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THE EXTIRPATION AND RE-ESTABLISHMENT OF COYOTES
IN THE EDWARDS PLATEAU OF TEXAS

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Abstract: In the early 1900's organized predator control was initiated to remove coyotes and wolves from the sheep and goat producing areas of Texas. Operations were begun in the Edwards Plateau, the largest area of sheep concentration. By the 1920's, many of the inner Edwards Plateau counties were considered to be practically free of coyotes (*Canis latrans*) and wolves (*Canis lupus*, *Canis rufus*). The 1950's found coyotes and wolves extirpated from most of the Edwards Plateau. After a coyote population irruption in the late 1950's, coyotes began to re-establish themselves on the periphery of the Plateau. This encroachment process continued throughout the next 2 decades and continues to progress in the 1980's.

Introduction

The Edwards Plateau and, to a lesser extent, other adjoining ecological areas presently account for 1996 of the sheep and 90% of the goats in the United States. The Plateau area was virtually free of coyotes for several decades until their encroachment began in the 1960's. The re-establishment of predators has been described to some extent by Caroline (1973), Shelton and Klindt (1974) and Hawthorne (1980). What is now known as the cooperative Texas Animal Damage Control Program has been involved in providing predatory animal control services for the last 70 years. It played an integral part in the extirpation of the coyotes from the Edwards Plateau and is now faced with the challenge of attempting to control the re-establishment of the coyote in the sheep and goat production areas.

The purpose of this paper is to further document and describe the extirpation and reestablishment of coyotes in the Edwards Plateau of Texas. The adverse impact that this reestablishment is presently having on the sheep and goat industry and the factors responsible for the coyote encroachment will not be dealt with at this time.

In order to adequately portray the serial events of the history of the coyote in the Edwards Plateau and adjoining ecological areas, it is necessary to review some of the history of the sheep and goat industry, the predator situation prior to and after organized control, and the present status of the coyote within and adjoining the present major sheep and goat production areas of the state.

Edwards Plateau

The Edwards Plateau (Fig. 1), comprising all or portions of 37 counties and embracing some 22,000,000 acres, is the chief area of sheep and goat production in present day Texas (Gould et al. n.d.). The Edwards Plateau, or as the eastern portion of this ecological area is called, the "Hill Country", has been described by Cook (1984) as follows:

The "Hill Country" is a rolling to rough area in west central Texas. It includes the Central Mineral Basin of Mason and Llano counties. The area is bounded on the east and south by the distinct Balcones Escarpment, but

Vegetational Areas of Texas



Figure 1.

blends into other areas on the north and west Elevations range up to 914 meters (3,000 feet). Average annual precipitation varies from about 36 centimeters (14 inches) in the west to more than 84 centimeters (33 inches) in the east Soils are shallow and rocky, underlain by limestone and caliche. This area is predominantly rangeland and often is heavily stocked with combinations of cattle; sheep and goats. White-tailed deer are abundant Climax grasses include several species of bluestem, switchgrass, Texas needlegrass and curlymesquite. The predominant brush overstory includes a variety of oaks, honey mesquite and Ash juniper.

Portions of other ecological regions of importance to the sheep and goat industry include the Trans-Pecos, the South Texas Plains, and the Cross Timbers and Prairies.

Texas Sheep and Goat Industry

According to Carlson (1982) there were about 376,000 sheep on the Edwards Plateau in 1880, representing about 16% of the state's total sheep population (Fig. 2). He indicated that by 1890 the number of animals had increased to 1.3 million, or 3796 of the state's production, making the Edwards Plateau the largest area of sheep concentration. In 1900 problems with fire, drought, predators, and low wool prices took their toll on the Texas sheep industry (Carlson 1982). At this time the number of sheep in the vast Plateau region declined (Fig. 3) to only about 642,000 head (Carlson 1982). However, in about 1920 the sheep industry in Texas began a steady increase which would last for over 20 years to peak in 1943 with more than 10.8 million head (Carlson 1982). Since the industry's peak, there has been an almost steady decline in stock sheep numbers in Texas. However, in 1985 (Fig. 4) Texas is still the leading sheep producing state with nearly 1990 or 1.7 million of the nation's stock sheep (Texas Crop and Livestock Reporting Service 1985).

The early history of the Texas goat industry in the Edwards Plateau began in about 1900 and has been described by Carlson (1982) as follows (Fig. 5):

During a period of low wool prices, the Angora goat and mohair industry claimed attention. Also, the interest mohair was attracting among textile manufacturers and the fact that the Edwards Plateau afforded a variety of the best Angora browse to be found in the United States were additional factors accounting for livestockmen's growing concern with Angora goats. There were perhaps fewer than a half-million goats of all kinds in Texas in 1880, most of them the Spanish variety. Through the next decade their numbers barely increased, but in 1900 Texas contained some 627,000 animals, over 75 percent of them concentrated in the upper Rio Grande Plain and the southwestern part of the Edwards Plateau. Of these, some 100,000 were Angoras or Angora crossbreds. Twenty years later Texas counted over 2,000,000 goats and accounted for over 75 percent of the country's total mohair clip. By 1930, over 3,000,000 goats were recorded in the state and the Edwards Plateau became the center of the industry, completely dominating the state.

After dropping to a low of 2 million head in 1953, goats in Texas steadily increased to a high of 4.2 million in 1966 and then have steadily declined over much of the last 20 years (Texas Crop and Livestock Reporting Service 1985). However, goat numbers in Texas have shown increases for the last 4 years and in 1985 recorded 1.5 million head which is the majority of the goats in the country (Fig. 6).

**Distribution of Sheep
1880**

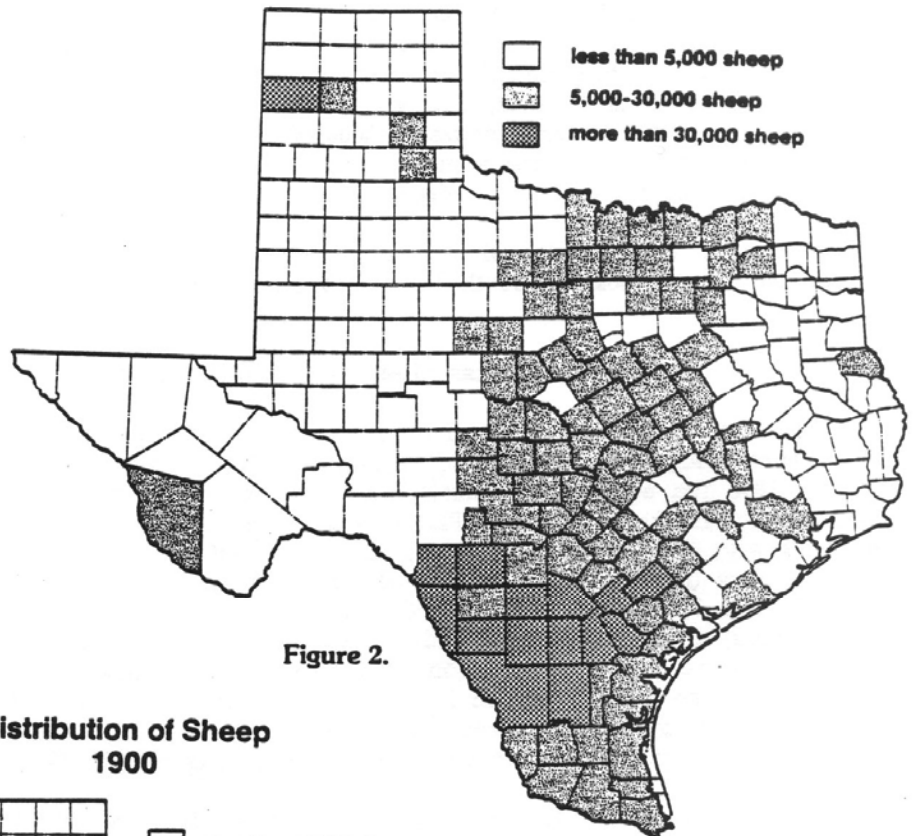


Figure 2.

**Distribution of Sheep
1900**

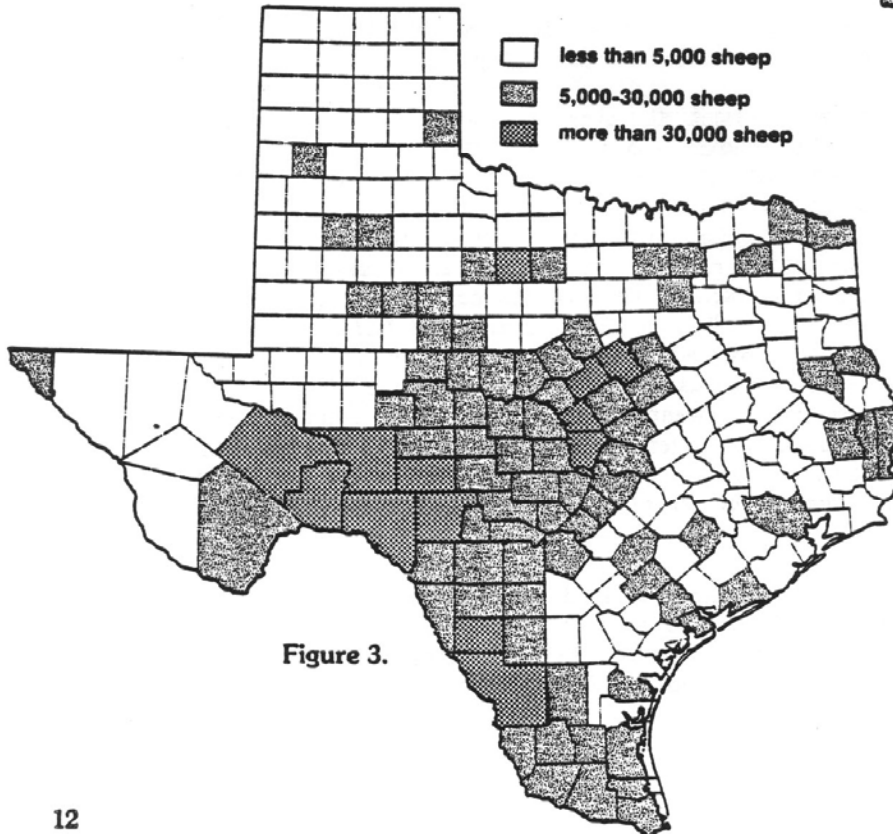


Figure 3.

**ALL SHEEP AND LAMBS, TEXAS,
JANUARY 1, 1985**

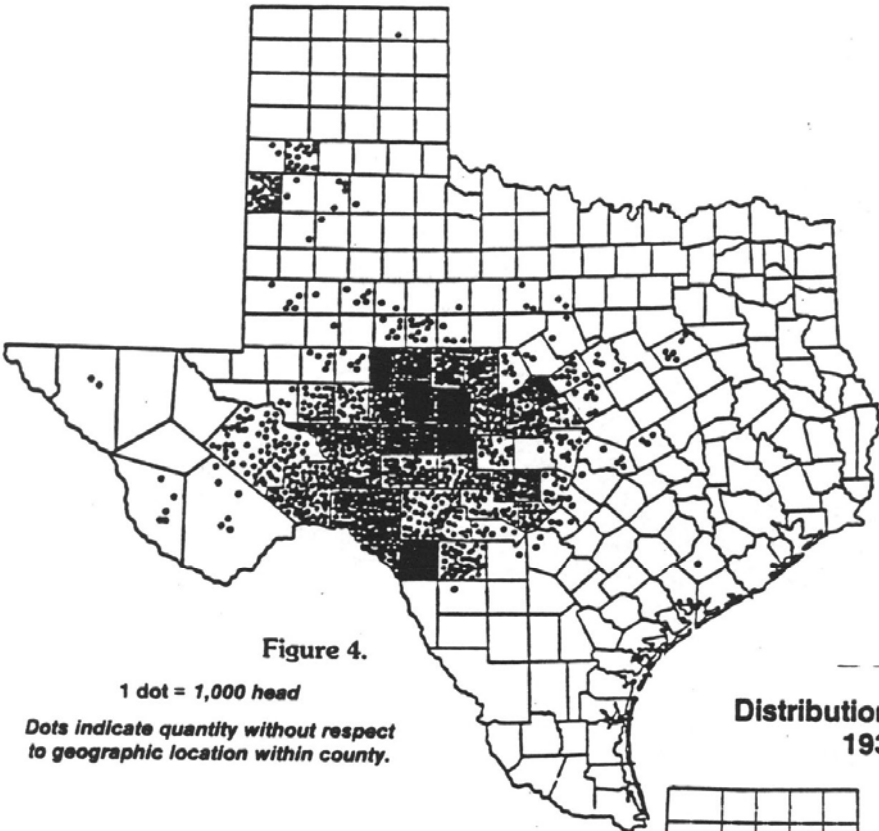


Figure 4.
1 dot = 1,000 head
Dots indicate quantity without respect
to geographic location within county.

**Distribution of Goats
1930**

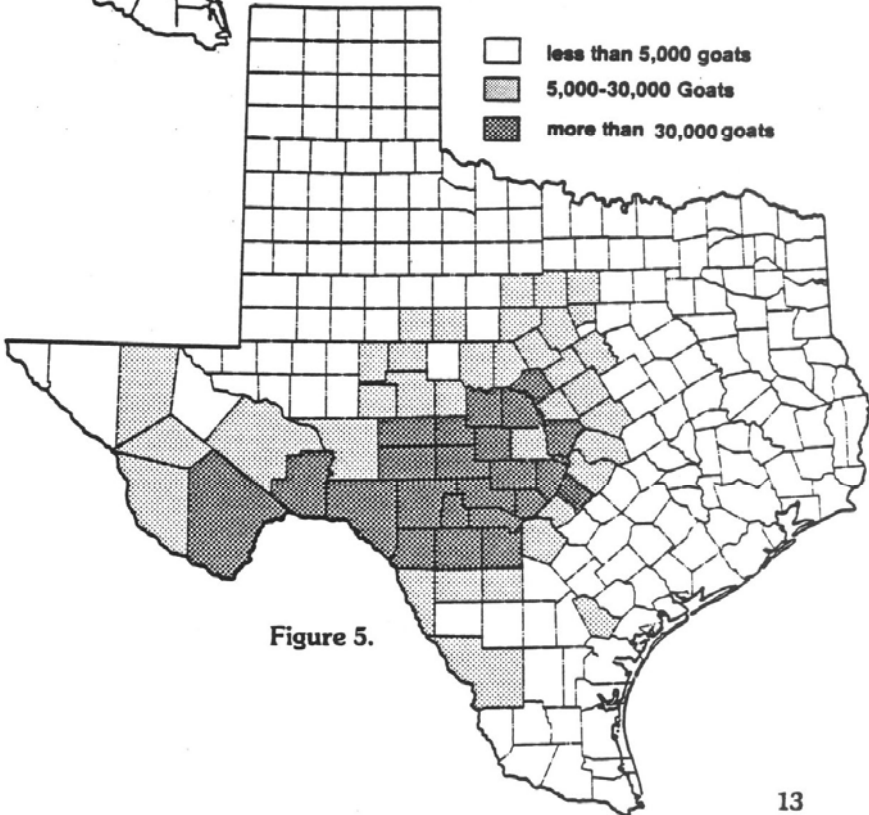


Figure 5.

**ALL ANGORA GOATS, TEXAS,
JANUARY 1, 1985**

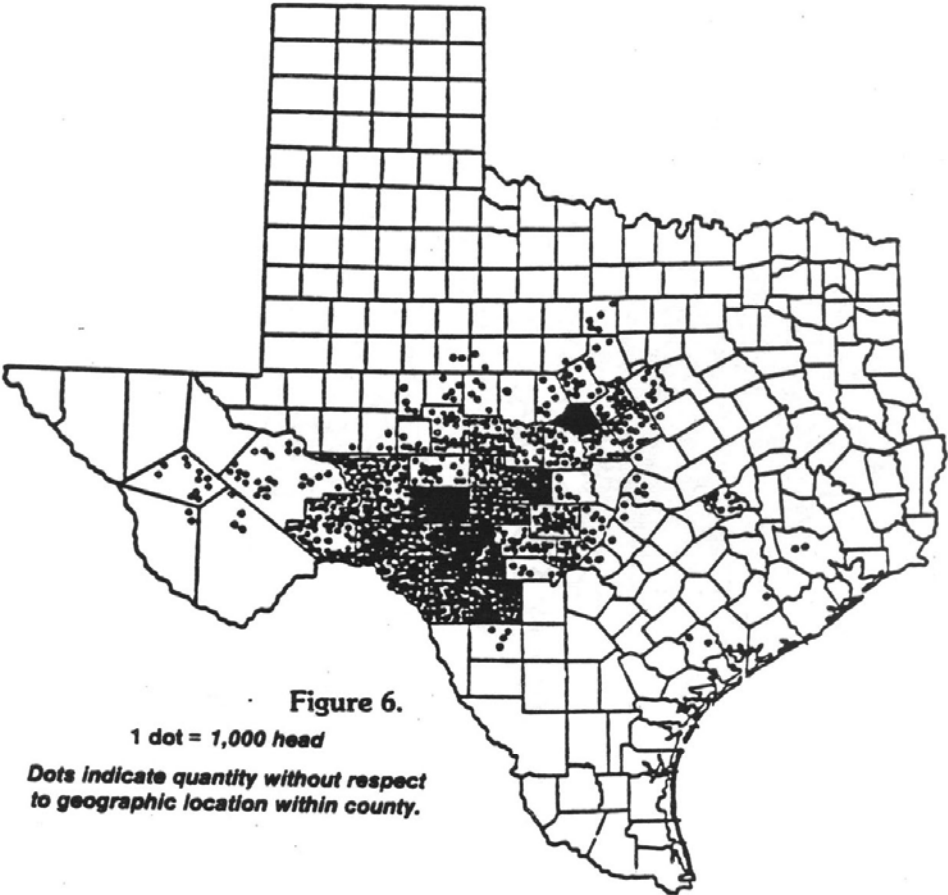


Figure 6.

1 dot = 1,000 head

Dots indicate quantity without respect to geographic location within county.

Early Predator Control

Among the records of the Texas Animal Damage Control Program is a short history of early predatory animal control which includes a description of conditions prior to the establishment of organized predator control as follows (Landon 1951):

Back in those days it was customary to run sheep and goats under herd and to pen them at night Lobo wolves were by no means rare and coyotes were numerous. If the herder lost some of his sheep, which frequently happened in brush country, the wolves and coyotes were quite likely to get most of them that night The late J. B. Moore told the writer of having let a small band lay out over night in a pasture he had leased just west of San Angelo. The next morning he trailed up where they had been by the dead bodies of the sheep killed during the night During lambing time the wolves and coyotes were so numerous and so bold that the herders would sometimes keep lanterns lit around their pens at night

During this period a change was taking place in the method of handling sheep and goats in Texas. About 1912 the late Sam H. Hill built one of the first woven wire fences in Texas and turned his sheep and goats loose, thus dispensing with the cost and aggravation of employing Mexican herders. Other stockmen adopted the same procedure and began to vie with one another to see who could build the best fences. Many of these men maintained packs of hounds for the purpose of catching or running out of their pastures the wolves and coyotes, which had entered by scratching holes under the so-called wolf-proof fences. Other ranchers and their men became quite adept in the use of steel traps. Notwithstanding the work of bounty trappers and the stockmen themselves, predatory animals continued to be numerous enough to cause severe losses. During the early years of running sheep and goats loose with the protection of herders, many sheepmen figured on a loss of 1096 per year from predators.

Organized Predator Control

In a 1931 article on the history of predatory animal work of the Bureau of Biological Survey in Texas, Mr. John P. Classen, Secretary-Treasurer of the Texas Predatory Animal Control Association, wrote the following (Classen, 1931):

In 1914 most of the sheep and goats in Texas were being run under herd. Wolves and coyotes were numerous everywhere and heavy losses were sustained whenever sheep or goats were lost from the herd or allowed to remain out overnight

About that time Sam H. Hill built one of the first wolf-proof fences in Texas and commenced a vigorous fight against predatory animals in his immediate vicinity. He soon realized the need for an organized effort for the control of these animals. With this end in view he requested the assistance of the Federal Government through Senator Sheppard and at the latter's request the Bureau of Biological Survey sent Dr. A.K. Fisher to investigate the situation. As a result, a small appropriation was made and some six men were employed in November, 1914. Mr. Hill supervised these men until the work was reorganized in July, 1915.

Mr. C. R. Landon was employed in July 1915 to conduct the predatory animal control work in Texas for the Bureau of Biological Survey with his headquarters in San Angelo, Texas. Predatory Animal Inspector Landon reported that during fiscal year 1916 his force of 8 hunters removed 1,059 coyotes, 136 bobcats, 68 Texas red wolves, and 8 lobo wolves (Landon 1916). The work was conducted within the heart of, and areas adjoining, the Edwards Plateau (Fig. 7).

Extirpation of the Coyote in the Edwards Plateau

By 1923 the successes of the predatory animal control program within the Edwards Plateau dictated that the state office be moved from San Angelo to San Antonio which was by then more centrally located within the problem area. The changes in predatory animal control operations at that time were reported by Landon (1924x) in his 1923 progress report as follows:

July 1st witnessed certain changes in the scene of our operations. Since the predatory animal work in this State started in November, 1914, the major portion of our operations have been confined to the sheep and goat country centering at San Angelo. In 1914 there were still between 30 and 40 grey wolves ranging along the Pecos River between Girvin and the mouth of the river below Comstock. Coyotes were so numerous at that time that it was almost impossible to run sheep or goats except under herd. There were a few woven wire fenced pastures then, but nearly all of them contained a few coyotes inside the fence. In 1923 a large portion of the country was fenced wolf-proof and I will venture to say two-thirds of the sheep in Texas were running loose. Sheep handled in this way shear better, require less range and do not require the expense of herders.

Landon (1924x) further reported that by June, 1923, Tom Green, Concho, Irion, Sutton, Schleicher, Crockett, Val Verde and Terrell counties were practically free of predatory animals, while in Sterling, Reagan and Upton counties their numbers had been greatly reduced. He also indicated that responsible stockmen had declared to him that the freedom from predatory animal depredations as the result of his work had increased the land values in many of the central counties of the Edwards Plateau from \$2.00 to \$5.00 per acre (Landon 1924x).

In Landon's annual report for 1924 he included a colored map (Fig. 8) depicting relative densities of coyotes and red wolves in the state (Landon 1924b). The information was collected from his own force of hunters and inspectors as well as county agents from throughout the state. Ninety percent of the animals west of the line depicted on the map were considered to be coyotes and 9096 of the animals east of the line were considered to be red wolves (Fig. 8).

Landon continued his description of the predator control scene in the Edwards Plateau in his annual report for 1925 as follows (Landon 1925):

As stated in my yearly report of one year ago, the average losses of sheep and goats from predatory animals 10 years ago often ran as high as 10 percent. Today the loss on the outer edge of the sheep and goat country averages approximately 1 percent, while the losses in the remainder of this country from this source are very much lower. A great many sheep and goat raisers have no losses whatever, the predatory animals in parts of many counties being practically exterminated. The principal factor in this improved

**Predator Control Work
Fiscal Year 1916**

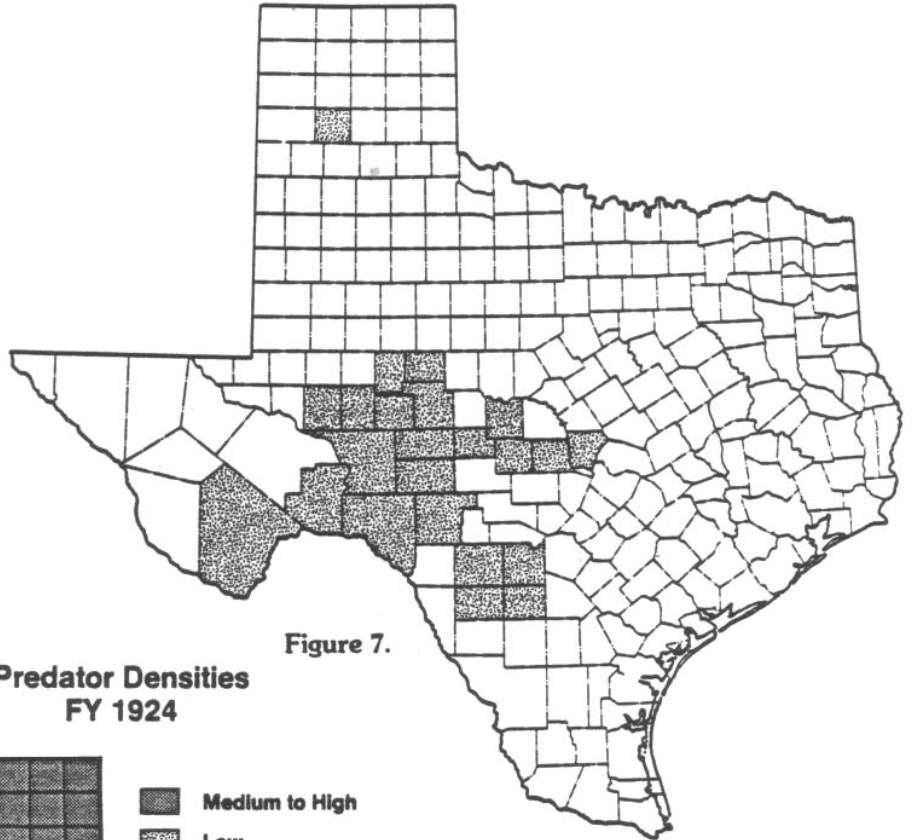


Figure 7.

**Predator Densities
FY 1924**

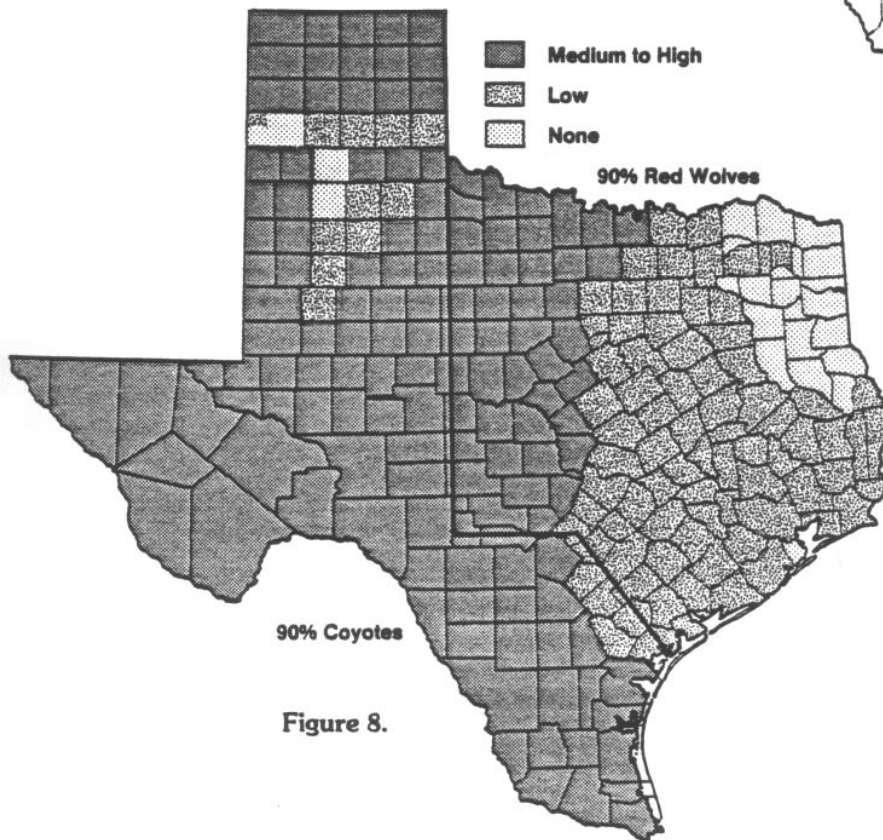


Figure 8.

condition has been the work directed by the Biological Survey in intensive trapping operations within the area and in intensive poisoning operations outside of the area. A contributing factor has been the cutting up of the big barbed wire fenced pastures into small woven wire fenced holdings, and the energetic efforts of stockmen in destroying the coyotes inside their woven wire fences in order that their sheep might be allowed to run loose.

In Landon's 1931 annual report he included another colored map (Fig. 9) depicting the relative densities of coyotes and red wolves in the state at that time (Landon 1931). He indicated that by 1931 coyotes and wolves were under complete control within and east of the Edwards Plateau. As indicated from his earlier reports, this accomplishment was well underway during the 1920's.

Throughout the years of providing predatory animal control service, the responsible agency has maintained records and annual reports of its activities. For the most part, the number of animals taken in each county during each fiscal year were recorded. However, due to the nature and use patterns of such control tools as Compound 1080 or strychnine, animals taken with these toxicants could not and were not usually recorded.

The earliest available records of the coyote and wolf take by county of the predatory animal control program is the cumulative take from July 1, 1915 through July 1, 1935. Figure 10 represents the counties where coyotes, both coyotes and wolves, or wolves were taken during this time period. As seen in Figure 10, there were at that time some counties on the southern and eastern edge of the Edwards Plateau where no coyotes or wolves were taken.

The wolves taken in west Texas and the Panhandle were usually gray wolves (*Canis lupus*). The wolves taken in central and east Texas were recorded as red wolves (*Canis rufus*). However, Nowak (1970) indicated that even before 1900, ranchers in the Edwards Plateau had noticed the existence of animals that seemed to be crosses between wolves and coyotes. Nowak (1970) postulated that a hybrid swarm formed in central Texas and migrated eastward occupying territory from which the red wolf had been extirpated. These extending coyote populations interbred with and eventually absorbed the scattered remnant red wolves, and by 1970 the only pure red wolves were found along the Gulf Coast of Texas and Louisiana (Paradiso and Nowak 1982). Eventually, even these populations succumbed to the unique process of genetic erosion resulting in the extinction of the red wolf in the wild (Paradiso and Nowak 1982). Thus, the records of red wolves taken in the program cannot be taken to indicate pure red wolves. The majority of these animals were probably coyotes or coyote and red wolf hybrids.

Figure 11 reflects the take by the organized control program of coyotes and wolves by county during fiscal year 1940 (Landon 1940). Those counties within the sheep and goat production areas which indicate no "catch", either had no program or had a program and did not take any coyotes. In either case, this usually indicated that few coyotes, if any, were present in those counties at that time.

By categorizing the numbers of animals taken per county into 3 groups of 1-10, 11-150, and over 150 animals taken and reviewing this data for every tenth year, a relatively representative picture of the extirpation and later encroachment of coyotes within the Plateau area is depicted. This representation seems to be especially realistic when taking into consideration other information provided in the program's annual reports, the field experiences of program personnel, other available literature (Pearson and Caroline 1981, Shelton and Klindt 1974) and more recent information provided by our computerized Animal Damage Control Management Information System.

**Predator Densities
FY 1931**

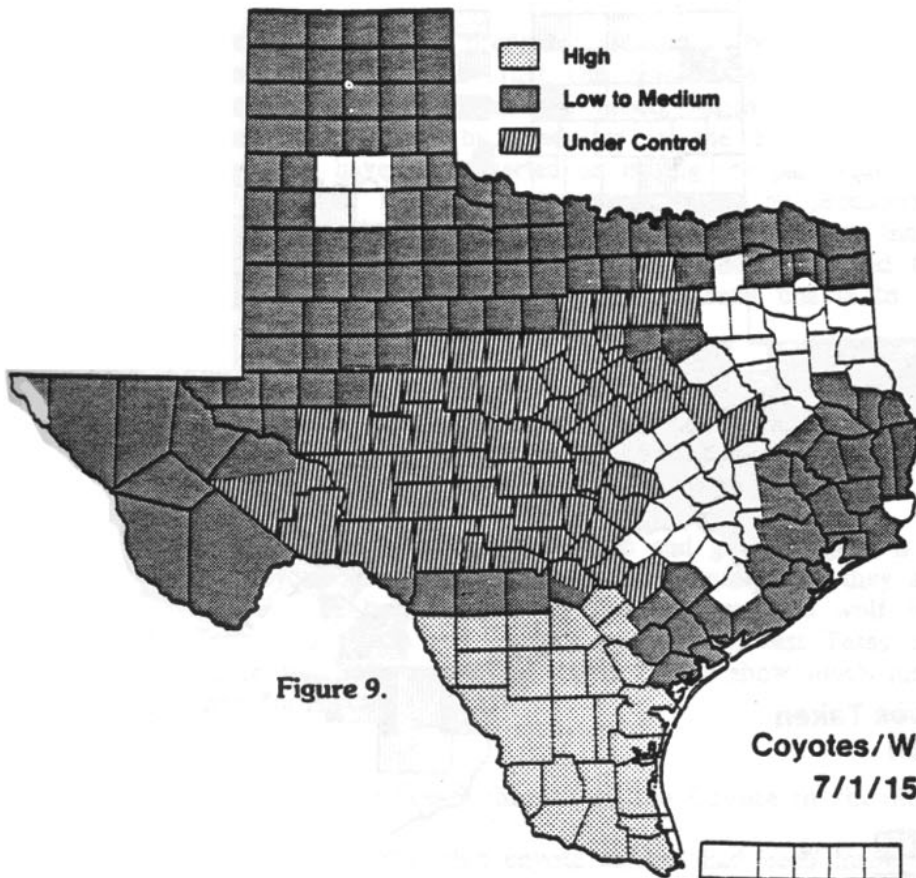


Figure 9.

**Coyotes/Wolves Taken
7/1/15 - 7/1/35**

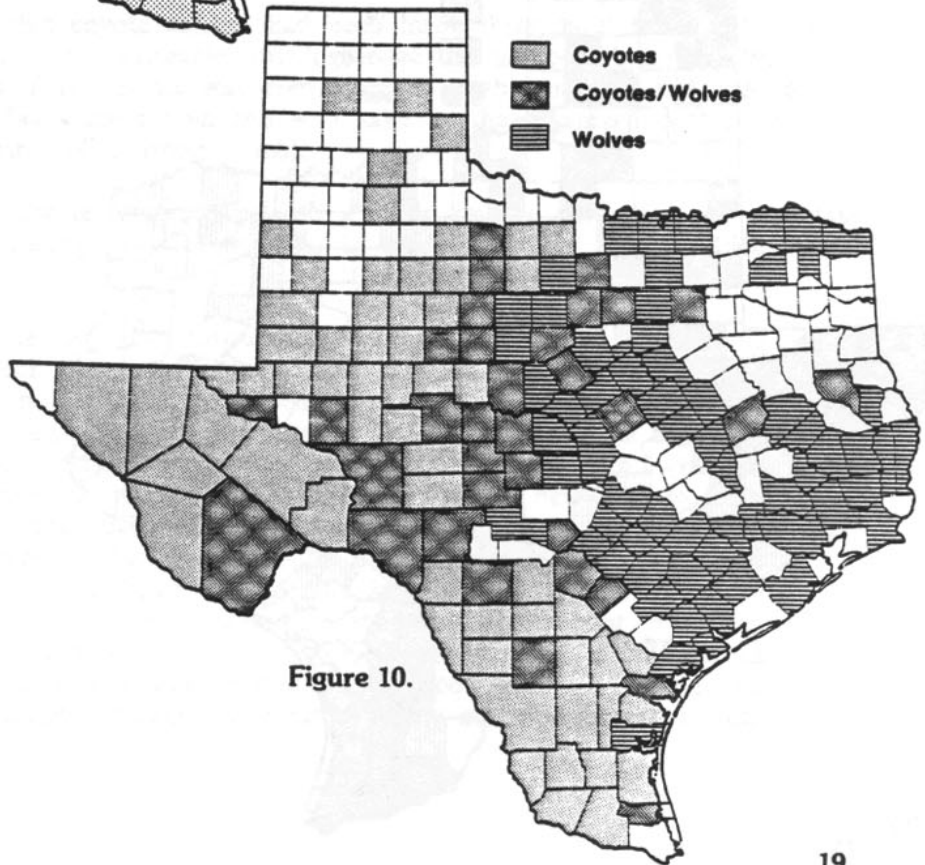


Figure 10.

**Coyotes/Wolves Taken
1940**

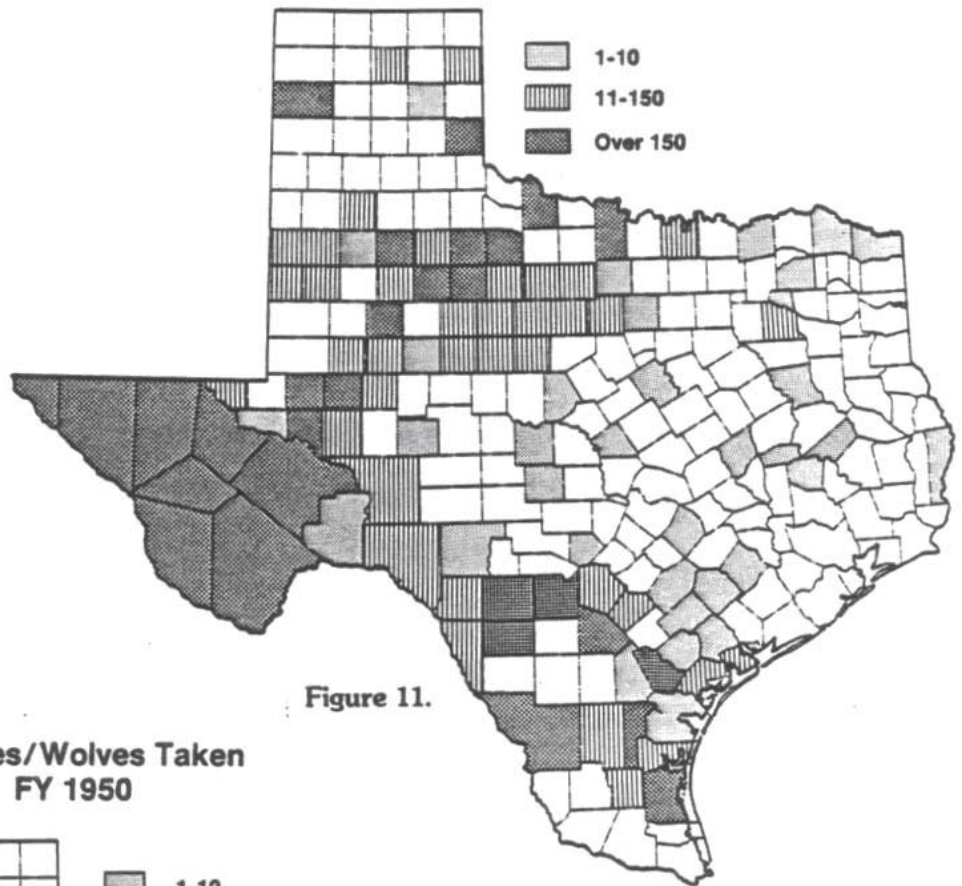


Figure 11.

**Coyotes/Wolves Taken
FY 1950**

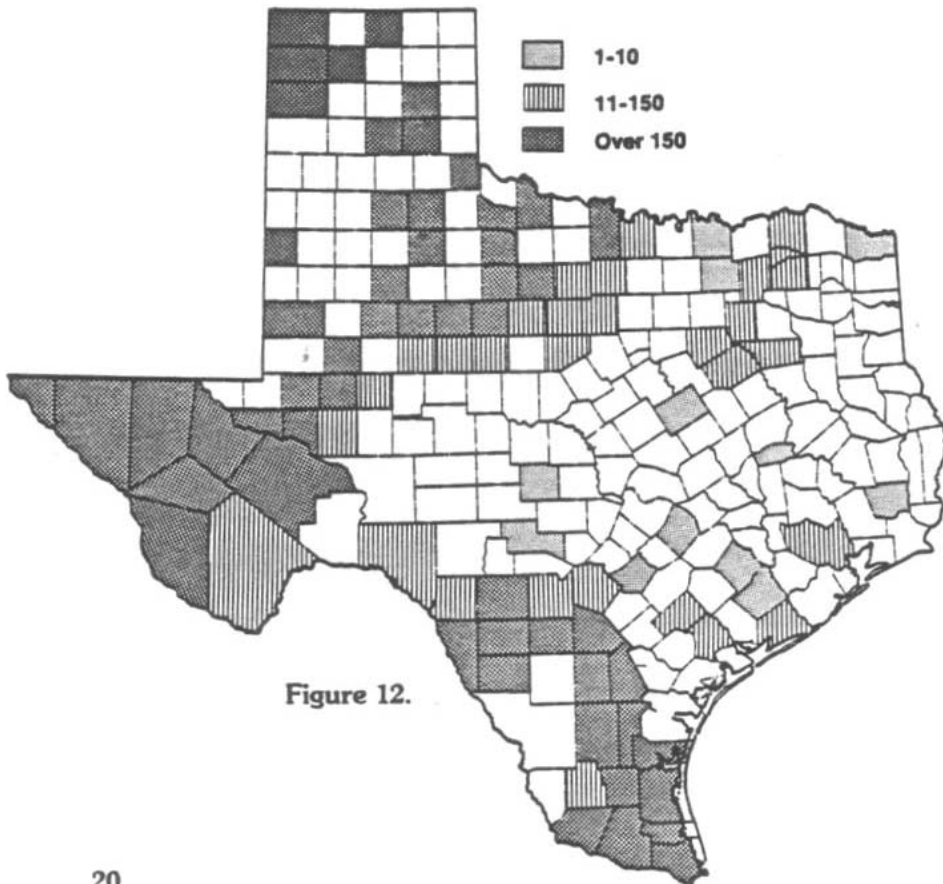


Figure 12.

In describing the predatory animal control scene for fiscal year 1941, which is representative of the information depicted in Figure 11, Landon (1941) indicated:

Livestock losses by predators are gradually on the decrease in Texas as a whole. As a matter of fact, throughout the area where eighty percent of the sheep and goats of Texas are raised, losses are practically nil at the present time. Game losses by predators in the hundred odd counties where our operations have been carried on during the past year have also been materially reduced. In our opinion game losses by predators over the state as a whole have decreased. This is based upon the fact that considerable control work has been done by the Texas Game, Fish, and Oyster Commission in some of the counties which we have been unable to reach due to lack of funds.

Figure 12 reflects the coyote and wolf take by the organized control program by county during fiscal year 1950 (Landon 1950). In the predatory animal control agency's 1958 annual report, the status of coyotes and wolves in the Edwards Plateau at that time which is representative of the 1950's was reported as follows (Landon 1958):

In those counties where the sheep and goat industry is of major importance, the coyotes have been practically eradicated, and they are well under control even in the border counties. The gray or lobo wolf is no longer found in Texas. The Texas red wolf of central and east Texas is no longer numerous where the hog, turkey and cattle raisers show much more interest in control than formerly.

The Re-Establishment of the Coyote in the Edwards Plateau

In 1960, exceptionally high coyote catches had been made throughout the coyote's range in Texas (Caroline 1960). A very noticeable upswing in coyote numbers began in 1958 with the drought-breaking rains: This increase was even more noticeable in 1959 and was continuing in 1960. Figure 13 reflects the coyote and wolf take by the organized control program by county during fiscal year 1960 (Caroline 1960).

The commonly called "coyote irruption" placed a strain on the personnel and resources of the cooperative animal damage control program as reported in the agency's 1960 annual report (Caroline 1960):

We are proud of the fact that coyote numbers have not caused tremendous losses in our livestock industry. Trappers have been able to hold losses to a minimum, although not without the expenditure of much volunteer overtime and long hours on duty. No group of men in Texas has worked as hard and as long as the Texas trappers during the year just completed. We have had to increase our trapper force by the employment of many new men to handle the increased work load. In some cases, we have had to delay the assignment of a trapper when requested by our cooperators until we could find a man whose abilities fitted him for the job. The employment of additional men has resulted in the necessity for increasing the amount of money the cooperating agency has to pay to secure the services of a trapper, as State and Federal appropriations proved to be too small to handle the increased load. In almost all cases, cooperators gladly met this increased cost.

**Coyotes/Wolves Taken
FY 1960**

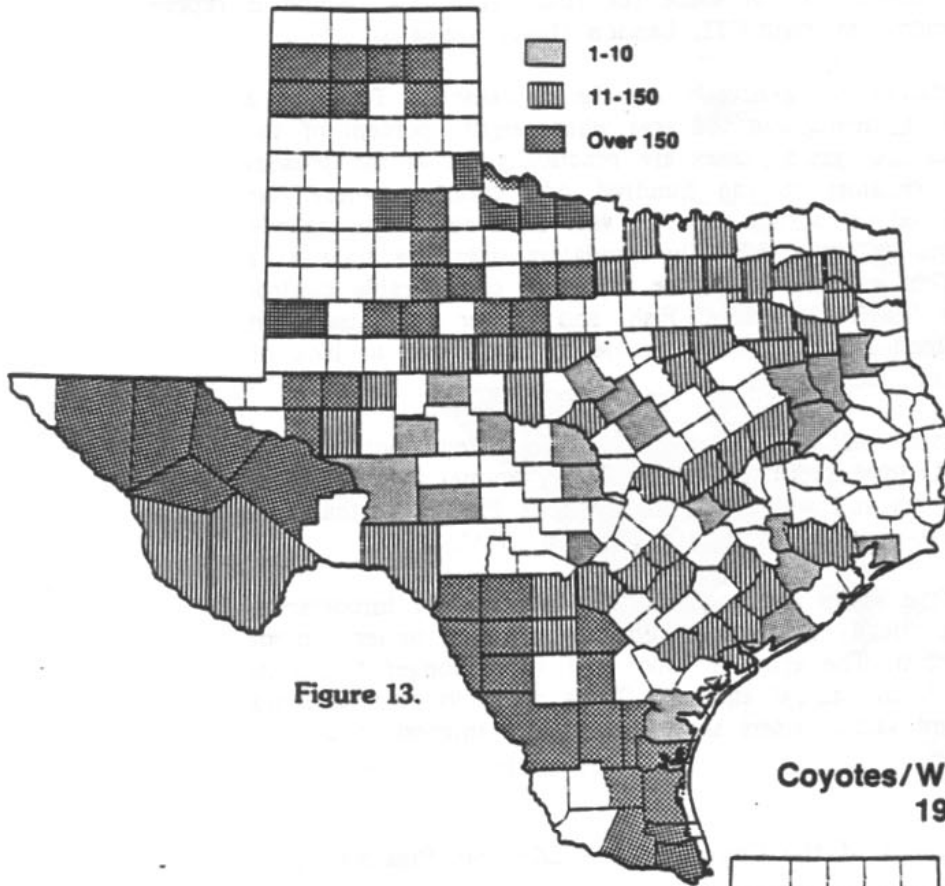


Figure 13.

**Coyotes/Wolves Taken
1970**

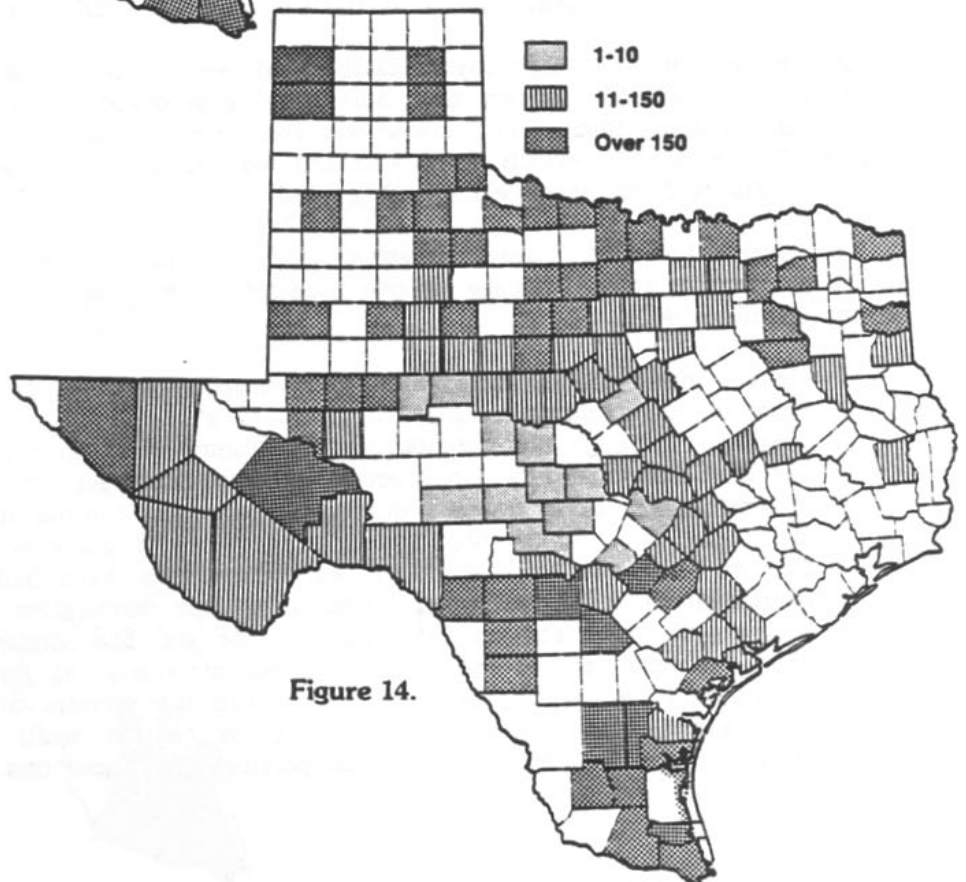


Figure 14.

Thus, with the breaking of what was commonly called the "7 year drought" in the late 1950's, the re-establishment of the coyote in the Edwards Plateau was underway by the early 1968's.

Within the next decade the take of coyotes within the Plateau area (Fig. 14) increased (Caroline 1970). In 1973 State Supervisor Milton Caroline reported (Caroline 1973):

In 1950 coyotes were a rarity in the heart of the Hill Country. On occasion a single animal would appear in the western part of the area but it was soon removed. Along the South Pacific tracks west of San Antonio ranchers to the north were interested in control south of the tracks. And for many years this was sufficient. However when the severe drought of the 1950's came to an end and after many ranchers cleared off their cedars and established more waterings, coyotes began to move in. Although much land improvement took place, "wolf-proof" fences were allowed to deteriorate. Coyotes could enter any pasture. (This is an important part because removal of the wolves was half due to fencing and half to organized control). For some time there was no one who recognized this fact. Losses were light and what were found were usually attributed to bobcats, foxes, and raccoons. By the time it was known that coyotes were present, there were far more of them than anyone expected. Consequently, today and in some cases as late as this year, there are coyotes in every formerly coyote-free county in the heart of sheep and goat country.

During the next decade the re-establishment of coyotes within the Plateau area seemed to have greatly accelerated as reflected in Figure 15 and the following excerpt from the animal damage control program's-1980 annual report (Hawthorne 1980):

Since 1972 when the use of chemical toxicants was restricted, the protection of sheep flocks from predators in Texas has been limited to conventional predator removal programs which include the use of traps, snares, shooting, calling, and aerial hunting. The M-44 became available in 1976 but with limited success in its use. These limitations of predator control techniques are a major problem that is contributing to the decline in the number of sheep and goat ranches in Texas. Those ranchers who continue to raise sheep and goats have increased difficulties with predator control as the area populated with sheep and goats is reduced in size. Land managers who do not pasture sheep or goats often do not engage in active predator control programs. Consequently, sheep producers on the fringe of the sheep and goat raising area find that it is virtually impossible to control losses to predators on their ranges. Although an isolated producer may expend as much effort as possible on predator control operation, it is most likely that his efforts to prevent or reduce losses to predators will have limited success.

The encroachment of coyotes into the sheep and goat producing areas had become such a concern in 1981 that a request for the emergency use of Compound 1080 bait stations as per Section 18 of FIFRA was prepared and submitted for approval, but without success (Nunley 1981).

The Present Status of the Coyote in the Edwards Plateau

Due to the many factors responsible for the movement of coyotes back into the sheep and goat production areas, this process seems to be continuing as reflected by our 1984

Coyotes Taken
FY 1980

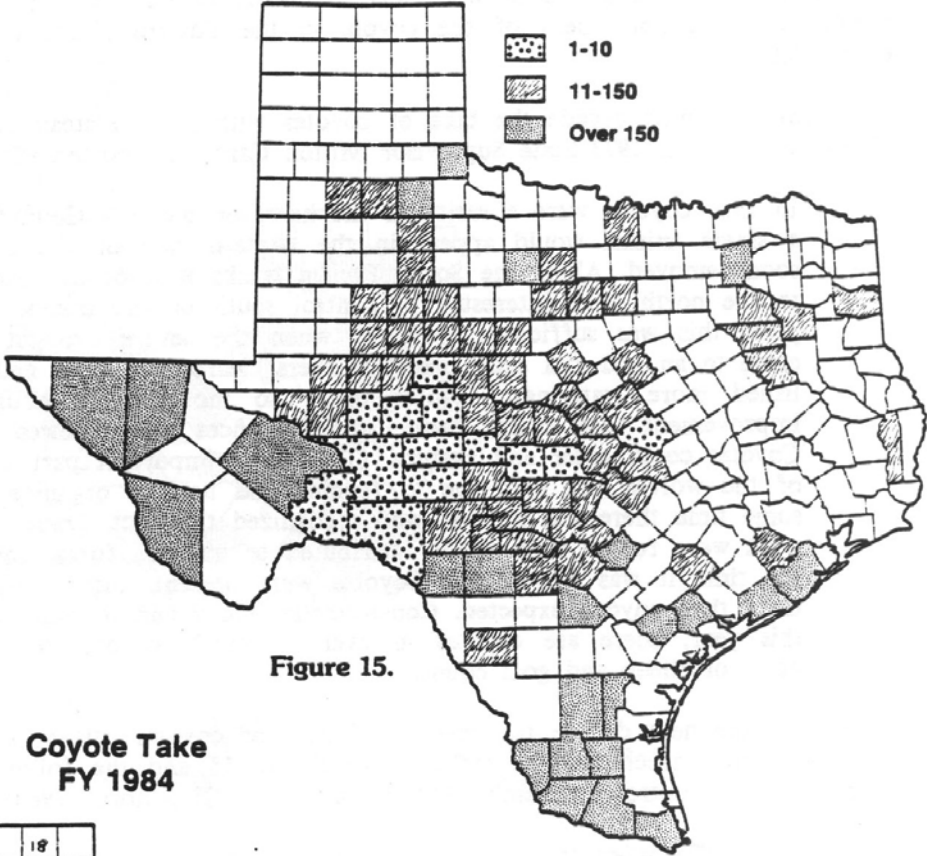


Figure 15.

Coyote Take
FY 1984

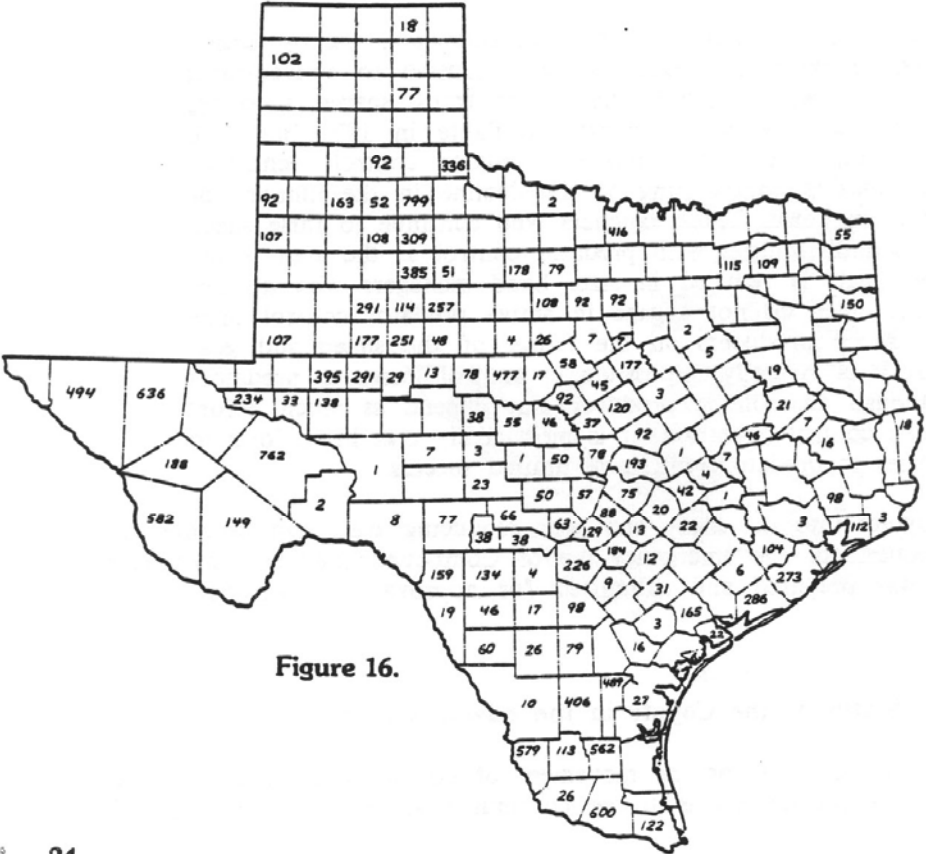


Figure 16.

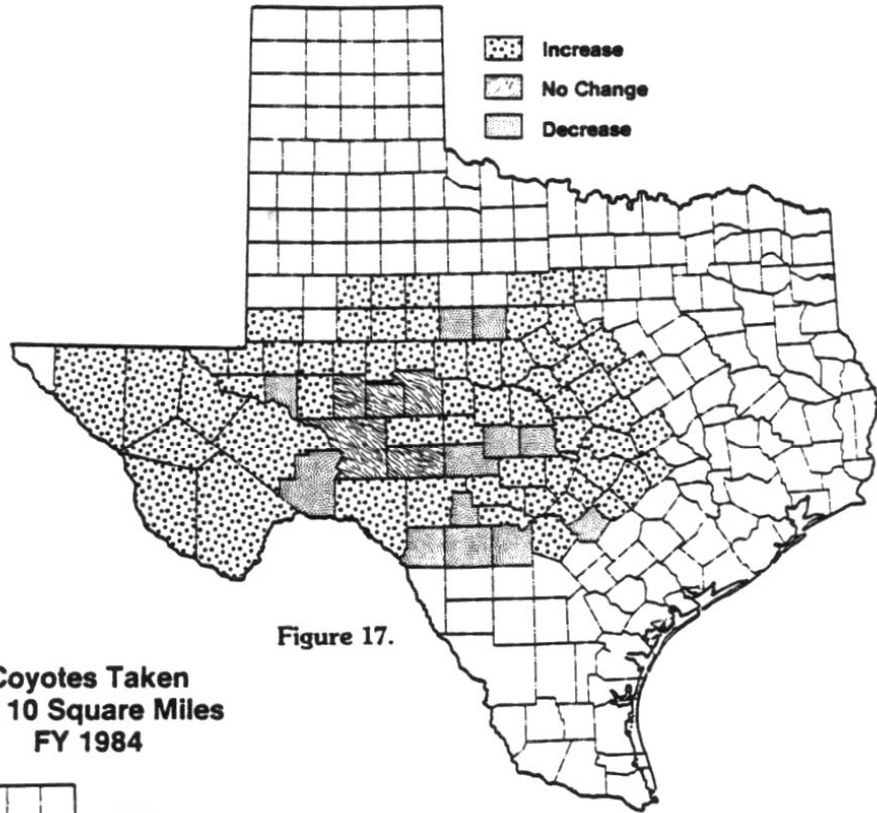
coyote take (Fig. 1b). Our work continues to increase within the sheep and goat production areas. In 1984, most counties within this region had shown increases in their coyote take over 1980 (Fig. 17).

The relative degree and geographical distribution of the coyote's infiltration of the sheep and goat production areas can be further observed by illustrating the graduated average county coyote take for every 10 square miles worked within each county (Fig. 18). As Figure 18 illustrates, our coyote take per unit of area worked symmetrically increases as you move from the center of the Edwards Plateau to the periphery of the Plateau.

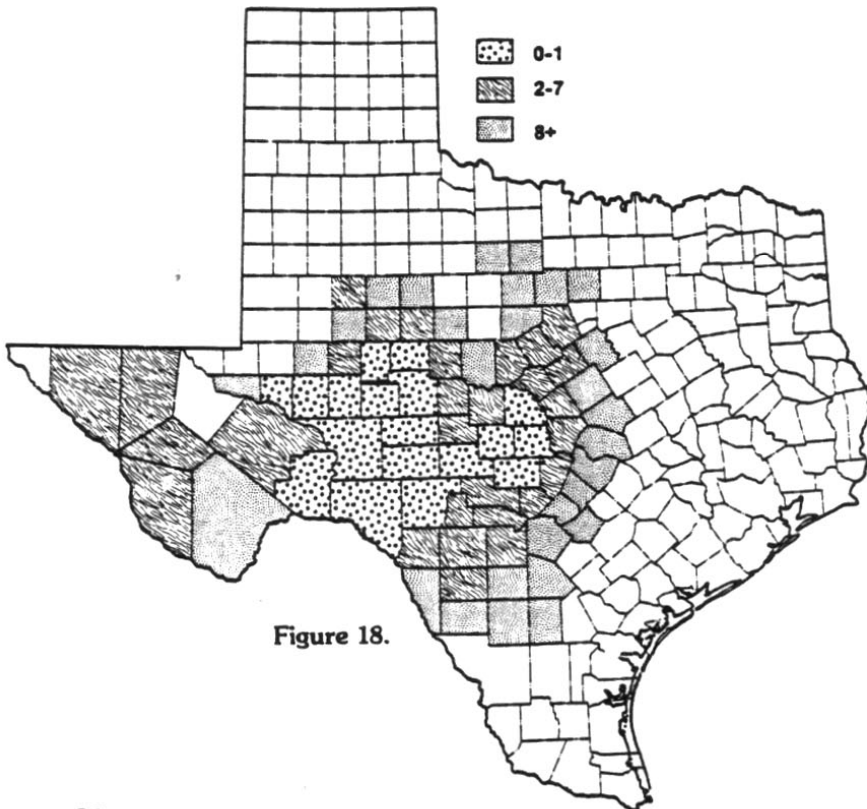
Summary

As indicated by the records and control work of the Texas Animal Damage Control Program, there has been a graduated increase in the number of sheep and goat operations exposed to coyote predation throughout the last 20 years. It is most probable that the factors which are responsible for the continued encroachment of coyotes into the Edwards Plateau will continue to exist. Thus, the challenges facing the Texas Animal Damage Control Program, as it attempts to protect the sheep and goat resources of the state, will certainly increase in difficulty and complexity.

**Changes in Coyote Take
FY 1980-1984**



**Coyotes Taken
Per 10 Square Miles
FY 1984**



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