

## Fire in the Range of Attwater's Prairie Chicken

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ATTWATER'S Prairie Chicken (*Tympanuchus cupido attwateri*-Bendire), near relative of the Heath Hen of New England, is indigenous to coastal prairies of Texas and southwestern Louisiana. In early times, chickens were common from Opelousas and Bayou Teche in southwestern Louisiana, south and west to near the mouth of the Nueces river in Texas (Lehmann 1941:1-4). Somewhat questionable records (Merrill 1878:118-173; Viele 1858:137; Spaight 1882:89) suggest distribution almost to the Rio Grande. Prairie chickens could not have lived south of the Nueces continuously, however, because of periodically severe drought (Lehmann and Mauermann 1963:718).

Highest and most continuous populations almost certainly were confined largely to the 30"-50" rainfall belt. That was territory from about Galveston Bay on the north to Corpus Christi Bay on the south and extending inland an average distance of about fifty miles (Fig. 3).

The total number of chickens in early times is unknown. Without benefit of historical records since uncovered, but with close first-hand knowledge of existing densities and cover types, peak early populations as high as a million birds have been estimated (Lehmann 1956:27). Since fire, grazing, drought, etc., evidently prevented optimum habitat and hence maximum densities throughout the whole range at any given time, however, my present thought is that early population

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highs of 300,000 to 500,000 Attwater's Prairie Chickens are more likely.

Attwater's Prairie Chicken was last reported from Louisiana in 1919 and the Texas population was reduced to about 8,700 by 1937. There was further decline to about 3,560 birds in 1956 and 1,335 in 1963. Population loss from 1937 to 1963, therefore, was about 7,365 or about 85% (Lehmann and Mauermann 1963:713).

Some of the principal factors influencing prairie chicken numbers; i.e., farming, oil development, overgrazing, and human population increase, have received more than casual attention in previous papers. With chickens now hovering precariously on the brink of extinction, it seems prudent to reexamine every possible influence. The purpose of this paper is to suggest additional consideration of prairie fire.

As background for a discussion of fire, it appears important to point out that the Gulf coastal prairie of early times was not the prairie of popular concept; i.e., one vast largely treeless expanse of uniformly tall grass. Over the bulk of the territory, bluestem (*Andropogon*), speargrass (*Stipa*), and associated tall grasses such as crinkle-awn (*Trachypogon*), tanglehead (*Heteropogon*), resin grass (*Elyonurus*), prairie dropseed (*Paspalum*), and smutgrass (*Sporobolus*) struggled for dominance (Tharp 1926:69-80; Weaver and Clements 1929:463-464). At maturity, their average height is from about 2½ to 4 feet. But mature tall grass seldom, if ever, blanketed the whole prairie complex at any given time.

En route from Fort St. Lewis in present day Jackson County across the heart of the Coastal Plain to the Trinity River in 1687, for example, Joutel encountered prairie with "little grass," some "belles" or beautiful prairies, and some cover (presumably switch cane) so tall it interfered with the progress of horses. In other territory, the vegetation was preponderantly weeds (Joutel *in* Stiles 1906:73-164). Wide variations in the composition, height and density of prairie vegetation are verified by many others (Edward 1836:66-67; Hall 1836:74-75; Bonnell 1840:48; Kennedy 1841:172; Bartlett 1854:15-23 and 525-526; Ziegler 1938:199; Tharp 1926:70). Because herbaceous cover did vary so widely, it was trees—not grass—which gave prairies of the Gulf Coast a fixed and distinctive character.

As Kennedy pointed out in 1841, the word "prairie" was borrowed from French settlers in the Mississippi Valley who used it to identify

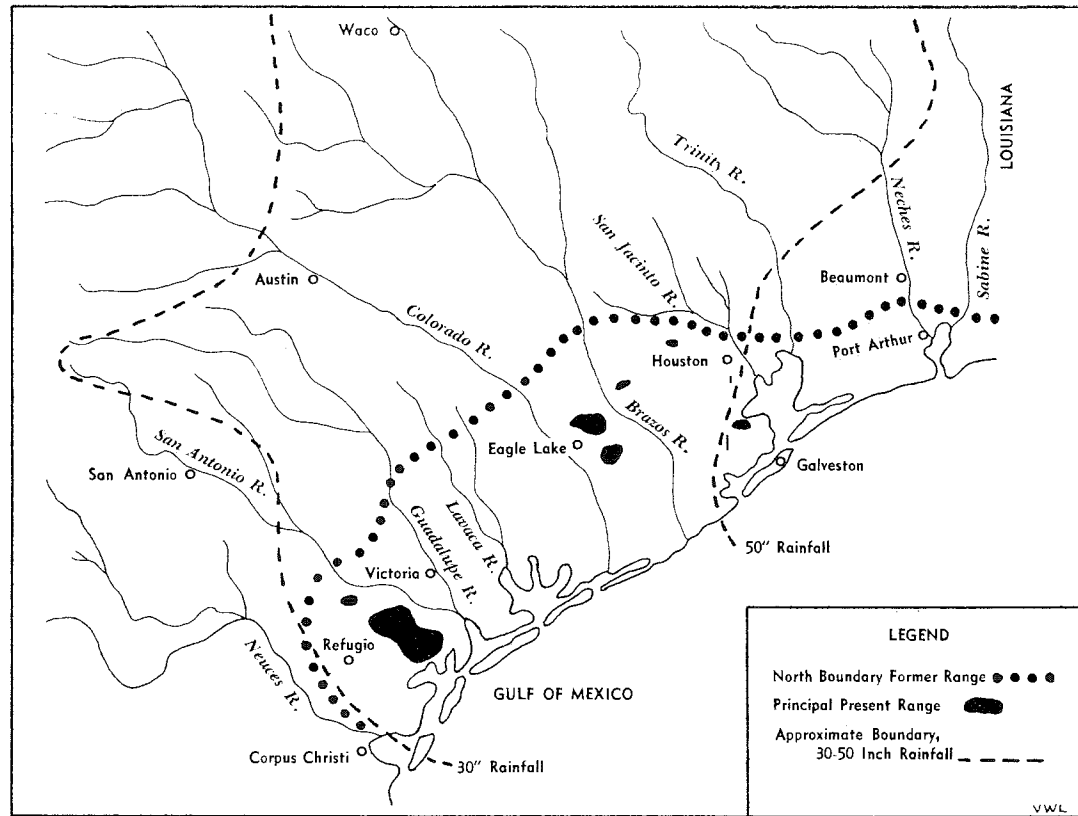


FIG. 3. Distribution of Attwater's Prairie Chicken in Texas.

“meadows rimmed by woodland.” Texas meadows or prairies, wrote Kennedy, (he was personally most familiar with Gulf Coastal Prairies) varied in size from one hundred to many thousands of acres. Citing Hall (1836), he wrote that their most characteristic and expressive feature was the surrounding fringes of timber (Kennedy 1841:104).

Drawing from Hall’s memorable “Statistics of the West,” Kennedy pointed out that woodland bordering the prairies resembled the shores of a lake. Indented with deep vistas, like bays and inlets, the timber threw out long points, like capes and headlands. Occasionally these points of timber approached so close on either hand, that the traveler passed through a narrow avenue, or strait. Where the plain was large, the forest outline was still to be seen in far perspective, like the dim shore when beheld at a distance from the ocean (Kennedy 1841:104-105). Mary Austin Holley—first historian of Texas—also reported that, “the peculiar beauty of a Texas landscape” was provided by “the alternate woodland and prairie.” This was in 1831 (Hatcher 1933:112).

Nine rivers (Sabine, Neches, Trinity, San Jacinto, Brazos, Colorado, Lavaca, Guadalupe, San Antonio) and many smaller streams bisect the upper coast of Texas; margins and often extensive “bottoms” were timbered in early times (West 1905:211; Kress 1931:54-61; Fisher 1841:11-26; Ikin 1841:19-20; Hallenbeck 1940:120-136; Bonnell 1840:19-102; Lindheimer 1879; Stiles 1906:117-138). Upland woodlands—pines and oaks east of the Brazos and oaks to the south—rimmed the outside of the Gulf crescent almost continuously; timber reached close to the coast in such places as Orange, Jefferson, Harris, Wharton, Colorado, Lavaca, Jackson, Goliad, and Aransas Counties (Bartlett 1854:22, 24-30; Ehrenberg 1935:18, 21, 170, 207-219; West 1905:209-210; Bolton 1925:406-422; Buckley 1911:38-40, 48, 54; Kress 1931:45-61; Reid 1858:39-42). And, there were clumps or “mottes” of trees in the prairie interiors (McConnell 1889:34-35; Stiles 1906:103-104; Ziegler 1938:115; Ikin 1841:19-20; Bonnell 1840:16, 90, 162).

In a real sense, therefore, there is not now and never was a Gulf Coastal Prairie as such. Rather, the Gulf Coastal Prairie of Texas, home of Attwater’s Prairie Chicken, was and is an assemblage of prairies. Timber has been present for 437 years of written record.

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Climate and soils evidently are about as suitable for timber as for grass. It follows that some factor or factors have operated to suppress timber and provide open areas for Attwater's Prairie Chicken. Perhaps the most important of these factors was fire.

Pineda discovered and mapped the Texas coast with remarkable accuracy in 1519 and several other marine expeditions formed shortly thereafter (Bannon 1964:98-99). However, useful records of coastal prairies, and of fire, began with Alvar Nunez Cabeza de Vaca, shipwrecked on Galveston Island in 1528 (West 1905:199).

Cabeza de Vaca lived among the Indians and largely within the range of Attwater's Prairie Chicken for about eight years. He reports the use of prairie fire, by Indians, in game management and for insect control. The natives, reported de Vaca, practiced firing the plains, to destroy mosquitoes and to compel deer and other animals to go for food where the Indians wished them to go (Hallenbeck 1940:66-67). Fire was also used to encircle game and stampede it within range of hunters (Newcomb 1961:40) and for other hunting purposes (Dodge 1877:29; Ehrenberg 1935:31-32; Lewis and Clark, Father de Smet, Pallister and others *in* Roe 1951:633-635). Indians also fired the grass in warfare (Roe 1951:850; Jenkins 1958:18; Sowell 1900:143 & 218) and, in a later period, to discourage settlers from invading tribal hunting grounds (Inman 1899:103-104; McCracken 1957:101).

La Salle was the commander of a French effort to establish an outpost, Fort St. Lewis, near Matagorda Bay (on Garcitas Creek in present-day Jackson county) and, soon after landing, his base camp was endangered by a prairie fire. Writing in February, 1685, Henri Joutel, remarkably exacting chronicler of the expedition, provided the following description:

. . . we perceiv'd a Fire in the Country, which spread it self and burnt the dry Weeds, still drawing toward us; whereupon *Monsr. de la Sale* made all the Weeds and Herbs that were about us, be pull'd up, and particularly all about the Place where the Powder was. Being desirous to know the Occasion of that Fire, he took about twenty of us along with him, and we march'd that Way, and even beyond the Fire, without seeing any Body. We perceiv'd that it run towards W.S.W. and judg'd it had begun about our first Camp, and at the Village next [near] the Fire. (Stiles 1906:84).

Joutel was a member of the small party of 17 that began the overland trek to the Mississippi beginning January 12 in the "wet" winter of 1687. Proceeding northeastward from Fort St. Lewis they crossed many disjunct coastal prairies before entering the woodlands of east Texas where La Salle was murdered by one of his own men. The grass of "several spacious Plains," reported Joutel, "was burnt." Prairie chickens or partridges were among the "wild fowl" numerous in many places (Stiles 1906:116-128).

The French fort on Garcitas Creek rekindled Spanish interest in coastal Texas. Alonzo de Leon in 1689 reached Fort St. Lewis and found that the French had departed or had been killed by Indians (Heusinger 1936:27-32). In part to discourage further excursions, mission outposts ultimately were established near Victoria (1714), Goliad (1718), Refugio (1790-91), and at a few other places (Thrall 1879:88-89). Spanish influence, however, was largely south, west, and north of the coastal prairie chicken range. The original pattern of periodic fire initiated by nature and the Indians persisted through the Spanish period and even after Mexico won independence from Spain in 1821 (Conkling 1883:51).

Mexico encouraged immigration under the colonization laws of 1823, 1824 and 1825. Some settlers from the United States arrived earlier, but the first colony from the United States to locate in the heart of the chicken range was officially established at San Felipe on the Brazos river in July, 1824. Settlers who cultivated the soil were granted one labor of land (177.7 acres) while those engaged primarily in stock raising received one sitio (4,488 acres) (Thrall 1879:152-158). Since land was an important incentive for coming to Texas in the first place, stock raising was the primary avowed if not the real occupation of Austin's colonists, and many which followed. And, for stock raising, prairie fire was considered important.

As is often the case in humid areas, tall grasses of the coastal prairies of Texas decrease in palatability and food value with maturity. The first frost of winter accelerates deterioration. Early settlers were quick to recognize that their livestock preferred "new" grass to old (Olmsted 1857:135). To clear away the old grass, they burned the prairies on a regular basis.

Parker (1836:175-176) wrote that prairies near the coast were

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. . . all burnt over twice a year—in mid-summer and about the first of winter. Immediately after the burning, the grass springs up again; so that there is an abundant supply all the year round.

Arthur Ikin (1841:53, 37) reported:

The long dry grass of the prairies is twice a year (summer and winter) set on fire; after which, the first rains which fall renew the face of the earth with the richest verdure.

The annual burning of the dry grass of the prairies must also free large tracts at once from . . . reptiles.

In 1842, William Bollaert, an English scientist, reported:

The prairies [of coastal Texas] are generally set afire to burn weeds and old pasturage, so as to make room for the new grass. Many distressing tales are told of travellers and cattle being burnt by the prairie fires (but it scotches an occasional snake or so) (Hollon and Butler 1956:75).

Olmsted observed that burning hastened spring growth. En route from Seguin to Gonzales in 1857, he wrote:

February is a spring month in Texas, and, in spite of the cold, we had already found one or two feeble flowers near our camps. To-day, the genial sun warmed the fresh moistened soil, and three or four more species opened into bloom. After this hardly a day passed without some addition . . . the whole prairie became radiant and delicious. A few days sufficed now, in fact, to change the whole face of nature . . . the elm-buds were green and bursting, and the wild plum was in fragrant blossom; the dreary, burnt prairies, from repulsive black, changed at once to a vivid green, like that of young wheat. The herds all left the dry sedge, and flocked to the new pastures. The unburnt districts, covered with the thick mat of last year's growth, were a month behind. (Olmsted 1857:233).

Whether fired for livestock or for other reasons, prairie fires burned widely with early settlement. Thomas Drummond, an early naturalist, described the country from Galveston Bay to Harrisburg in 1834 as:

. . . the worst country for insects that I ever saw; the custom of burning the prairies probably accounts for it. (Geiser 1937:84).

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Writing from San Felipe on September 26, 1834, Drummond said:

I am sorry to say that I have found no insects, as they are very scarce in these and all prairie countries, owing to the frequent burning [over] of these lands. The whole country from the Rio Colorado to the Guadaloup [sic], a distance of eighty or ninety miles, is as destitute of verdure as the streets of Glasgow, except for some small patches along the creeks. (Geiser 1937:85).

Herman Ehrenberg, son of a Royal official in Prussia, was among the first foreign volunteers who left New Orleans to join the Texas Army in October, 1835. His vivid description of a night fire between Bastrop and San Antonio bears repetition.

The hour was late. A profound stillness lay over the prairie, which night had shrouded in darkness. A dusky reddish light which shone dimly somewhere in the distance had attracted our attention; we wondered where the glow came from and tried vainly to account for it. Our horses seemed to scent danger. Instead of scattering about the camp, they huddled near the dying embers of the [camp] fire and kept close to us as if they were afraid.

Suddenly, piercing the unbroken silence of the night, a clear sound like a dog's bark rang out, striking at times so hideous a note that it sent cold shivers down our spines. A second and somewhat deeper voice broke in. After a few moments a third, then a fourth, a hollow bass, was heard. Several minutes later thousands of them mingled in a deafening chorus. The performers of this frightful serenade were the coyotes. Soon the wolves took their turn and swelled with their deep howls the shrill dog-like clamour of the coyotes. This unexpected din roused us from our slumbers . . . we waited under our rugs until restored quiet gave us another chance of having a nap before daybreak.

The dark masses of clouds which had by degrees spread over the entire half of the horizon were lit up by a crimson glare not unlike an aurora borealis, and the sky was tinged with deep vermillion hues. The returning sentries roused us, and, like the novices we were in prairie traveling, we gazed with gaping mouths at these bright lighting effects.

'The prairie must be burning; it means that the Indians are near,' cried someone finally. 'They have been hunting today, and I guess that many a poor deer, to escape the fire, will run into the muzzles of these scoundrels' guns.'

Suddenly, fiercely burning flames, like an army, like a torrent,



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rushed past a hill at some distance from the camp, then leapt forward in our direction, vying in speed with the wind. We sprang up, ran after our horses, already frightened by the fire, and drove them into the island of trees, which in these desolate wastes are an oasis of coolness, verdure, and damp earth.

In apprehensive wonder, we saw that boundless sea of fire sweep over the prairie. The flames leapt closer and closer; dark clouds rose up and rolled slowly over the burning grass; then, abruptly, the whole incandescent horizon, as far as the eye could reach, flickered out; solitary sparks spluttered wildly aloft, but only for a few brief moments; soon everything was over; all that remained were the odor and thick columns of smoke mounting into the air.

We had no new excitement during the remainder of the night, and slept undisturbed until four o'clock. At this hour the first gleams of dawn lit up the sky . . . Blue mists which lay over the prairie slowly melted away until the sun, bursting at last through the thin vaporish haze, cast around us its blinding, fiery glare. But how different was the view on this morning from what it had been the day before! A grim, desolate sight met our eyes now. An immense black shroud spread from the ground under our feet to the vague, distant skyline, where earth and heaven seemed to merge. Leaves, shrubs, grass—everything had gone; nothing remained but an appalling blackness.

Meanwhile, our march through the burnt prairie proved rather unpleasant. The wind drove dark eddies of dust and ashes against us, filling our eyes, mouths, and noses, so that we could scarcely breathe or see. Toward four o'clock our small detachment came to the steep and rocky banks of the Cibola river. (Ehrenberg 1935:29-35).

Ehrenberg was among the fortunate few surviving the Goliad massacre on Palm Sunday, 1836. Proceeding to the east, night overtook him on

. . . a bare plateau, the grass on which had recently been burnt. On the fifth day the sun rose clear and bright in the deep blue sky and dropped its warm rays over a lively and ever-changing landscape . . . Prairies and islands of dark foliage surrounded me; numerous herds of cattle, horses, and red deer gazed at me as I walked past them; flocks of wild turkey drew by me eyeing my lonely figure with distrust, while prairie hens filled the air around me with their monotonous greetings. (Ehrenberg 1935:215-216).

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William Bollaert was aboard ship anchored between the San Bernard River and Cedar Creek (a few miles down the coast from present Freeport) when introduced to prairie fire on May 4, 1842.

As night came on [I] saw a very large patch of prairie on fire, which as the night was dark, looked strange indeed. Its occasional vivid streaks of light, when the wind fanned the burning grass, then the huge black vapors rising and rolling about it; it did not require a very considerable stretch of the imagination to picture some large city on fire; then the wind would alter the appearance, and being low land, the fire appeared to issue as if out of ocean depths, as if it were the extended crater of a volcano. (Hollon and Butler 1956:74-75).

In 1849, the German scientist, Dr. Ferdinand Roemer, found the grass burned nearly all the way from San Felipe on the Brazos River, to Columbus on the Colorado, a distance of approximately 23 miles.

The monotonous black ground extended as far as the eye could see. A few deer which were cropping the tender green blades of grass appearing here and there among the burned stubble were the only living things we saw. At another place several prairie chickens (*Tetrao Cupido L*) fluttered out of a strip of long yellow grass which had not been burned, owing to the moist soil found there. (Mueller 1935:79).

Frederick Law Olmsted (1857:98) entered the southern prairies after crossing the Brazos River near present-day Navasota. His introduction to the grasslands was an introduction to fire. He wrote:

The prairie opened fair in the course before us, and our trail led directly across it. The waving surface soon became regular, like the swell of the ocean after the subsidence of a gale which has been blown long from the same direction . . . on the left we saw . . . the far away skirt of the dark wood; on the right, only the remote line of the prairie swelling against the horizon. Here were red and black clouds of distant fire.

As is evident from the records of Gregg (1844:193, 306), Greer (1935:9), Constant in Krueger (1956:3), McConnell (1889:46), Roe (1851:633-635), Marcy (1866:191), Roemer in Mueller (1935:204, 231), and Loomis (1959:33-34, 42, 54), accidental fire from camping was a by-product of early settlement. Also there were vandals in

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early times. Mary Austin Holley provides a vivid description of a fire evidently set for amusement in December, 1837:

A dozen of us rode to the mouth of the Brazos to pass the day & get fish & oysters. One of the party, with Lucifer, set fire to the prairie & produced the finest scene I ever witnessed or imagined. There was some wind, & with us. The fire spread at such a rate we had to whip up our horses, & the last of the party [had] to ride through the line of fire. We left it far behind & could see it burning briskly all day. Returning as the sun was setting brilliantly behind us—the roaring sea at our right—nothing but a sheet of fire before—The company paired off galloping in diverging lines, from Mr. Somerville & myself in the rear. The curlews were singing—the cranes screaming—the deer & cattle scampering. Never was anything so beautiful. Think of a prairie large as a sea with all these objects spread out wide—grass, without a track under our feet. We approached the line of flame extending to the right & left 8 or 10 miles—We approached & saw our whole company pass within. Though it seems a line, there are frequent spaces of many yards where you can pass—the heat of grass is not great. In this pass the smoke & flame curled up high like an arch. I said to my companion that looks like the door of a nameless place—'yess,' he said, '& if we don't make haste we shall not enter.' True, it was closed before we reached it, our company on the other side, & we had to seek another. When we were within, the ground being all burnt over, it was as black as Erebus. There was another line of fire far ahead & to the right & left—a complete picture of the fanatic's Hell, except there were no yawning monsters, except those of the imagination. I felt no terrors but those of being lost, for the darkness was made visible by the distant, lurid lights—like burning cities. The scene was strange & grand. As the idea was creeping over me of being kept out all night (as often happens on these prairies, from the sameness of the scenery at night) a welcome halloo from those ahead reassured my spirits. As we passed the outer confines of this Hades (reaching the space the fire had been all day running over at the speed of a race horse) the moon rose in splendor—& the stars around her glistened. Never did I experience so much of the true sublime. (Hatcher 1933:74–76).

In a real sense, therefore, the upper coastal prairies were the tinderbox of Texas: the region where fire, purposeful and otherwise, burned most often, and for the longest time. True enough, history provides records of prairie fires about everywhere else in Texas;

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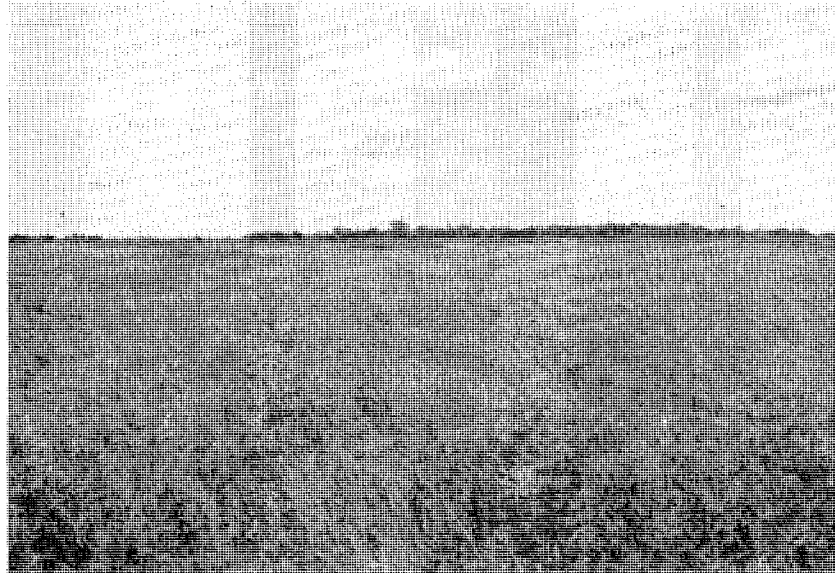


FIG. 4. Scene on Duncan Bernard River pasture. Probably the best chicken pasture (highest population) in the State. Photo by V. W. Lehmann, August 26, 1936.

i.e., East Texas (Stiles 1906:138), Central Texas (Jenkins 1958:18; Greer 1935:9), the Rio Grande Plains (Bartlett 1858:II, 524-525; Bollaert in Hollon and Butler 1956:369-374), Texas Hill Country (Roemer in Mueller 1935:222, 239), Low Plains (McConnell 1889:32-33; Marcy 1886:197), High Plains (Wellman 1939:290-291; Rush 1936:250-251), and even in the arid Trans-Pecos (Bartlett 1854:I, 38; Froebel *in* Olmsted 1857:447). Nowhere else in Texas, perhaps nowhere else in the whole Plains Region, however, were such large stores of combustible material produced over a comparable area so continuously. And, because of Nature's unique protective system of fire guards, and feed reservoirs in low spots and stream "bottoms," nowhere else could stockmen burn with less danger of being without feed until the next growing season. So burn the prairies they did—from the time of Austin's Colonists, through trail-driving days (when the coastal prairies probably provided more cattle for northern markets than did any comparable area), and even to and beyond our first prairie chicken survey in 1937. Even in this stronghold where man had lived so well with fire for more than four centuries, however, fire was finally extinguished in the late 1940's. An anti-fire ex-



FIG. 5. Attwater's Prairie Chicken is what its name specifies: a bird of the prairie. Photo courtesy R. G. Mauermann, Texas Parks and Wildlife Department.

tension program of the United States Soil Conservation Service plus government subsidies for pasture mowing were greatly responsible.

Although my own research has long centered on other problems, I strongly suspect that the over-all effect of fire exclusion has been the opposite of good for Attwater's Prairie Chicken. Fire caused little direct mortality of adults. While wild animals, livestock, and even people have been killed or maimed by prairie fires (Wellman 1939: 291-292; Kendall *in* Gregg 1844: 306-307; Roe 1851: 633-635; Inman 1899: 107-110), I have seen adult Attwater's Prairie Chickens flying to safety ahead of fires on many occasions. The prairie fires I saw admittedly were not burning pristine prairie. Catlin (1866:II, 16) witnessed an early prairie fire near Fort Leavenworth, Kansas, however, and reported that chickens escaped without difficulty.

That fires during the laying and hatching seasons can be destructive goes without saying. In past years, however, purposeful burning largely preceded nesting (March-May). In contrast, the machines of weed and brush control operate throughout the breeding season. Losses of nests, chicks, and even adults, are widely reported.

Concern with fire as it relates to chickens should not begin and end with direct mortality, however, or even with temporary displacement such as sometimes occurs when fire leaves too little cover

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for immediate needs. Attwater's Prairie Chicken is what its name specifies: a bird of the prairie. While it is quite true that chickens periodically utilize cultivated fields, fallow fields, brushland and even forested river bottoms, prairie is the only habitat type which is or can be made highly satisfactory for nesting and for all other life requirements. And, in the absence of purposeful fire, much coastal prairie is changing to brushland at what appears to be an accelerated pace.

Our principal census method of the late 1930's, it will be remembered, involved a rope or steel cable pulled between two automobiles driving parallel and 50 to 100 yards apart. Census by the rope method would no longer be possible on most former census areas in northern Aransas and southwestern Refugio counties; mesquite and associated semi-desert shrubs are now too tall and dense.

Brush has also changed spectacularly in northern Victoria and southern DeWitt counties. In 1937, there was live oak brush too tall and dense to be negotiated by automobile, but most of it was confined to draws and creeks. Live oak on frequently-burned upland was mostly short and open. This territory has since had more than usual attention with brush shredders and chemicals. Live oak, however, has spread laterally, and increased in height and density. All former study areas would now be impractical to census by automobile. Thickets in some could hardly be negotiated on horseback!

Fire exclusion probably is not solely responsible for increased brush in recent years. Fire exclusion, however, may be an important contributing factor. When fires were reduced in the East and North, for example, prairies changed to brushland in a few years (Conley, Watson, Smith, Trumbull, Owens and others *in* Hall 1836:29-35). Brush also followed close on the heels of fire reduction in parts of Texas (Smith 1899:13-16; Bray 1901:118-122, 211-217, 272; Bray *in* Humphrey 1963:53-54; Cook 1908:1-3), and in many other places (Phillips 1962: 85-88; Shantz 1947:13-44). With fire continued long after settlement, however, the coastal prairies of Texas remained relatively open for centuries. This was hardly accidental.

Removing fire, a force which had been a part of the environment for hundreds and perhaps thousands of years, may not only have affected brush-grass relationships, but also the nitrogen cycle, general soil fertility, soil microorganisms, invertebrates, insects, reptiles, ro-

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dents, game birds, non-game birds, fur animals, and even livestock carrying capacity. The nature and degree of change resulting from fire exclusion is presently unmeasured. Furthermore, research to measure the effects of fire exclusion is not in early prospect.

In this time of vast scientific achievement in space, it is ironic that so much remains to be learned about the land. While human knowledge is increasing very fast and may be approximately doubling each decade (Oppenheimer *in* Morgan 1958:38), it not only appears important, but urgent, for land operators and the public to realize that such is by no means the case in range science or, more particularly, in the application of science to range practice. Wildlife presently suffers from this condition, man may well suffer in time.

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