculture, economics, forestry, political science, and wildlife. In our field of wildlife management, knowledge of long-term land-use trends can be linked to long-term wildlife population trends through monitoring programs such as the North American Breeding Bird Survey (Sauer et al. 2008) and rural mail-carrier surveys. Our objective

was to describe land-use changes in Nebraska during 1866–2007, with an emphasis on agricultural trends. We also discuss known and potential causes of short- and long-term land-use trends and synthesize information useful for natural-resource applications in Nebraska and other Great Plains states. We used the best available information on which to provide our interpretations of events directly or indirectly related to land-use changes in Nebraska.

STUDY AREA

The state of Nebraska is located in the Great Plains of the central United States, and exhibits diverse ecological systems, particularly along a longitudinal gradient. Elevation starts at about 300 m in the east, steadily sloping to over 1,500 m in the west, a result of sediment deposition occurring east of the Rocky Mountains during the Tertiary period (Maher et al. 2003). The western extent of glacial moraine, deposited during the Quaternary period, is limited to eastern Nebraska (Maher et al. 2003). The rolling hills of eastern Nebraska are the result of this glacial deposition, while topography in the north-central region is dominated by the Sandhills; much of the remaining topography consists of bluffs, escarpments, plains, and the Platte River valley (Carlson 1993). Eight soil parent materials are present in Nebraska, with sand and loess dominating the landscape (Elder 1969). The Sandhills (grass-stabilized sand dunes) are a large expanse resulting from 10,000 years of blowing sand; loess covers the eastern Rolling Hills and southern portions of the state (Carlson 1993). Large deposits of sand and gravel in east-central Nebraska increased groundwater storage capacity (Carlson 1993). Much of Nebraska contains a large-volume aquifer holding high-quality water (Conservation and Survey Division 1986).

Nebraska is divided into two climate types under the modified Köppen system: humid continental in the east and semiarid midlatitude steppe in the west (Elder 1969; McKnight 1996:fig. 8-5). Normal annual precipitation in Nebraska during 1971–2000 ranged from about 34.8 cm in the west to 89.1 cm in the east (High Plains Regional Climate Center 2008), an increasing gradient from west to east (Neild 1977:fig. 1.1). Most (>70%) precipitation falls during April–September (High Plains Regional Climate Center 2008).

Nebraska covers about 199,100 km² (U.S. Census Bureau 2008), and is divided into 93 counties. Human population during 2006 was about 1.77 million people; population density increased from 7.9/km² in 1990 to

8.9/km² in 2006 (U.S. Census Bureau 2008). Agriculture is a major component of Nebraska's economy, with 186,150 km² producing almost \$10 billion of agricultural-related products (e.g., crops, livestock) during 2002 (U.S. Department of Agriculture [USDA] 2004). The Panhandle and north-central Nebraska are generally considered rangeland suitable for grazing livestock, whereas the remainder is predominately cultivated (Neild 1977:fig. 1.9). The growing season ranges from 120 days in the northwestern Panhandle to 170 days in the southeast (Neild 1977).

METHODS

We used multiple sources to describe land-use changes in Nebraska during 1866–2007. We compiled agricultural land-use data from the USDA National Agricultural Statistics Service (2008a) database. This source contained annual area planted to each crop type (e.g., alfalfa [*Medicago sativa*], corn, oats [*Avena* spp.], soybeans [*Glycine max*], wheat); in years prior to about 1920, only data on land area (ha) harvested were available which we then used as a surrogate measure of area planted to each crop type. Data on hay were not collected until 1909, so our analyses for the period 1866–1908 lack this information.

We calculated an annual Simpson Reciprocal Index of Diversity (SRID; Simpson 1949; Krebs 1999:443) to quantify diversity of crops within Nebraska during our study period. Diversity increases with greater SRID values (Krebs 1999:443) according to:

$$\frac{1}{D} = \frac{1}{\sum_{i=1}^m p_i^2},$$

where p_i is the proportion of crop area within the state planted in crop i ($i = 1, 2, \dots, m$). For our study, we used $m = 15$ seed-crops (alfalfa, barley [*Hordeum* spp.], chickpeas [*Cicer arietinum*], corn, dry edible beans [*Phaseolus* spp.], flaxseed [*Linum usitatissimum*], oats, potatoes [*Solanum brevifolia*], proso millet [*Panicum miliaceum*], rye [*Secale* spp.], sorghum [*Sorghum* spp.], soybeans, sugar beets [*Beta vulgaris*], sunflower [*Helianthus* spp.], wheat) planted or harvested in Nebraska during 1866–2007. The SRID increases with an increasing number of species (e.g., crop types) and with species evenness (i.e., as each species becomes more evenly represented) in the sample. Thus, SRID should be lower in our study during years when fewer crops were planted in Nebraska or during years when a small number of crops dominated the landscape.

We used Palmer Modified Drought Index (PMDI) data (National Climate Data Center 2008), an assessment of long-term meteorological drought, to describe conditions during the period available (1895–2007) for the state of Nebraska. The PMDI is derived from several weather-related measurements (e.g., precipitation, temperature, evapotranspiration) calculated on a monthly basis and indexed to long-term normal conditions (i.e., PMDI = -0.49 to 0.49 for normal years; severe drought = -3.99 to -3.00; very wet = 3.00 to 3.99; Heddinghaus and Sabol 1991). We calculated mean statewide PMDI during April–September of each year to describe growing-season conditions. We defined a drought event and a flood event as any year with PMDI < -3.00 and PMDI > 3.00, respectively. We gathered a description of events causing or correlated with land-use changes in Nebraska (see Table 1). We used ProStat v4.81 (Poly Software International, Inc., Pearl River, NY) for statistical analyses and figure construction.

RESULTS AND DISCUSSION

Despite minor instances of missing data, our analyses provided patterns of descriptive value for a statewide assessment of agricultural land-use trends. For example, the number of farms increased at the highest rate immediately following statehood (1867) to the beginning of the 20th century; the number of farms remained stable until the 1930s, then declined steadily so that 2002 values were similar to that of about 1870 (Fig. 1). Mean size of farms (ha), however, increased steadily since about 1880 and peaked in 2002 at about 380 ha (Fig. 1). Total area in cropland showed the greatest rate of increase during 1865–1930; from about 1930 to about 1970, cropland area decreased, after which it was relatively stable (Fig. 2A).

The statewide diversity of seed-crops in Nebraska peaked in the 1950s and 1960s (Fig. 3). Since 1966, crop diversity in Nebraska has steadily decreased, and cropland is currently dominated by corn and soybeans (Figs. 4, 5). During the peak crop-diversity period (1950–1965), cropland area in wheat, sorghum, and oats was higher than present-day levels. Corn, wheat, and oats dominated the landscape during the early periods of lower crop diversity (1866–1915). Local diversity of agricultural landscapes also decreased during the 20th century as larger farms (Fig. 1) were composed of larger fields (Fig. 5).

Using our threshold values of -3.00 (drought) and 3.00 (flood), we defined two statewide drought events and four statewide flood events (Fig. 6; Table 1). Drought events occurred during 1934 (PMDI = -4.04) and 1936

TABLE 1
TIME LINE OF LOCAL, NATIONAL, AND GLOBAL EVENTS POTENTIALLY AFFECTING
LAND USE IN NEBRASKA, 1803–2008

Year	Event	Description
1803	Louisiana Purchase	U.S. acquired large tract of Great Plains from France
1854	Kansas-Nebraska Act	Allowed settlers to prohibit or allow slavery within territory borders
1862	Homestead Act	Encouraged settlement in Nebraska
1861–1865	Civil War	
1867	Nebraska achieves statehood	
1869	Union Pacific Railroad completed	
1902	Reclamation Act of 1902	Earmarked federal aid for irrigation projects
1905	Statewide flood conditions	
1914–1918	World War I	
1915	Statewide flood conditions	
1933	Moratorium on farm foreclosures	
1934	Statewide drought conditions	
1934–1936	Cropland Adjustment Act	Controlled supply of agricultural goods through incentive payments to farmers for voluntary reductions in production
1935	Soil Conservation Act	Established Soil Conservation Service, allocated funding to farmers practicing soil conservation
1936	Statewide drought conditions	
1936–1946	Agricultural Conservation Program	Sought to reduce surplus of soil-depleting commodity crops (corn, cotton, wheat) by paying farmers to replace them with soil-building perennials or annual cover crops
1936–1996	Agricultural Conservation Program	Provided cost-share to agricultural producers to help address excessive soil loss and reduced water quality
1939–1946	World War II	Higher demand and prices for U.S. farm commodities followed end of war
1951	Statewide flood conditions	
1956–1970	Agricultural Act	Created Soil Bank by removing 11.7 million hectares of farmland from production and enrolling in the conservation reserve, developed a reserve program that paid farmers who reduced land area planted to certain crops
1961–1985	Emergency Feed and Grain Act	Paid farmers to annually idle a percent of cropland area to decrease supplies of commodity crops
1985	Farm Bill	Established Conservation Reserve Program (CRP) to remove highly erodible lands from production
1990	Farm Bill	Expanded eligibility of lands that could be enrolled in CRP for environmentally sensitive areas (e.g., buffer and filter strips, riparian forests)
1992	Constitutional Amendment (1300)	Voters approved amendment (Ballot Initiative 300) to prohibit large corporations from buying farmland
1993	Statewide flood conditions	
1996	Farm Bill	Shifted portion of payments from price supports to direct payments for farmers producing certain commodity crops
2002	Farm Bill	Increased total area that could be enrolled in CRP, continued direct payments and price supports, and increased funding for crop insurance
2006	Constitutional Amendment (1300) overturned	Federal court rules against the amendment (violated federal commerce clause and unfairly discriminated against out-of-state landowners)
2008	Farm Bill	Decreased total area that could be enrolled in CRP, maintained crop support system of preceding bills, and provided farmers and ranchers protection from agricultural disasters

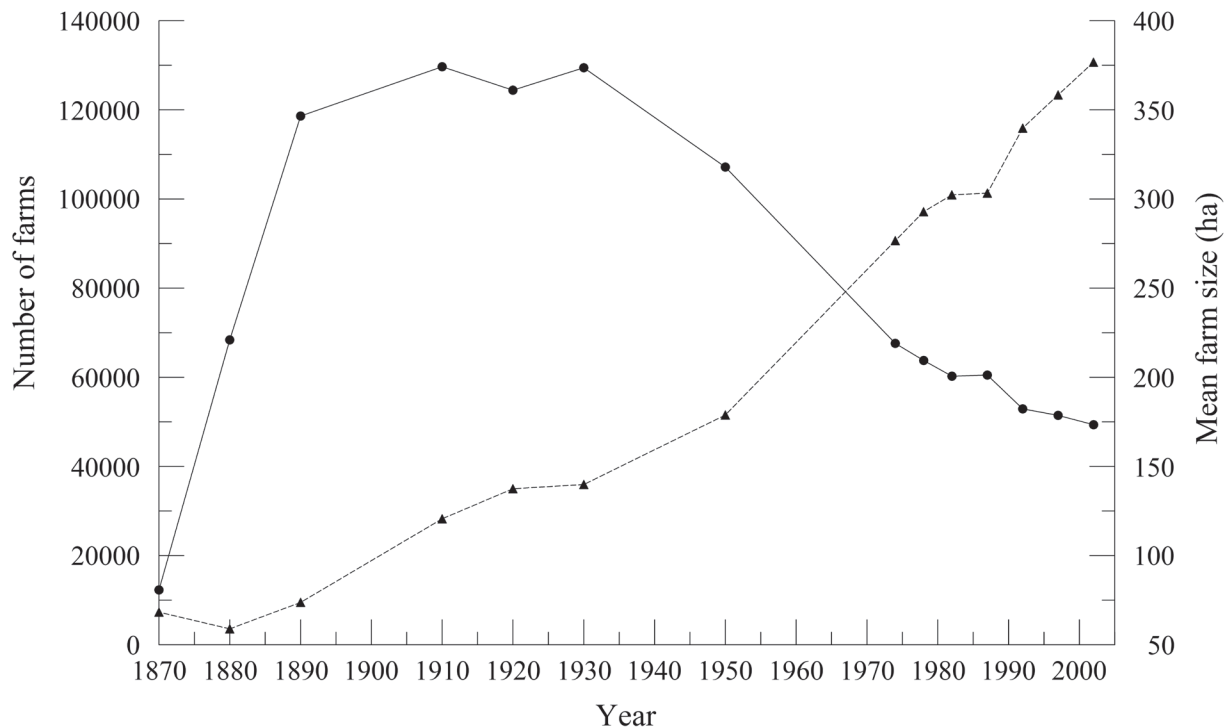


Figure 1. Estimates of number of farms (circles with solid line) and mean farm size (triangles with dashed line) in Nebraska, 1870–2002. Source: U.S. Department of Agriculture, National Agricultural Statistics Service.

(-3.15); flood events occurred during 1905 (3.78), 1915 (4.52), 1951 (3.69), and 1993 (3.85). Two periods had near-drought conditions (i.e., 1939–1940, 1955–1956; mean PMDI for each period approximately -2.80), with the latter period actually affecting more land area through wind erosion than during the 1930s (Lockeretz 1978:fig. 6).

We found general land-use trends to be related to period events at local, national, and global scales (Table 1). The adoption of the Homestead Act in 1862, which required landowners to reside on and cultivate claimed lands, brought a large influx of homesteaders and significant landscape changes. With the resolution of the Civil War in 1865, many soldiers and citizens dispersed west for the opportunity to make a new living on the abundant free land (Ottoson 1979). This situation resulted in a large increase in the number of farms in Nebraska over the next several decades (Fig. 1). Official recognition of the statehood of Nebraska in 1867 provided a sense of civility, and the completion of the Union Pacific Railroad provided a more efficient means of travel for homesteaders dispersing to Nebraska and a means for more efficiently shipping agricultural goods across the country (Luebke 2005).

From the 1860s to about 1933, crop production in Nebraska experienced nearly continual growth. During this period, there were only three years in which the total area

planted to crops declined (1917, 1922, and 1924; Fig. 2A). In 1917, during World War I, there was a large decrease in area planted to wheat and an increase in area planted to corn (Fig. 2B). However, there were efforts to increase wheat production for mill flour for the war effort. Consequently, in 1918, area in wheat quickly rebounded and area in corn declined. Following the end of the war until 1933, an increase in agricultural area used for corn production appears to be the primary reason for an increase in total area of cropland (Fig. 2B). Prior to World War I, area in corn, wheat, and oats seemed to be experiencing equitable increases in total area. Before 1900, horses and mules provided the primary energy for farming crops and for transportation, but by the 1930s most farming in Nebraska was mechanized (Vogel 1996). The ability to mechanically till more land, coupled with farm prices that had been inflated during World War I, led to tilling of marginal lands and erosive soils, which contributed to economic distress during the 1920s and 1930s (Ottoson 1979).

In 1932, a record 9.8 million ha of crops was planted in Nebraska (Fig. 2A). During that time, extensive tillage was the norm. However, cropland area quickly began to decrease with the drought of 1934, the first year of the Dust Bowl, a period of poor agricultural and economic

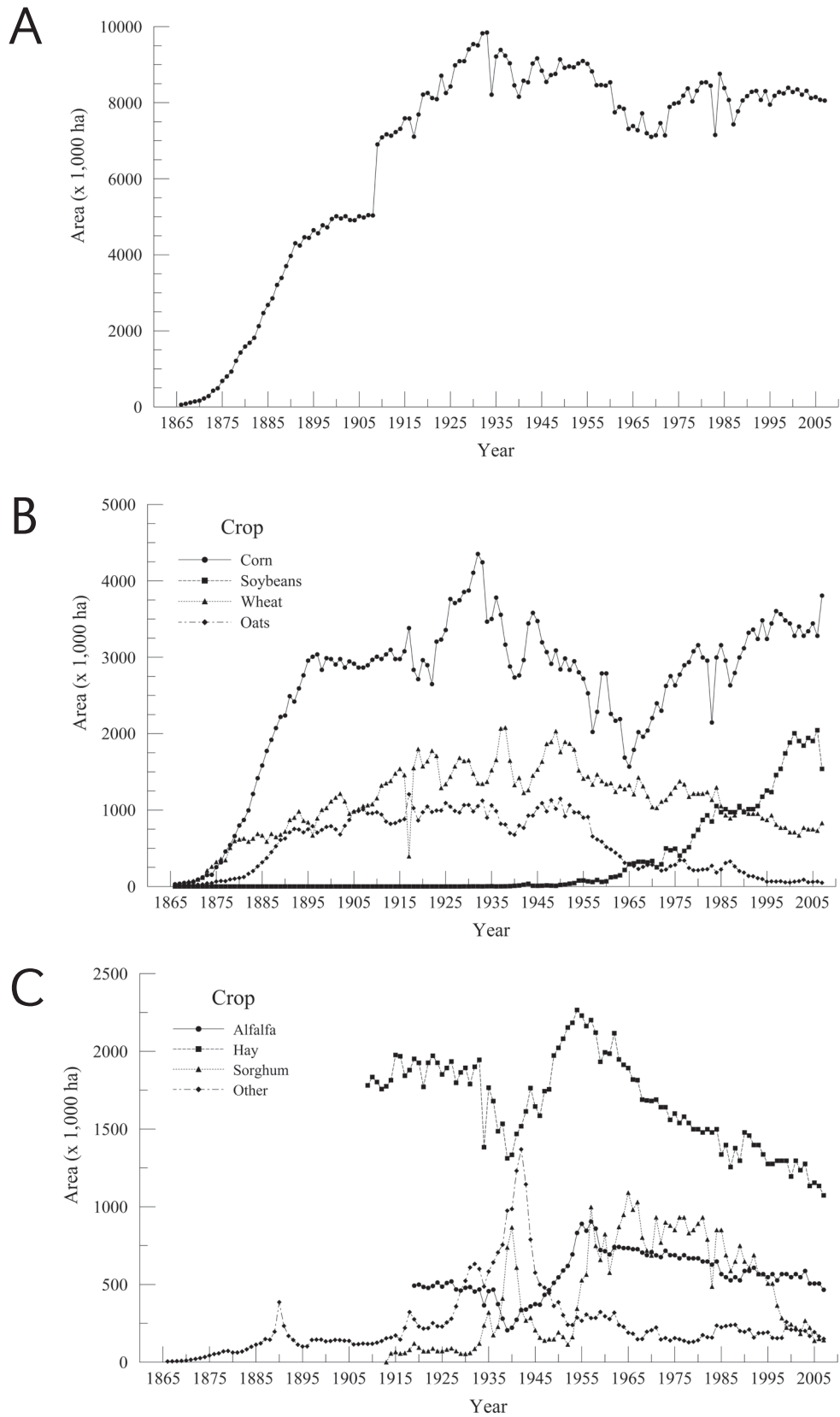


Figure 2. Annual agricultural land cover in Nebraska during 1865–2007: (A) total area in crop production, (B) area of four dominant crop types, and (C) area of other crop types. Source: U.S. Department of Agriculture, National Agricultural Statistics Service.

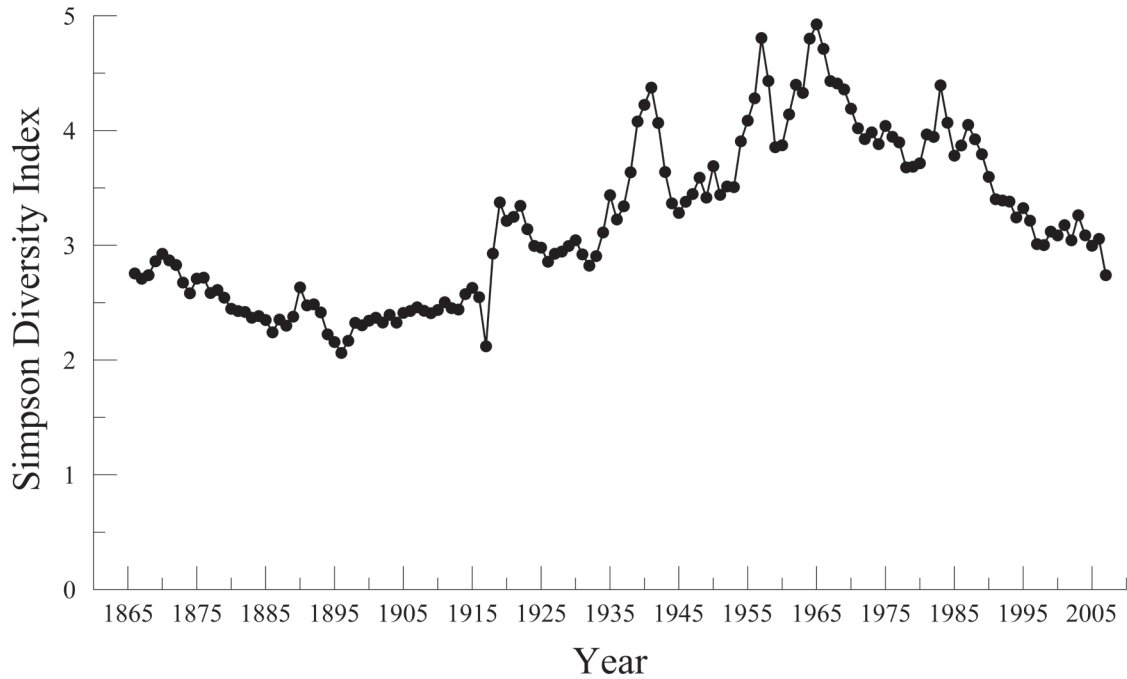


Figure 3. Diversity of agricultural seed crops in Nebraska during 1866–2007, using the Simpson Reciprocal Index. Seeded crops included corn, wheat, alfalfa, sorghum, oats, barley, soybeans, rye, potatoes, flaxseed, sugar beets, dry edible beans, chickpeas, sunflower, and proso millet. Source: U.S. Department of Agriculture, National Agricultural Statistics Service.

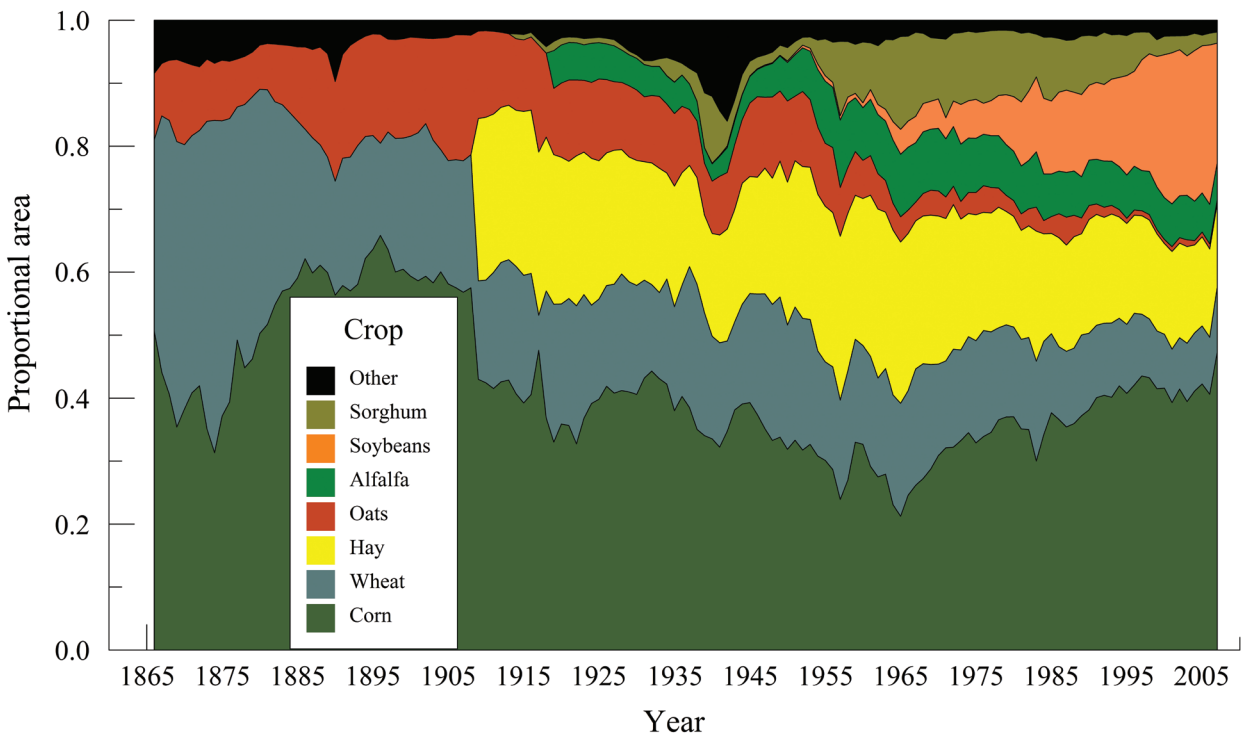


Figure 4. Proportional area of agricultural crop types in Nebraska during 1865–2007. Source: U.S. Department of Agriculture, National Agricultural Statistics Service.

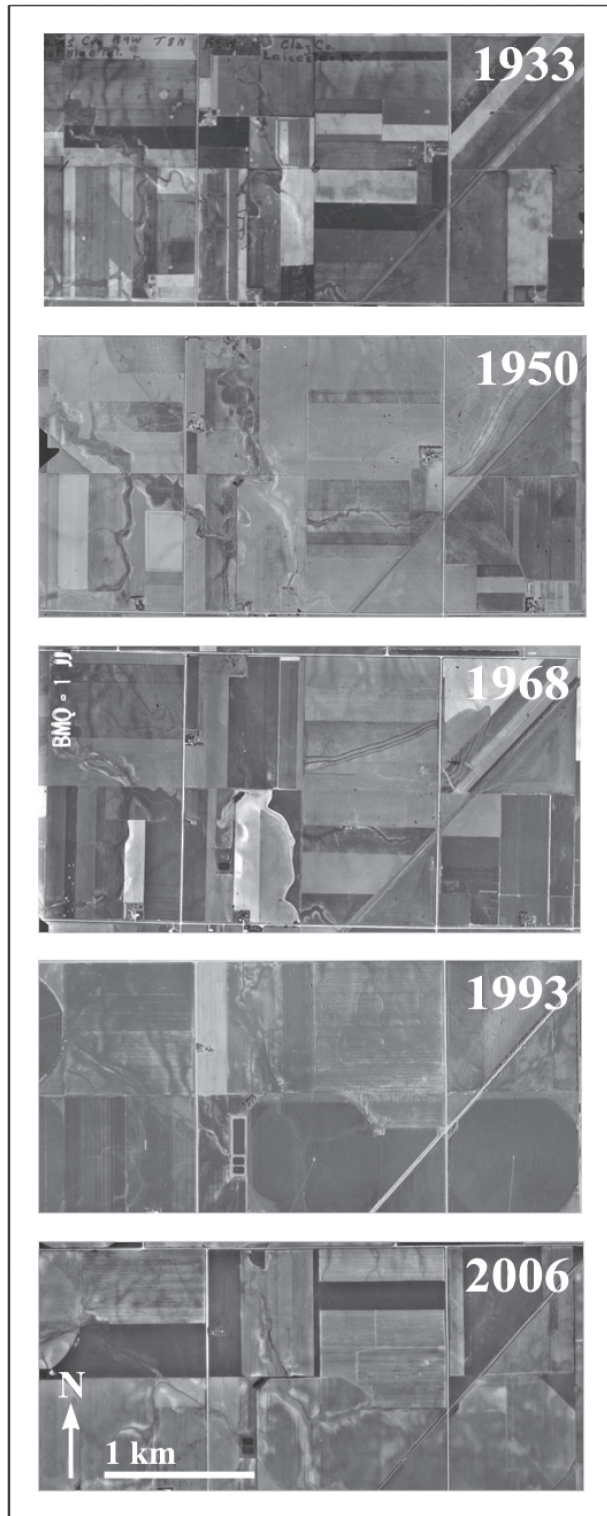


Figure 5. Time-series aerial photographs of the same 627-ha area of agricultural land in Clay County, Nebraska (UTM Easting: 561847, Northing: 4504750) from 1933 to 2006.

conditions that would last until 1936 (Ottoson 1979). Throughout the southern Great Plains, drought conditions led to low crop production and high erosion of unprotected tilled soils (Luebke 2005); the effects of erosion were exacerbated in areas where soils and climate were marginal for farming, even for wheat (Lockeretz 1978). Following the Dust Bowl, the U.S. Congress created the first of many federal programs designed to stimulate agricultural production; they also created federal agencies within the Department of Agriculture to address soil erosion and loss, improve farm economy, and administer farmer assistance programs (Berner 1984). Some agricultural areas not planted during 1934–1936 were likely enrolled in cropland diversion through the Cropland Adjustment Act; however, in many cases farmers simply permanently abandoned their farms.

Following the Dust Bowl, corn hectares (Fig. 2B) declined likely due to the higher water requirements of corn compared to wheat and oats (Yonts 2002). More land was then planted to wheat (almost 2.1 million ha; Fig. 2B) in Nebraska than at any other time. Grain sorghum and barley were also planted much more extensively following the Dust Bowl through the end of World War II in 1946. These small grains both produced crops using less moisture and provided more soil cover to prevent erosion even if crops failed to produce grain (Lyon 2004). During 1936–1946, farmers were paid to annually replace crop hectares with soil-building cover crops either annually or in successive years through the Agricultural Conservation Program (ACP). An additional benefit of ACP beyond reducing surplus commodities and increasing soil productivity was the increase in wildlife habitat quality and quantity, especially for many avian species. Species in the Order Galliformes seemed to increase in abundance, as suggested by increased annual ring-necked pheasant (*Phasianus colchicus*) harvests (Edwards 1984; Berner 1988). Also following the Dust Bowl, the Prairie States Forestry Project (i.e., the Shelterbelt Project) was implemented to reduce wind erosion by planting more than 45 million trees in Nebraska during 1935–1942 (Droze 1977:table III).

During World War II (1939–1946), the amount of corn planted in Nebraska again increased, as did total cropland area (Figs. 2A,B). The onset of the war brought prosperity to other sectors in Nebraska, and demand continued for agricultural goods (Matos and Wagner 1998). Following the war, both demand and prices for farm commodities were high. However, the total area of crops planted did not increase. Area planted in wheat began to increase during World War II and continued to increase until about 1950,

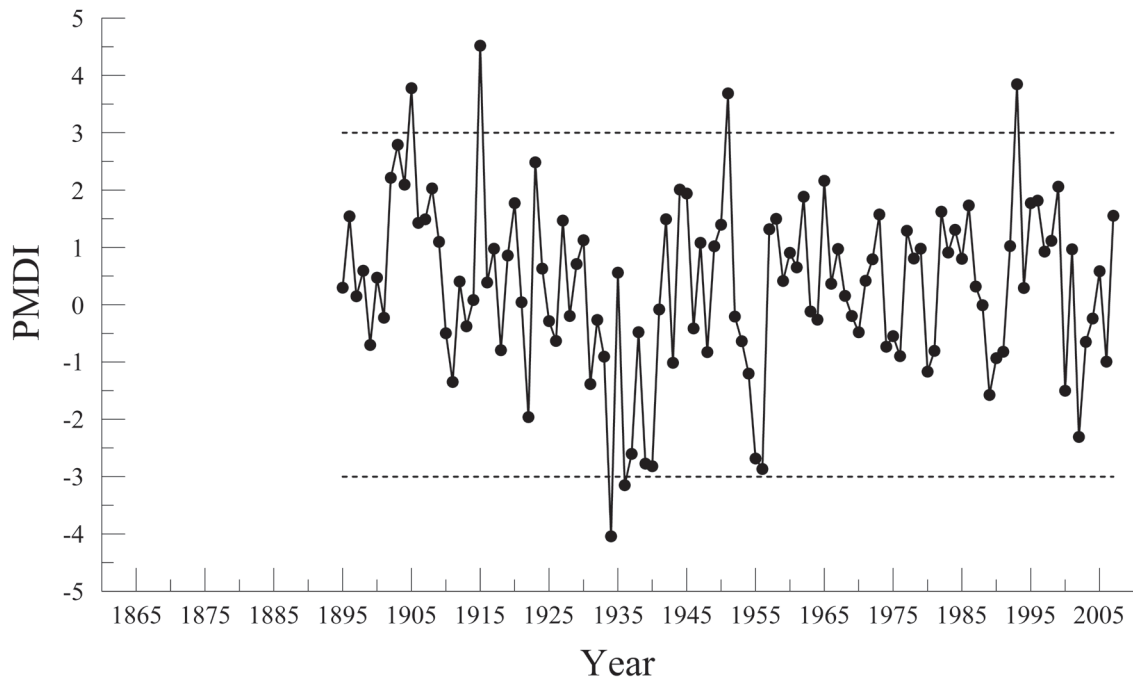


Figure 6. Palmer Modified Drought Indices (PMDI; average of monthly values from April to September) for Nebraska, 1895–2007. Values of -3.00 and 3.00 define drought and flood thresholds, respectively. Source: National Climate Data Center.

whereas area planted in corn began to decline between the end of the war and the late 1950s (Fig. 2B). The greatest impact World War II had on crop production was probably the development of pesticides (e.g., DDT [dichlorodiphenyltrichloroethane]) and new sources of fertilizer (i.e., anhydrous ammonia that had been produced for munitions was shifted to produce crop fertilizer; Matos and Wagner 1998). The industrial growth that resulted from World War II also led to increased manufacture of mechanized agricultural implements and irrigation equipment (Olmstead and Rhode 2002), which allowed individual farms to increase in size (Fig. 1). The amount of irrigated farmland increased steadily by about 50,000 ha per year, from 255,864 ha in 1945 to almost 3.5 million ha in 2007 (USDA 2008).

By 1956, agricultural production outpaced demand and caused farm incomes to decrease (Cain and Lovejoy 2004). This resulted in congressional action to create the Soil Bank program. The Soil Bank program actually consisted of two programs: an annual Acreage Reserve and the Conservation Reserve that provided 3- to 10-year contracts to encourage farmers to retire cropland from production and to plant perennial grasses or legumes (Family Fabaceae). Cropland retired under the Conserva-

tion Reserve program has been positively correlated with changes in agricultural wildlife populations, especially game species (Schrader 1960; Dalgren 1967; Bartman 1969). Even before the Soil Bank, the area planted in grain sorghum began to increase (Fig. 2C), apparently replacing corn, which required more fertilizer. By the mid-1950s, grain sorghum had replaced oats as the third dominant crop (excluding forage crops such as hay and alfalfa) in Nebraska following corn and wheat. During the first five years (1956–1960) of the Soil Bank in Nebraska, total cropland area appeared to remain stable (Fig. 2A). However, total cropland area declined from the early to mid-1960s, primarily from a decrease in the area planted to corn and the continued decline in area planted to oats. The decline in hectares of corn likely reflected farmer participation in Conservation Reserve; during this period, enrollment in Conservation Reserve peaked (Berner 1988).

Area of cropland planted to soybeans became a more prominent feature of Nebraska's landscape in the 1960s. During this time, land area of wheat continued on a slow downward trend, whereas land area of oats decreased at a faster rate (Figs. 2B, 4). In 1961, the Feed Grain program was implemented because of continued overproduction of commodity crops and low crop prices (Berner 1984).

Corn and grain sorghum were the initial targets of the Feed Grain program, and landowners were required to replace crop hectares with conservation areas, which remained fallow to receive program compensation (Cain and Lovejoy 2004). Nebraska had significant reductions of corn hectares during this period (Fig. 2A), but grain sorghum hectares increased during the early 1960s (Fig. 2B). For farmers, financial compensation from the Feed Grain program for having only a portion of their land in crop production was more lucrative than compensation from the Conservation Reserve program; payments for corn were typically higher than those for other commodity crops covered by the programs (Berner 1984).

From the late 1960s through the mid-1980s, cropland area planted by Nebraska farmers and area planted in corn and soybeans generally continued to increase, whereas area planted to wheat and oats generally continued to decrease (Fig. 2B). One factor contributing to this trend was Earl Butz's encouragement of farmers to farm "from fence row to fence row" (Fig. 5). Butz, the U.S. secretary of agriculture from 1971 to 1976, called on farmers to increase production to provide food for Russia, and Russian grain purchases kept demand and prices high. Conservation areas from previous programs were replaced by crops during this period (Cain and Lovejoy 2004). Nebraska's cropland increased during the 1970s (Fig. 1B), especially for corn and soybeans (Fig. 2B).

In 1983, a record number of hectares was set-aside from production in exchange for Feed Grain program payments, resulting in an almost 1.3 million-ha decrease in area planted within a single year (Fig. 2A); this seemed to be the only interruption of the decline in number of farms and the increase in mean farm size since the 1930s (Fig. 1). The large reduction in area planted was part of the Payment-in-Kind effort to stabilize agricultural economics due to surplus commodity crops, low crop prices, and problems in the farm credit and banking sectors due to a substantial decrease in agricultural land values (Cook 1983; Berner 1984). However, after idling a significant amount of cropland in 1983, Nebraska farmers increased the total amount of land in crop production in 1984 to a level not seen since 1940, despite low prices and surplus supplies of farm commodities.

The 1985 Farm Bill (i.e., Food Security Act) was the first to include a separate conservation title, including the creation of the Conservation Reserve Program (CRP), a voluntary, long-term land-retirement program that paid farmers to establish and maintain permanent cover on highly erodible croplands (Heard 2000). The CRP initially was focused on reducing soil erosion and controlling com-

modity supplies, but evolved into a multifaceted conservation program that has continued in each successive farm bill since 1985 (Heard 2000). The area in crop production in Nebraska initially declined as land was enrolled in the program during the first few years following enactment of the 1985 Farm Bill. However, enrollment of approximately 28,000 ha in CRP in 1986 cannot explain the decrease in over 400,000 ha of cropland between 1985 and 1986, which could have further been affected by a poor agricultural market. Following the first few years of declining cropland after 1985, the total area in cropland began to increase, and generally continued to do so, especially for corn and soybean production, through 2007. In 1986, soybeans supplanted wheat as the second most dominant crop planted in Nebraska in terms of land area (Figs. 2B, 4). Corn and soybean crops combined now make up >66% of Nebraska's total cropland area (Fig. 4).

FUTURE LAND-USE TRENDS

Nebraska's agricultural landscape has been affected by foreign policy, mechanization, economics, politics, energy policy, and availability of agricultural chemical inputs. Although the factors are large-scale and often international in scope, we are constantly reminded that individual landowners make the annual decisions that affect Nebraska's landscape. In part, decisions have been formed based on agricultural policies and programs, some of which may not be well suited to address new forces affecting contemporary issues in U.S. agricultural economy (Dimitri et al. 2005). Individual farms are unique, but Nebraska has seen a general trend of fewer and larger farms that produce a less diverse portfolio of commodities. Nebraska mirrors other states in the Great Plains with these agricultural trends (Dimitri et al. 2005; National Agricultural Statistics Service 2008b).

As wildlife biologists, we are interested in landscape compositional and structural changes. Certainly, the loss of cover through fencerow removal and landscape simplification (Fig. 5) has the potential to impact wildlife populations (Flather et al. 1992). We encourage biologists to use spatial, historic landscape, and wildlife monitoring data to investigate the effects of landscape change in Nebraska on wildlife. We hypothesize that most Nebraskans have not perceived the broad scope of long-term land-use changes outlined in this paper. We encourage state and federal agency personnel who work with private landowners to share information, which may encourage better-informed decisions by landowners concerned with wildlife habitat and landscape issues. There are lessons in

history and Nebraska's policymakers may be able to learn from the lessons imbedded in past policy decisions.

Current pressures for biofuels have the potential to act in similar fashion to Earl Butz's call to plant crops throughout the Great Plains. Just as conservation hectares disappeared from the landscape in the 1970s, we anticipate a dramatic drop in conservation hectares in Nebraska during the next 5–10 years. Because corn and soybeans are both used in biofuels, we do not anticipate a change in the trajectory of Nebraska's crop diversity; corn and soybeans will likely continue to dominate agricultural area. For wildlife, this trend is not promising.

The potential for switchgrass (*P. virgatum*) use as a biofuel (Parrish and Fike 2005) provides one possible adjustment to our predictions. If regional markets for switchgrass are successfully developed, Nebraska's landscape may become much more diverse. Switchgrass can increase habitat quality and quantity for some grassland birds and other wildlife species (Murray and Best 2003), although a monoculture of switchgrass provides habitat conditions that are very different from the diversity of native prairie plants. The future of Nebraska's landscape is not certain, but we are certain the state's landscape will continue to be affected by the same forces we have documented for past land-use decisions. Documentation of future impacts will remain critical.

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