

FORESTRY CONDITIONS IN MONTGOMERY COUNTY, INDIANA.

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The recent interest in forests and forestry problems in Indiana makes it very important that every one collecting accurate information regarding the forestry conditions in any part of our commonwealth, present in as complete a manner as possible everything that may be of general importance in arousing public interest and at the same time serve as a basis for intelligent work in that particular part of the State.

The writer has studied with some degree of thoroughness the conditions in Montgomery County, which conditions, as revealed by the following facts, demonstrate the very serious nature of the problems we are confronting and the lines for future work.

Montgomery County is located in the middle western part of the State and contains 504 square miles, or 322,560 acres. Owing to its large size, its prominent location and the diversity of its surface and soil it may well be considered as a typical section of the central part of Indiana. Hence, what may be said of the forestry conditions and the plans and possibilities of its reforestation may in a general way be considered true of the whole central portion of the State.

The surface of the county is pleasantly diversified. The western and central part near the principal streams is hilly and broken, in the north central it is gently undulating and at the east and southeast flat and level. The northern part of the county is notably a prairie region, level or gently rolling.

The drainage takes direction from the dip of the underlying rocks generally a little west of southwest. The main stream is Rock River or Sugar Creek, which enters south of the northeast corner and traversing the central area, passes out six miles north of the west corner of the county. Its tributaries from the north are Black and Lye creeks; from the south, Offield, Walnut and Indian creeks. The southern and southeastern parts are drained by Big and Little Raccoon creeks and at the southwest by Coal Creek, which flows directly into the Wabash.

The early settlers found the county one vast forest, broken only by the wind swept streak of the cyclones or the marshy land of the prairies. So dense was the wilderness that their way had to be cut with the axe. Trees and saplings were cut and their trunks made into corduroy roads.

Everywhere were the most valuable varieties of forest growth, such as the oak, walnut, ash, poplar, cherry, maple, elm, hickory, beech, mulberry, buckeye, locust, willow, sycamore, cedar, and some hemlock, each towering and climbing and ever contesting for the necessary light of the sun. The lower branches were of little use in the shade and soon died away, thus by the natural pruning leaving the stem of the tree smooth and unbranched.

To appreciate something of the size of these giants of the forest we need but note the following:

<i>Common Name.</i>	<i>Diameter.</i>	<i>Height to First Limbs.</i>	<i>Total.</i>
Burr Oak	7	72	160
White Oak	6	60	150
Black Oak	6.5	75	165
Red Oak	7	94	181
Black Walnut	7	74	155
Poplar	8	91	190
Sugar Maple	5	62	120

All the ground was covered with underbrush and litter which had been accumulating for ages, producing a deep, rich loam which is still evident in the richness of the cultivated fields. Here were myriads of birds making their homes in the kindly shelter of the trees, and in turn destroying the multitude of insects which threatened the life of the forest. Thus when we closely examine the natural conditions we find the forest is a unit, a natural community in which each factor plays its part. An equilibrium is established, the result of the adaptation of each element to its environment; and when this equilibrium is disturbed the result is an undue development of one factor and consequent suppression of others. In this instance thoughtless man has destroyed the equilibrium, and the drying up of the wells and streams, the decrease in fertility of the fields and loss to our crops are a few of the disastrous results.

Now but little remains to remind us of the luxuriant forests of this county sixty years ago. Here and there are scattered patches of woodland standing like islands in a wide sea of clearing, and most of these so thinned and mutilated that they can scarcely be called forests at all. To the student of such affairs the destruction of this once mighty forest has all the features of a long continued tragedy. It is a crime against the past, present and future, a crime which may never be forgiven nor

forgotten. Though undoubtedly required by the necessities of civilization and population, it has been carried too far, and future generations may have to curse the wanton waste of the past. Our fathers had a constant grudge against trees. The best were cut into rails or hewed into sills, or used for firewood. Regular logging bees were held and tree after tree was cut, rolled together and burned. There is not a farm in the county today but would, if left in timber, have been worth six times its present value. And worst of all, this same policy is being continued. Every year forest owners, either through carelessness or ignorance, are wasting valuable property. Concerning the market value of the various crops which the farm produces the farmer is usually posted, but concerning the market value of the various trees making up his timberland he is usually ignorant. The amount of timber that has been allowed to go to utter waste in the past history of the county, because of the failure to appreciate the true value of forests, would have been sufficient, had it been preserved and sold at current prices, to have paid for every acre of land in the county. Save for occasional groves, almost all the black walnut has been removed because of its great value, and yet on every farm in the county, rows of rail fences built of black walnut and poplar, puncheon floors, rafters of old barns and sheds attest to its reckless use in the past.

In this country where all the land is in the hands of private owners, nothing can be done save through the intelligent co-operation of land owners.

No land in the county has been reforested by artificial means. A number of farmers, however, maintain groves of catalpa and black locust which furnishes material for posts and poles. Numerous instances could be cited where a few acres of black locust furnish a constant supply of posts for the fencing of farms containing hundreds of acres each. Such groves are easy to propagate and furnish the best of posts, which can not be purchased on the market for less than thirty cents each line post. The catalpa groves have not proved so successful, owing in some instances to the planting of catalpa bignonoides which is of small growth, crooked and seldom forming a well-shaped tree. The valuable variety to plant is *C. speciosa*, which is a very rapid grower and furnishes wood valuable for posts, ties, telegraph poles and lumber.

Not only has there been no planting of forest tracts, but there has

been a constant cutting off of the remaining timberland. The following figures from the statistician's report shows this condition:

1881.....	67,574 acres timberland.
1882.....	62,983 acres timberland.
1883.....	69,390 acres timberland.
1884.....	69,451 acres timberland.
1885.....	46,508 acres timberland.
1886.....	44,183 acres timberland.
1900.....	7,184 acres timberland.

The discrepancies in the early returns are due to inaccurate data; the later reports are more reliable. They are sufficient to show the vast decrease in our forest area. In fifteen years 39,324 acres of timber was removed at the rate of 2,621 acres per year. If this rate were kept up all the remaining timberland would be deforested in 2.7 years, but, of course, the decrease in the amount and value of the timber would tend to lessen the annual rate of removal.

The census report for 1900 states that the number of acres in timber but not in pasture land in Union Township is 2,240. Much of this, however, is in small lots or groves and has had most of its best timber removed. This 2,240 acres is but 3.1 per cent. of total area of the township and is divided into 103 tracts or lots, only thirty-seven of which contain twenty acres or more. Of this latter number only eighteen contain as much as forty acres, and only one of 100 acres.

Ripley Township is rugged and broken toward the south and has remaining a larger proportionate acreage of forest. There are twenty-six tracts of twenty or more acres reported, making a total of 1,273 acres, comprising 59 per cent. of the total area. Much of this land is covered with beech, which, however, is not a very profitable timber. The soil, especially toward the southern part, is generally poor clay, and if stocked with young trees would soon bring much more than can be realized from the same ground at present.

Brown Township is also much broken along the course of Sugar Creek. Only fifteen tracts of over twenty acres were reported, but most of these areas are large, giving a total of 950 acres or 2.7 per cent. Much of this timber is beech, though white oak is also abundant. The region near the mouth of Indian Creek, known as Pine Hills, is covered with pine and hemlock. Some of these trees are very large with straight, towering

stems reaching to lofty heights. Hundreds of seedlings are growing everywhere and if left alone will perpetuate the excellent forest condition now prevailing. Farther down the stream are the "Shades of Death," an area of 200 acres in virgin forest, especially noted for its beautiful scenery. The sides and slopes of the sharp hills and promontories are covered with a thick growth of evergreen hemlocks and cedars and the tip-top heights with pines which lift their foliage 200 feet above the brook, averting the sun's rays and filling the deep chasm with a gloom typical of the "Valley of the Shades." Here one sees typical forest conditions, the forest litter holding the moisture and feeding gradually the many pure, cold springs. This land, if deforested, would be worth practically nothing, but under proper management a large return could be secured annually from the timber growing there. This area, however, has been recommended by the State Forester as a forest reserve with the purpose of increasing its efficiency as a park. Dr. Henry Moore, of Irvington, Indiana, was chosen president of the board of control. No other recommendations have been made.

Walnut Township reports fifty-eight forest tracts containing a total acreage of 4,493 acres of 20 per cent. whole area. These forest tracts are comparatively large, thirteen of them containing 100 acres or over.

Franklin Township reports eleven forest tracts, of twenty acres or over, making a total of 420 acres, or 2 per cent. The areas are small and most of the good timber has been removed. The boulder trail passes through the western portion of the township and the land in its vicinity would be worth much more if properly covered with timber than it is in its present condition; the large number of boulders making cultivation of crops very difficult.

Sugar Creek Township reports seven tracts or 302 acres, 1.4 per cent. of total area. Most of the region is black prairie land and the timber is mostly in groves which have grown since the settlement of the country. The prevailing species are shellbark hickory and white oak.

Madison is also a prairie region and its condition of soil and forest closely resembles Sugar Creek. Seven tracts are reported, giving a total of 458 acres, though the total acreage of the township, including smaller tracts, is reported as 501 acres or 21 per cent.

Coal Creek reports but two tracts of more than twenty acres, though the total acreage amounts to 201 acres or .6 per cent. of the total area of the township.

Clark Township returns indicate four forest tracts containing over twenty acres. Only one tract contains over forty acres. The total area is 135 acres or .6 per cent.

Wayne has but eleven forest tracts, making a total of 399 acres or 2 per cent. of the total area. The tracts are small, only one containing as much as sixty acres.

Scott Township reports no forest tract containing as much as twenty acres. The total area of the timberland in the township does not exceed ninety-five acres or .4 per cent.

From this glance at the townships it will appear that the amount of available timber is very limited and most of the forests now remaining are so small, open and scattered, that the benefit derived from them is but a small per cent. of that accruing from well regulated forest areas.

The General Assembly of the State of Indiana enacted, in 1899, a forest reservation law, whereby upon any tracts of land a portion, not exceeding one-eighth of the total area, could be selected as a permanent forest reservation which should be appraised for taxation at one dollar per acre. The land to be exempted must contain 170 trees per acre, either naturally or artificially propagated. The act makes further specifications as to the maintenance of the tract, and designates what trees shall be known as forest trees within the meaning of the act. The law was a step in the right direction and has resulted in 284 exemptions covering a total area of 5,312 acres in the State. In Montgomery County, however, not a single exemption has been filed. This condition in this county is largely due to the lack of information on the subject, and succeeding years will no doubt witness a large number of exemptions.

Deforestation of the headwaters has produced a marked effect in the size and value of the county's streams. In its early history Sugar Creek was navigable for good-sized boats and was much used as a means of transportation. In 1824 William Nicholson came from Maysville, Kentucky, to Crawfordsville in a keel boat of ten tons burden which landed at the mouth of Whitlock's Spring branch. It floated down the Ohio to the mouth of the Wabash and thence was rowed up to the mouth of Sugar Creek, finally, after a long voyage, reaching its destination. Afterward two men took the same boat down to Terre Haute for a load of corn. Other instances could be cited, but these are sufficient to show the extent of the navigability of the stream which at present would scarcely

float an old time flatboat. Much of this is due to the filling in of the channel with the products of the denuded fields above.

Records show that Sugar Creek has furnished a motive power for at least nineteen mills situated along its course in Montgomery County. At the present time the number does not exceed four and these are obliged to use steam during most of the summer season. As is well known, a constant water supply furnishes a most economical and reliable motive power which would tend to lessen the cost of any manufactured products. The owner of the Sperry Mill, at Crawfordsville, asserts that the cost of running the mill one day by steam power, including coal, fireman and all expenses, is \$5; while the total cost of water power for *one year*, including repairs to the dam and wheel, is \$40. In other words, the amount required to run the mill one day by steam would pay the cost of running the same mill by water for nearly forty days.

The amount of power exerted by the stream in its course would, if utilized, be sufficient to turn every wheel in every factory within the county. This would be of especial importance in furnishing an economical motive power for concerns under municipal ownership, thereby greatly reducing the expense of operating. But while the volume of water carried by Sugar Creek in a year has probably remained constant since the county was discovered, yet the flow is so irregular and uncertain that it is no longer of great economical importance.

Deforestation has also had a very disastrous effect upon the fish supply of our streams. In the early settlement of the country Sugar Creek was full of edible fish. It is related by an old settler that during one night in 1824, 900 fish, consisting of pike, salmon, bass and perch, were caught in a large fish trap. The settler often carried them by skiff loads from the fish trap and placed them in a pond to be retaken later and sold or used for food. Now this condition has entirely changed and but few food fishes remain in our streams. It is true that stream pollution and illegal fishing are responsible for much of this, but the decrease in the volume of water, rendering it stagnant during the summer months, is almost directly the result of deforestation of the headwaters. The unusually high water at the season of spawning seriously interferes with the reproduction of the species. This sudden rise of the stream is prevented by the forest. The litter receives the rain, and, owing to its looseness and lack of capillarity, prevents rapid evaporation. The relatively low temperature of the forest is also a factor in lessening the rate of

evaporation. The unevenness of the forest floor, with sunken logs and piles of debris, prevents the formation of gullies and consequently the water sinks into the ground instead of running off on the surface. It can not wear away the soil upon steep slopes, nor form sudden and disastrous freshets as in a naked and treeless region. The streams rising in woodlands may swell after a rain, but more gradually, and they will subside again more slowly. If they rise in woodland swamps, they are scarcely liable to floods at any season and tend to an even flow throughout the year.

The soil of Montgomery County is generally very rich and the disastrous effect of the removal of the forest will not be evident for many years. The land is especially adapted for agricultural pursuits, and rational farming and rotation of crops is doing much to maintain its productiveness. Yet some tracts have been cleared which are of very little use for farming purposes, and fail to yield a profit for the labor exerted upon them. We have seen large areas of good timber cut down, much of it wasted and destroyed, merely to add to the farm land an area almost worthless for cultivation. Such land should be immediately reforested with the most profitable kinds of timber, since by this means the most profitable returns can be secured.

An examination of our corn crop yields since 1873 shows the following gains:

1873-1877.....	24 bushels per acre.
1878-1882.....	31 bushels per acre.
1883-1888.....	37 bushels per acre.
1889-1893.....	32 bushels per acre.
1894-1900.....	42 bushels per acre.

In considering these figures we must remember that much newly cleared land, rich from forest litter, has been added yearly and tends to increase the average yield per acre.

Our wheat crops have not fared so fortunately and the averages for five year periods since 1872 show the following decrease:

1872-1876.....	21.18 bushels per acre.
1877-1881.....	15.45 bushels per acre.
1882-1886.....	14.21 bushels per acre.
1887-1891.....	13.10 bushels per acre.
1892-1896.....	13.30 bushels per acre.
1897-1900.....	11.60 bushels per acre.

The exact cause of this decrease is not known, but to the student of forestry conditions, it seems that deforestation is, in part at least, responsible.

By far the most susceptible of our crops to the changed condition is the apple. Though our statistics on this subject are very limited, yet the memory of every person of mature years will testify to the great decrease in our apple crop. The raising of perfect apples in this county is very difficult and yields such poor financial returns that the growers have almost entirely abandoned the pursuit. However, the decline in yield is by no means proportional to the decline in the number of trees. The following figures are taken from the statistician's reports for Indiana and express approximately this condition:

1879.....	42,007 bushels apples.
1880.....	37,781 bushels apples.
1881.....	20,476 bushels apples.
1885.....	14,544 bushels apples.
1886.....	98,933 bushels apples.
1897.....	3,084 bushels apples.

The yield has so decreased that at the present time we are compelled to import almost all of our apples. The immoderate ravages of hordes of insect pests is mainly responsible for this condition, though the apple rust is also very injurious. The disastrous effect of the latter, however, is probably no greater now than at previous times and will not account for the remarkable decrease in our apple crop.

Besides a decrease in our soil productiveness, the county has also lost many valuable wood industries. Until recently there was located at Crawfordsville a heading and stave factory which used large quantities of timber and furnished employment to many men. The scarcity of available timber made further operation unprofitable and the concern was moved to Arkansas. At one time the county was liberally dotted with sawmills, but now scarce a half dozen remain, and these are compelled to import a large proportion of their logs, in some cases nearly one-half.

Crawfordsville at present has but two important wood industries. The Indiana Match Company uses large quantities of cottonwood and basswood and the supply of this county was soon exhausted. For some time past the company has purchased these woods in different districts, chiefly in lower Illinois, but the new Chicago drainage canal has flooded so much

of the timber country that the wood can not be gotten out. The company is in a difficult position and the scarcity of any material may cause it to close down or to be removed. The Casket Company uses annually \$38,000 worth of material, turning out a finished product worth \$58,500. The factory furnishes employment to forty persons, paying annually in wages, \$18,000. Most of the material is shipped here. There are prospects of another industry for the manufacture of wooden novelties for which there is claimed an excellent market. In order to have the desired capacity, about thirty men would be employed at first and if the venture proved successful the capacity and working force of the plant would be doubled. The principal woods used are the maple and beech, and the county still has a good supply of the latter.

Such industries contribute largely to prosperity of the county and whatever would tend to foster them in a proper way is promoting the general welfare. The reforestation of a sufficient area would make good timber available and not only prevent the removal of our present industries but invite new ones as well.

NOTES ON THE CLEAVAGE PLANE IN STEMS AND FALLING LEAVES.

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Adaptation to climate and environment is nowhere better illustrated than in the forest. Especially is this true of the temperate regions where adaptation is in response to the winter cold. The deciduous trees, instead of protecting their delicate leaf structures from the severe cold of winter, have formed the habit of dropping them and again putting out new leaves when the warm season returns. The deciduous trees have developed the working powers of their leaves to such an extent that the great surface exposure and delicacy of structure make it impossible to carry them through the winter, therefore, the necessity of the deciduous habit.

However, this habit of shedding is not confined to the leaves only, for many trees annually shed twigs and branches. The dropping of twigs and branches is probably to prevent too great a density of foliage. This last habit is not restricted wholly to the deciduous trees, for some of the conifers have the same trait.