TEMPORAL IMPACTS OF CHANGING AGRICULTURAL PRACTICES, RURAL POPULATIONS, AND LANDOWNER GENDER ON SOUTH DAKOTA WATERFOWL HABITATS AND POPULATIONS

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ABSTRACT

With the advent of thousands of non-native settlers into the northern Great Plains regions in the decades of the late 1800s and peaking in early decades of the 1900s, the landscape ecology and the native flora and fauna of the native grasslands, wetlands, and woodlands have been impacted in various ways. Our goal is to briefly describe some of the temporal, social, technological, and landownership changes that have fostered several of the more obvious ecological impacts that affect key wildlife and waterfowl species that currently provide recreational and/or economic incentives for residents or destination visitors or their combinations. Some recommendations for future large-scale information needs will be offered for consideration.

Keywords

wildlife, agricultural practices, women farmers, farm and rural population demographics, South Dakota

INTRODUCTION

Following the last glacial activity in South Dakota ≈15,000 years ago, the landscape consisted of large expanses of native prairie grasslands that were separated into east and west divisions by the Missouri River. The eastern division lies within the glaciated Prairie Pothole Region (PPR) (Mann 1974) of the northern Great Plains and Parklands landscapes of the United States and Canada, most of which consists of rangelands and croplands dotted with numerous natural wetland basins. Historically the combination of grassland and wetland habitats in the PPR provided ideal waterfowl production habitats for breeding, foraging, and nesting activities. Above average duckling production occurs most often in the PPR during years with suitable residual water conditions and annual precipitation events

that facilitate ample spring and summer water in basins and average or above growth and density of upland grassland habitats. Results of surveys, using data from 1979-1986, show that South Dakota contained over 65% of the original wetlands totaling about 1 million basins that cover about 9.8% of the land base acres in the eastern glaciated portion of the state (Johnson and Higgins 1997). An additional 172,867 basins occur in the west river portion of the state (Rieger et al. 2006). However, tillage agriculture has greatly lessened the duck production capability of the PPR area in U.S. and Canada (Higgins 1977).

The first few settlements of European immigrants in South Dakota occurred during the latter decades of the 1800s and were associated with river boats on the Missouri River. In contrast, over 500 townsites and settlements were platted between 1880 and 1915 (Hamburg 1981), and most of these were associated with the infusion of hundreds of miles of railroads within the state. These railroads facilitated the transportation of people, equipment, livestock, goods, and services on steam powered trains (Conzen 2010). Ironically, railroads also provided transportation for many of the earliest residents (settlers) during their exit from the state, and particularly so from smaller towns. However, with the establishment of improved gravel roads, many of which were later converted to pavement roads, rubber-tired automobiles and trucks replaced most of the railroad systems as the primary means of travel in South Dakota and other parts of the northern Great Plains.

Recent surveys show that South Dakota is becoming less of a rural populated state as people from family farm operations and small towns continue to move to urban centers for greater access to health care services, employment opportunities, recreation, entertainment, and retirement facilities (Turner et al. 2010; Jacquet et al. 2017). In less than 100 years, the average ranch and farm has more than quadrupled in size, many of which are managed as agribusiness farm operations in which multiple smaller farm acreages are leased or are farmed-on-shares. As a result, many farm operations now exceed 10,000 acres in size. Population statistics also indicate a four-fold decline in farm landowner populations where farming or ranching was the landowner's primary occupation and source of income. In many areas with depressed rural economies and poor soil producing capabilities, numerous farmers and ranchers and/or their spouses had to obtain additional employment off their operations in order to remain profitable enough to make payments on loans, property taxes, health and property insurances, and living expenses such as above average winter heating and snow removal expenses which can extend for up to 7 months/year. As a result, South Dakota lost an average of 5.2% of its farm families in a decade. Wright and Wimberly (2013) projected that at this rate of loss, only 19,000 farms would remain in South Dakota by the year 2020.

Based on U.S. Census Bureau and Department of Agriculture surveys, the rural population comprised 54.4% of the U.S. population in 1910 compared to only 19.3% in 2010. Furthermore, according to township plat books, considerably fewer small towns, churches, and schools occur in rural areas today in comparison to the first five decades of the 1900's. Besides having fewer families on farms, a 2007 Census of Agriculture determined that women currently comprised about

31% of the farmers in the U.S. and about 26% of farmers in South Dakota. Survey results also revealed that during the 5-year period (2002-2007) women working as the principal operator of all U.S. farms increased by 29%. These demographic data trends are strong indicators that practitioners and conservationists must continue to broaden our understanding of social demographics and decision-making processes in order to provide greater acceptance of farming and ranching practices that will benefit society and our wild flora and fauna via the best land use and wetland management guidelines available.

Larger farming enterprises have become more economically sustainable because of major technological advances in broad scale chemical and fertilizer application processes, larger and more powerful farm tractors and harvesting equipment, and the development of new varieties of crop seed stocks that are more resistant to diseases, drought, and chemicals. Some major technological changes include the development of super-powered diesel tractors, trucks, etc.; improvements in hydraulic cylinders and systems that facilitate the use of larger equipment and their lifting capabilities, all of which increased the acreage which can be cultivated or harvested in one day's efforts by one person. For example, in 1925 a farm tractor was rated at 25 horsepower, and it was estimated that one person working a 10-hour day could potentially plow 15 acres or plant 30 acres of corn or 40 acres of wheat in a day (Higgins et al. 2002). By 1995, tractors with up to 400 horsepower enabled a person the potential to plow 90 acres or plant 320 acres of corn or 480 acres of wheat in a day (Higgins et al. 2002). As of 2018, some tractors are rated up to 600 horsepower providing one person the potential to plow 160-200 acres in one day or plant 480 acres of corn or 640 acres of wheat in one day (Farm Dealership, personal communication). Size of acreages tilled, planted, or harvested also depend on the width of equipment used and the type of soil, topographic relief, and obstacles (e.g., rocks, trees, ditches, wetlands, etc.) that may lessen potential results. For example, a strip of land 8-feet wide by 1 mile long equals an acre. Thus, an 80-foot wide chisel plow being pulled at 5-miles per hour equates to 50 acres per hour or 500 acres per 10-hour day. Likewise, a combine with a 40-foot wide harvest head travelling at 5 miles-per-hour can potentially combine 250 acres of wheat in a 10-hour day. Understandably, potential rates of converting original sod acreages or formerly seeded grassland acreages would reduce the cultivation and/or harvest estimates by about 50% in comparison to fields with a history of annual cultivation.

Other technological advances include the use of airplanes to seed fields, spread chemicals, etc. and to facilitate aerial photography of fields and changes in landscapes. More recently, computers, GPS, and hand-held gadgets are used to facilitate on-site communication, calculations, and ready access to instructions and records relative to crop types, crop health, proper chemical use and application, and post-treatment cleaning and disposal procedures. Drones have also become a new tool to use in farm and livestock monitoring activities. These computerized technologies are also enabling many new advances collectively labeled as "precision agriculture techniques".

A report by the Environmental Working Group and Defenders of Wildlife (Faber et al. 2012) indicated that high crop prices and crop insurance subsidies

contributed to the loss (conversion) of more than 23 million acres of grassland, shrubland, and wetlands in an 11 state area between 2008 and 2011, essentially eliminating primary wildlife habitats that formerly helped sustain populations of many wildlife species. Between 1987 and 2001, in eastern South Dakota alone, about 168,000 acres of native rangeland were converted to annually tilled cropland in 21 counties where cropping for soybeans was becoming more popular and profitable, even on marginally productive soils (Higgins et al. 2002). In South Dakota, more land is expected to be converted to commodity crop production from the Conservation Reserve Program (Feng et al. 2013) and other grasslands (Gates et al. 2016; Reitsma et al. 2015; Wright and Wimberley 2013). Thus, in response to these and other types of economic and social incentives for farmers with young families and those of retirement age or with health issues, farmers and farm families continue to move away from family-operated, diversified grain and livestock operations to a new set of urban life styles or to enter into larger monocultured agribusiness styles of tillage agriculture (i.e., bigger is better, sometimes).

Incentives and decisions to leave or remain living on family farms or in rural communities are complex, but are often based on personal economics, age, and time spent in a community (Ulrich-Schad et al. 2013). Motivations for rural people to migrate can also include a set of social, family, and community values or attachments (Ulrich-Schad et al. 2013). Similarly, Jacquet et al. (2017) found that for rural South Dakotans, community satisfaction, attachment, and quality of life are important in determining migration intentions. Many of these social and community values also affect decision making related to whether conservation practices are adopted as part of the overall farming/ranching operations being conducted on one's farm or ranch (Ulrich-Schad et al. 2016; Mullendore et al. 2015; Floress et al. 2018; Doherty et al. 2013; Higgins et al. 2002; Floress et al. 2017). More often than not, conservation and wildlife managers and administrators are involved in program development and implementation based on little or no relevance to sociological, economical, or attitudinal variables that affect farmers' willingness to adopt or support conservation programs as part of their overall life style or land and water management practices.

Our goal herein is to draw attention to some of the latest changes in farming practices, equipment, technology updates, and changes in social, cultural, and demographic trends that are occurring in rural North America that are also affecting occupancy on rural farms and in rural communities plus some conservation decision processes that are relevant to South Dakotans and to numerous wildlife species within the state.

LAND OWNERSHIP AND MANAGEMENT TRENDS

Starting with the Homestead Act of 1862, settlers, including both men and women, might each acquire up to 160 acres of land for a nominal fee, on condition of five years' residence on it with active cultivation of the plot of land. Most homesteads had a house, and some also had out buildings and/or a barn. In many instances, men and women homesteaded adjoining properties and later married,

increasing the total farm property to 320 acres. Farming was performed with draft horses or oxen and was labor intensive. For the most part, land ownership and operations were controlled primarily by men during the first century after the onset of the Homestead Act.

Over the years following the Homestead Act period, the percentage of women owning farm and ranch lands has greatly increased due in part to spousal deaths, divorces, inheritance, and some personal investments. In parts of the U.S., nearly 50% of the agricultural land is currently owned or controlled by women, sometimes solely; sometimes jointly with other family members (Ulrich-Schad et al. 2016).

Having farmland ownership is one classification; however, depending on location and level of involvement in total operations of the crop, livestock, and/or conservation practices, a farmer can be classified in one or more subcategories related to farmland ownership or operatorship (Ulrich-Schad 2016). Major category levels involve whether farmers are resident landowners and live on their land and/or whether they are actively involved in the crop and or livestock production on their land. For example, farmers could be classified as a resident or non-resident landowner. As non-resident (absentee) landowners, farmers could live locally, but not on their farmland, such as within the county, or they could be non-local or absentee out-of-state or out-of-county farmland owners. Or, if a farmer were the sole operator of cropping and livestock enterprises on his/her land, then he/she could be categorized as an owner-operator and also be in a resident or non-resident sub-category. Further, if a farmer were the operator of farming activities on the farm but not involved with ownership, he/she could be categorized as the resident or local-operating non-landowner or a local-tenant operator who rents, leases, or share-crops the land, etc. Farmland in the U.S. and in South Dakota is increasingly owned by non-operators, many of them women.

Besides the type of landowner category or land operator category that a tract of farmland fits within, there are several social and cultural factors that may affect landowner and operator decisions relative to state, federal, NGO, or other supporters of private conservation practices on farmlands, such as those that improve water quality or those that benefit butterflies, ground nesting birds etc. (Mullendore et al. 2015; Higgins et al. 2002). Whether a landowner and/or operator chooses to enter into a conservation practice agreement on a farmland tract that they own or operate is often affected by one or more social and/or personal explanatory factors (Mullenore et al. 2015; Ulrich-Schad et al. 2013). These include, but are not limited to: gender, sense of place (e.g., identity, attachment, or dependence), community attachment, place attachment, connections to family and/or friends, or environment and aesthetics either functionally or emotionally, a persons' age, education, and interaction with land management professionals/advisor and/or past experiences by oneself or neighbors or progressive leaders in the community, or the practice provides some level or positive economic values above the annual norm. Wells (2003) determined that in some instances where there was joint farmland ownership with additional family members including women, some women landowners would pursue actions that would maintain peace amongst family members rather than adopt other actions that might be or

lead to controversial emotions such as the adoption of some specific conservation practices.

Several research studies demonstrate that South Dakota is losing its overall character as a predominately rurally populated state as citizens from family farms and ranches and small towns migrate to more urban centers within the state or elsewhere (Jacquet et al. 2017). For example, average farm size has quadrupled or more in size in less than 100 years, whereas the proportion of South Dakota residents residing on farms has decreased by three-fold despite continual increases in the statewide population metrics. In 1995, South Dakota's urban population exceeded its rural populations for the first time since statehood (Higgins et al. 2002).

Annually, the glaciated PPR of the U.S. and Canada is estimated to produce 50-80% of North America's waterfowl production, and eastern South Dakota is a major component of this production area. Besides waterfowl, many other migratory bird species nest in South Dakota and/or use the state's upland and wetland habitats during their northward and southward migrations. But, unlike other non-migratory upland game species such as grouse, turkeys, and pheasants, all migratory birds, whether classified as game species or non-game species, are protected via a treaty involving the U.S., Canada, Mexico, Japan, and Russia (Anderson et al. 2018) which has been in place since 1917.

CONCLUSIONS AND RECOMMENDATIONS

One of the most challenging tasks of natural resource conservationists, practitioners, and administrators is the implementation of land and habitat conservation programs and/or practices on privately-owned and managed farm and ranch lands for the benefit of providing habitats for wildlife or to implement practices to avert degradation of soils, water, native grasslands, timberlands, etc. In other words, how can we encourage more landowners and operators to adopt practices that will be beneficial to the natural sustainability of the region?

Historically, implementation of known conservation practices, such as how to establish grasslands or woodlands, or how and where to construct dams in drainages, or to advise what level of grazing pressure and time between herd rotations will produce high quality grasslands were conducted on site mainly by county, agency, or University outreach specialists or conservation practitioners. For example, larger land conservation programs such as the Soil Bank or Conservation Reserve Program (CRP) are contracted with specific guidelines for establishment, seed mixture types, and periodic treatments to control noxious plants, etc.

Historically, "how-to" guidelines were largely successful because most landoperators were residents on the land they owned or were in the process of owning. However, as pointed out in this paper, implementing conservation practices today is much more complicated than it was historically because fewer landowners are residing directly on the land which they farm or ranch, and as a result they have less of a sense of place, community attachment, and obligation to family to manage the land sustainably. All of this becomes even more complicated when

the landowner is an older non-resident landowner who has rented the cropping operations and has transferred the decision-making and responsibility for aesthetics and environmental sustainability to the renter (Ulrich-Schad et al. 2016).

For the future, one step we recommend is that those receiving University education and training in natural resource research and management should also receive instruction in the social, cultural, and demographic processes relevant to land management decision-making (Polasky 2008; Rogers and Vandeman 1993; Petrzelka and Marquart-Pyatt 2011). Knowledge of why landowners and land operators make the decisions that they make regarding residence, operations, and conservation practices would be beneficial to natural resource managers whose job it is to promote conservation practices.

ACKNOWLEDGEMENTS

We offer special thanks to Editor Robert Tatina and the SDAS for the invitation to include this paper in the 2018 SDAS Proceedings. We also thank Krecia Leddy and two other anonymous reviewers for their helpful comments and editorial suggestions relative to this manuscript.

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