

FOREST RESOURCES OF TEXAS.

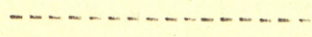
by

J. Olin Graham.

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- II. Causes Determining Forest Distribution in Texas.
 - Rainfall,
 - Nature of the soil and rock,
 - Temperature,
 - Sunlight and winds.
- III. Natural Divisions of the State.
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Conclusions



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I. Natural conditions affecting forest distribution in Texas.

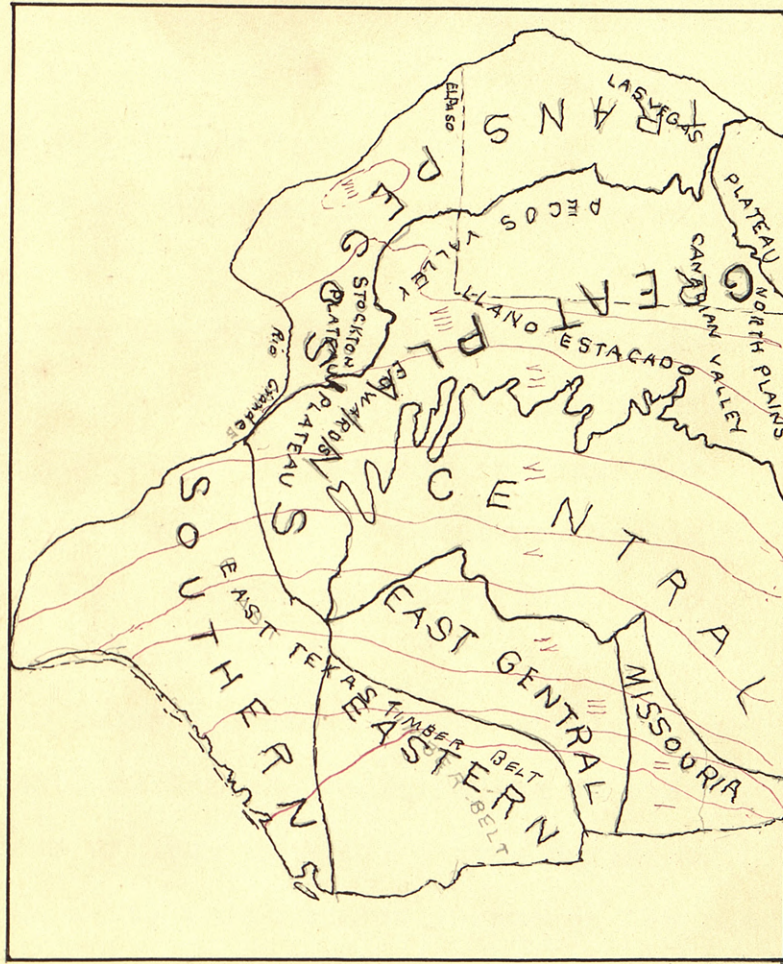
Within the state of Texas the natural conditions on which depend the range and make-up of the forest are of the most diverse character. In geographical position its southernmost point lies almost in the edge of the Tropics, while its far northern portions are within the wheat and corn belt of the Middle Western States. Its climate varies from the even warmth of the coast lowlands, tempered by the softening influences of the Gulf, to the rigors and extremes of the mountainous interior, and from the heavy rainfall and moisture-laden air of the eastern portions to the arid, hot sand of the western desert, with its dry and scorching winds.

In elevation the state rises from the sea-level, by more or less gradual gradations to 4,000 or 5,000 feet above the gulf, then to the mountains which attain an elevation of nearly 10,000 feet. This vast uneven area has been further diversified by extensive erosion. The geological structure has resulted in the formation of soils of such different types, as the alluvial bottomlands of the Gulf coast, the waxy loams of the prairies and the wooded parts, and broken masses of the Plateau and Cordilleran Region.

Corresponding with these differences in environment, the state presents a variety of forest types which pass from the swamp and bayou forest of the eastern part of Texas which is essentially the same as that of the states border-

Precipitation

- I. Over 50"
- II. " 45"
- III. " 35"
- IV. " 30"
- V. " 25"
- VI. " 20"
- VII. " 15"
- VIII. " 10"



Minor subdivisions of the greater Texas region.

(From Hill's Physical Geography of Texas.)

ing on the lower Mississippi, through the great timbered belts of the long-leaf pine on the south to the no less valuable region of the post-oak on the north, to sheparral and mesquite of the Rio Grande Plain, and to the stunted bull-pine and red fir of the summits and the elevated portions of the west.

II. Causes determining distribution of forests in Texas.

The principal natural influences which have determined the distribution and character of forests in Texas are: Rainfall, nature of soil and rock, temperature, sunlight, and winds. The first two are the most important.

Rainfall.

The rainfall of Texas decreases progressively from the extreme east, with an annual precipitation of over fifty inches, by more or less parallel strips north and south to the extreme west, which scarcely reaches ten inches. Corresponding to these different zones of rainfall there is a series of different forest types. In the eastern portion where the rainfall is around forty-five inches, are found the swamp and bayou forests of cypress, tupelo, water oak, and swamp hickory; as the region becomes less swampy and consequently better drained the black-gum cottonwood, sycamore, beech, birch, spinal oak, and after them the red oak, white oak, walnut, pecan, magnolia, holly, and the kindred species. ^{verb} On higher lands come the pines, loblolly; on the sandy knolls and ridges of the Coast Plain, longleaf; and on the more rolling sand, barrens of the Fayette Prairie and the shortleaf on the higher uplands of Lignitic belt.

The second forest belt consists of oak barrens lying westward of the regions just mentioned and in a zone where the rainfall is 45 - 35 inches. Next is the central Texas zone with a rainfall of thirty to less than twenty-five inches where occur mountain cedar, mountain oaks, cedar elm, Mexican persimmon, Bois darc (Osage Orange) and others.

Last of all comes the dwarfs, of which people always think of in connection with the forests of Texas: Chaparral, mesquite, catclaw, all-thorn, palo-verde, and many others. Rainfall alone, however, does not determine the limit within which these species grow. There are many canyons in the region where the annual rainfall is less than twenty inches in which may be found not only the oaks, hickories, and similar trees, but even the swamp-loving cypress. While the moisture demands of the different kinds of trees constitute the most potent factor determining their distribution, it is not the amount of moisture falling to the ground so much as the ability of the soil to hold moisture that affects them. This distribution is consequently modified very greatly by the varying geological and soil conditions.

Nature of the soil and rock.

It will be naturally supposed from the foregoing that only the heavy timber is found in the regions of the greatest rainfall, which is not strictly true, however, as some of the canyons in the dry region contain heavy timber which is probably due to the geological structure of the land, and is furnished with moisture by the supply of perculating

waters. The heavily timbered canyons of Keer County is a good example of this. On the other hand, upon the pine barrens of eastern Texas, although the rainfall is heavy, the form and habit of growth of the young longleaf pine show evidently its adaptation to periods when there was a lack of moisture, a lack which the older trees overcome by sending their roots down deep into the soil through which the rain water drained away from the surface.

In general, erosion, the broken strata of the mountain masses and the canyons tend to explain the relatively heavy timber in the far western part of the state. So also the waxy soils of the prairies which tenaciously retain the moisture of precipitation and support a forest growth which could not exist in the lighter, more porous soils. The swamp forests, the alluvial bottom forests, the loblolly and the hard wood, and the shortleaf, are distincy forest types in which soil texture, chemical make-up, and elevation are determining factors.

To get an idea of the forest types in the state it is necessary to take into consideration alone with the rainfall, the geological formation and the topographical, which not only determine the minor classifications in each type but also modify the types of the larger areas. Also a better general survey of the forests of Texas can be had by looking at the natural divisions which will be given farther on in a sketch. Never-the-less it is rainfall rather than the nature of the soils and rocks which have played the most part in producing the main types into which the forests of the state naturally divide themselves. This is shown by the

fact that the gradual change from the moisture-loving to the drought-enduring species takes place along the lines of decreasing rainfall and across the line of the successive geological formations. These successive formations lie approximately parallel with the Gulf coast, so that they transverse the rainfall nearly at right angles.

Temperature.

On the whole, the trees which compose the forests of Texas are those characteristic of the southern part of the united States. The presence of the live oak, palmetts, magnolia, longleaf, and loblolly pine show this. On the other hand many of the species of the Middle States and even of the North Atlantic States occur almost to the Gulf, but in the Guadalupe Mountains, where the state reaches its greatest altitude of 9,500 feet, there also appears some characteristic species of the Northwest Pacific coast, such as the Western yellow pine and red fir. Along these lines, temperature is the dominating agency.

Sunlight.

The area of Texas presents extremes in the amount and intensity of sunshine which are shown in the character of its forest growth. Thus in the eastern forest area the most intense sunlight is prevented by the blanket of moist atmosphere and the high percentage of wholly or partly cloudy days. In this area is to be found the thick-crowned hardwood forests, having a heavy under-growth of shade-loving species.

In the Rio Grande, on the contrary, the sun beats down with all its force during the growing season, and its force is little weakened by the dry air and continuously unclouded

sky. The trees thus favored are of extremely light foliage, producing practically no shade, such as the mesquite, and the acacias, which hardly break at all, the force of the sun's rays, and therefore give little shelter to the shade-loving species. , except in the moist canyons and alluvial bottoms. The Texas region west of the 97th. meridian is distinctly wanting in shade-loving species and in fact in shade-loving vegetation of all kinds.

Winds.

The wind plays its part in hindering the encroachment of timber. Its power along this line can only be appreciated when one attempts to start a plantation of any kind which has light-winged seeds. Particularly is this also true along these regions where the Gulf breezes have sway. In the coast regions and on the Staked Plains, the habitual direction and force of the wind must be taken into consideration before starting a plantation. The strip method is the most successful. The periodical recurrence of the Gulf hurricane has had a profound effect on the history of forest extension on the present aspects of the forest on the Coast Plain. For example, the hurricane of 1875, a vast area of pine in Montgomery and San Jacinto Counties, was totally destroyed and afterwards much of the debris burned. In the hurricane of September 9, 1900, which all Texans remember, the loblolly pine and white oak in the coast country west of the Trinity river, were blown down and destroyed in enormous quantities, which disturbed the forest equilibrium until now.

The evident effect of these storms is written in the

ragged, uneven growth of timber in much of the coast country.

III. Natural Divisions of the State.

The divisions of the state which are of significance for a discussion of the forest growth are of topographical rather than geological nature. They are the following:

1. The Coast Plain.
2. The Fayette Prairie.
3. The Lignitic Belt.
4. The Rio Grande Plain.
5. The Black Prairie, Grand Prairie, and Edwards Pla.
6. The Central Denuded Region.
7. The Red Beds Prairies.
8. The Staked Plains.
9. The Stockton Plateau.
10. The Cordilleran Region.

1. The Coast Plain, over 15,000 sq. Miles in extent, is the low, flat plain lying along the Gulf from which it has emerged in recent geological time. It comprises a strip fifty miles in width and more or less parallel to the Gulf and scarcely exceeding fifty feet in altitude at any point. The rainfall exceeds fifty inches in the east but decreases to thirty inches soon after passing the 97th Meridian. The coast Plain from 90° 30' westward may be included in the Rio Grande Plain. The soils thus limited consist of compact clays and silts, mixed with areas having a larger proportion of sand, and are therefore more porous.

2. The Fayette Prairie contains 12,000 sq. Miles in extent and is a narrower more uneven belt, lying next inland and parallel to the Coast Plain. The rainfall conditions of the

10. The Cordilleran Region comprises a vast area of over 30,000 sq. mi.. There are large tracts of high grass plains and scattered mountain masses with intervals of undrained parts. The altitude is high enough to increase the rain to 20 inches where the normal for that region is 15 inches. The rough, uneven type of this region makes it capable of sustaining heavy timber of the Southern Rocky Mountain type, especially in the Gaudalupe, Davis, and Chisos mountains.

IV. Character of the Forest.

The character of the vegetation is very clearly a product of climate and geological conditions. The structure and habits of the woody vegetation combine to indicate that it is a xerophytic or dry climate vegetation; but through this is true of it as a whole, conditions vary enough to give in some places, as in well-watered and sheltered canyons, a relatively luxuriant growth, while in other sections, as upon stony arid slopes, there is the scantiest vegetation, by no means sufficient to hide the glare of the chalky soil. The trees which make up the forests of Texas belong, chiefly, to the Atlantic type of forest, although Rocky Mountain species and semi-tropical Mexican species occur also.

The first in quantity, variety and value, stands the oaks, among which are the white oak, live oak, cow oak, black oak, red oak, Texas oak, willow oak, and water oak. Many of the trees of this state are its own peculiar product for each specie has its own peculiar characteristics. Next in importance comes the ash, with the white ash first and the green ash second. The hickories are represented by the sweet and

bitter pecan, white and shagbark hickory. There is an endless quantity of gum, comprising the sweet and black gum or tupelo, and much sycamore, cotton-wood, and elm, with a fair amount of linn, white maple, holly, magnolia, iron-wood, hornbeu, and much of the north Texas prairie, Bois 'darc (Osage Orange). Black walnut was formerly very plentiful but nearly all of it has been cut out. The common persimmon and Canadian red-bud, mulberry, hack-berry and kindred species are to be found in great profusion. It must not be inferred from what has been said that forests of Texas are anything like continuous even in its rougher parts. On the contrary the timber is very much interrupted by open, grassy uplands, while long strips of continuous and luxuriant forest growth, which follow the streams and canyons in the mountaineous regions, are predominant.

Where conditions are well watered and sheltered, the timber attains large dimensions and is a thick canopied shady forest, under whose protection many shade-loving shrubs and plants from the moister areas have established themselves. In such places cypress, American elm, sycamore, pecan, the overcup oak, basset oak, cotton-wood, and hack berry become large trees, sometimes five feet in diameter. Of the smaller growth, the black cherry, box-elder, walnut, soap berry, and many others, are to be found.

Mixed timber:--This constitutes by far the larger part of the timber lands of the Edwards Plateau while not important as timber they must not be over-looked because they cover such a large territory. This is a type of forest occurring on the

breaks of the Colorado from Austin west to and along the Gaudalupe.

The stand of timber varies in density with local conditions. Where the soil is deep and black there is a mixture of cedar, black oak, cellar elm, hack-berry, mountain oak, shin-oak, and other species. This kind of timber also occupies the side gorges and draws leading out from the main stream ways, where it forms an almost impenetrable break, while on the arid parts this timber is not so closely set but that the white glare of the soil is clearly visible.

Shinneries: A special feature of the mixed timbers is a covering which has received the name of "shinnery." Although they are made up of mixed timbers, they are usually thought of as oak skinneries, because of a predominance of dwarf oak, which a height from one foot to fifteen or twenty, forming dense thickets which cannot be penetrated. It constitutes a favorite haunt for deer and coyotes.

As a soil retainer and gatherer this is unsurpassed. Live oak and hack-berry are mixed in occasionally. In addition to these types of mixed forests which are only distinguished from each other by their difference in density and growth rather than make-up, there are three different types, two of which are pure, while in the third, two species of oak dominate. These are the mountain oak thickets, cedar breaks and post oak timber.

Mountain oak thickets, called the Spanish oak, makes a tall, straight, symmetrical tree and a rapid growth. Its timber is valuable for fuel and a few other purposes. On slopes and in mountain gorges the mountain oak grows thick

and closely inter-woven with various kinds of vegetation, making a very effective covering and protection. It also catches debris rapidly. Its close stand, uniform growth and fresh green foliage gives it a beautiful appearance.

Cedar breaks:-- Are abundant and important in the limestone country. This specie resembles the red cedar of the Atlantic States. It is said to be the most pronounced and hardy xerophytic tree of all the arid wouth-west and also one of the most valueable assets of the region. It grows in mixture of other species and attains its largest size where there is more water and a deeper, richer soil.

The typical cedar break is an almost impenetrable growth of interlocking branches of the close-set trees persisting to the very ground. In general, cedar breaks occur upon all the hilly or rough parts of the lime-stone region of Texas, from Palo Pinto County to the Colorado, and westward to the Devils River.

Post oak timber:-- This is a type of small oaks covering all the sand and gravel-covered areas e. g.--East Texas Lignitic Belt and the carboniferous area in central and northern Texas. Black jack and post oak constitute the chief elements of this type.

The largest areas of this timber are found in the granite country. This is the most abundant oak in Texas. It is apt to be diseased in the drier parts of Texas.

V. Importance of Forest Management.

The state of Texas with a merchantable forest that covers ten per cent of its entire area cuts nearly 5,000,000

ft. of lumber yearly. The lumber industry is exceeded only by the cattle and cotton industries. But of this small area of timber 125,000 acres are cleared yearly and cut in such a way that timber will not grow again. Under present management, the exhaustion of a great economic resource is taking place, and conditions affecting the prosperity of wide areas is rapidly growing worse. The only alternative is forest management. Not only as a direct resource is this important, but also as an indirect resource; i. e. The relation of the forest to the surrounding conditions as this is perhaps the direct relation of the farmer to forestry.

There are two questions involved; namely, the effect of a forest cover within its own area and on that of adjoining territory. That the degree of influence depends largely upon the kind and condition of the forest growth itself, is evident. It must differ according to the kind and composition, the height and age of the trees and the density. The influence upon the conditions under its own cover are mainly due to mechanical carriers with which the canopy of foliage interposes between the sun, the rain, and the winds. The exclusion of the sun and winds reduces evaporation, hence the soil and air under the forest cover should, as a rule, be cooler and moister than in the open field. Trees, to be sure, need water, but it seems that they require less than growing fields and since they bring up the water from greater depths and transpire the greater part of it into the air, they increase the humidity of the air. Yet it is still an open question whether forests contribute to an increased rainfall in their

neighborhood. One of the most important offices of the forest cover is the changing of surface drainage into sub-drainage, and thereby conserving the moisture against dissipation by the evaporative influences of the sun and winds. The forest growth keeps the soil porous and with its deep-reach-int root system assists in the percolation of the surface waters and permits their sub-drainage instead of being wasted by evaporation.

Forestry in Texas should aim at the following ends:

1. To plant trees in regions where there is no forest growth but where it can be usefully introduced.
2. By the promotion and maintenance of woodlots and connection with farms by spreading information concerning their care and usefulness.
3. To care for forest growth along streams for their protection.
4. To devise economical fire protection. It is to private management that forest protection must be made to appeal to, since 95 per cent of the Texas forest is in private hands. It is plain from a survey of the conditions that the application of certain principles of forest management on a small scale by farmers and ranchmen has a large possibility of usefulness both public and private.

The field is different from that of large concerns organized for the management of extensive forests. The latter can operate permanently only where large tracts of timber land exist where farming can not be profitably carried on. Then, too its returns are not immediate, often extending many years

5. Next in series inland lies the vast Cretaceous Belt which include the Black and Grand Prairies and the Edwards Plateau, an area of some 40,000 sq. mi. This is a typical grass country which is capable of supporting heavy timber but the very compact, waxy soil and impenetrable chalk beds, gives grass the advantage over the woody vegetation. Rainfall here is about 30 in. The Edwards Plateau, some 15,000 sq. mi. from the southern province of the Great Plains Region toward the northeast, the altitude is over 2,000 feet and it merges at last into the Staked Plains.

6. The Central Denuded Region is in area, perhaps half as the Edwards Plateau and from which Cretaceous strata have been eroded, exposing granite at the south and carboniferous sandstone at the north. Both are rough areas with hills and bluffs. Post oak grows on the higher parts and cedar and mesquite on the flats.

7. The Red Beds Prairie comprises an area of about 10,000 sq. mi. in the north central part of Texas, abutting on the Staked Plains. Over this area the influence of altitude, soils impervious to water, and distance westward leads to a complete predominance of grass vegetation.

8. The Staked plains with an area of 44,000 sq. mi. are ideal for forest growth so far as soil goes. But the dryness of the climate does not permit forest growth of any kind except in canyons and on bluffs.

9. The Stockton Plateau is a continuation of the Edwards Plateau beyond the Pecos River. This is not a timbered section at all except in the canyons and on some rough breaks. This extends to the eastern point of the Cordilleran Region.

Coast Plain are repeated here, but the disposition of the water is different owing to the deep beds of sandy clays which characterize this belt. Its soil is particularly favorable to forest growth, which consists for the most part of post oak, live oak, and black jack. These extend to the Nueces River, or farther west of this is classified as the Rio Grande Plain.

3. The Lignitic Belt, over 30,00 square miles in area, is older in geological formation (Marine Eocene) and lays next inland to the Fayette Prairie. The altitude is greater, ranging from 200 - 500 feet and erosion has left a more uneven country than either of the preceding divisions. Counting that portion west of $97^{\circ} 30'$ as Rio Grande Plain, the remainder comprises a large area of sandy clay ridges and hills, occupying all of the east Texas interior to the Fayette Prairie. The inner boundary line runs, approximately, from Seguin through Elgin, Cameron, Corsicana and Sulphur Springs to the Red River. The open soil structure and the heavy rainfall makes this a natural forest.

4. The Rio Grande Plain of over 20,00 sq. mi. includes the western portions of the three preceding divisions from $97^{\circ} 30'$ to the Rio Grande. Its interior boundary is the escarpment of the Great Plains Region whose southern province is the Edwards Plateau. The soils of the Rio Grande Plain are largely favorable for timber growth, but the luxuriant growth of forest is prevented on account of the limited amount of rainfall. The woody vegetation consists for the most part of chaparral, which grows to an arborescent height in the regions where the rain is greatest.

before such returns are to be sold. Only the long-lived corporations can afford to go into this on such a large scale. Even in the most fertile soils there is scarcely a farm that does not contain a patch of timber large or small, that could not profitably be kept as a woodland, providing a source of profit in the form of fire-wood and posts and at the same time benefitting the farmer in other ways. The importance to the farmer in his own timber is as evident as the raising of his other crops.

CONCLUSIONS.

The forest preservation which the State of Texas as a whole demands can be attained only by the adoption of a definite policy, both state and private. Such a policy to meet the demands of the situation ought to include not only a system of private management but also a state reservation. It should be established and administered on such a firm basis as to assure the hearty cooperation of all. It should be scientific, employing all the technical knowledge obtainable and practical, so far as the adjusting itself to the conditions, so as to obtain the support and confidence of those with whom it must deal. Its broadest success will depend not only upon legislation by the state but its acceptance by the people as a whole.

The formation of such a policy should be brought about by the creation of a state commission; one that would examine the workings of the existing laws concerning the forests, and recommend changes or additions necessary; one that would arouse public interest; and one that would investigate the benefit of making of reserves and of finding what areas should be included. This could be done by cooperation with the Bureau of Forestry and by experiments.

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