

FOREST CONDITIONS IN INDIANA.

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Certain economic statements may serve as a suggestive introduction to this study of Forest conditions in Indiana. Some of these will be more fully elaborated later in the paper, others need no comment since their mere statement is sufficient to call attention to existing conditions.

A reference to the Census report of 1880 will show that at that time Indiana ranked sixth in the list of lumber producing states. In 1908 it ranked twenty-seventh.¹ Not only had it fallen to this low position in the list of lumber producing states, but the cut of 1908 was very decidedly less than that of 1907. While some part of this latter loss may be attributed to the reduced demand for lumber in 1907, all of it cannot be so referred. As a matter of fact the cut made represented all of the high grade timber upon which lumbermen could lay their hands.

While certain regions of the state, notably in the southern counties, still appear to be heavily timbered, an examination shows that practically all forms of high value have been cut from them. They have been swept clean of their yellow poplar, white oak, black walnut, and cherry and are made up almost entirely of what may be regarded from an economic standpoint as second grade or inferior forms. It is these inferior forms that are furnishing the future forest, if indeed there is any promise of a future forest. The splendid forests of the past,² splendid not only in extent but in the quality of the timber they yielded, have disappeared and the forests that remain are infinitely inferior to them both in extent and quality. Present conditions indicate a still further deterioration unless prompt remedial measures are taken.

A rather careful examination of the existing areas, supplemented by the opinion of lumber buyers, leads to the conclusion that few extensive areas in the state will show a stumpage of desirable forms exceeding 2,500 feet board measure. My own judgment is that the average stumpage

¹ Forest Products No. 2. Lumber, Lath and Shingles, 1908. Bureau of the Census, issued November 15, 1909, p. 8.

² Stanley Coulter. The Forest Trees of Indiana. Trans. Ind. Hort. Soc., 1891, p. 8. A. W. Butler. Indiana: A Century of Changes in the Aspects of Nature. Proc. Ind. Acad. of Sci., 1895, pp. 32, 33.

is below this figure. In order to reach this estimate it has been necessary to include beech, elm, and sycamore, species which for various reasons are not to be classed with white oak, yellow poplar and black walnut. Indeed the eager search for beech and elm is a fairly conclusive evidence of the paucity of forms of higher quality in the forests of the state. Of course there exists here and there throughout the state small tracts showing a heavy stumpage of high grade species, but such areas are the exceptions that prove the rule.

A constantly increasing number of wood-working plants are shutting down because of inability to secure the needed raw material. The radius marking the limit from which this raw material can be drawn is very definitely limited by freight charges. I have received a statement, which may be considered as official, that fifty per cent. of the veneer plants of the state are shut down because they are unable to secure logs suitable for their work. What is true of the veneer industry is true in varying degree of other wood-working industries. This means, unless checked, loss of employment to hundreds or even thousands of men, and either a removal of capital to other states or its absolute loss. The reduction in the number of wood-working plants in the state within the last decade has been startlingly large and can only be explained by the rapidly waning supply of suitable raw material.

While the data in my hands are not yet complete, I have records of over five hundred thousand (500,000) acres of waste land in the state. This waste land, located in a very great measure in the southern portion of the state, is the result in almost every instance of destructive lumbering. Concerning this conclusion there can be no doubt. We have knowledge of former forestal conditions, and in many cases the history of the cuttings of specific tracts. These waste lands lie open and are absolutely waste; they are not used in agriculture or horticulture and have wasted to such an extent that they are completely abandoned. They yield revenue neither to the owner nor the state. The indications are that the amount of deforested land abandoned by the owners is constantly increasing. The surer, indeed the absolutely unmistakable sign of a decadent state from an economical standpoint, is a constant increase in the area of abandoned lands.

To counteract the conditions indicated in the preceding paragraphs, tree planting has been undertaken in the state on a fairly large scale within

the past few years. These plantings have been made by individuals and by corporations. The tree plantations run up into the hundreds and the number of trees into the hundreds of thousands. A careful inspection of sixty-nine of these plantings, embracing two hundred fourteen thousand (214,000) trees was made in 1908-09 by Messrs. U. C. Allen and H. C. Kennedy. The plantations examined covered the state with the exception of the southeastern counties and represented practically every type of soil and drainage conditions. Supplementing their records by my own observations and those of Secretary C. C. Deam of the State Board of Forestry, I am led to the conclusion that afforestation operations in the state have been, in a large measure at least, unsatisfactory. While there are occasional instances of successful and apparently profitable tree culture in the state, it is very certain that, taken as a whole, the results are not of such character as to give promise of any relief from present conditions in the immediate future. The plantings have been chiefly catalpa and black locust. Only in exceptional cases, and then rather as the result of chance than a definite purpose have other species been tried. A very few small plantings of black walnut and white ash practically represent the attempt in growing trees of high grade.

The reasons for these unsatisfactory results are not far to seek. They may be grouped under three categories:

1. Ignorance of the silvical qualities of the species.
2. Poor seed or seedlings which were not of the species desired.
3. Ignorance of the cultural requirements for securing rapid and healthy development.

Apparently in many of the plantations no question as to the fitness of the soil, or drainage, or exposure entered. In another large series of catalpa plantings the larger number of the trees were not the hardy catalpa (*speciosa*) but *C. bignonioides* or some hybrid. In more than one-half of the cases absolutely no attention was given after the planting, to cultivation, to pruning or to coppicing. A study of the conditions in these plantations is sufficient proof that afforestation operations will not be successful in Indiana until a much fuller knowledge of the silvical qualities and requirements of the species selected becomes common property.

Bad as the existing conditions are, the case is far from hopeless. The aggregate timbered area of the state is still large and while the stumpage is not heavy nor the quality all that could be desired, yet these areas

furnish not only the hope but the assurance of the future, if, *and only if*, they are intelligently managed. All of the timber lands in the state, with the exception of the State Forest Reservation, is held by private owners. As a rule these holdings are relatively small and our forests may be considered as made up of a large number of wood lots. It is a fact that cannot be too often repeated or over emphasized, that it is a much more certain and a much cheaper process to maintain and improve an existing stand of timber than to produce a new one by planting. Not only is it much surer and cheaper, but it is also much more rapid.

The problem of the future of the forests of Indiana is merely the problem of securing the proper handling and care of the wood lots and small timbered areas held by individual owners. If such areas are wisely handled and conservatively lumbered there is no reason why they should not for years yield a steady and increasing income and at the same time show a marked increase in quality and value. In other words the problem of the future timber supply in the state is very largely a problem of education. Owners of timbered tracts must be brought to a realization of the value of such holdings and trained in methods of management which will secure the results indicated. It must be shown also that such methods of management are profitable, for unless this can be done no method, however theoretically desirable it may be shown to be, will ever come into general use. The real peril lies in the fact that this process of education is a very slow one and that existing timber areas may be greatly reduced in value or completely destroyed before a knowledge of the better methods has become common property. An examination of a number of such tracts covering many counties of the state indicates fairly well what may be considered the average condition of the forests of Indiana today.

Almost without exception these timbered areas are used as pasture land, and have, in most instances, been so heavily overpastured as to practically destroy all prospects of the regeneration of the forest after the removal of the present trees. An examination of seventeen such wood lot pasture tracts during the past season which were distributed through twelve counties of the state, revealed the fact that in not a single one could any young seedlings or healthy, well formed saplings be found. Any system of management under such conditions is perfectly useless. Unless the condition of the wood lot areas is improved and the regeneration of the forests provided for by an abundant and vigorous growth of seedlings, the end of our forests is not far distant.

In most instances the withdrawal of the tract from pasturage will be sufficient to permit an immediate springing up of sufficient seedlings to care for the future of the tract. This withdrawal from pasturage should be absolute until such time as the young growth is beyond danger from browsing animals. After that time light grazing may not be injurious, although if grazing is permitted at all, there is the constant temptation to overgraze.

The effect of this overgrazing is very easily demonstrated by simply enclosing a tract which contains no seedlings, thus protecting it from cattle. Almost invariably a dense and abundant undergrowth representing many species of tree forms will spring up and in a few years will have provided a stand sufficiently dense to allow improvement cuttings and thinnings, leading to the formation of a new forest.

In the State Reserve a large acreage was burned over the year before the State took possession of the tract. At the present time, some eight years after the fire, the tract which was burned over is densely covered with a growth of vigorous and healthy young trees, with valuable species represented in such large numbers as to give certain promise of a fine even-aged stand after the cleaning and thinning cuttings have been made. The area was regenerated from adjoining seed trees. No treatment of any kind was given the tract; it was simply freed from pasturage.

In the hill regions of the southern counties, and especially in localities where the hills faced the Ohio river, the forests were removed many years ago. For years such tracts were left unfenced and during those years the land wasted through erosion and no seedlings obtained a foothold. At a later period when laws forbidding stock running at large were passed and when wire fencing came into general use, these denuded hills were quickly covered with a dense growth of vigorous young trees. No planting had been done, the soil had received no treatment, but the tract as in the former case was freed from pasturage. Such instances could be multiplied almost indefinitely and from them can be drawn a conclusion of high economic value, namely, that very many of the denuded areas of the state could be afforested by the simple process of relieving them from the burden of pasturage. It is safe to say that 90% or more of the timber areas of the state are so heavily over-pastured as to preclude any possibility of their future improvement or growth. Until the owners of these small forest tracts realize the utter destructiveness of over-pasturage but little

can be done to improve forest conditions in the state. That these statements are not exaggerated is a matter of fairly easy demonstration by any person who will go through an average forest in his vicinity and make a close examination for the young trees which stand as a prophecy of the future forest. In almost every instance they will be found to occur in such small numbers as to indicate a constantly waning forest. Indeed, in very many cases not a single seedling or sapling of a desirable species can be found.

A further examination of these areas within our state shows that in by far too many cases they have suffered damage by fire. In very many instances these fires have spread into the timber tract from the right of way of railroads or from meadow fires which have been started for the purpose of cleaning and have escaped control. However they may have originated, their effect upon the forest has been two-fold. First, in a serious damage to the mature trees and second, in practically obliterating all the young growth which may have become established. As a result of the action of such fires, not only is the young growth killed but the soil is placed in such condition as to preclude a future growth for several years. The damage by forest fires in the state during the past year, which was by no means an exceptional one, amounted at a conservative estimate to at least \$100,000. A very large part of this loss could have been avoided by exercising ordinary care. Very much more of it could have been prevented by the rigorous application of the laws fixing the responsibility for the occurrence and spread of forest fires.

The value of these wood lots as they stand might also be very greatly improved in many cases if improvement cuttings of various kinds were undertaken. Almost all of them need "cleanings" in order to remove from them various undesirable forms. It must be remembered, however, that such cleanings must not be too vigorously undertaken lest too great an amount of soil be exposed to the action of the sun and the wind. Sudden changes in ecologic conditions are particularly fatal to young tree growth. Where the undergrowth or undesirable forms are at all dense, probably not to exceed 25% should be removed at any one time and the ground should not be cut over again in less than four or five years. In these cleanings the object should be to remove all forms the absence of which would improve the forest and give the trees left standing an opportunity for a more perfect development. In this cleaning should ultimately be removed

all trees, which, even if allowed to reach full maturity, would never have an economic value. It should also include all trees that are dead or dying, since such trees are not only deteriorating in value but also serve as centers from which various diseases destructive to the forest may spread, and because in addition they furnish natural breeding places for many species of harmful insects. When such dead or dying trees are infested with fungus diseases or injurious insects, they should be completely burned. The cleaning should also include all trees which are over-mature or for any cause are losing value. Trees which are undesirable in shape or from other causes do not promise to make a satisfactory growth should also be included in the cleaning. Special attention should be paid to seed bearing trees of undesirable species. These should be removed whenever found in order to prevent their seedlings from occupying the ground at the expense of the more desirable forms.

As has been suggested, these operations must not be carried on too vigorously since the young seedlings, which are to make the future forest, require shelter from the wind and from the sun during their earlier years and if the removal of these undesirable forms is made too completely at a single operation the object in view will be defeated. By the application of such methods not only may the condition of the wood lot be constantly improved so that in the end it will contain a vigorous and healthy growth of valuable forms, but at the same time much material which may be utilized for fuel and for other purposes will have been removed from the area. In almost every instance, if care is taken, these cleaning cuttings will more than pay for the expense required to make them. It is a conservative statement to say that over one-half of the existing wood lots in the state would be very greatly improved in value and in productive capacity by a series of judicious cleanings.

In addition to these cleaning cuttings, in certain regions "thinnings" seem to be required. Two trees of a valuable species may stand so close together that if both were allowed to remain, neither would develop into a good tree. One of them should be cut away. In almost every wood lot also, there are to be found clumps of trees which stand so close together that they have developed thin, weak stems instead of stout and sturdy trunks. Enough of these should be cut out to insure a healthy and vigorous growth on the part of the trees that remain. The thinnings differ from the cleanings in that, while the cleaning removes undesirable and injur-

ious forms only, the process of thinning removes desirable forms where they are wrongly placed in order that the trees left standing may have a better chance. There is scarcely a wood lot in the state in which manifold instances of the value which would result from careful thinning cannot be found.

The existing wood lots can be still further maintained in good condition by a more careful use of the material which is cut from them. There is a constant tendency to cut such trees as will work up most easily, whatever may be the purpose for which they are to be used. Good straight white oak of sufficient size to have a high value for lumber is cut for fire wood, or rails, or posts, when a score of other species which have no lumber value might serve these purposes as well if not better. In the same way large numbers of vigorous and straight young saplings are cut down for hoops, for poles, or for other of the manifold uses of the farm. Such wastefulness under present conditions is little short of criminal. The woods of high value should be allowed to come to their full size and development and the ordinary uses of the farm supplied from inferior timbers which are of less value and of less general usefulness.

Great care should also be taken in working up the tops of the trees cut in such a way as to utilize them as far as possible. Not only does such utilization reduce the number of trees that are cut from the tract, but it at the same time protects it from damage by fire, since the dry tops of trees burn fiercely and are always a great peril in case of fire. An examination of an ordinary cutting whether for wood or lumber or clearing will show that scarcely 50% of the tree is utilized.

It is very difficult to form any estimate of the amount of the present timber stand of the state. As contrasted with the past the average amount per acre has been very largely reduced. As examination of the sources of supply of wood manufacturing plants will show that a large proportion of the more valuable timbers which they use in their work are secured from without the boundaries of the state. As an illustration, information derived from certain veneering companies of the State may be given.

The Indiana Veneer and Lumber Company uses in its operation oak and principally white oak. Most of this is derived from the states between Ohio and Missouri, but not above 25% of it is secured from Indiana.

The Evansville Veneer Company cuts gum, poplar, white oak, red oak, sycamore and beech. They purchase these woods in Tennessee, Kentucky, and Mississippi, getting none from Indiana.

The Goshen Veneer Company uses bass wood, maple, ash, elm, sycamore, beech, poplar, oak and walnut. The oak they buy in Illinois and Kentucky; the poplar south of the Ohio river. As nearly as they can estimate, 60% of the material which they use comes from Indiana.

The Hoosier Veneer Company uses white oak very largely, with some red oak. About 35% of this material comes from the south and about 65% from Indiana.

Showers Brothers Company, Bloomington, cut only those woods that are native to the southern part of the state. They include in their work the different varieties of oak, poplar, beech, maple, sycamore, elm, ash, and hard gum with occasional logs of walnut and cherry. The last two are taken from southern Indiana. A direct quotation from the letter of their secretary is extremely suggestive. "There is yet quite a quantity of timber in this section of Indiana. It is, however, becoming very much scattered. The visible supply of veneering timber in Indiana is rapidly diminishing. In my opinion *within four or five years it will be necessary for the larger mills to draw from out of the state a large part of their logs.* The quality of southern Indiana logs, principally the oak varieties, is the best in the country for veneering purposes. The texture of the grain and of the figure being far superior for cabinet purposes to the southern varieties. We use in our veneering mill alone about 35,000 feet log measure of timber per week. It is my opinion that further development of the veneering industry will do more to save the diminishing supply of timber in this state than any other one thing, as in working timber into veneer an enormous saving in waste is effected."

The Diamond Veneer Company uses only quartered oak in its operations, buying flitches from the saw mills and not buying logs. The company estimates that about 90% of its stock comes from Indiana mills, but has no knowledge as to the sources of supply of the mills.

The Putnam Oak Veneer Company uses practically any of the native woods of Indiana. The woods principally used are white, burr, and red oak, ash, hickory, bass wood, soft elm, poplar, walnut, black gum and beech. "Probably 20% of the wood, such as gum, cottonwood, poplar, red and white oak, comes from our native forests, the balance comes from the

south, where the timber is better as to size and cheaper as to price than our own timber. In my judgment we do not furnish over 40% of the lumber consumed in the state, the balance comes from the south. As is a well known fact, Indiana oak is the finest grade of oak that was ever grown in this continent. It is beyond the power of any living man to produce the wonderful forests of oak, poplar, ash, and walnut that once covered this state of ours. We gather our supply from all over the state. Fifteen to twenty-five years ago we were able to buy bunches of oak timber in from 75,000 to 100,000 feet lots, but now we pick up a tree here and there where possible. The condition has been reached that the state is swept practically clean of all its native oak."

Mr. Howard I. Young, Secretary of the National Veneer Association, estimates that there is in the neighborhood of ninety million feet of oak veneer manufactured in Indiana annually. This output is classified broadly into two parts, quartered oak veneer amounting to about sixty-eight million feet, and rotary cut oak veneer, amounting to twenty-two million feet. While much of the oak material is secured from Indiana, Ohio, and Illinois, a very material quantity of oak logs are shipped from the southern states to fill the demand for this class of material.

These extracts indicate that for many years selective cutting has been practised and in fact has been increasing as the years have passed. Timber area after timber area has been swept clean of its black walnut, its yellow poplar, its white oak, its cherry, and other trees of high grade and large size. As a result the forests that are left are composed of less desirable forms, and it is these less desirable forms that are furnishing the forest of the future in so far as any such future is to be hoped for. It is very evident from this statement of facts that if the high reputation of Indiana timbers is to be maintained and that if Indiana continues to be able to provide material for its own wood manufacturing industries, some close attention is demanded along the lines of the regeneration of existing wood tracts with desirable species. This may mean planting in certain open places, but even in spite of the considerable expense involved in such a process, the results reached would far exceed in value the cost incurred. While the experimental period at the State Forest Reserve has as yet been too brief to furnish data for authoritative conclusions, the indications all point to the fact that high grade trees such as yellow poplar, black walnut, and ash will grow as rapidly as the catalpa and black locust.

Not only are the indications that they will grow as rapidly, but also that they will maintain themselves in a healthy state, in good form and be relatively free from insect attack and fungus disease. While it is true that the oaks which are at present in very high demand will not make such rapid growth, it has been found that they will make a sure and healthy growth and that in all probability a natural regeneration of the existing wood tracts with our native oaks and other high grade timbers would be easily within the range of possibility, were it not for over-pasturage, damage by fire and destructive lumbering.

All of this means that in the use of the wood lot or small timber tract the owner should have constantly in mind *its perpetuation in unimpaired value*. No tree should be cut unless there is evidence that its place will be quickly taken by another equally desirable form and this evidence is always at hand in the presence of an abundant young growth. If such a young growth is not present, cutting cannot be done without diminishing the value of the stand. In every case the owner should regard a stand of timber as an investment from which he should derive a constant revenue, while at the same time the investment remains unimpaired. The scarcity of high grade timber, the eagerness with which it is sought and the relatively high stumpage values all combine to tempt the owner to such an impairment of his investment, but a yielding to the temptation is an indication of poor business judgment.

It may be necessary in many instances to reinforce the relatively slow process of natural seed regeneration. This may be done cheaply and efficiently in many ways, which are self-suggestive, yet which will bear re-statement. The weeds and brush may be cut away from the immediate neighborhood of the "mother seed tree" in order that the seeds may come in closer contact with the ground when they fall, thus greatly increasing their chances of successful germination. If the soil is hard and compact it may be broken with a hoe or plow so as to furnish a more satisfactory seed bed. In some cases where the litter of leaves is quite deep it may be advisable to rake it off in order to expose the mineral soil and even in extreme instances to burn it off, although burning over a tract to reinforce natural seed regeneration is an extremely doubtful process in unskilled hands. The methods suggested do not cover wide areas and are the ordinary methods used in the management of other crops. Whatever form they may take the result sought is the same, an increase in the number of seeds germinating by improving the character of the seed bed.

It is very obvious from this résumé of conditions that unless the owners of existing wood lots attack the problem in an intelligent way the time is not far removed when practically all of the material used in our wood manufacturing plants will have to be shipped in from other states.

The conclusion to be drawn from the statements in the above paragraphs are all but obvious. Practically all of our forests are in private hands and it is very evident that the timber problem in Indiana is to be solved by private forestry. The obstacles to private forestry are summarized by Treadwell Cleveland, Jr.,³ as fire risk, ill-devised taxation and cheap stumpage. The first two of these he suggests are "artificial obstacles" which may be removed by suitable state legislation. Concerning the third, Mr. Cleveland says: "Cheap stumpage is the chief material obstacle to the wide extension of private forestry. Forestry involves an investment in growing timber. If the investment is to show a satisfactory profit, the product must not sell too cheap. As long as the product sells cheap, expenditures will not be made to produce it, and the lumberman will continue to be the nomad and the speculator which past conditions have inevitably made him. In order to hold out inducements to private enterprise, forestry must offer a reasonable margin of profit above the cost of growing the timber.

This obstacle to forestry is being steadily removed by the depletion of the virgin forests and the consequent rise in stumpage prices. Already the scarcity of supplies has resulted in a number of cases in the holding of tracts for more than a single crop."

It is evident that if the timber supply of the state be maintained there must be cooperation between the state and private owners. Just what form state laws for the encouragement of forestry should take is not perfectly clear. It is evident, however, that legislation should develop out of state conditions and until the resources of cooperation have been exhausted, definite legislation should not be enacted. An examination of State laws encouraging forestry shows that they may be grouped under two general heads. First, those which seek to stimulate tree planting by bounties or tax exemptions; second, those establishing Forest Commissions and, in late years, State Foresters charged with duties suggested by the conditions in the state creating these offices. The laws under the first group have been, almost without exception, ineffective and in very many

³ Status of Forestry in the United States. Forest Service Circular 167, pp. 23-24.

cases have been repealed and in a considerable number of other cases declared unconstitutional. Such laws "have had some slight educational value, but they have led neither to the planting nor to the preservation of forests."⁴

Laws falling under the second group, on the contrary, seem to have greatly advanced the cause of forestry. This has been done mainly by gathering information, cooperating with private land owners and giving advice concerning the care of private holdings and tree plantings. In many states, state forests have been established and these have in every instance proved of high value. To quote directly from Mr. Cleveland,⁵ "These State forests represent a line of state action which has been pre-eminently successful. New York leads the list in State forest area (1,611,817 acres), followed by Pennsylvania (863,000), and Wisconsin (253,573 acres.) The smaller attempts of Minnesota, Michigan, Connecticut, Massachusetts, New Jersey, Indiana, etc., are all important. The State forests speak for themselves. First, they furnish object lessons of great value; second, they form the nucleus of what some day must be the principal center of state forest work. It is a fundamentally sound policy for the State to own land, especially land which does not offer the conditions necessary for prosperous settlement."

Under existing conditions in our own state, the most important and immediate duty is an extension of knowledge concerning the significance of existing timbered areas in their relation to the future of the forests and of the wood working industries; of their value as investments; of methods of management and utilization which will secure the maximum revenue without deterioration of the stand; of the importance of reinforcing natural seed regeneration and of a more general practice of wisely considered afforestation methods. The most casual inspection of the present timbered areas would prove sufficient to convince the most skeptical of the importance of intelligent and persistent effort along the lines indicated. If, in addition, we consider the large area of land at present utterly unproductive, areas which are increasing in extent each year, some wisely planned and judiciously applied remedial measures seem absolutely imperative. The Academy of Science could do much as a body and through the efforts of its members to aid in this work. The problem is sufficiently acute to

⁴ and ⁵ Status of Forestry in the United States. Forest Service Circular 167, September, 1909, p. 21.

indicate that the time for destructive criticisms of present attempts for its solution has passed, and that the time has arrived for cooperation in this work. If this cannot be given, the criticism should at least be constructive. In eight years of service on the State Board of Forestry, it has been my privilege to hear many sharp criticisms of its personnel and its work, but in all that time there has come neither to the board nor to any individual member of it a single suggestion as to how either might be improved.

It may be assumed without argument that a complete invoice of the present stand, as to amount, composition and distribution is absolutely necessary in order to secure results which are even approximately satisfactory. As a matter of fact, it has been demonstrated that with the present sources of information and with the present limitations as to the functions of the State Board of Forestry the collection of such data is absolutely impossible. Yet, it is evident that such a census of our forests and such knowledge of their composition and distribution are conditions precedent to any successful work looking to the maintenance of our timber supply. It is at this point that the state should cooperate with the National Forest Service. In many states, such a forest census has been or is being taken, the Forest Service detailing experts for the work and the state paying the expenses of the survey. Such cooperation gives the most complete, the most accurate and the most easily comparable results in the shortest time and at the least expense. If such cooperative work is impossible, then the Board of Forestry should as rapidly as its means will permit, collect and organize information covering these points. The slightest consideration of the future of the forests and of the wood-working industries of the state will show that the results of such a census would prove of the highest importance, not only in determining the policy of the state but in emphasizing the significance and value of existing timbered areas.

There is need also of much more exact and indeed of much additional knowledge in relation to the selection of species for planting in the different soil, drainage and exposure conditions of the state. There is need also of equally exact knowledge concerning the silvical qualities of these species, the most economical methods of propagation, their spacing in plantings, their cultivation and care and above all their rate of growth under variant conditions. The securing of such data is a matter of years of continuous experimentation and this work the state is properly under-

taking on the State Reserve. There is necessity, however, that the fact should be kept in mind that results sufficiently definite to prove of general application can only be secured as the results of large series of experiments continued through many years. In order, however, that such work may reach its highest value there should be close cooperation with individual land owners throughout the state. Cooperative experimental plats should be found in every part of the state. The seedlings should be furnished from the state reservation and should be planted and cultivated under regulations prescribed by the State Board of Forestry. Regular reports should be made by the owners to the Board and regular inspections of such plantings should be made by its Secretary. The conclusions resulting from observations covering a wide range of conditions and involving varying degrees of care and attention would evidently be of much greater value than those possible under present methods.

There is cause for congratulation in the fact that the state realizing the gravity of the problem confronting it is taking steps to avert the disaster which our rapidly waning timber supply seems to indicate. Caution in such matters is of course wise, but it should not be forgotten that as a rule a Fabian policy is ineffective in acute cases. There is every reason for confidence, however, in believing that no backward steps will be taken and that as the years pass the development of a wise forest management on the part of individual land owners, will under the guidance of the state be far more rapid than in the past. There is reason for hope also in the general observance of Arbor Day for it gives assurance that the next generation will have a fuller knowledge and a truer appreciation of the value of our forests than their parents ever possessed.

Summarizing; the present forestry conditions in Indiana being as stated, three great lines of work suggest themselves as immediately necessary if the timber supply of the state is maintained:

1. An educational propaganda emphasizing the importance of correct forest methods, the value and potentiality of existing wood lots, and of the importance of reclaiming waste lands by tree planting.
2. A census of the present timber stand, its composition and its distribution.
3. Cooperative experimental work on the part of the state and individual land owners, for the determination of suitable species for afforestation, their silvical qualities and their rate of growth.

Quite apart from any sentiment, no more acute problem nor one which directly affects more business and individual interests confronts the state. Others may be of greater magnitude, but certainly no other one touches so intimately such wide and varied interests.

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