

THE BLACK ROCK FOREST

BULLETIN NO. 13

HENRY H. TRYON, *Director*

THE MANAGEMENT OF YOUNG VOLUNTEER HARDWOOD STANDS

By

HENRY H. TRYON



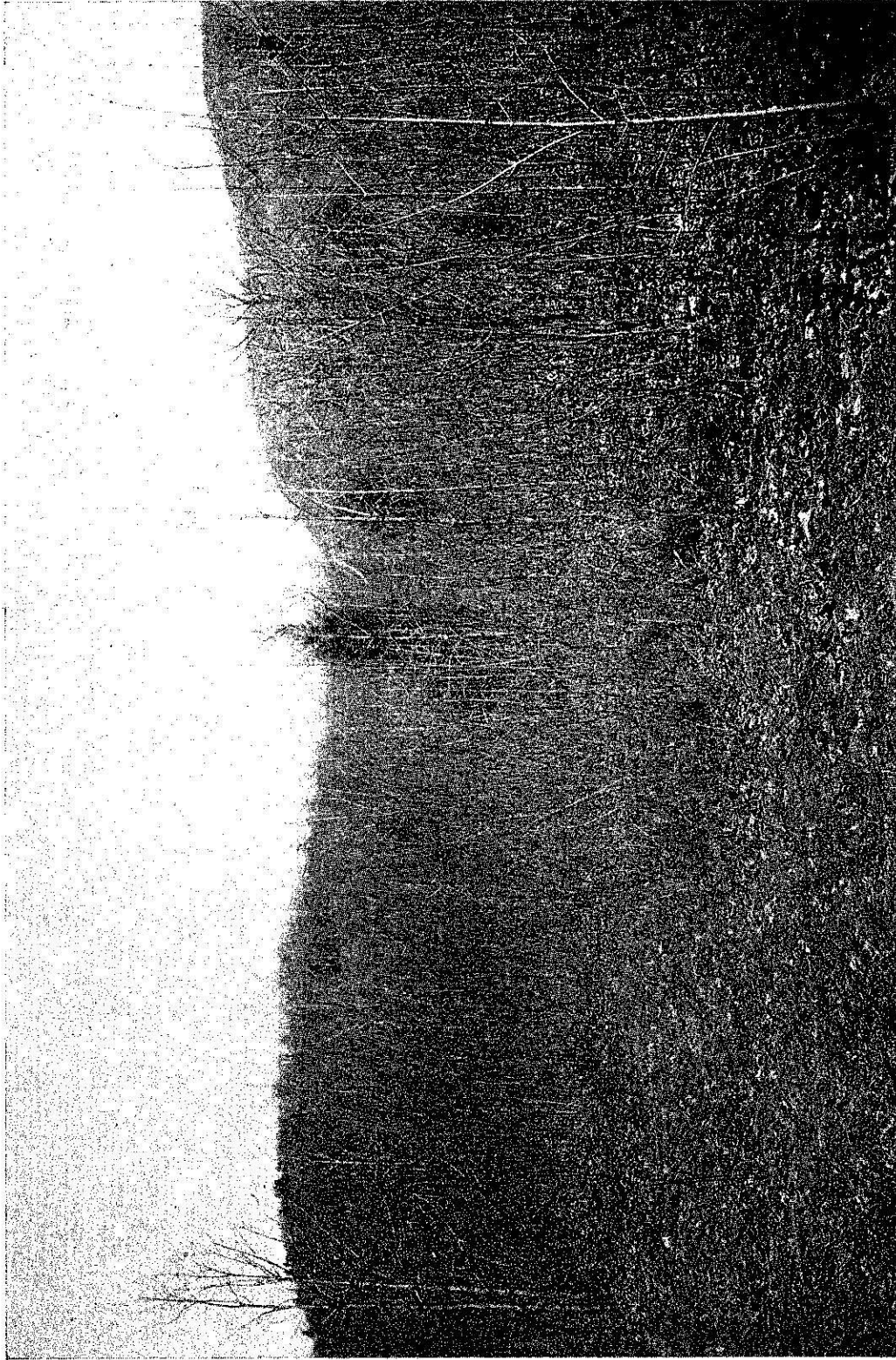
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THE ASH PATCH

Photo taken April, 1936. An excellent example of the indigenous old-field invasion by red cedar, red maple, white ash, and some scattering sugar maple and white oak. The older portions of the stand are now precisely ready for the initial cleaning. It is just such areas which can be easily 'tended' and which will respond so readily and so profitably.

INTRODUCTION

LITTLE detailed data has been published about the several vegetational stages which appear on abandoned fields, clear cuttings and burns in the hilly region of the Hudson Highlands. The progress of such areas through the various pioneer, secondary, perhaps tertiary and sub-climax cover types up to the climax association appears to be a subject of large silvicultural and economic importance. The successful silviculturist should know these different types thoroughly, both as to composition and suitable treatment; in addition, he should be equipped to decide, in regard to a given site, whether it will be more profitable to develop and to retain thereon the true climax or to work for the maintenance of some sub-climax association which may require some extra attention but which will yield, in the end, a considerably higher cash return per acre plus, perhaps, a more rapid turnover. Intimate knowledge of each successional stage is essential to making such correct decisions.

This paper will first outline the principal types occurring hereabouts in this vegetational progress; and second, will set forth tentative suggestions for their most profitable management. The latter have been drawn from several interesting areas on this Forest which have been under observation and treatment for the past 10 years. It so happens that this tract contained several acres carrying precisely the associations needed to illustrate the points discussed here.

In the following pages the local names of the several areas are employed.

THE ABANDONED FIELD

(See Frontispiece)

The Ash Patch

Formerly cultivated, later a hayfield, then a pasture, which has lain fallow since about 1920. The area is some 4 acres; the slope is moderate and northwesterly. Owing to several seasons of careful cultivation and fertilizing, the soil is generally deep and good. The field is quite free of ledge or large stones.

To-day, save for occasional small open "wells" the area is exceptionally well stocked with native hardwoods, averaging 20-22 years old. White ash, in some portions running as high as 28 stems per mil-acre is easily the numerical leader. With it are occasional sugar and red maple; and here and there is a wizened, overtopped red cedar, undoubtedly a hold-over from the initial pioneer stocking appearing immediately after abandonment. The area is flanked on the north and west by numerous large, open-grown, heavy-crowned seed trees in the following order of frequency: white ash, white oak, sugar maple, red maple.

In the open grassy wells previously mentioned, the setting is primarily white ash averaging 24"-30" high and accompanied by sumach, poison ivy, running blackberry, grasses, goldenrod, huckleberry, and an occasional small red or white oak.

Under the more dense portions of the ash stand the leaf litter is now (1945) very scanty. Many middens are present. Owing to the rather heavy shade cast by the dense young ash overwood, the ground cover and advance growth are very scattered, totalling only a few stunted white ash, a similar white oak, or perhaps a small patch of poison ivy.

It should be remarked that the sugar maples present, whose age averages 17 years—2 to 3 years older than the accompanying white ash—average some 3 feet greater height than the latter species.

From ring counts, it is clear that the area was first invaded by red cedar. Red maple appeared very shortly thereafter, and white ash, sugar maple and white oak last. Apparently sugar maple has here displayed pioneer characteristics, (something rather unusual in this territory). Possibly the unusually large, fruitful seedtrees to the northwest, whence come our prevailing autumn winds, coupled with the rather high soil fertility are responsible for this seeming out-of-line succession.

To our best knowledge, there is no aspen nearby, and none were found on the area proper. A few gray birch are present in the stand, but the total stems are very few. To the southwest the ground is slightly higher than at the north end. On this somewhat better drained part the percentage of sugar maple is perceptibly greater than on the more moist northerly portion.

Treatment

Much of this area is at the ideal stage of height and density where the first releasing can be most effectively applied. The few small open areas or "wells" need no attention. They are re-stocking nicely by natural means—by far the cheapest method.

Obviously the principal crop tree will be white ash. This will reach commercial dimensions first, probably with some red maple in mixture. While many of the sugar maples now present are running even with the ash, it is believed that these will in time fall behind to form the later second crop together with the slower-growing white oak and occasional red oak. What is the correct treatment now?

The only other tree that is causing, or is apt to cause trouble includes some of the larger red maples. Probably

a few of these will have to be removed. The rest of the problem deals with what ash trees should be cut, for this species is now so numerous that it is actually getting in its own way. See Text Figure I.

Note that the scraggly, over-sized red maples are marked for removal as their spreading crowns are blocking the growth of the more desirable ash. Also, practically all of the small, stunted ash are to be cut. Were the stand less dense, this recommendation would not hold, but when dealing with several thousand per acre, it seems best to take these runts to reduce root competition.

This understory can be rather drastically reduced without fear of upsetting matters as such a cutting will not break the crown canopy at all. Where, however, small white oak or sugar maple are found, it would seem best to leave them. These are more tolerant species and they might serve you very well as "fillers" at some later date.

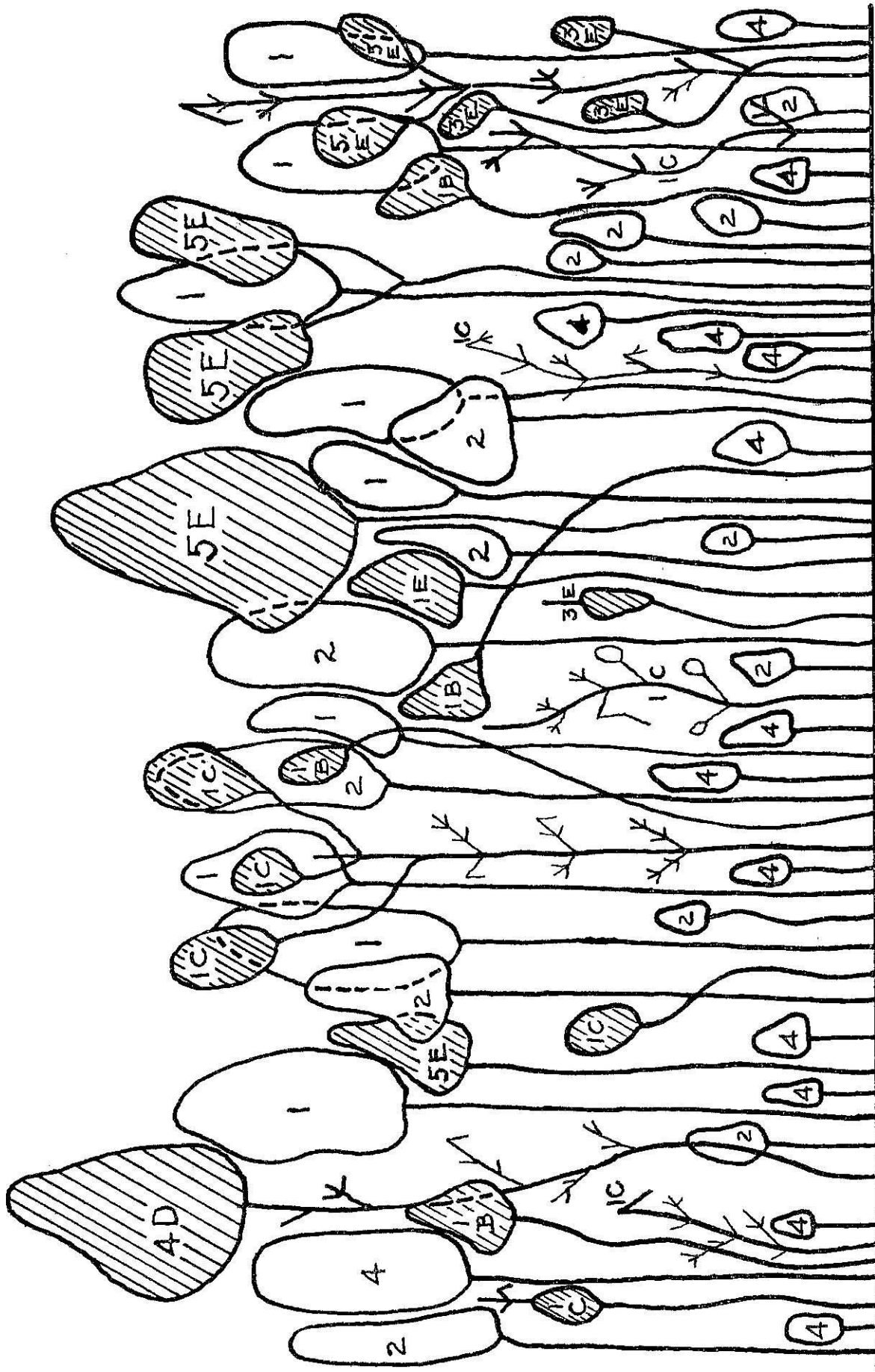
Observe also, that when the cutting is finished the crowns of the remaining trees are at approximately the same height. On a good site such as this, it is quite safe to make numerous small holes in the main crown canopy, for white ash, under the growing conditions afforded here usually responds very rapidly and will close such openings in a comparatively short period.

The Abbott Area

This was a hayfield until the last mowing in 1927. The slope is gentle, and to the north. Today the turf is thick, heavy and tough; there are dense patches of grasses, goldenrod, aster and blackberry. The tree population is distinctly bunchy, with gray birch, red maple, sumach, white ash, red and white oak being the numerical leaders.

In the high forest adjoining on the west there is a good scattering of mature aspen, but only two of this species were found in the old field. This is another bit of proof of aspen's dislike of heavy turf as a germinating bed.

Of commercial species present—red and white oak and



TEXT FIG. I.—The Ash Patch, NW portion, Aug., 1944. *Species*; 1, white ash; 2, sugar maple; 3, elm, cherry, red cedar; 4, white oak; 5, red maple. The hatched crowns indicate trees to be removed.

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100

white ash—the first two average 24" high with white ash running even with the other pioneer species at about the 6 to 8 foot level.

Treatment

At the moment there is no cultural work needed unless the owner should be willing to plant some seed of the commercial species *which are already present*—white ash, red and white oak. Nothing can be gained by cutting back weed trees at this stage, for the stand is far too open and the subsequent sprout growth would quickly neutralize any releasing work.

Such areas should be carefully watched, for they come back to a tree stand almost before you realize it. Take note that the Ash Patch, where the trees average only about 5 years older than on this Abbott Area, is today, in the main, a fully-stocked stand. So be patient; such open, bunchy areas may be ready for their first treatment in relatively few seasons.

The Abbott Plot

Without question, this plot was heavily timbered in the pre-colonial days. It was later cleared and devoted to agriculture and was subsequently utilized as a hayfield until 1910, the date of the last mowing. Excepting the removal of a few ash trees and several red cedars (for fence posts) no cutting has since been done here.

The successional steps since 1910 are very clearly marked. They were as follows:

1. Development of the coarse turf characteristic of fallow fields in this section.
2. Appearance of scattered red cedars.
3. Appearance of a few scattered aspens sown by the seed trees standing in the adjacent high forest to the south. It is suspected that these may have seeded in

and germinated following a burning of the heavy turf.

4. Appearance of gray birch and red maple. These, with the aspen, provided a fair amount of light shade.
5. Appearance of pignut hickory, white ash and cherry.
6. Appearance of red oak, black oak, white oak and sugar maple.

Today the stand is principally white ash averaging 40 feet high. Red maple comes second, averaging about the same height. White oak, red oak and sugar maple form the third group, averaging respectively 21, 39 and 24 feet.

Clearly, there is present here the makings of a valuable timber stand. The pioneer species have come in and flourished for some 20 years and are now beginning to fade out of the picture while the more valuable commercial species are starting to take over. It should be noted that this plot has a gentle slope to the northeast, that it is rather free from large boulders or ledge and is well watered by the run-off from Whitehorse Mountain.

Treatment

Here again the objective is to hasten the formation and growth of a crop of the more valuable species. Left untended and kept free from extraneous disturbances such as fire, this would materialize of itself in due time. But what we seek is to speed up the process. It is this writer's belief that these natural processes of selection can be very considerably accelerated and at only slight cost.

In 1940 a number of pioneer species were dropped and the stems and tops cut up and laid close to the ground to hasten decay. Each tree so felled was selected because it was either (1) dead, (2) sickly and dying, or (3) large enough to inflict mechanical damage on the crowns of nearby valuable neighbors. In June 1941 about two dozen gray birches and a few sugar maples, cherries and iron-

woods which were either dead, dying or completely suppressed and decidedly sickly were also dropped and cut up as before. Some 20 more gray birches were removed in both 1942 and 1943, and an equal number in the late winter of 1943-44. All of these trees were unhealthy and nearly all had been bent down in varying degree by ice-storms. During this last treatment we found that all of the previously cut stems and brush were rotting rapidly and very nearly all of the sprouts which had started from the cut weed stumps were very small, being rarely over 24 inches high—clearly the outcome of careful selective cutting which did not admit enough sunlight to stimulate this sprouting to a dangerously competitive extent.

In summation, such areas (where the age does not exceed about 20 years) offer a fine opportunity to produce a stand of high quality hardwoods at the expenditure of relatively few man-hours per acre; but treatment must not be too hasty; *it should accord closely with the natural trends taking place within the stand.* We have found on this particular plot that a "cleaning" once a year, taking perhaps 4 or 5 hours at the most, is a very profitable effort. Hence, keep close contact with the progress of the pioneer species, the chief idea being to hasten their disappearance from the stand just as rapidly as is consistent with the maintenance of good forest conditions both on the ground and amongst the incoming climax or sub-climax species. Without doubt an occasional member of these two latter groups will develop an abnormal growth rate and will forge ahead so rapidly that its crown will become a detriment to the slower-growing good trees. Such individuals must be ruthlessly removed, preferably just before they begin to inflict injury on their neighbors.

This objective—of removing the competing weed species—offers a very definite goal at which to aim. It is not difficult to attain, but cannot be too hurried. Cautious, fairly regular cleanings based on shrewd, studied familiarity with the stand will produce truly remarkable

results, but do not proceed too rapidly. It is far easier to thin too lightly and then return later for another bite than it is to replace a tree which was not quite ready for removal. The golden rule is to alter stand conditions slowly.

The Pete Lewis Place

A former farmstead, sloping to the southeast. The soil mantle is very thin; the old farm is really sitting on a huge granite ledge. It is a dry spot. It was apparently abandoned between 1905 and 1908. The present tree growth is extremely bunchy; being interspersed with open areas which are still covered by thick turf with plantain, goldenrod, huckleberry, hawthorn, wild cherry and now and then a small red oak, perhaps 18 inches high. The old apple trees in the orchard adjoining the house yard are dead or dying; the presence of numerous 20-year old aspens in the northwest corner of the farm gave rise to the suspicion of a former fire, and an investigation of the growth rings in the nearby territory revealed fire-scars 22 years old.

The tree population is gray birch, white ash, aspen, cherry, sumach (where this occurs it is in small, dense pure patches) red cedar and sassafras. There is also present some scattered advance growth of red and white oak and hickory, all averaging 18 inches high.

Treatment

There is but little to be done here as yet. As with the Abbott Area, the tree population is still too bunchy and spotty. No cutting should be attempted except in the occasional patches of white ash. Here a minimum amount of releasing might be profitably applied, but operations should be strictly limited to that. Possibly the most logical and productive step would be to gather a few pounds of white ash, red oak and pignut hickory, stratify them

over a winter and spot them in the grassy openings the following spring.

The Barton Farm

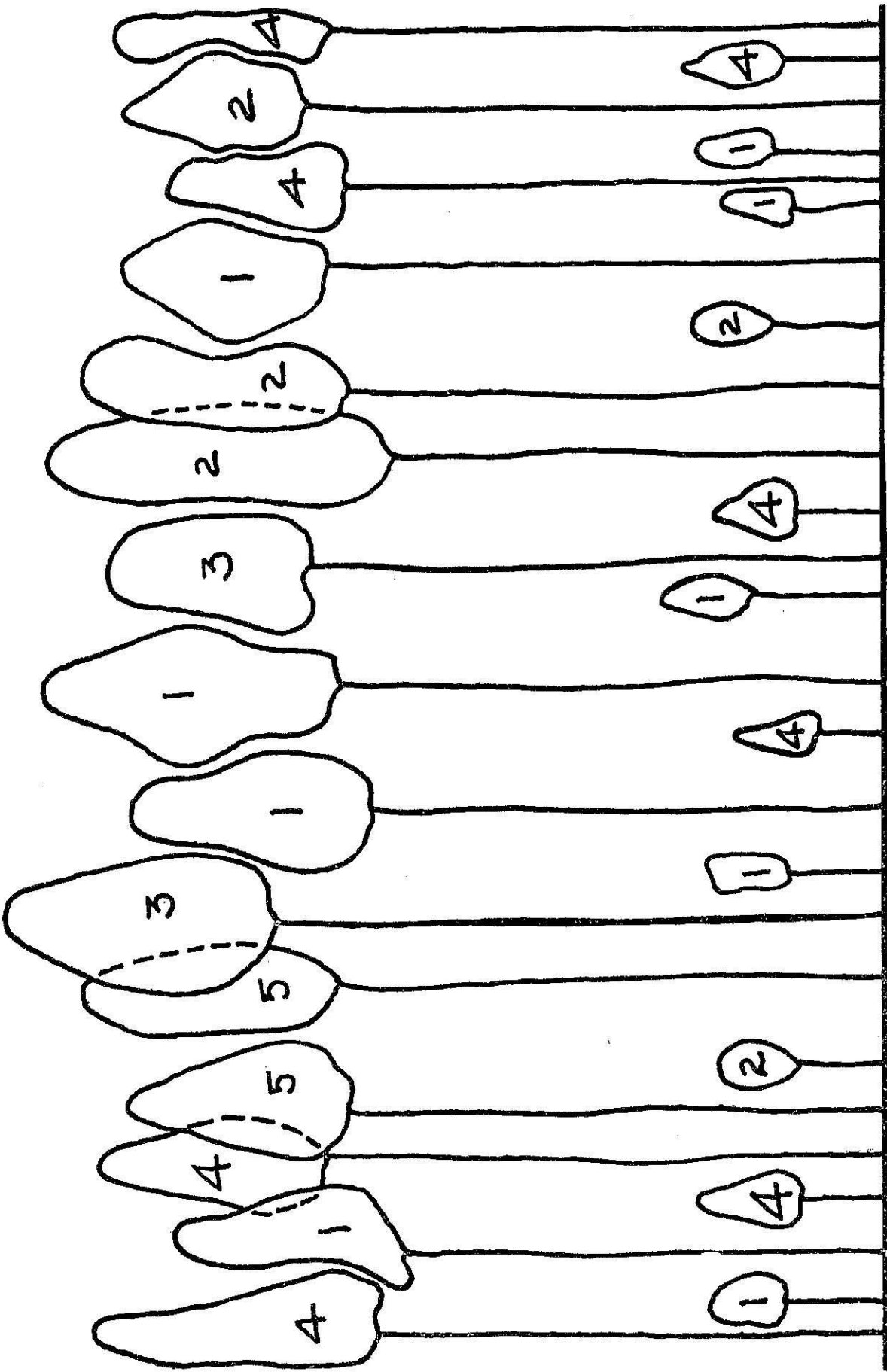
At one time a flourishing farm. The north portion slopes rather sharply to the southeast; the southern section has the same aspect but drops with a much more gentle gradient. The steeper area averages a lower moisture content than is found on the lower, more gentle slope.

Ring counts indicate that red cedar and sassafras were the primary invaders, followed in order by white ash, cherry, red and chestnut oak. After a short lag, aspen, red maple, black and gray birch appeared. This successional step indicates, and this is borne out by the fire-scars found, that those portions where this last association appeared were burned over several years after abandonment.

Today the pioneer species are rapidly fading out. The cedar, cherry and sassafras are fast becoming overtopped and stunted; the aspen is fungus-infected and dying, and nearly all of the gray birch stems have been badly ice-bent to a position where their crowns can no longer do any further harm. The commercial species—red and chestnut oak and white ash—are all in good, thrifty condition.

Treatment

Here we are dealing with a much older stand. Ring counts show that the gray birch still present is from 30 to 32 years old, while the commercial species (red oak, white ash, red maple, black birch and chestnut oak) run between 28 and 30 years. Practically every pioneer tree on the area can now be cut to good advantage. Such an operation should yield around 20 to 30 cords of mediocre fuel. It is to be regretted that the releasing was not started at least 10 years ago, for the damage has been done, and the present stand promises to be, in most part,



TEXT FIG. II.—The Clark lot, mixed hardwood area, Aug., 1944. This was carefully released in 1935 and again in 1942. *Species*:
 1. white ash; 2. red oak; 3. yellow nonlar; 4. white oak; 5. black oak.

only pretty fair cordwood. The form of the crop trees is of rather low caliber, owing to weed crown competition. Some careful attention earlier in the day would have undoubtedly set the stage for the production of both timber and fuel of much higher quality.

The Clark Lot

Formerly a cow-pasture, sloping rather sharply to the north. It is distinctly moist in spots, with small springs breaking out here and there. It is completely surrounded by vigorous, mature seed trees including red, chestnut and white oak, yellow poplar, white ash, sugar and red maple. It has lain fallow since 1910.

By now the area is fairly well set to tree growth of one kind or another. There remain occasional open wells which are in heavy turf with goldenrod and aster, but with numerous small white ash seedlings appearing therein.

From the ring counts, the pioneer association here was red cedar, gray birch, sassafras and red maple. In the summer of 1935 all of the gray birch, some of the sassafras and such of the red maples as were injuring more valuable leaders were nicked and broken down. Seven years later, the entire area was given a thorough releasing with the machete.

Intermittently, since 1936, this tract has been a dumping-ground for odds and ends of planting stock left over from various reforestation projects. A few dozen yellow poplar and Asiatic chestnut have been set in the "wells"; these are now in promising condition. Today (1945) this area reveals several fine examples of what can be accomplished by a few hours of well-timed releasing work. Where the volunteer stocking of commercial species was adequate—that is, by our standards, one good stem per milacre—the releasing work of 1935 and of 1942 have produced some of the most promising stands of fine, straight seedlings of desirable species that we now possess. It is

little short of amazing to contemplate these young stands and to realize that such knife work, if not applied too early, (or too late) can make all the difference between a scraggly crop of indifferent cordwood and a stand of straight, clear stems which can be later harvested either as Grade A fuel or can be left to swell up into valuable saw timber. On the average, one man can release an acre in one 8-hour day. See Text Figure II.

Today the sprouts from the cut weed stumps are overtopped, shaded, and generally feeble, while the released commercial seedlings are very much on the up-grade. On some portions where, in 1942, the advance growth was too scanty to warrant much releasing work, the desirable species are now infiltrating in under the pioneer canopy. Such areas will be in line for releasing at some later date.

Treatment

This parcel presents a varied and interesting array of mixtures on which to work. The open, grassy areas are not yet ready for any cultural work except perhaps to do some planting where the natural regeneration has not yet taken hold in sufficient numbers. But such work is not really needed since the balance of the area offers ample proof that the adjacent seedtrees will attend to this.

One portion, bordering the south edge, has supported a nearly pure stand of sassafras since 1927. White ash began to appear under this in 1935. It was believed that if the sassafras crowns could be opened up a trifle—just enough to admit a little more sunlight to the forest floor—the infiltration of white ash would be hastened. And so this particular patch was given an extra half-hour of attention with the result that today there is present a nice setting of 6" to 10" ash under the remaining sassafras overwood. This is not yet adequate to warrant the complete removal of this overwood, but it is clear that a good start has been made in the right direction. This cutting was a very cautious job and since the sassafras stems ran

about 15' to 18' high, they could be safely cut off at about waist level. Not very many trees were dropped; only here and there was one taken whose removal would make a small hole in the crown canopy. With these a number of suppressed and overtopped sassafras were also cut. The conditions now existing seem to attest the soundness of the treatment. See Text Figure III.

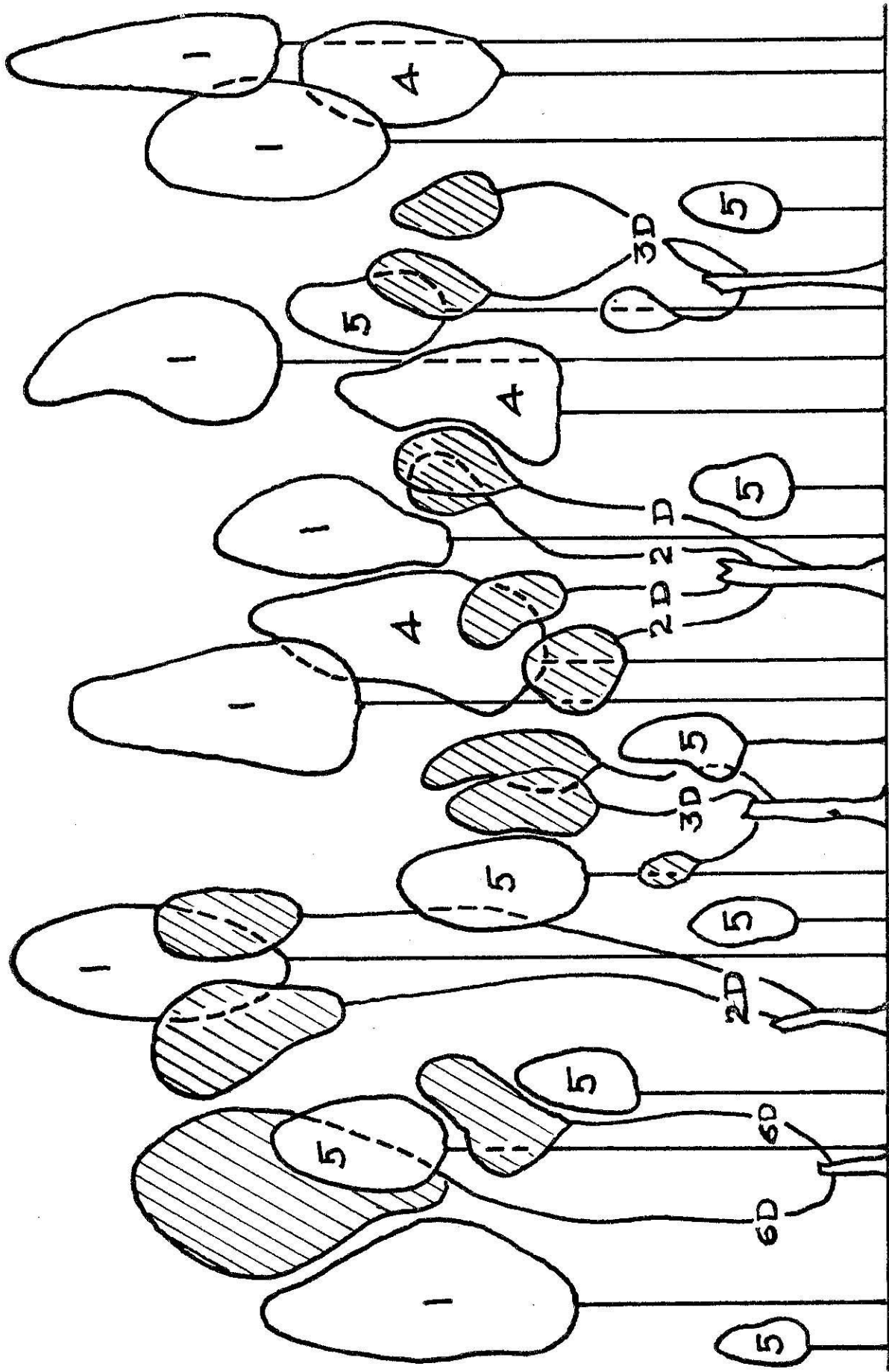
On other portions of the tract, there is a rather dense, heterogeneous mixture of white ash, red oak, white oak, black oak, yellow poplar, sugar maple, red maple, ironwood, hop hornbean, dogwood and gray birch sprouts. The careful releasing job of 1940 was applied primarily to such well-stocked spots. At that time these stands were in thrifty condition, but the pioneer and weed species were overtopping the good trees.

Note that in general the weed crowns were above those of the commercial species. Following the releasing, this situation was generally reversed, with the good trees well in the lead by 12' to 15'.

The favorable response to this treatment is already pleasantly evident. The crop species are developing longer leaders and making faster height growth each year, while their crowns are acting quickly to spread sideways and fill in the holes left by the cutting. This side spreading is of course helping the general situation in that the increased leaf surface now becoming available to the crop trees is greatly to their advantage, while the extended crown spread is helping to shade and to hold down the sprout growth from the cut stumps.

On such areas where the crop stand has attained adequate density and is of sufficient height (7' to 8') similar releasing has been applied, the chief difference being that the cutting was somewhat less severe and the weeds were cut back to about knee height to impose the maximum possible handicap on the inevitable sprout crop.

It might well be noted in passing that where a weed tree such as cherry, gray birch and the like has to be cut



TEXT FIG. III.—The Clark lot, sassafras area, Aug., 1944. *Species*: 1, white ash; 2, gray birch; 3, sassafras; 4, yellow poplar; 5, white or red oak; 6, red maple. Hatched crowns indicate trees to be removed. Reasons for removal as in Text Fig. I.

back more than once, as so frequently happens with our aggressive native species, the most telling results are obtained by cutting, in the second and subsequent operations, the sprouts themselves, *and not the main parent stem*. Cut the sprouts just above their point of origin. See Text Figure IV.

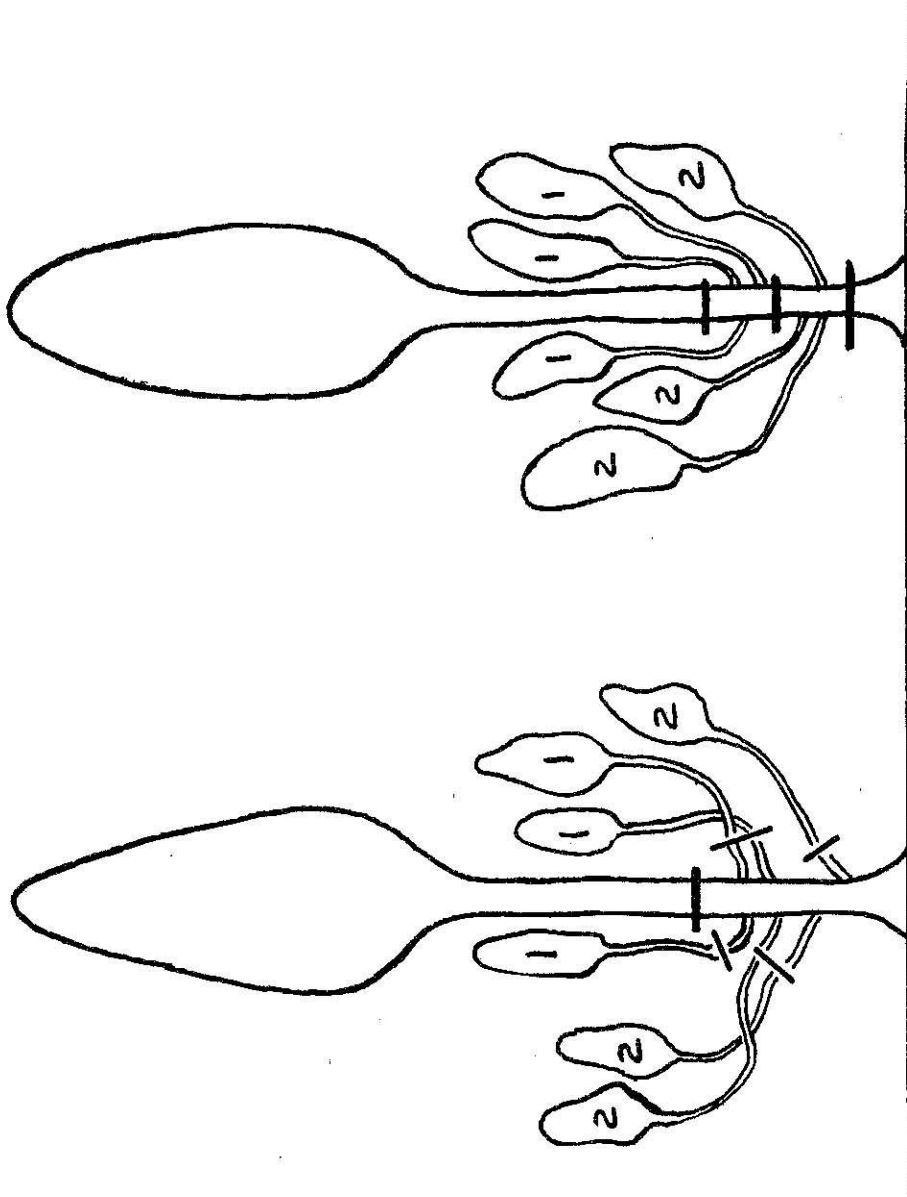
The physiological reason for this has not yet been unearthed, but the practice seems to get results and, in addition, it greatly simplifies the field work.

CLEAR CUTTINGS

Cutting #4a

In the winter of 1930-31 a 2-acre block in Compt. VI was cut clean. About one-half (the south portion) lies on a large flat ledge overlaid with a thin soil mantle. The original stand was red and chestnut oak with a few native chestnut, some scattered black birch and red maple. The north half is a wet flat traversed by a shallow, active brook, the original stand being yellow birch and white ash with an occasional red oak growing on a dry hummock. The cutting was made with the intention of setting up the sort of stand condition which usually followed the commercial fuelwood clear cuttings so often made here in former years, with the objective of testing the possibility of improving both the quality and quantity of the final yield by giving such stand conditions a few man-hours of moderately intensive silvicultural treatment.

On the higher and drier south portion the stand today is practically pure red and chestnut oak sprouts with some red maple, black birch and chestnut in mixture. On the ground is huckleberry, laurel, viburnum, witch hazel and swamp pink with a few chestnut oak seedlings averaging 15 inches maximum height. The chestnut oak sprouts are heavily infested with Golden Oak Scale. There has been practically no change in the stand compo-



DO THIS

DON'T DO THIS

TEXT FIG. IV.—Right and wrong methods of making successive loppings on a single gray birch clone. In the left-hand figure, the main stem was cut in the first operation. In the subsequent cuttings each crop of new sprouts was severed just above the point of origin. In the right-hand figure, the main trunk has been cut each time that a new clump of sprouts appeared. The first method is believed to be the more effective.

sition here; neither has any marked seedling stand appeared despite the fact that several heavy mast years have occurred since the cutting was made.

On the wet flat to the north there is now a stand of fine clean, straight seedlings, chiefly yellow birch with some white ash and red maple and an occasional yellow poplar, all averaging 20-25 feet in height and running about 20 stems per milacre. Not a single oak stem was found on this north area. These trees average 12 years old, 85% of them are seedlings, they are pruning extremely well and show much promise. Advance growth is very scanty. Here and there an occasional sugar maple, yellow birch or red maple was found, but these were invariably in rather stunted condition. The dense young overwood casts very heavy shade, which is probably the basic reason for the dearth of new growth.

This entire area is surrounded by heavy-crowned mature seed trees. To the north and south these are chiefly red, chestnut and white oak; to the east and west they are yellow birch, white ash, basswood, hemlock, yellow poplar, black birch and red maple. The successions which followed our 1931 operation were just as set forth; oak sprouts took over on the high, dry portion, with yellow birch, white ash and red maple seedlings invading the moist flat.

The South Portion

Treatment

Some experimental cultural work has already been applied here. In the summer of 1934 this area was divided into three equal north-south strips. The sprout growth was dense, averaging 5'-8' in height. With the idea of producing the maximum amount of bulk fuel of fair quality and at the minimum cost, the east third was thinned lightly, using the machete. It is to be remembered that the tree population then was practically 100% sprouts. Each clump was carefully scrutinized and all of its over-

topped members were lopped off just below the bottom of the main crown level. The remaining crop sprouts were side-pruned quite heavily. It was hoped that cutting these overtopped sprouts at a moderately high level would produce a vigorous pollarding effect which would lay heavy side shade on the crop stems, thereby reducing side sprouts. This rather novel piece of work took one man about one day. The following brief tally of several clones, made on this pruned strip late in 1935, indicated that side-sprouting had not developed to any great degree save on red maple.

<i>Species</i>	<i>Side sprouted</i>	<i>Not side sprouted</i>
Chestnut oak	4	14
Red oak	0	2
Sugar maple	0	1
Red maple	6	1

The west strip was gone over lightly. No pruning was done; only the overtopped sprouts were cut at the same high level as on the east third. This took one man about half a day.

The central strip was left untouched as a control.

As to the future, we see no need for further cultural work here. The stand is now forming a fairly good array of fuelwood stems, and existing conditions indicate that it should best be left to its own devices, until ready for final cutting. The interesting period will be when the three strips are harvested and tallied so that we may learn whether or not the application of the few man-hours involved was warranted by any increase in either yield or quality. No saw timber may be expected from this area, but if the current increment rate is maintained the final crop should be ready for the axe by 1951—a rotation shorter by about 15 years than was allowed hereabouts in the old days when the procedure was to cut clean, let the sprouts come up, and then cut clean again, usually after about a 35-year interval.

The North Portion

The wet flat was carefully weeded in 1932, and again in 1935. At this time the promise was high. Owing to excessive wetness, there were several small, open patches of sedge and viburnum, making the tree growth rather spotty in well-defined groups.

By the latter date it became disagreeably clear that the 1932 weeding operation may have had some slight beneficial effect, but not sufficient to warrant such an early expenditure of so many man-hours. This job should have been postponed at least 2 years.

The high percentage of yellow birch present, with the several dense patches of pure blue beech offer two interesting problems. It should be remarked that these species seldom occur here in mixture.

Here, yellow birch rarely occurs in the so-called climax. Hence it would seem reasonable to view these dense young stands as primary steps in the sere following the sudden over-exposure of the side. To borrow from Tansley's philosophy, "The sere has been thrown too far back."¹ This type is quite common here and farther to the south, and it usually shows a very rapid height growth for the first 20 years, followed by a marked slowing up. So, although these young birch stands now look to be full of future promise, it is felt, after piecing together all the known facts and factors, that they should most accurately be classed as a primary cordwood association, and should be so managed. It is recommended that they be given, later on, periodic fuelwood thinnings designed to release the more valuable commercial species which may be confidently expected to appear in time beneath these birches.

As regards the blue beech, no great height growth may

¹Tansley, A. G., and Chipp, T. F.; *Aims and Methods in the Study of Vegetation*. London.

be expected here. At present this species is classed as an understory climax, and the most practical handling would seem to be occasional liberation cuttings, these to be applied as rapidly as the development of the anticipated commercial understory warrants. No financial return may be expected from such work; the product will be too small to be saleable. The actual cash return will materialize later when the blue beech is relegated to its rightful position in the understory beneath a canopy of valuable species.

Cutting #8a

During the winter of 1927-28 a 19-acre parcel, well-watered for the most part by two brooks, was given a reproduction cutting. The original stand was the familiar red oak-white ash-basswood association with red maple, sugar maple, black birch and yellow poplar in mixture. The area is a broad flat, with a rather stiff northeast slope along the west edge and a more bland descent to the southwest along the east line. These two slopes are far better drained than is the central flat. Two very good seed years of oak, and one of white ash followed this operation. The tract is nearly completely ringed by high, mature hardwood forest of oak, ash, sugar maple, yellow poplar, red maple, some yellow birch, black birch and black gum.

In 1934, owing to favorable market conditions, the old overwood was cut clean. Since this operation there has appeared on the flat and on the steep slope along the west edge a curiously dense setting of hardwood seedlings. In the numerical order of appearance these are principally yellow birch and white ash, with sugar maple and black gum. On the dry hummocks scattered throughout the flat, and on the slope along the east edge the stand is chiefly white, red, chestnut and scarlet oak sprouts with some hickory, red maple and hop hornbeam included. To-

day there are present five well-defined principal associations. These are:

- a. white ash in mixture with red maple, cherry, and the usual shrubby local species.
- b. pure yellow birch.
- c. pure blue beech.
- d. sugar maple with red oak and an occasional yellow poplar.
- e. pure black gum.

White ash with red maple and cherry

Treatment

While we do not now class white ash as a climax species here, it is one of our best cash crop trees, and does very well on these low, moist sites. Hence it should be favored by periodic liberations. Such work is fully warranted in view of the possible high cash return. But here again, do not be hasty. Your time and effort will be quite wasted unless you postpone your first releasing until the crop trees are at least 6 to 8 feet high. And as the stand of crop trees fills out and crowns begin to interlock, it will doubtless be possible to make occasional cordwood thinnings which may include such of the ash as is overtopped or ill-formed, together with any red maples or other low grade weed species whose rampant crowns may be causing or are about to cause damage to the crop leading shoots.

It is believed here that by careful study coupled with shrewd cuttings, such sites can be kept continually producing nearly 80% white ash stock without damage to the soils.

Pure Yellow Birch and Blue Beech

The conditions found here are identical with those described under Cutting 4a—the north portion.

Sugar Maple with Red Oak and Some Yellow Poplar

This association was found entirely on the northeast slope lying along the south edge of the area. Indications are plentiful that this is a rather good quality site. When such stands are not less than 8 feet high, they may have their first releasing.

Pure Black Gum

The occasional dense, tangled seedling thickets of this species can be regarded as only transient tenants. While we have as yet no complete life-history on them, it is believed that in time such thickets will yield to a mixture of white ash, with some yellow poplar, red maple, and red oak. Black gum is of but slight commercial value here, and since it can hardly be rated as a climax species the practical procedure is closely similar to the handling of the blue beech association. Make careful, periodic observations to determine what sort of tree association is seeking to establish itself beneath the gum stand—and then pattern your release cuttings or thinnings gradually to remove the gums as fuel or other minor product so that your most valuable species will be favored to form the final crop. *But be sure to retain as crop trees the valuable commercial species which belong on the soil site represented.* This last suggestion should not be difficult to follow since all of the associated species are probably well suited to the rather moist site usually so occupied, and the question resolves itself into selecting from among the concomitant species those trees which will not only grow best but which will carry the highest cash value at maturity.

BURNS

The Jim Pond Burn

In the spring of 1939 a hot surface fire ran over a good acre lying on a gentle south slope at the foot of a high, rocky cliff. Previously, this carried a very promising stand of sapling hardwoods, chiefly red oak, white ash,

white oak and red maple. Nearly every tree was killed by the fire, and was promptly salvaged, leaving a few dozen stems which looked as though they might pull through. Later these died and were removed, making a 100% clear cutting.

In August 1943, the sprout population was very dense and vigorous, showing an average height of 5 feet. There had come in a great deal of aspen, averaging 8-10 feet high. The arrangement of the species shows a curious condition; the aspen is completely concentrated in the central portion, and between this and the unburned, surrounding hardwood stand is a distinct annulus averaging perhaps 50 feet in width where the aspen is almost completely absent and where the stand is composed of hardwood sprouts with sumach, witch hazel, red maple, viburnum, cherry and sassafras in mixture. There are also patches of sweet fern with some blackberry in the occasional open, grassy areas.

Treatment

Owing to our pleasant freedom from fires of late, there are no data to hand on the handling of such areas. But today, 5 years after the fire, the conditions resemble somewhat those found on the south portion of the clear-cut plot in Ctg. 4a. (P. 16). We may hazard the suggestion that perhaps similar "pollarding" of the less vigorous members of each clone should improve the final yield, and at no great cost per acre.

Such machete work should be withheld until the crop sprouts are fully 7 feet high to insure the suppression and eventual killing of the pollarded "trainer" stems. It is further urged that it would be very wise to split this work into two light operations rather than in one job. Plan to go over the area once, in light fashion, cutting at a fairly high level only the least promising sprouts in each clump and leaving all of the good, or fairly good ones.

Observe then what takes place after one or perhaps two seasons. If you then find that your crop sprouts are again being threatened by the unworthy members of the community you can repeat the treatment, this time polishing off such remaining undesirable stems as still threaten to hamper the performance of the ones you plan to keep for the final cutting. Again, it is far simpler and cheaper to thin lightly and to return later for a second session than to be faced with the sometimes disastrous conditions caused by too severe a thinning.

DISCUSSION

THE outstanding lesson to be drawn from the foregoing discussion is the evident fact that when land of almost any sort is left exposed to full sunlight the area will be promptly and inexorably invaded by various tree species in a series of well-defined associations. The first of these comparatively short-lived cover types will endure with rather curious persistence until the establishment, under their shade, of the near-climax or climax associations, both of which are, in most cases, of considerably higher commercial value. Hence it would seem to be nothing but good business to hasten both the establishment of these more valuable associations and the removal as rapidly as is consistent with good management, of the less worthwhile, temporary cover types. It has been suggested that both of these objectives can be gained by the timely application of proper release cuttings at the cost of relatively few man-hours per acre. But such work calls for rather thorough knowledge of each of these plant stages; the operator must recognize the mixture with which he is confronted, *its place in the succession*, and the silvicultural requirements of the several species represented. Only with such knowledge as a basis can he make intelligent application of the needed cultural work.

This "theory of successions"—which is today no longer a theory—is not to be regarded as a tool or instrument which will solve ecological or silvicultural problems in some magical, formular fashion. Rather is it a way of looking at the forest. It is by no means a set of rigid rules. "Succession is an extraordinarily mobile phenomenon." To develop the habit of viewing the forest as being composed of groups of living communities, to be constantly aware of the vast number of "mutually interacting organisms which are affected by, and which themselves affect, a great complex of environmental factors" is to acquire the true biological feel for the woods which is the finest possible basis for sound and profitable silvicultural practice.

The woodland owner who can take a given area apart in terms of the climax type which will in time naturally become established thereon, and who can, moreover, determine and even roughly classify the successional stage now present is well equipped to practice silviculture in close harmony with the natural forces. Such practice is held by this author to offer the best combination of minimum cost and maximum production.

"German experience confirms the biologic fact that the forest is a complicated community of living beings, in which each tree species is merely a member, no more and no less important for the health of the whole than the other members. A single species may not be used with impunity in plantations where it is entirely isolated from its natural organic complex. The foundation and the elements of practical silviculture are not the individual species of trees, but the natural life communities of which these economically desirable tree species are a part. The growing of commercially less valuable, but biologically important, species in mixture with those of high economic value is equivalent to paying an insurance premium against later losses."¹

¹ German Forestry; Heske, F.; Yale Univ. Press, 1938.

CONCLUSIONS

1. Open land, if left untended will quickly revert to forest of some sort.
2. The first species to appear thereon are usually the fast-growing, short-lived, "pioneer" species such as red maple, red cedar, gray birch, aspen and cherry.
3. Such pioneer stands will in time yield to tree associations of considerably higher value.
4. It is entirely possible, through careful observation combined with shrewd release cuttings, greatly to shorten the time interval between the disappearance of the low-value pioneer type and the establishment of the more profitable and longer-lived climax or sub-climax associations.
5. The climax association is by no means invariably the most valuable cover type. Not infrequently is the near-climax much higher in the financial scale.
6. It now appears to be possible to maintain an area in the more valuable near-climax stage for a more or less indefinite period.
7. Release cuttings in these young stands of mixed hardwood must not be made too early. The crop species should be at least seven to eight feet high. Nor should such work be delayed too long.
8. Such cuttings should not be overly severe. It is better to make two light operations rather than one heavy one.
9. The stands of pure black or yellow birch and black gum so frequently found on clear-cuttings are definite pioneer associations and should be managed for cordwood with the objective of having the birch

cover virtually entirely removed by the time the expected understory of better commercial species has become thoroughly established.

10. Where aggressive weed trees have to be cut back more than once, in the second and subsequent operations cut the sprouts immediately above the point of origin; and do not cut the main parent stem again.
11. A practical working knowledge of the various forest types and their places in the local vegetational successions, as well as of their silvicultural requirements is essential to the successful furthering of this program of "accelerated successions."