Resource characteristics of the Lesser Prairie-chicken (*Tympanuchus pallidicinctus*) and its survival on the High Plains of the United States

Johnny Coomansingh
Minot State University, Minot, North Dakota, USA
johnnycoomansingh@minotstateu.edu

Abstract

There are indications that the Lesser Prairie-chicken (*Tympanuchus pallidicinctus*) has been declining in numbers since the late 1800s. Partially responsible for the dwindling numbers of the bird are factors such as farming, hunting and other anthropogenic activities. To date, efforts to include this bird on the endangered species list have been futile. In an attempt to call for a cessation of habitat destruction that would allow the animal to survive, this research brings in view the resource characteristics of the Lesser Prairie chicken on the High Plains of Colorado, New Mexico, Texas, Oklahoma, and Kansas as a means to spark new interest in the preservation of the bird. Bird watching (tourism), photography, fine art, poetry, song, the possibility of community prairie-chicken days and inclusion of studies of the Lesser Prairie-chicken in elementary, middle, and high school curricula could serve as worthwhile activities that may enhance the survival and preservation of the Lesser Prairie-chicken.

Introduction

Although not regarded by some as having any real significance with respect to resource use and development on the High Plains, the Lesser Prairie-chicken (Figure 1) possesses some unique resource characteristics that are worth highlighting. It will be discussed in light of its capability to facilitate tourism ventures such as bird watching, photography, fine art, and sporting (hunting) activities. As part of the ecosystem of the High Plains, its presence plays an integral part in the biodiversity of the area, which includes to some extent, biological control.

In the first part of the paper, the taxonomy, habits and habitats of the Lesser Prairie- chicken will be examined. This will be followed by a discussion of the main reasons for the long-term decline in the number of the chickens. The resource characteristics (potential benefits, economic and otherwise) will then be examined, as will ways to promote these characteristics in the hope of halting or reversing the decline. In a final section, recent and very promising developments regarding the numbers and habitat of the Lesser Prairie-chicken will be presented.

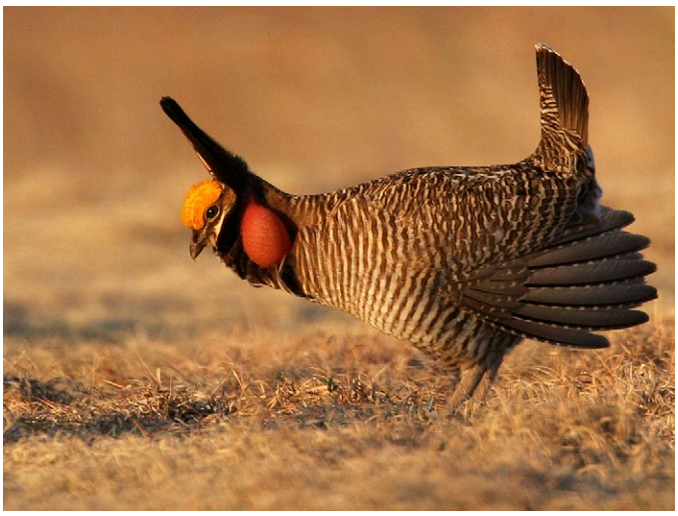

Figure 1: The Lesser Prairie-chicken (*Tympanuchus pallidicinctus*). (Photo courtesy of John Ennis)

Taxonomy and Description of the Lesser Prairie-chicken

The Lesser Prairie-chicken is categorized in the order Galliformes, the family Phasianidae and the subfamily Tetraoninae (Mote et al. 1998). The adult Lesser Prairie-chicken can weigh between 700 to 800 grams and has a length between 38 and 41 cm (Johnsgard 1983; Olawsky 1987). Smaller than the Greater Prairie-chicken (*Tympanuchus cupido*), the coloration of the stocky, chicken-like, Lesser Prairie-chicken (DiscoverTheOutdoors.com. Inc. 2001-2002) could be a lighter brown or a deeper gray compared to the Greater Prairie-chicken (Grange 1940; Hjorth 1970). On the breast, belly, back, and tail feathers there are alternating dark brown and light buff cross barring stripes. The plumage on cocks and hens are similar. The tail of the Lesser Prairie-chicken is short (Short 1967).

During courtship, the cocks flaunt dull red esophageal 'air sacs' and yellow supraorbital eyecombs complemented by pinnae or long tuffs of feathers on the sides of the neck (Copelin 1963; Sutton 1977; Johnsgard 1983). The coloration of these parts of the male distinguishes it from the female. During courtship displays, the pinnae become erect (Mote et al. 1998). It is clear that this gallinaceous bird is quite beautiful and could, with proper promotion, entice birdwatchers, photographers, and artists.

Based on differences in vocalization, habitat use, morphology, and behavior between the Greater and Lesser Prairie-chickens, Jones (1964) reported that there is a distinction between the two. The American Ornithologist's Union (1957) also recognized the Lesser Prairie-chicken as distinct from any other species (Robb and Schroeder 2005, citing Baker 1953 and Sharpe 1968). As a highly social animal, the Lesser Prairie-chicken is characterized by its unique and captivating courtship exhibitions, and 'gobbling' sounds when cocks visit leks or display grounds (DiscoverTheOutdoors.com 2001-2002).

Mating and Reproduction: Lekking

In spring the cocks mark out or set up breeding territories called leks located on hilltops, or slight mounds where the vegetation is minimal, and because they need to be seen by hens, they choose a spot where visibility is excellent (Conway 1995). Cocks also use as leks or mating sites heavily-grazed areas near watering facilities, abandoned oil production sites such as oil pads, unused roads with little traffic, burned areas, herbicide treated areas, and cultivated fields adjacent to grassland (Jamieson et al. 2002; Robb and Schroeder 2005). At these sites, cocks numbering 10-15 at a time will dance, call, and fight at sunrise or at sunset as part of the mating ceremony. The courtship ritual is elaborate. The entire process is called lekking (Taylor and Guthery 1980).

The number of males will fluctuate seasonally or annually depending on habitat type, flock density, and daily weather conditions (Mote et al. 1998). They usually come to the leks 30-60 minutes before sunrise, and may remain for 3-4 hours (Copelin 1963; Sharpe 1968; Crawford and Bolen 1975; Giesen 1998). Hens are usually attracted to the leks, where dominant males fertilize their eggs. Fertilization occurs during the period late March through May (Mote et al. 1998; DiscoverTheOutdoors.com 2001-2002). Eight to 14 cream to buff- colored eggs speckled with fine dots of pale brown or olive (Mote et al. 1998) are laid in nests sited between three-quarters of a mile to two miles from a lek. Hens may lay one egg per day and sometimes skip a day. Incubation of the eggs takes about 22-26 days, and success of hatching is much greater during wetter years. Denser, taller grass is preferred over shorter, sparser grass. Hatching success may be affected negatively by drought and extremely hot weather (DiscoverTheOutdoors.com 2001-2002).

Range

The historic distribution of Lesser Prairie-chickens is difficult to establish because early observers confused them with the Greater Prairie-chicken. However, Mote et al. (1998) identified that their current occupied range is limited to southeast Colorado, southwest Kansas, western Oklahoma, eastern New Mexico, and northern Texas (Figure 2).

Habitat Requirements

The original habitat requirements of the Lesser Prairie-chicken have not been accurately documented but more recent research has shown that habitat requirements may vary depending on the time of year and the activity for a particular period. Lesser Prairie- chickens require basic habitat types, which include breeding, nesting and brood habitats (Mote et al. 1998). According to Jones (1963) the species prefers vegetative cover where there is a mixture of grass and short shrubs which is found primarily on sandy soils.

Suitable for the survival of the species are two general habitat types: (1) a mixture of sand sagebrush (*Artemisia filifolia*) and sand bluestem (*Andropogon hallii*) and (2) Harvard or shinnery oak (*Quercus harvardii Rydb*.) and sand bluestem. These two habitat types are modified by the species to meet their requirements for breeding, nesting and brood rearing. In Kansas, Oklahoma, Colorado and some areas in Texas and New Mexico the sand sagebrush environment is present. However, in Texas, Oklahoma and New Mexico the shinnery oak environment is also present. Sharpe (1968) pointed out that these two vegetation types conform to the distribution of Lesser Prairie-chickens during the 1800s. The sand sagebrush/grassland environment covers areas occupied by the Lesser Prairie-chickens in Colorado. Present in this area are little bluestem (*Andropogon scorparium*), switchgrass (*Panicum virgatum*), sideoats grama (*Bouteloua curtipendula*), and red threeawn (*Aristeda longiseta*) (Taylor and Guthery 1980; Mote et al. 1998; Jamison et al. 2002).

In Kansas the highest densities of Lesser Prairie-chickens can be found south of the Arkansas River in the sand sage prairies. The environment here is quite similar to that of southeastern Colorado (Sexson and Horak 1978). Sand prairies dominated by mid- to short-grasses may also contain a few flocks

Figure 2: Lesser Prairie-chicken distribution in Colorado, Kansas, New Mexico, Oklahoma, and Texas (Modified from K. M. Giesen, Colorado Division of Wildlife, Ft Collins, CO in Jamison et al, 2002).

in southwestern Kansas (Taylor and Guthery 1980). However, Baker (1953), Hoffman (1963), Horak (1985) and Giesen (1991) revealed that in both Colorado and Kansas the species preferred, or was restricted to, areas covered with sand sagebrush, sand dropseed (*Sporobolus crytandrus*), sideoats grama, threeawn and blue grama (*Bouteloua gracilis*). It was noticeable that year round in Kansas, Lesser Prairie-chicken cocks selected sand sagebrush grassland over cropland, tallgrass, Conservation Reserve Program (CRP) grassland (for example, Cimarron National Grassland), and other types of grass habitats (Jamison et al. 2002; Robb and Schroeder 2005). In addition, the optimal habitat for the Lesser Prairie-chicken is a combination or mosaic of various vegetation subtypes which enhances the survival potential of the species in terms of nesting habitat, brood habitat, fall-winter habitat and lek sites (Davis et al. 1979; Applegate and Riley 1998).

Lesser Prairie-chickens in western Oklahoma inhabited three vegetation types. Copelin (1963) states that combinations of shinnery oak, mid- and tall-grasses, sand sagebrush, sand dropseed, sideoats grama, blue grama, buffalo grass (*Buchloe dactyloides*), and hairy grama (*B. hirsuta*) formed the habitats of the species in this area. Lesser Prairie-chickens in New Mexico are most abundant in shinnery oak and sand sagebrush rangelands (Frary 1956). Also found at New Mexican habitat sites are big bluestem (*Andropogon gerardi*), yellow Indiangrass (*Sorghastrum nutans*), prairie sandreed (*Calamovilfa longifolia*), yucca (*Yucca spp.*), mesquite (*Prosopis spp.*) and fragrant sumac (*Rhus aroatica*).

Most of the vegetation species in the habitats mentioned in the other states can be found in Texas. Sand chicksaw plum (*Prunus angustifolia watsoni*) was the only additional species found in Texas mentioned in Taylor and Guthery (1980). According to Crawford and Bolen (1976) Lesser Prairie-chickens seem to thrive much better in habitats with shinnery oak rangeland combined with a 5-37 percent small grain cropland scenario than they do in 100 percent rangeland. It is apparent that habitats with less than 63 percent native rangeland are not suited or are incapable of sustaining populations of Lesser Prairie-chickens (Mote et al. 1998; Woodward et al. 2001).

Food Habits

The food ingested by the Lesser Prairie-chicken varies by season. A combination of insects and native prairie plant seeds constitutes the major sources of forage for spring and summer months. Not only is shinnery oak great protection for the species but also the fruit of this plant makes up approximately 52 percent of the diet of these birds (Bounds 1997). Insects (grasshoppers, beetles and treehoppers), leaves, flowers, young succulent buds, wild buckwheat (*Erigonum annuum*), wheat, western ragweed, blue grama, sixweeks fescue seeds, grain sorghum, corn and other cultivated grains adjacent to native pasture are also eaten (Taylor and Guthery 1980; Mote et al. 1998; Jamison et al. 2002; Robb and Schroeder 2005). Mote et al. (1998) pointed out that the diets of Lesser Prairie-chickens less than 10 weeks of age contained insects, especially short-horned grasshoppers (*Acrididae*), long-horned grasshoppers (*Tettigonidae*), and beetles (*Coleoptera*).

Decline of the Lesser Prairie-chicken

As far as the recorded history of the High Plains show, the Lesser Prairie-chicken is indigenous to the High Plains. Bounds (1997) indicated that the species inhabited the area under review long before Europeans settled North America. In fact, during the Pleistocene era, the species enjoyed a wider range. Bones of the species dating back to this era were found in Oregon (Bounds 1997).

It is, however, apparent that the area occupied by, and the numbers of, Lesser Prairie-chicken have declined dramatically since the latter part of the 1800s. Estimates of these declines vary, but one source claims that the geographic area occupied by Lesser Prairie-chickens encompassed 358,000 km^2 in the 1800s, but declined to 125,000 km^2 by 1969 and only 27,300 km^2 by 1980 (Robb and Schroeder 2005, citing Taylor and Guthery 1980, based on Aldrich 1963 and Taylor and Guthery 1980). Within the occupied area it is estimated that there has been a decline of 97 percent in the number of Lesser Prairie-chicken since the mid- to late-1800s (Mote et al. 1998; Hagen et al. 2004; Robb and Schroeder 2005, citing Giesen 1998). For studies of declines in recent times for the various parts of the area, see Giesen (2000) for Colorado, Boyd and Bidwell (2001) and Horton (2000) for Oklahoma, Bailey and Williams III (2000) and Bailey et al. (2000) for New Mexico, Jensen et al. (2000) for Kansas and Sullivan et al. (2000) for Texas.

The pace of these declines appears to have varied spatially and temporally, however. Arritt (1998, 1), for example, cites Walter Colvin's description of the prevalence of the Lesser Prairie-chicken in the region in the early 1900s (Outing magazine 1914):

> We saw a flock of 500 or more, and when they arose it seemed that a hole had been rent in the Earth. Two miles farther along we came to Ed Ward's. Such a sight I have never seen before nor since. Chickens were flushing everywhere, and droves of fifty to a hundred would take down the corn rows, sounding like a moving avalanche. As we trashed back and forth across the grain field, the chickens arose in flocks of fifty to five hundred. Mr. Ward and I estimated that there were from thirty-five hundred to four thousand chickens in this one field, a sight never to be forgotten.

Bounds (1997) supports the findings of Arritt (1998), that until at least the latter part of the nineteenth century that populations of Lesser Prairie-chickens were quite high. The concentration of the species in these five states was probably attributable to the 'patchwork type of farming' employed during this period, which invariably provided a food source for fall and winter (Jackson and DeArment 1963 cited in Taylor and Guthery 1980, 2; Bounds 1997, 3). In other words, farming was probably not as intense as it was to become and, apparently, there was plenty of habitat space complemented by a cultivated food source that augured well for the growth and development of the Lesser Prairie-chicken.

What then were the factors that caused the decline of Lesser Prairie-chicken populations on the High Plains? Jamison et al. (1999) argue that the long-term population decline in Kansas is possibly attributed to the conversion of sand sage prairie to centre-pivot irrigated crop fields. Such irrigation exploits are made possible by tapping into the Ogallala aquifer, the water of which is being withdrawn ten times faster than its recharge rate (Opie 1992). Conway (1995) suggests that the decline of Lesser Prairie-chicken in Colorado has occurred for much the same reasons. The Kansas population of Lesser Prairie-chickens has experienced an overall 90 percent decline since the late 1800s, and this decline has been primarily due to intensive agricultural practices which led to fragmentation of the breeding habitat and populations. Combined with the effects of farming were the deleterious effects of intensive market hunting of the bird and the prolonged drought of the 1930s (Jensen et al. 2000, 170).

Chadwick (2002, 52) reported that market hunters ushered in the "first wave of assault," and then came the crop farmers who destroyed thousands of acres of Lesser Prairie-chicken habitat. Uncontrolled grazing by livestock also contributed to the decline because Lesser Prairie-chickens experience difficulty in raising their young if grazing of livestock is too intense on the native sand sage prairie. In this case, the birds lose their protective cover of tall grasses and shrubs and may become targets for predators (Conway 1995). In Texas, for example, the Lesser Prairie-chicken million-strong population was reduced to a mere 9000 by 1937, largely because of farm expansion coupled with urban sprawl around Houston. According to Woodward et al. (2001, 271), "Lesser Prairie-chicken populations have high site fidelity and may be dependent upon landscapes with minimal change. Stability of shrublands appears to be particularly important to Lesser Prairie-chickens." In addition, droughts followed by stormy breeding seasons wiped out about 500 birds in one county in Texas. However, some of the greatest threats to the species now come from disease (Schafer 2001), storms, starvation, and collision with fence wire and other anthropogenic installations. Predators including hawks, owls, snakes, and mammalian species such as coyotes, badgers, ground squirrels (Rodd and Schroeder 2005) and skunks also take toll on Lesser Prairie-chickens. "Don't tell these chickens the sky isn't falling. The sky is falling…no false alarm", wrote Chadwick (2002, 52).

The Natural Resources Conservation Service (NRCS) of the United States Department of Agriculture in 1999 also reported that the Lesser Prairie-chicken has experienced a sharp drop in population since the late 1800s. This situation has been exacerbated today by anthropogenic factors such as herbicide use, hydrocarbons and other mineral extraction activities, excessive grazing of livestock on rangelands, the conversion of native rangelands to cropland, fragmented habitat and decreased habitat quality (Sullivan et al. 2000; Breen 2001). According to Smalling (2001), the Lesser Prairie-chicken remains a candidate to be entered in the federal endangered species list. Plummeting numbers of the species in New Mexico during the 1990s raised some concerns, and the bird was recommended for the endangered species list, but it failed to make the list in 1996. Moreover, farmers, ranchers and oil and gas developers expressed concerns about the bird making it on the list. They argue that

state listing of the Lesser Prairie-chicken on the endangered species list could negatively affect their industries (Smalling 2001).

Beyond any shadow of doubt, the Lesser Prairie-chicken is facing an uphill task with respect to its continued survival. Many are the factors both natural and human-induced which prevent the growth and successful development of larger populations of the species. As Schafer (2001,1) posits: "Lesser Prairie-chickens aren't booming, but the birds do continue 'booming' on the High Plains." During the lekking season, cocks court females by enacting colorful displays while simultaneously making gobbling or booming vocalizations. These sounds can sometimes be heard a mile or more away (Bounds 1997; Mote et al. 1998; Bain and Farley 2002). Intensity of this performance heightens when hens are on the lek (Mote et al. 1998). It may very well be that the 'booming' could be the ticket to getting the bird the attention it deserves towards its preservation on the High Plains.

Resource Characteristics: The Inherent Value of the Lesser Prairie-chicken

Tourism is not the panacea or the ever-present solution to solve difficult scenarios such as the dire situation with the Lesser Prairie-chicken. However, tourism activities in areas where the species is still present could greatly enhance not only the economic position of such communities but also stake a claim for the promotion of the Lesser Prairie-chicken and its continued survival. The lekking behavior of the Lesser-Prairie chicken could very well be one of its characteristics for attracting tourists. Dunne (2004, 20) describes the experience: "A seat in a blind by a lek in Canadian, Texas: $75. The booming of a Lesser Prairie-chicken: priceless." In the same vein, Lantz (2007, 44) opines that the Lesser Prairie-chicken "has found an unlikely ally in the rancher…few in this part of the world considered that outsiders might pay to watch birds, rather than hunt them."

Communities in the five southern states that are largely dependent on a single resource for existence, be it corn, wheat, or cattle, may fall prey to the ill effects of international pricing structures, disease, and market pressures exerted by supply and demand. Such communities may also suffer as a consequence of the total obliteration of primary activities when production factors change for the worse such as the probable drying up of the Ogallala aquifer or when mineral mines or gas and oil wells become uneconomical. In the world of business, especially in a market economy, the bottom line is what matters. When a community is dependent on a single resource for its existence Krannich and Lulloff (1991) warned that caution should not be thrown to the wind. Could the humble Lesser Prairie-chicken save the economy of such communities?

What is it that tourists desire to see? What is it about the Lesser Prairie-chicken that is so unique, and intriguing? What type of experience do tourists want to get from viewing the bird? An attempt to answer these questions is addressed in the account given by Johnsgard (2001, 1) about the Lesser Prairie-chickens of the sand sage prairies of Kansas (Garden City to be exact) as follows:

> There was a bright moon in early April, and I approached the display ground, or lek, where I had already set up a small blind, almost an hour before sunrise. The males were already present on the ground, calling in a way that I might not have even recognized as coming from prairie-chickens if I hadn't already heard recordings of their calls. As darkness gradually gave way to dawn, it was evident that nearly 20 males were present, just as I had hoped. They paid almost no attention to the blind, except when camera sounds startled them. Their performance struck me as something resembling a choreographed drama that I had previously witnessed, but that now was being performed in an entirely distinctive manner, and on a very different ecological stage. The bird's movements were surprisingly fast and their aggressive cacklings were unusually high-pitched. The repeated threats made by males at their territorial boundaries were apparently mostly bluffs…I never saw an actual fight.

According to Youth (2000, 12) the tourist searches for the "intensity of fascination," to be held captive by a work of nature behaving in all its glory, to taste the essence of what is natural, and to embrace the feeling of what is wild. This growing fascination with wildlife appears to be a global phenomenon with large economic and ecological implications (Youth 2000, 12). How much value, then, should be tagged to a pair of Lesser Prairie-chickens? Many people would pay much money to see the return of the green Carolina Parakeet, the Passenger Pigeon, the Heath Hen, the Great Auk, or the Labrador Duck, but these species are now extinct because of habitat mismanagement and destruction. Cokinos (2000, i) penned these lines as a reminder:

> There was a time when massive flocks of Passenger Pigeons blotted out the Sun, and bright green Carolina Parakeets were so numerous, that they looked, according to an early American pioneer, "like an atmosphere of gems." But these birds—as well as the Labrador Duck,… the Heath Hen, and the Great Auk—now live only as tantalizing but hazy legends.

In terms of the vulnerability of the species, Youth (2007, 5) adds:

> The abundance of lekking grouse once seemed as unshakable as the plains and sagebrush ranges that stretched across the horizon. Ranchers, farmers, hunters, and birders still enjoy watching the early-morning spring rites of the lekking grouse that typify the wide-open range. But the performances play at fewer venues each year. Today, these birds seem to be riding an imaginary pendulum, one that could swing toward the heath hen and extinction, or toward an endless continuation of the "sex play" upon which these species depend for survival.

Will the Lesser Prairie-chicken suffer the same fate as the extinct birds discussed in Cokinos (2001)? Indeed the Lesser Prairie-chicken is in a very vulnerable state at the moment in light of the destruction of habitat, and the constant encroachment of irrigated agriculture on sand sage rangelands.

There is no doubt that the Lesser Prairie-chicken has some commercial value. In Kansas alone, a total of $629,300 was realized in 1996 from bird-watching activities, which included the Lesser Prairie-chicken; the species was viewed on the Cimarron National Grassland, the Finney Range, and the Pratt Sandhills (Mote et al. 1998). What can communities do to create a particular climate around a particular species such as the Lesser Prairie-chicken? Through the sequence of awareness, interest, evaluation, trial, and adoption, residents in communities could present a united front to offset the destruction of the biome by establishing the species as integral to the survival of the community.

Recommended for the survival of the Lesser Prairie-chicken are Prairie-chicken days or Prairie-chicken festivals, with the inclusion of categorized competitions with respect to Prairie-chicken dances, costuming, art, booming, poetry, song, prose, photography and parades. These may stimulate a community's economy as well as give the clarion call to preserve the species. In view of such type of activities, Youth (2007, 1) gave an example:

> Native Americans…emulated the spring mating rituals of prairie-chickens on the North American plains with their wriggling, shaking, stomping, and feather-flipping prairie-chicken dance. Prairie-chicken dances held an honored place in many powwows, and—like the birds' displays—took place after harsh prairie winters. Mimicking the prairie-chickens, male dancers pranced around inside a circle, their female counterparts watching from outside the ring.

These suggestions may sound far-fetched, but just think about what the "Yellow Brick Road" did for Sedan, a small town in Kansas (Kansas Wildflower Society 2004; Straf 2007). Not surprisingly, there is a now a Yellow Brick Road Festival in Sedan. There certainly could be a Sagebrush Festival with the Lesser Prairie-chicken as the mascot or centrepiece. An event of this nature, the annual High Plains Prairie Chicken Festival, first occurred at Milnesand, New Mexico in 2004 (Robb and Schroeder 2005). Creativity for such activity is a valued talent, and this means that a high degree of purpose and cooperation will be at stake for the creation of a product. The aesthetic value of the species could surface at such events. The Lesser Prairie-chicken is a thing of beauty, something to be photographed and filmed, something that is worth putting on canvas and something worth saving.

Programs of this nature require astute coordination and organization, as well as funding from corporate sponsors and other sources. Marketing the product must involve a well developed strategy. Such programs call for cooperation from all sectors, especially private landowners on whose holdings the Lesser Prairie-chickens can be found. Even though enabling such activity sounds like a great idea, there are social and political repercussions, and ensuing conflict and uncertainty when ideas of this nature are bandied about. Nevertheless, events of this nature bring money into the community via fuel sales, food sales, souvenir purchases, lodging, and other taxes such as trespass fees.

Despite the fact that Lesser Prairie-chicken numbers are dwindling in Kansas and Texas, the hunting of Lesser Prairie-chicken is still legal. According to Pearce (2010), the only state with a season for hunting Lesser Prairie-chickens is Kansas. In Kansas, the revenues from hunting the Lesser Prairie-chicken amount to close to $200,000 annually. In 1996 and 1997, the hunting season for Lesser Prairie-chicken in New Mexico was suspended (Arritt 1998). It is accepted that one of the resource characteristics of the Lesser Prairie-chicken is sport in the form of hunting (Arritt 1998; Mote et al. 1998). However, it must be understood that in light of all the forces which stand in opposition to the survival of the species, there should be a moratorium on hunting in all five states for at least five years. This author is not averse to the hunting of the Lesser Prairie-chicken, but allowing a little window of time for the animal to regain a better population status is advisable.

The soil that sustains agricultural production in the present was produced by the interactions of fauna and flora working in tandem with the physical environment in the past. It is more than a measure of arrogance to ignore the Lesser Prairie-chicken as integral to the smooth harmony in the biological workings of the High Plains. The presence of the Lesser Prairie-chicken is an indicator of the health of the ecosystem because it facilitates biological control of other species of animals such as grasshoppers, beetles and treehoppers (Taylor and Guthery 1980; Mote et al. 1998). Although the literature does not provide any evidence of the daily quantities of insects in terms of weight that are eaten by Lesser Prairie-chickens, Mote et al. (1998, 10) described the general biological role of Lesser Prairie-chickens as they relate to the High Plains as follows:

> The prairie has value that exceeds the sum of the values of its individual species. By living, eating, excreting, moving about and dying, Lesser Prairie-chickens contribute to their prairie ecosystem through seed dispersal, recycling, transport and concentrations of nutrients and providing a food source to predators and scavengers. If the prairie ecosystem has value, its value must be diminished whenever ecosystem components are lost through extirpation or extinction. To paraphrase Aldo Leopold (1949): "The first rule of intelligent tinkering with productive ecosystems is to save all the parts."

Recent Developments and Concluding Remarks

The great philosopher Jean Jacques Rousseau once said that if we reverse the usual practice we might almost always do right. However, unless there is some real reason, be it political, social, economical, or otherwise, to abandon the resource development processes and irrigated fields of the High Plains, there will not be any reversal in the decimation of the Lesser Prairie-chicken. In the psyche of many Americans, development means removal of native grassland for replacement by cropland, road building, irrigation, electrification, telephonication, and resource mining. Structures are erected adjacent to Lesser Prairie-chicken

habitats, which serve as perches for predators such as hawks and owls (Bounds 1997). Grazing cattle also damage nesting sites and leks (Taylor and Guthery 1980). In Power Engineering (2008, 112) it was recorded that in Oklahoma, Lesser Prairie-chickens would keep their distance from wind turbines and will not breed amongst the installations. The article further states: "Maps of wind power potential overlap almost exactly with the Lesser Prairie-chickens' Oklahoma habitat. Eighty-seven of the 96 known Lesser Prairie-chicken breeding circles in the state are within five miles of 'excellent' wind farm territory."

Coupled with all the factors that work against these birds, seasonal hunting continues to reduce numbers. Can anything be done to stem the tide of the slaughter of the birds and the destruction of their habitat? We must remember that without substantial numbers of the birds, the tourism effort will go for naught in rural communities. It is quite possible that at the rate of decline of the Lesser Prairie-chicken the sensitive balance of the High Plains ecosystem could be well out of alignment. Only time will tell.

However, all is not lost. There is some good news. In recent times, certain steps were considered to avert the disaster of the bird's extinction. Arritt (1998, 3) states: "Overwhelming scientific evidence suggests that the Lesser Prairie-chicken is biologically threatened in a significant portion of its historic range." In view of this, Marie E. Morrissey, a biologist based in Boulder and Denver, Colorado, petitioned the U. S. Fish and Wildlife Service (USFWS) to list the bird under the endangered species act (ESA). Morrissey, cited in Arritt (1998, 3) opines: "The bird must receive statutory protection before this unique species becomes extirpated from its entire range and we lose the opportunity to recover [it] in the wild." Morissey's valiant effort to save the species from extinction led to some positive steps. A salient aspect in this regard was that in 1996 the Lesser Prairie Chicken Interstate Working Group (LPCIWG) was inaugurated. This new group operates in a state partnership program with the states of Colorado, Kansas, New Mexico, Oklahoma, and Texas to enhance the welfare of the species. Decisions regarding the bird are done in conjunction with the United States Forest and Wildlife Service (USFWS), the Forest Service, the Bureau of Land Management (BLM), businesses and individuals from the private sector. The goal of the group according to Arritt (1998, 4) "is to develop a regional conservation plan that will ultimately reverse the decline of the Lesser Prairie-chicken before it is too late."

In light of this, property owners in Oklahoma and Kansas are cooperating to increase the number of Lesser Prairie-chickens (Grass & Grain 2003) in the area. A grant in the sum of US$100,000 to the Comanche Pool Prairie Resource Foundation (CPPRF) has been recently approved by the USFWS to assist with prairie chicken habitat restoration. Around 7,000 property owners in southern Kansas and Northern Oklahoma comprise the CPPRF. Property owners have the opportunity to apply for funds from the CPPRF to help with habitat restoration, part of which is the removal and destruction of red cedar trees in pastures. Removal of cedar trees on grazing land will greatly enhance Lesser Prairie-chicken habitat (The Associated Press 2001; Grass & Grain 2003).

Concomitant with all the ideas projected to keep the decline of Lesser Prairie-chickens at bay, a serious program concerning all aspects of the species and its management in terms of sustainability should be immediately woven into the curricula of schools, at least in the five states where Lesser Prairie-chickens are found. Elementary, middle, and high schools should embark on a strategy in their environmental science modules to educate students about the ecology of this animal through the USFWS, agricultural extension services, hunting associations, the Audubon Wildlife Society, and birding societies.

A statement uttered by Chief Seattle will convey my true feelings about this wonderful creature: "What is man without the beasts? If all the beasts were gone, men would die from great loneliness of spirit, for whatever happens to the beasts also happens to man. All things are connected. Whatever befalls the earth befalls the children of the earth" (Nerburn and Mengelkoch 1991, 2).

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