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HARDWOOD BRUSH DISPOSAL IN THE HUDSON HIGHLANDS

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The slash left after a hardwood operation usually forms a fire hazard of considerable duration and magnitude. Here, where our proximity to the thickly settled areas brings a steady flow of layman visitors who are seldom woods-wise, we have always been concerned over this risk. Our first cutting was made in the fall of 1927. At that time, since the Forest was not at all known as a laboratory area we deemed it only wise prevention to burn our hardwood brush for the first few operations.

We did this for the ensuing three cutting seasons, although with continuous misgivings, for it increased our operating costs and in addition lost us a good many tons of valuable organic material which would have been very welcome to our soils. But by the autumn of 1930 we felt that we could safely abandon, or at least modify this expensive practice, and since that year the only burning done here has been an occasional 3 or 4-rod strip where a cutting skirted a heavily-travelled trail.

On the balance of the area operated since 1930 we have tested out the following methods of brush disposal:—

1. Scattering brush broadcast, with some lopping of the heavier branches.
2. Piling brush in long windrows.
3. Making large piles averaging 4′-5′ in height.
4. Making numerous small piles, none of 2.5′ in height.

Excepting No. 1, the cost of each of these methods has been automatically absorbed in the chopping costs as we have paid our choppers by the cord. The lopping and scattering method formed an added cost item as this work was done by a separate crew after the regular cord-cutters had completed their job. Table 1 gives a statement of the man-hour costs of piling and burning on 6 different operations, and of lopping and scattering on 1 clear-cutting operation.

The diversity in man-hours per acre or per cord may

Table 1

Cost Summary

Case No.	Area Burned, Acres	Yield per Acre, Cords	Method of Disposal	Costs		Remarks
				Man-hours per Cord	Man-hours per Acre	
1	1.2	12.5	Pile and burn	1.44	18.0	A cleaning
2	9.5	16.8	Pile and burn	1.47	24.7	A cleaning
3	13.5	12.7	Pile and burn	2.70	34.3	A cleaning with many heavy tops
4	13.5	11.7	Pile and burn	4.40	51.5	A cleaning large, heavy crowns
5	30.0	5.1	Pile and burn	4.08	20.8	A cleaning with strip burning
6	20.0	5.7	Pile and burn	7.00	39.9	A cleaning with strip burning
7	7.5	23.0	Lop and scatter	0.40	9.2	A clear cutting

Table 2

Summary of Average Pile Depth by Age and Site, with Number of Piles Tallied

Age of Pile, Years	No. of Piles Tallied	Average Depth, feet			Grand Average	Remarks
		Cove	Mid-slope	Ridge		
1	30	2.5	2.5	2.5	2.5	Little decomposition. Birch slash showed occasional Schizophyllum.
2	30	1.6	2.1	2.4	2.1	Polyporus versicolor and hirsutus; Dadalea, Schizophyllum. Piles on wet flat omitted.
3	80	1.1	1.3	1.5	1.3	Polyporus versicolor most frequent. Schizophyllum second. Some P. hirsutus and Dadalea.
4	63	0.7	1.0	1.3	1.0	Polyporus hirsutus and versicolor; Schizophyllum and Dadalea.
5	50	0.4	0.5	0.6	0.5	All piles well flattened and infected.
6	60	0.4	0.4	0.6	0.5	All piles well flattened and infected save those upheld by Kalmia.
7	69	0.4	0.4	0.5	0.5	Piles generally well decomposed. Some Panus, Polyporus and Agaricacae present. Some moulds forming on drier sites.

be accurately defined as a function of the crown density of the area under treatment. Cases 3 and 4, where the labor figures are high, were thorough weedings in heavy-topped stands growing on what had once been cleared land. While the yield in cords per acre is fairly good, our local market has not, as a rule, taken very kindly to limbwood under 3.5 inches in diameter. The disposal of these many large crowns called for a good bit of extra work. Case 7, where the yield was very good, was a clear-cutting job in another heavy-crowned stand, but at the moment (the autumn of 1934) there existed hereabouts a pronounced scarcity of wood of all sizes, and we had little trouble in disposing of a great deal of the smaller limbwood.

In the autumn of 1937 we measured the maximum depth of 382 brush piles scattered through 9 different cutting operations. All of these piles were at least 2.5′ high when first made. Measurements were taken in the coves, or at the bottoms of slopes, at mid-slope and at, or near the ridge-tops. Table 2 gives a summary of these measurements, with the several average pile depths by ages for the different sites.

Lopping and scattering is clearly the most effective method of hastening decay. Our one test of this treatment, over 7.5 acres, showed that after 3 summers the brush was nearly completely infected with fungus of one species or another, resulting in such a high proportion of "dozy" wood that the fire risk could be classed as very low. But in this hilly country where the chance is often difficult, this plan, as with No. 2 (making long windrows) has a serious disadvantage. Either system leaves distinct obstacles in the way of hauling off. The teamsters or their helpers are having continually to stop to clear a road, which may add materially to the hauling costs. Where fuelwood is cut full length and snaked with a single horse to the wood-saw for bucking, brush may be lopped and broadcast without much of this trouble if skilled, thoughtful choppers be employed. We are using this method this winter with excellent results, but it is plain that to obtain the maximum efficiency there must exist a high degree of cooperation between the choppers and the hauling crew. Making large piles (method No. 3) will immediately produce protests (and with reason) from choppers cutting by the cord. Furthermore, such piles are extremely slow to decay except in the bottom layers.

Our observations clearly indicate that for this country the most efficient plan—i.e., that which combines the minimum cost with the most rapid decomposition and subsequent lowering of the fire hazard—is the fourth method, namely to make many small, shallow piles, none to be over 2.5′ high. Such disposition does not hinder the hauling; the choppers do not object to the small amount of extra work required, even when cutting by the cord; and as a rule, after two summers have passed the piles are so well rotted that the risk is appreciably reduced.

Text Figures I and II were plotted from the average pile depths by sites summarized in Table 2.

These curves portray the progressive shrinkage of the piles over 7 years. This factor apparently is a highly elastic variable whose behavior is partly dependent upon snowfall, and in very large measure upon the uniform distribution of rainfall through the warmer months of the growing season.

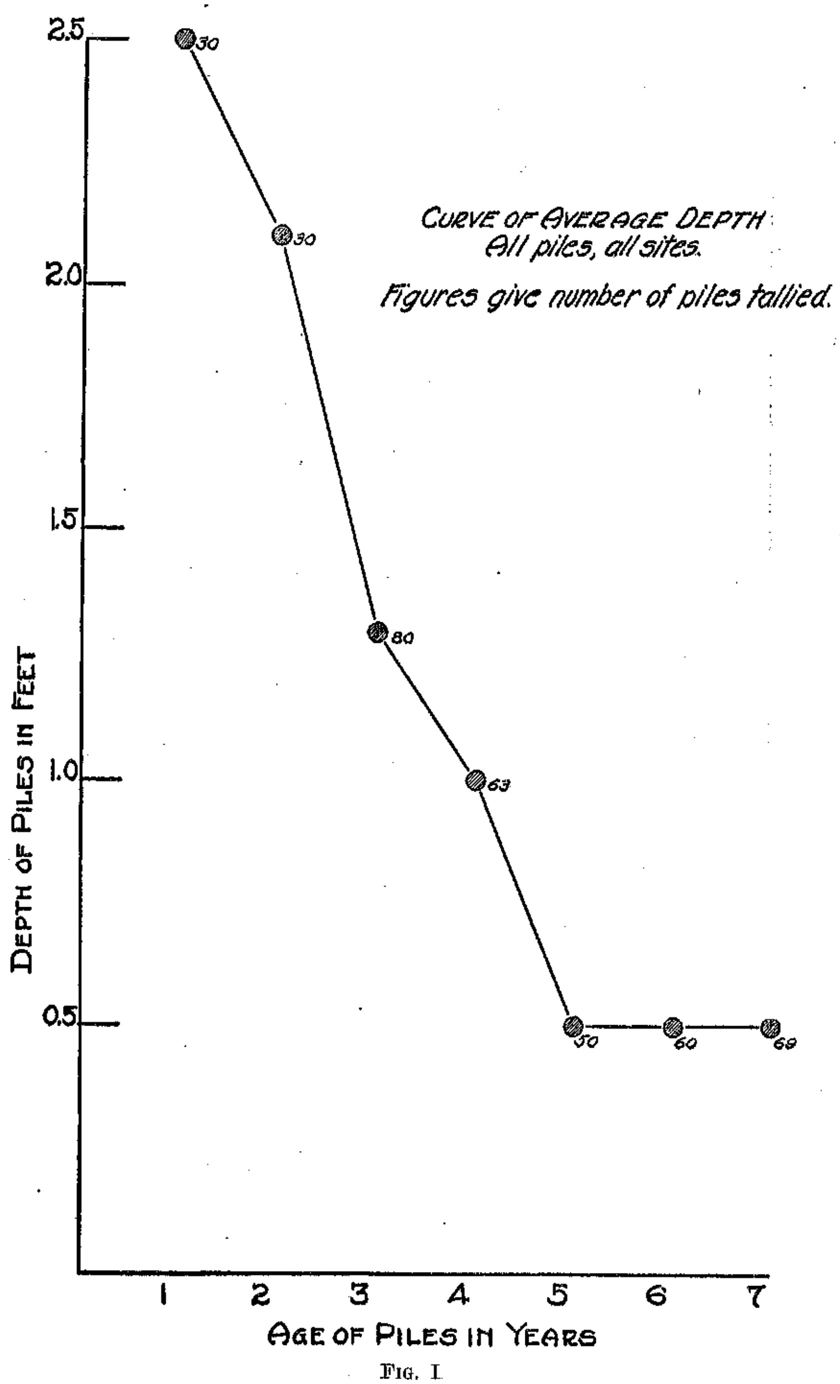


Fig. I

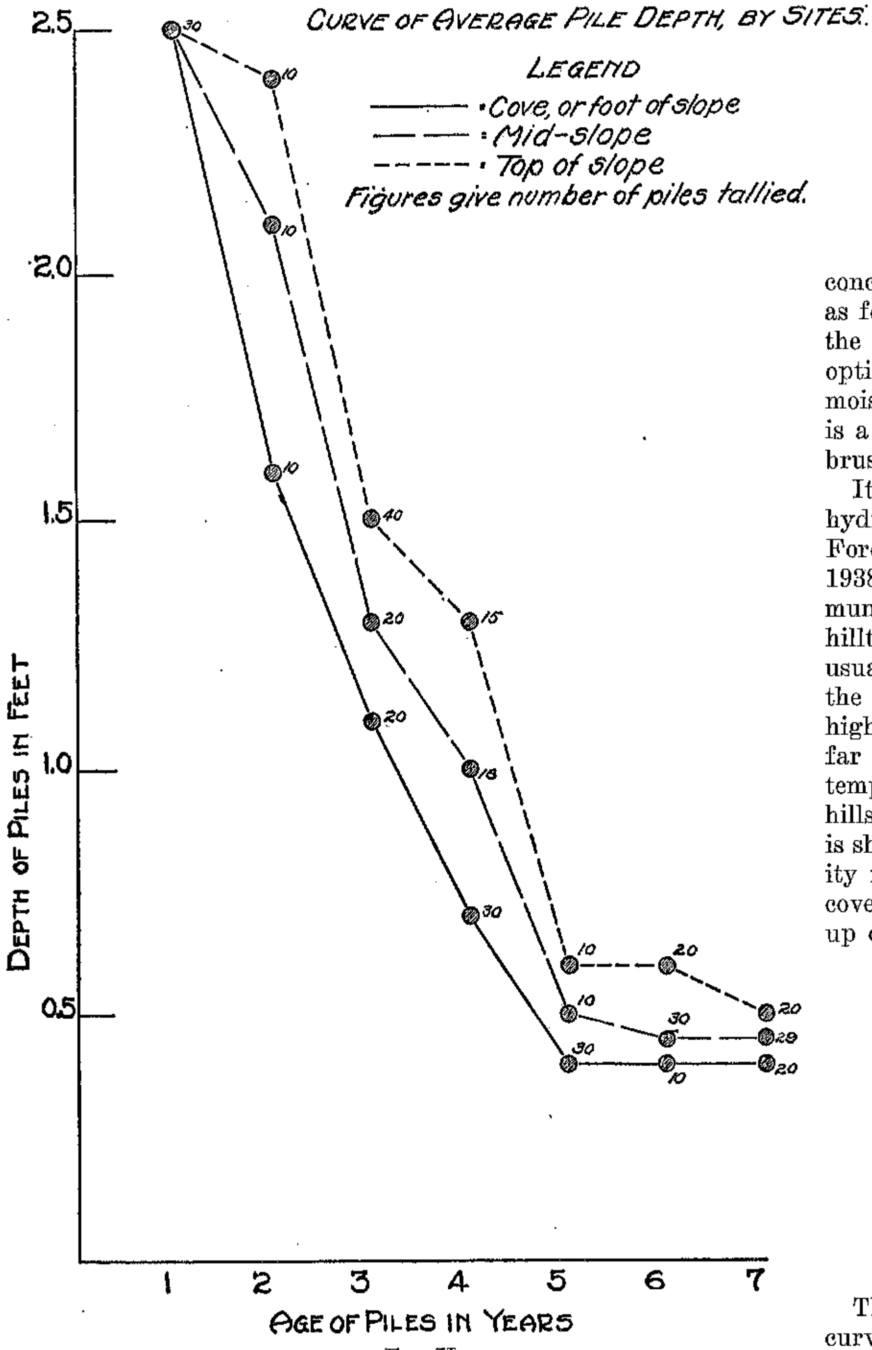


FIG. II

We have not essayed here any intensive correlation of these climatic factors except to indicate the general trends. Text Figure III gives the monthly precipitation during the growing season, Text Figure IV shows the average maximum and minimum temperatures for the same period, and Table 3 gives the total snowfall in inches for the winter period immediately following the making of a given array of brush piles.

While performance is not uniform throughout the period of observation, we invite the reader's attention to the years 1933 and 1935. The former showed 11.4 inches of rain during August (the second hottest month of the season), and an excess of 2.03 inches over the 7-year average for September. The snowfall during the previous winter was only slightly abnormal. The growing season for 1935 showed a perceptible deficiency in precipitation, but the snowfall of the preceding winter overran the 7-year average by 39%.

These two instances are not put forward as bases for definite, hard-and-fast conclusions. We feel they may serve in part as food for thought and as added substance to the truism that fungi operate best under optimum conditions of air, temperature and moisture—and that the crushing effect of snow is a recognized factor in the disappearance of brush piles.

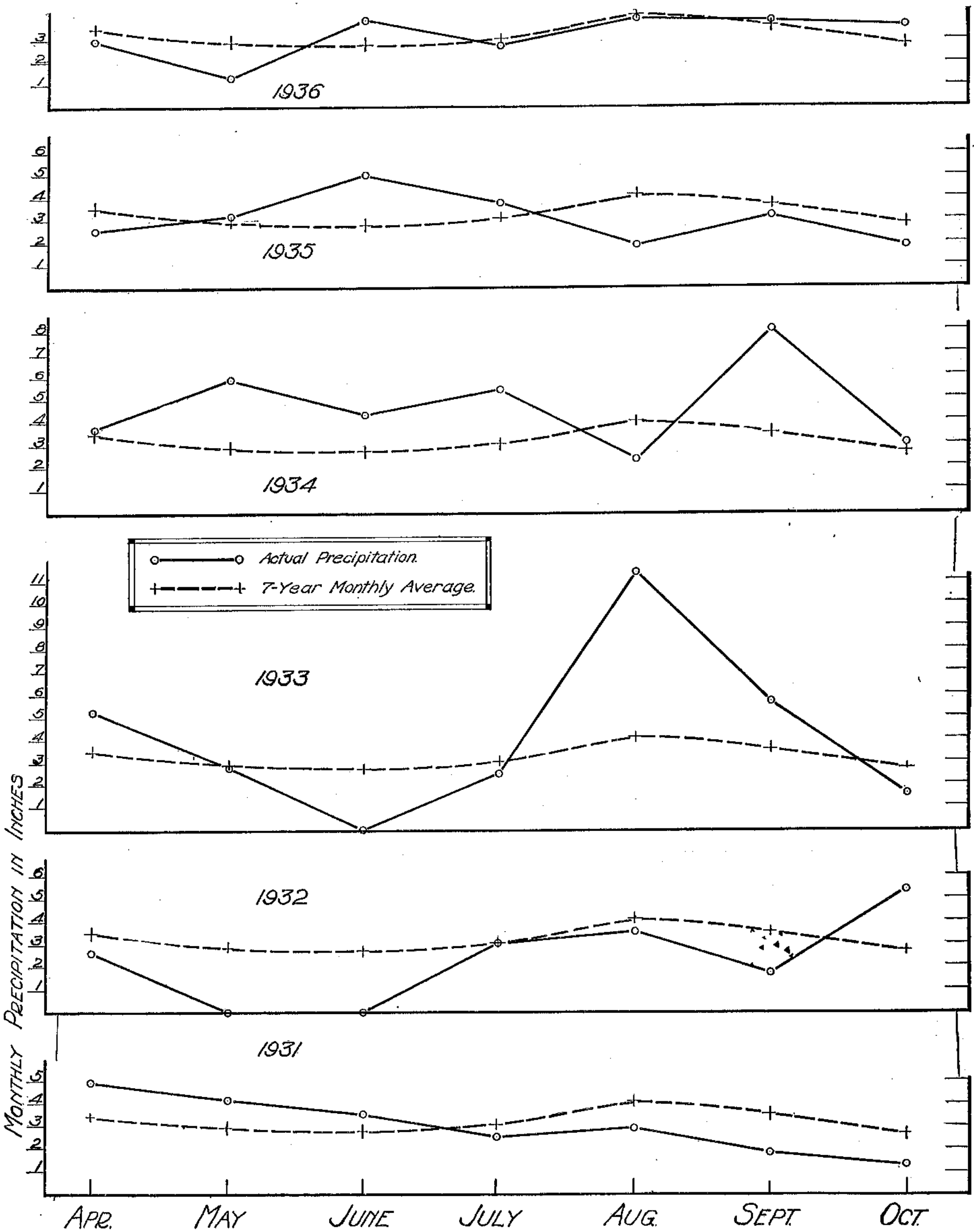
It seems appropriate to mention that brief hydrothermographic observations made on the Forest during the summer of 1937, (Raup, 1938, in press) indicate that the daily maximum temperatures average 2°-5° higher on the hilltops than in the coves. The former are usually reached between 2 and 4 o'clock P. M., the latter about high noon. Cooling at the higher levels takes place rapidly; in the coves, far more gradually. Hence the lower daily temperatures endure somewhat longer on the hills, and the peak during the heat of the day is sharper. In consequence the relative humidity fluctuates more on the heights than in the coves, with perhaps a proportionate slowing-up of fungal activity on the former sites.

TABLE 3

Winter of	Total Snowfall in Inches
1930-31	27.11
1931-32	10.30
1932-33	33.10
1933-34	46.60
1934-35	44.70
1935-36	31.20
Average	32.17

The outstanding fact brought out by these curves is the curiously parallel shrinkage performance by sites. While we have no data to explain this, our present theory is that the higher relative humidity and soil moisture content prevailing in the coves and along the foot of the slopes probably produce more favorable conditions for fungus attack and development.

The point has frequently been raised that piles of hardwood brush may have a retarding effect on hardwood reproduction. After 7 years of observation we do not believe that the shallow piles recommended will act, in this region, as any great deterrent. We feel that the low cost of this method, coupled with the reduced fire hazard which it quickly produces will more than offset what little loss might be represented by the stunting or distortion of a few seedlings.



1936
1935
1934
Actual Precipitation.
7-Year Monthly Average.
1933
1932
1931
Monthly Precipitation in Inches
Apr.
May
June
July
Aug.
Sept.
Oct.

Fig. III

variant durability of the species involved. It is entirely probable that the more rapid rotting found in the piles located in our coves is partly due to the fact that these types are composed chiefly of White Ash, Basswood, Beech, Hemlock, Red and Sugar Maple, Yellow and Black Birch and Yellow Poplar—none of these being especially durable species. In contrast the piles left on our slopes and at the higher levels are mainly Red, White and Chestnut Oak. We note that Yellow Birch is often attacked by a small fungus (not a Basidiomycete) which operates under the bark and so weakens the wood of the twigs and smaller branches that they drop off within 2-3 years.

This factor of relative durability of species is probably of greater import than is realized, and offers a field for study in itself. Brush disposal practice could be made very fine-drawn (and proportionately expensive) by varying the method to fit the site and the species involved. But in this paper we are only describing what we have found to be the most economical, efficient, tried-and-tested plan.

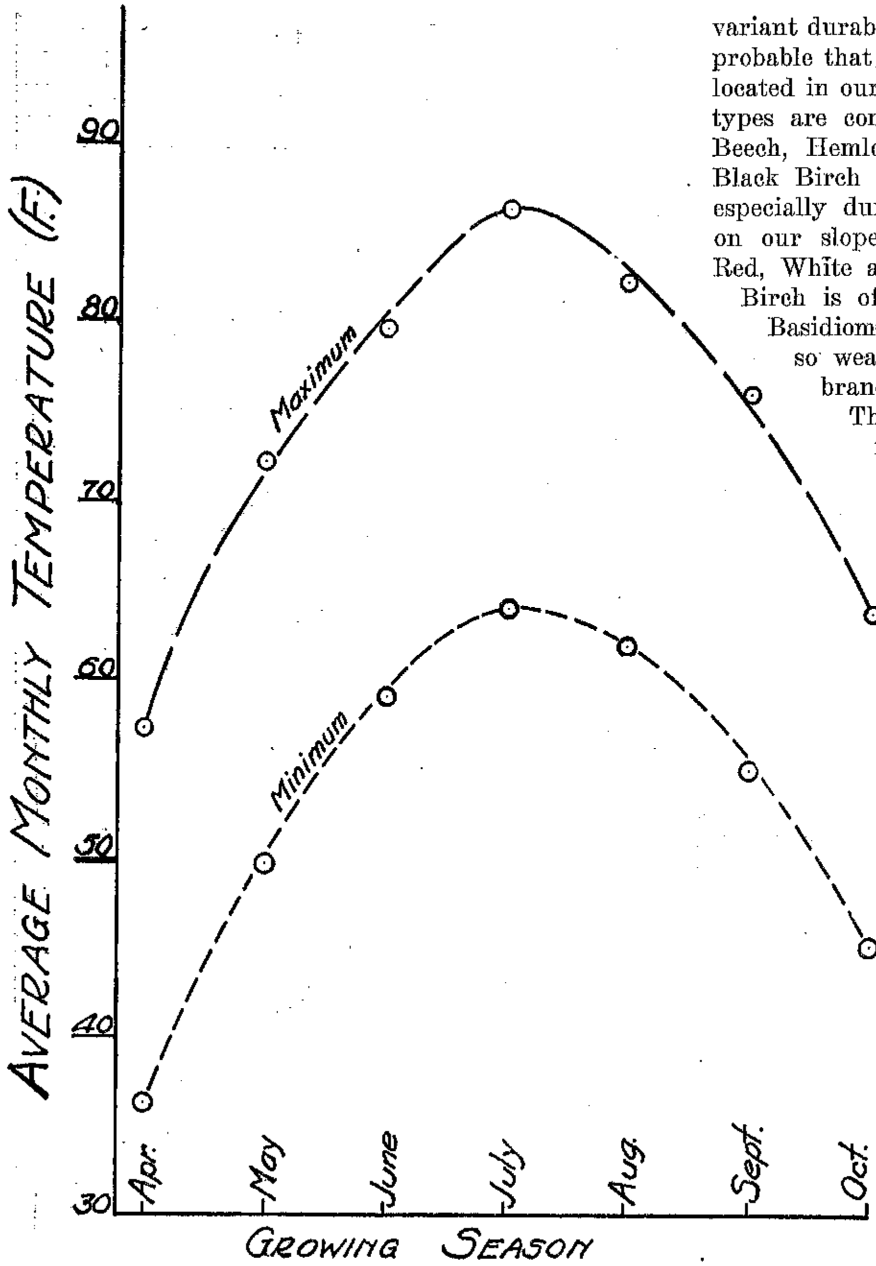


Fig. IV

While shallow piles in coves or along the bottoms of our slopes unquestionably show the quickest tendency to decay, this is not at all true of piles made on constantly wet flats, where the brush may become waterlogged and so resist both decay and fire for a surprisingly long period.

Obviously there enters into this problem a number of factors which have not been intensively investigated. There is, for instance, the mechanical factor of snow weight. Heavy drifts will frequently compress a brush pile and bring it close to the soil in one winter, thereby approximating the condition achieved by scattering broadcast. There is the fact that the various species of fungi operate at different speeds, and frequently in succession, one apparently taking up the work where its predecessor stops. Nor should we omit mention of the

HINTS ON PILING

Avoid making piles in places which are continually wet. Do not pile higher than 2.5 feet. The diameter of the piles may be quite large; the limiting factor here is what reproduction may be present. Do not make piles on the large flat rocks and outcrops so common hereabouts. Piles so made will parch out and remain hard, dry, and inflammable for years. If you are operating where there is much dead timber, try to have the well-dried sticks put at the bottom of the piles. Avoid making piles in, or on top of Laurel thickets (Kalmia latifolia). The stiff stems of this plant will often hold a heap of brush entirely clear of the ground, thereby seriously delaying decay. Incidentally, Laurel itself is very durable.

There is a definite technique to handling brush. Where the limbs are merely tossed on the pile just as they come to hand the result is often a crisscrossed "jackstraw" heap, frequently forming a singularly well-braced structure which may be far more resistant to the desirable crushing effect of snow than are piles formed with the sticks all laid parallel and with the butts all pointing in the same direction. We recommend this latter practice; it requires very little additional time.

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