The Compleat Marker:

A Guide To Managing Northern Hardwoods On Michigan State Forests

Edited by Bill Botti

Contributing Authors:

Paul Pierce
Jim Bielecki
Bill Mahalak
Dan Farnsworth

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MICHIGAN DEPARTMENT OF NATURAL RESOURCES
FOREST MANAGEMENT DIVISION

THE COMPLEAT MARKER:

A PRIMER ON NORTHERN HARDWOOD MANAGEMENT

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INTRODUCTION

This booklet will review the principles of single-tree selection used on Michigan State Forests in the management of primarily sugar maple stands. These stands are managed to produce high-quality sawtimber and veneer logs. Notes are provided showing how to maintain and enhance the value of the stands also for wildlife and to maintain desirable aesthetic properties.

The products we are working for are long, straight stems with no limbs or other defects. Such trees will produce the kind of high quality wood needed by Michigan's furniture and veneer industries.

The great majority of the space in this booklet is devoted to discussion of timber management concerns. That is due, not to an overriding value of the timber resource, but that manipulation of the timber is the only practical way to manage the habitat and the aesthetics. Timber covers the cost of management for all values. A set of rules and procedures is presented which will direct our management toward high-value timber products while maintaining habitat diversity and aesthetics.

Management of quality hardwoods is more challenging in some ways than managing for pulpwood. The need to protect quality adds another dimension to hardwood silviculture. Thinning and logging must be done carefully so as not to damage crop trees. A mechanized thinning trial done in Kalkaska County in 1973 looked good superficially, but actually resulted in root wounds which led to decay in a third of the residual stand!

We need to bear in mind whenever we are working in northern hardwoods that our major objective is to improve stand quality. Any of the treatments described herein can work against us if they are not applied carefully and correctly.

Most stands of hardwoods on what is now state land were clearcut in the early part of this century. Michigan's iron smelting industry had a great appetite for charcoal. Hardwood stands were clearcut to feed the charcoal kilns and the land was allowed to revert to state ownership for non-payment of taxes.

Thus, most stands are even-aged as we enter them for the first time. We have a choice of continuing to manage even-aged, or of converting gradually to uneven-aged structure. Even-aged management is attractive in that it is easier to do, but there are two major disadvantages; it winds up looking like a clearcut, which looks bad aesthetically, and it produces less volume and grade. Selection cutting, when applied according to the system described, will result in an extra sixteen-foot log in the stems of our crop trees and contribute 50% more volume growth to mature, or regulated, stands.

It's important to remember that thinning is not a magic process. It doesn't increase a stand's overall growth. (Fig. 1) A given acre will produce a certain volume of wood; thinning allows that

volume growth to be concentrated on fewer stems. Thus our crop trees grow faster, but stand growth is about the same. (Stand growth will be increased, ultimately, by the extra height of trees under uneven-aged management. This is a result of the management system, not the thinning process.)

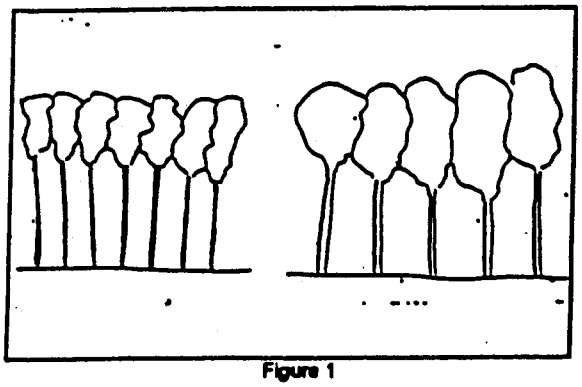


Figure 1

Thinning doesn't increase overall growth - it allows growth to be concentrated on fewer trees.

This means more revenue from unevenaged stands in the long run but it also means the stand will always have big trees and will provide aesthetic and wildlife benefits not available for many years under even-aged systems.

Our goal, then, is to develop our stands into an all-aged structure which conforms to Fig. 2. Once we have achieved this stand structure we should begin to harvest the same volume we're growing. This volume is generally between 200 and 250 board feet per acre per year.

We could enter each stand every year and take the annual growth in the form of one tree for every couple of acres, or we could allow the growth to accumulate for 10 years or so and take 10 times the annual growth, or 2000-2500 board feet per acre. The latter method is generally preferred, being a more efficient use of manpower. Currently many areas are working with 15 and even 20-year cutting cycles. This is acceptable due to immature stands and lack of manpower, but it lacks the intensity we should be applying as our stands mature. We lose more trees to disease and windthrow when we use long cutting cycles than we would if we were entering the stands more frequently.

Many people will ask whether all this intensity of management is warranted. Can we afford to send someone in with a paint gun every 10 years to mark a stand? Let's assume that person can mark 10 acres per day and that the stand is regulated and producing 200 board feet per acre per year. Our marker is making $18.00 per hour, and stumpage is $200/mbf, woods run. With fringes, paint, mileage and office overhead, let's allow $30.00/hour for the marking.

Cost: $30/hr. x 8 hrs/day = $240/day . 10 acres/day = $ 24/Acre

Return: .200 mbf/ac/yr. x 10 yrs. = 2.000 mbf/ac x $200/mbf = $400/acre

Remember, this applies to stands which have reached regulation. We cannot harvest at the rate of growth until we reach the desired stocking level. Most of our stands have twenty to thirty years to go. We do have numerous stands in the northern Districts that have achieved regulation, however, and it's interesting to note that the stumpage from some of those stands is bringing $300/m; not $200. This high price is due in part to birdseye also, and unfortunately, we don't know how to manage for that.

The Forest Development Fund is designed to help us make the needed investments to speed the development of our hardwood stands toward regulation. We have 100,000 acres that should be there in thirty years.

CHAPTER I

MAKING A MARKING PRESCRIPTION

Before you start to mark, you must make an examination of the stand to find out what it needs to move it along the desired path toward regulation. The examination should be made using our Operations Inventory's Ancillary System.

Data gathered in this stand exam will allow your computer to generate stand tables (you could do it, too, but it's easier and quicker to let the computer do it!) Stand tables should be compared to q-curves (Fig. 2) to determine how the diameter distribution in your stand compares to the ideal distribution. Thus you can see which diameter classes are over-represented and where, ideally, you should concentrate your marking.

Notice the word "ideally" in the preceding paragraph. This is one of the aspects that makes timber marking both difficult and fun - we have to apply a good deal of thought. More about that in the next chapter.

The computer generates stand tables in two forms - one showing trees per acre; the other showing basal area. Basal area is easier to use, but the B.A. curve doesn't clearly show the relative numbers of trees in the separate diameter classes. That is why both q-curves are shown.

The q-factor is an interesting term. The "q" doesn't really stand for anything - it's just a name given to the factor that expresses the relationship between diameter classes. Starting with the largest diameter class, in our case, 22", multiply the ideal number of trees per acre (3) by the q-factor to determine the number of 20" trees, then multiply that times the q-factor to get the number of 18s and so on. The q-factor of 1.3 has been determined to be the ideal relationship to ensure sufficient numbers of young trees without overpopulating.

The computer will also show you in the stand table the cruiser's choice of trees to cut and trees to leave (Fig. 3).

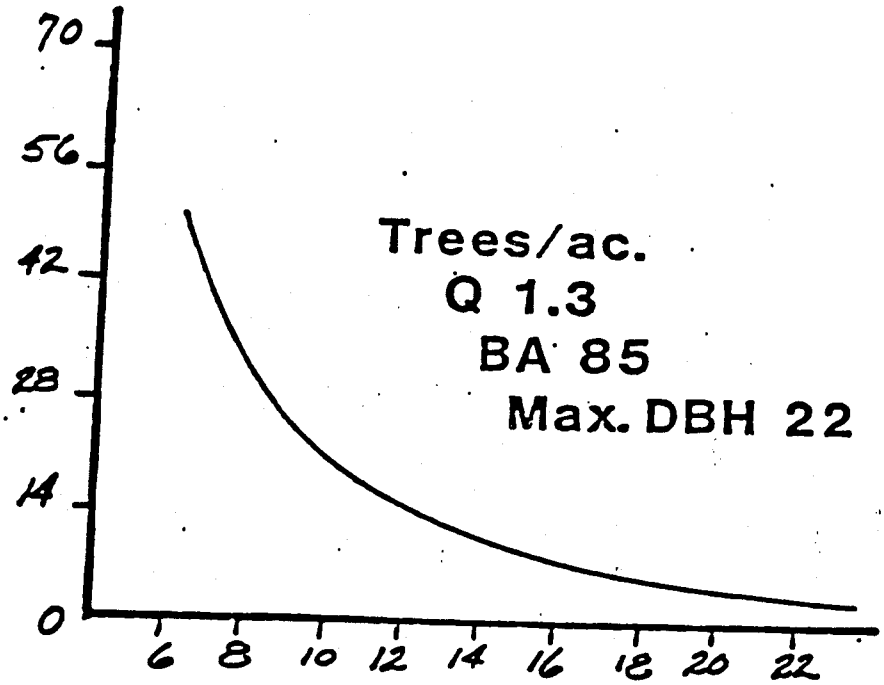
You will need to move from your stand table to the Stocking Chart (Fig. 4).

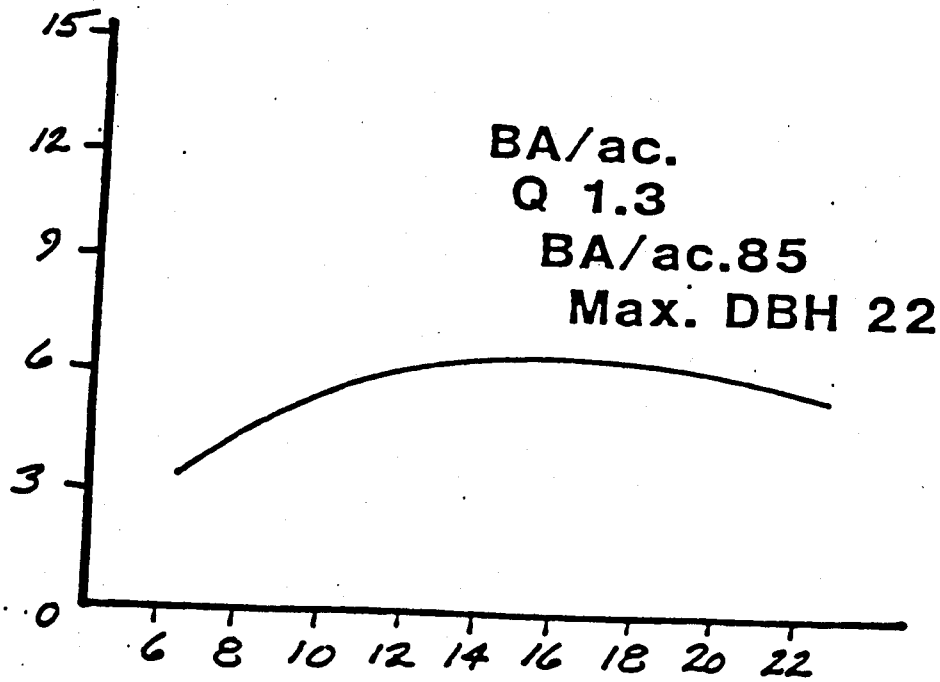
If this chart looks complicated to you, it's because it is! But you can figure it out. First, just notice a few things about it - tree diameters along the top, percent crown cover in the lower right, basal area up the left side, and trees per acre along the bottom.

Notice the line showing 80% crown cover is broken and it stops at 9" dbh. This indicates we can only thin to 80% crown cover if the residual stand averages 9" or less and the dotted line reminds us we can only go that low

Figure 2

Q-Curves showing trees per acre and basal area.





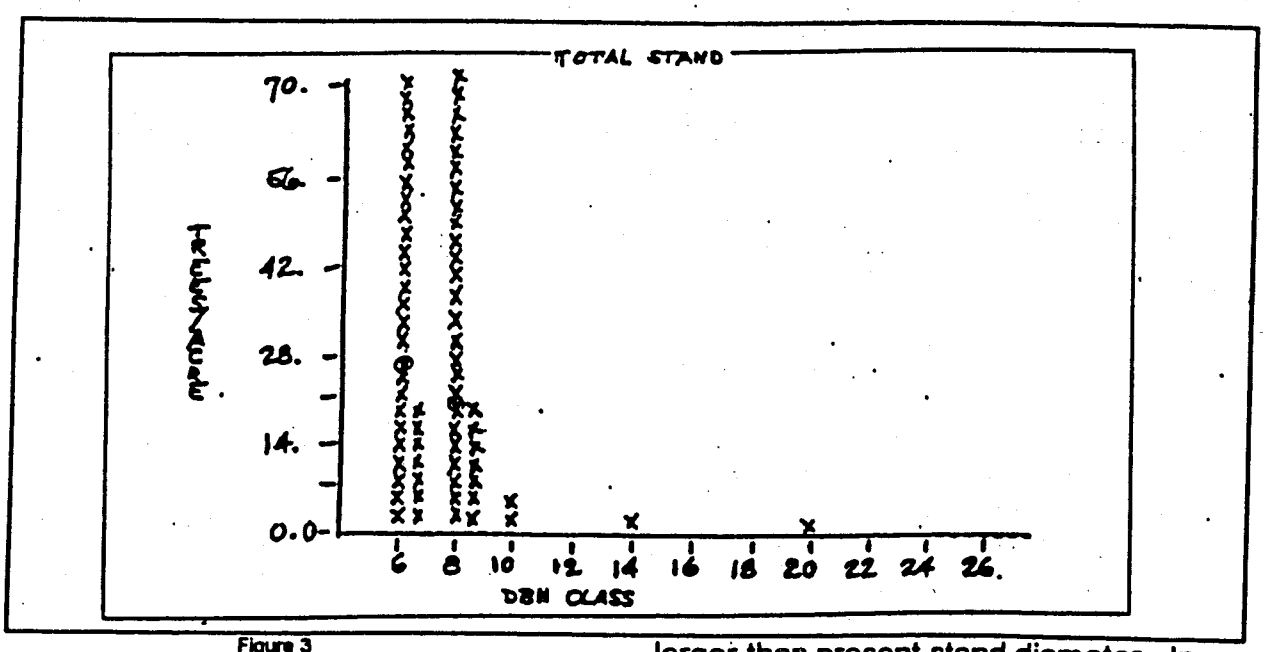


Figure 3

Stand table in graphic form showing trees per acre by diameter class.

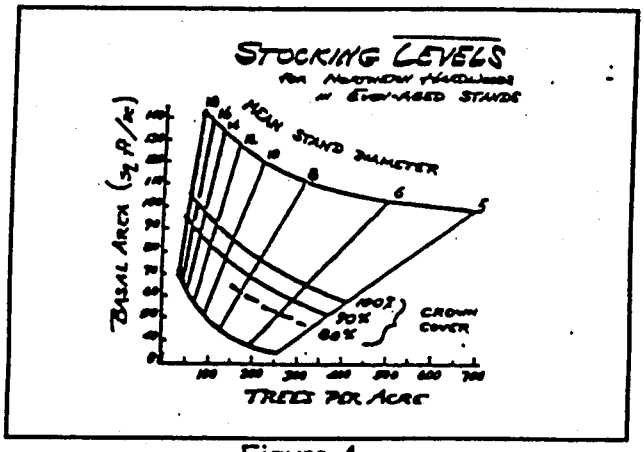


Figure 4

once without retarding the stand's development.

Let's use the stand shown in Fig. 3 to see how to use the stocking chart. This shows that half the trees in the stand are 6" dbh and half are 8", for an average of 7". Since there are few larger trees, the average diameter of the residual stand will be about the same. There is a rule of thumb: residual is 1" larger than present stand diameter. In the next chapter we'll see that our prescription would be to thin this stand to 80% crown closure; the stocking chart is here to help you figure out how to achieve that. Start from the top line where 7 would be on the dbh scale. Move down, halfway between the 6" and 8" lines 'til you hit the 80% line. From that point, move horizontally to the left to find the corresponding basal area - about 55, or straight down to find the number of trees per acre - about 200 (15' x 15'). Thus you can mark the stand to 55 square feet or 15-foot spacing to achieve the desired stocking level.

In thinnings where the average dbh is more than 9" or where one heavy (80%) thinning has already been made, thin to 90% crown cover. Use the stocking chart to determine appropriate basal area. The stocking chart is most helpful in poletimber; the stand tables from the Ancillary System will be more and more valuable as the stands progress toward regulation.

CHAPTER II

MARKING IN POLETIMBER

Before we jump into a technical discussion of marking in pole stands, let's review the history and objectives of this stand we'll be working with. Most of our pole stands originated from charcoal clearcuts fifty to seventy years ago. They are even-aged.

When you make your stand inventory, you'll need to be looking for quality crop trees. In order to justify the expense of marking, the stand must contain at least 50 potential crop trees per acre (a crop tree every 30 feet). A crop tree must show the potential to produce a grade 1 or better sawlog. Defects which will disqualify trees are crook; rot and heavy branches. That is to say crop trees must be clean and straight.

Let's assume you are going to mark in the stand discussed in the previous chapter, depicted in Fig. 3.

The average residual diameter is under 9" so you are going to mark it down to 80% crown cover, 55 sq. ft. Basal Area or 200 trees/acre - a tree every 15 feet. This treatment releases the crowns of the crop trees and speeds up their growth.

In marking, start by choosing a good crop tree - one that has the potential to become a grade one sawlog or veneer log. Pick the best quality tree in that place regardless of species. Look at the crowns of the crop tree and its competitors. For trees less than 8", mark enough crown competitors to provide seven feet of open space around the crop tree's crown (Fig. 5). For trees greater than 8", mark most important 2 crown competitors.

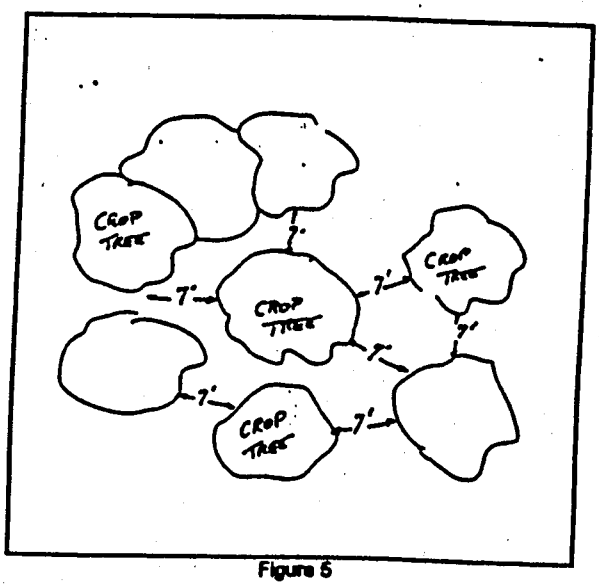


Figure 5

Provide seven feet of open space around each crop tree's crown.

If the crop tree has a fork, a crown competitor should be left on the weaker side of the fork (Fig. 6). This will discourage growth of that side of the fork and will eventually correct it. Release on three sides of the crown is o.k.

Next, remove high-risk and cull trees that don't look as if they'll last until the next entry year. (Some of these may be

excellent den trees, so don't feel you have to take them all. More about this in the next chapter.)

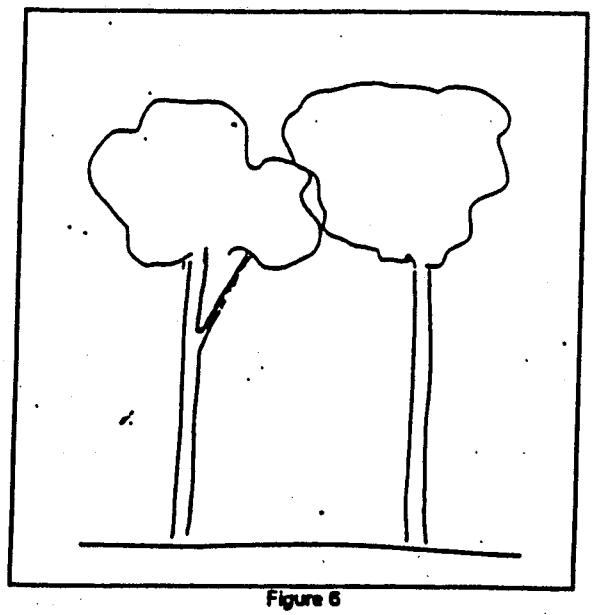


Figure 6

Leave a crown competitor to shade the weak side of a fork.

About 5 30-foot openings per acre will be needed eventually to establish regeneration. Still, sometimes it is necessary to keep poor quality trees to maintain proper stocking. Don't forget to clean up the openings.

Don't feel compelled to remove all the high-risk and culls. In addition to the possible wildlife value, some of these trees may be of value to hold up your stocking to the minimum level (Fig. 7).

While it might seem silly to keep a tree that shows no potential for improvement, we need to maintain our minimum stocking in order to gain the extra tree height that's characteristic of uneven-aged management. We'll have opportunities to get them out of there in the future if we need to.

Now, having said that, we must point out the need for a few openings in developing stands. When your stands are mature and regulated, for sugar maple you'll need to make about five 30-foot crown openings per acre each time you enter the stand For basswood, ash & red oak, you'll need to make larger openings - about 60 feet crown openings and only 1 or 2 per acre. These openings will provide space for regeneration to become established.

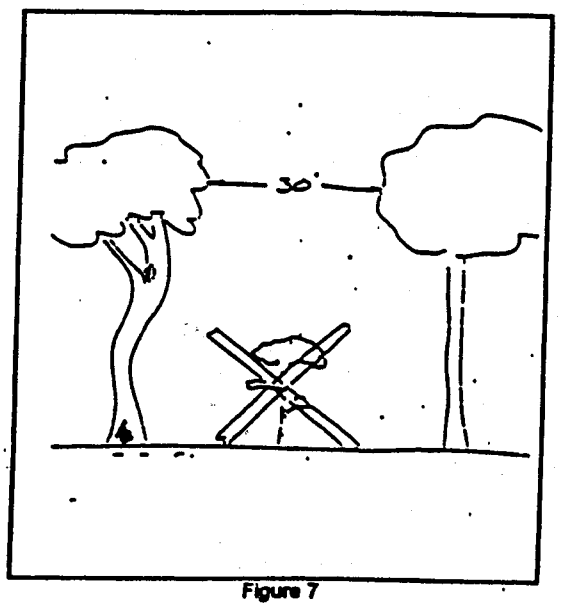


Figure 7

About 5 30-foot openings per acre will be needed eventually to establish regeneration. Still, sometimes it is necessary to keep poor quality trees to maintain proper stocking. Don't forget to clean up the openings.

When in the life of the stand you begin to make these openings will depend quite a lot on the quality of the trees. There's no point in throwing away good quality pole-sized trees just to make holes for regeneration. These poles are more than half-way to their rotation and only need to be fattened up. If you can maintain your desired stocking at 90% crown closure in potential #1 trees you should do so. You can make holes in the canopy later, when your crop trees have matured.

On the other hand, if you have a lot of high risk and culls, there's no harm in starting your crown openings now. But remember you still need to maintain

your stocking to encourage regeneration to grow tall.

When you decide to make crown openings for regeneration, be sure to do the whole job. There often are flat-topped, defective saplings present which will expand to occupy growing space, but will not develop into high quality stems. So when you make holes, clean'em up (Fig. 7).—all trees 1" and larger. The larger openings created for oak, ash & basswood should be scarified to expose mineral soil seedbed.

Remember through all of this that our goal is quality. If we already have it let's keep it and work with it; if we don't have all that much, let's start some new trees.

If, after marking out your high risk and cull, you still need to take more trees to get your stocking down to the proper level, thin from below the canopy 'til you get to where you need to be.

Reviewing the marking sequence, first remove crown competitors to provide 7' of expansion room around the crop trees for trees under 8". For trees 8" and larger, remove 2 most important crown competitors. Second, remove high risk and cull. Third, thin from below 'til you reach desired stocking.

That's the textbook part and it makes it sound easy. Many stands are easy, they almost "mark themselves", the choices are so clear. Others aren't so clear. The worst ones are those in which all the stems are good.

In those "all good" stands, look at the crowns to determine which trees are crowded. Take out trees in the codominant position in these tough choices (Fig. 8).

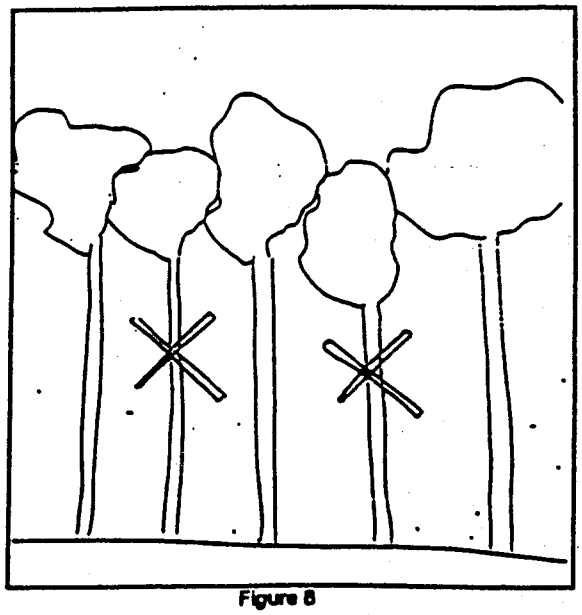


Figure 8

When all stems are good try to remove codominants. You must make holes in the canopy to do any good.

It's o.k. to leave stocking a little high in these all-good stands, but your treatment won't do any good at all unless you make some room in the canopy for crop trees to expand.

Another difficult situation occurs when all the stems are bad. Many good stands have patches of culls, poor quality poles or species of relatively low commercial value (Fig. 9).

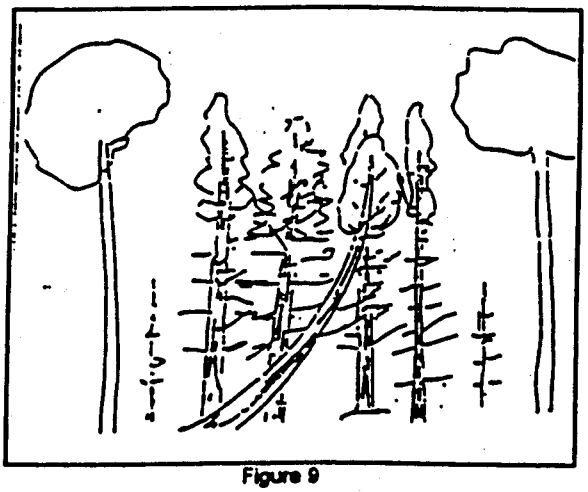


Figure 9

It's often best to go around patches of conifers and save them to add diversity and wildlife habitat to the stand.

Often these can form the basis for wildlife habitat enhancement. It's perfectly o.k. to go around these patches. We don't need to make each acre the same as every other. More about this in Chapter V.

Review: Hardwood Pole Stands

1. Seven-foot crown release, less than 8", 2 crown competitor, greater than 8".

2. Remove high risk and cull.

3. Thin from below until stocking level is reached.

   a. 5 30-foot canopy gaps per acre for maple (and clean 'em up);

   b Odd patches unmarked.

   c. Higher stocking if everything is good.

4. Manage for best tree in place.

CHAPTER III

MARKING IN SAWTIMBER

All of our operations in hard maple stands are designed to move the stand toward the ideal diameter distribution, or q-curve (Fig. 2). Operations Inventory should be done in all maple stands using the Ancillary System.

Look at the stand table for the stand you'll be marking and compare it to the q-curve. This will quickly show which diameter classes are over or under-represented. All things being equal, this tells you which diameters to concentrate on when marking.

Before we start a discussion on marking in sawtimber stands, we need to be sure we understand some of the basics of sawtimber economics. Most buyers recognize four grades of logs: 1, 2, 3 and veneer. The #1 and Veneer logs are the money-makers, #2's are break-even and #3's are pulpwood or firewood, barely worth the cost of removal from the woods. The proportion of a sale that is in #1 and better affects the value of that sale.

The definition of a sawlog is 8" diameter inside bark at the small end, in the Lower Peninsula and 10" in the Upper Peninsula, and reasonably straight and sound. (There are a lot of technical rules to describe straightness and soundness, but straight and sound is good enough for our purpose here.) A veneer log must be 14" in diameter at the small end, real straight, real sound and clear of defects. (Again we'll spare you the several pages of grading rules.)

Veneer logs sell for more than twice as much as sawlogs. Therefore it makes good sense to grow as much veneer as you can. Remember this when you're marking and you come upon a choice between a real nice 14-inch maple (with a 13" top) and a so-so 18. Even if you're overstocked in 14's and under in 18's, you would be better off keeping the 14 which will be a veneer log next time and cutting the 18 which will still be just a sawlog no matter how long you wait.

We have to balance three measures of stand structure: diameter distribution, basal area and quality. Of these, the most important is quality, then basal area, then diameter distribution. Always manage for the best tree in place.

We must keep our basal area up to maintain quality in the regeneration. Sometimes this means keeping a few poor quality trees. But, it doesn't mean we should sacrifice two nice 14's to keep a 24-inch cull so we'll match the q-curve better. Eventually we will reach the q-curve distribution, but it's more important to favor our best quality stems.

(That doesn't mean we shouldn't leave some culls for wildlife - we should, but

when we do, we save them for their wildlife value not because of their large diameter.)

This is, perhaps, the point to mention it is necessary to walk all the way around every tree to be sure you know which ones are the best quality. It's possible for a cull to look pretty good from one side.

When marking in sawlog stands, 1) first remove high-risk and cull trees. These are trees that wouldn't be expected to last until the next entry year. 2) Then take trees of poor form. Diameter distribution is less important than removing the poor quality stems. 3) Next, work in the diameter classes shown in your stand table to be over-represented. Wherever you are, work for the best quality stem regardless of species or diameter.

Our maximum diameter target for the residual stand is 22". If you have trees larger than the 22" maximum, you can mark them if there are better trees to favor. If you have already taken the basal area down to the target by marking defective trees, you can leave big ones for stocking.

The only hard and fast rule is, "Work for quality."

When you are marking trees with large crowns you will be automatically making the canopy gaps discussed in Chapter 3. As with pole stands, clean up the opening by marking all poor quality stems 2" and larger in the opening.

It's also important to size up that big-crowned tree to determine which way it is likely to fall. Chances are you'll need to mark a path for it. Your credibility will be seriously damaged if you mark a big tree for cutting, but don't provide the logger a way to get it to the ground. The logger might be tempted to hang it up in your nicest nearby crop tree, thereby hoping to obtain permission to cut it, too.

It sounds a bit complicated, and it is, but bear in mind that quality is our objective. Mark to 85 ft^2 and you'll do fine.

CHAPTER IV

ORGANIZING YOUR WORK

We are definitely talking about intensive management here - not only walking around every tree in the stand, but also analyzing its relationship to the community to which it belongs. It is necessary to organize your approach in order to avoid skipping spots. You should mark in strips one to two chains wide. Marks should all be on the same side of the tree in any given sale or block within a sale.

Work across the slope with marks facing downhill generally. Marks should be easy to see from the road so that loggers will not have to search for marked trees.

When marking in teams, one person starts ahead of the others; the second guides on the edge of the first one's strip. The third one starts a few minutes later, guiding on the second strip, and so on.

Tally sheets must be kept neat and legible. They will be needed for volume computations and may even be called as evidence in court proceedings. Your tally sheets will be the best record of what was marked, so keep them in case there is a suspected trespass. As values continue to climb, this will be more and more likely. A sample tally sheet is included in the Appendix.

In high quality timber, it will be worth the time and effort to measure each tree as it is marked, but in pole timber, you won't need to measure every tree you mark. You should start each day with a few measurements to "tune" in your eye. You need to check your eye on heights as well as diameter. Mistakes in height lead to greater errors than diameter mistakes. A good way to do this is to make friendly wagers with your workmates and then actually measure the heights and diameters.

Paint marks need to be good, solid marks, not a light sprinkling. We may need to be able to see them for four or five years and remarking a stand is very costly and unproductive.

Each tree gets at least two marks - one at eye level and one on the stump. A proper stump mark must be placed in a cove between roots where it is protected against being obliterated in the skidding operation. It should be at the ground line with about 2/3 of the mark on the stump and 1/3 extending onto the ground. Well-placed stump marks are invaluable when it comes to sale administration. Without good stump marks it is impossible to know whether a cut tree had been marked. (Usually a marker knows when unmarked trees have been cut, but without good stump marks, it's impossible to prove.)

Generally, winter is not a good time to mark because snow prevents good stump marks, but late winter provides some good opportunities when the snow has melted around the base of the trees.

The upper mark is generally placed at eye level, but should be high enough to be seen above the snow for winter logging. This may mean placing it higher in deep snow country.

A slash is more easily seen than a spot. Use plenty of paint.

A marking system used in some districts involves adding a dot or a cross-slash for each half-log tallied. For example, a log-and-a-half would be shown by a slash with three cross-slashes or three dots. This not only tells the logger how you cruised it but it also allows you to check yourself by seeing what is actually cut from a tree you cruised. This system will make a better estimator of you.

Testing done by the Michigan Department of Public Health has shown the paint we use to be safe when applied with reasonable care. Markers were fitted with devices that drew air in to simulate breathing. Results showed very little exposure to paint fumes and no harmful implications. Blood tests of a number of marking crew members tested low to low/normal lead.

Still, it is wise to avoid standing too close to trees you are painting and to try to stay upwind of your targets to prevent excessive splashback. Your clothes and boots will look better, too! Wear gloves and/or wash paint from your hands before eating.

When not in use your paint gun should be stored in a can of fuel oil or other solvent (not gasoline!). Squirt a couple of shots of solvent to rinse out the nozzle.

CHAPTER V

PUTTING THE ICING ON THE CAKE

With all the rules for growing quality timber in your mind, let's look at the non-timber values and how to enhance them. How can we work for wildlife habitat and aesthetics and recreational opportunities while managing intensively for timber?

Wildlife Division has asked us to leave 2 to 4 snags and/or den trees per acre. These do not need to be evenly distributed throughout the stand, but can be bunched if need be. We have also been asked to leave mast trees and hemlocks. In most situations this can be accomplished with little effect on timber management.

You will often come upon odd patches within a stand. These may be beech and hemlock, or white pine and red maple or balsam and spruce, or aspen, or many other possibilities. We are often as well off to just go around these patches and manage them for wildlife as to scratch our heads and try to figure out what to cut or what to leave. Very often such spots contain a lot of defect. These make great places to save for wildlife habitat. It's not as if we're leaving the poorest areas for wildlife - they may be poor for timber, but quite good for wildlife.

Obvious den trees, trees with raptor nests and certain mast trees should be kept in the stand. Picturesque trees along roads should be retained. Even an occasional porky den won't hurt us much, if some care is used. Porky dens are fine, for example, on swamp edges or in one of the wildlife patches. On the other hand, they should not be left in your best quality basswood patch!

Conifer patches within hardwood stands offer special wildlife habitat niches not available in pure hardwoods. Inclusion of such patches should be a part of our management.

Developing an eye for wildlife values and aesthetics is the icing on the cake. This will make you the complete timber marker. Your product will be not sawtimber, not revenue, not wilderness, but healthy, attractive forest stands with multiple values both today and in the future.

APPENDIX A

Dealing with some common situations

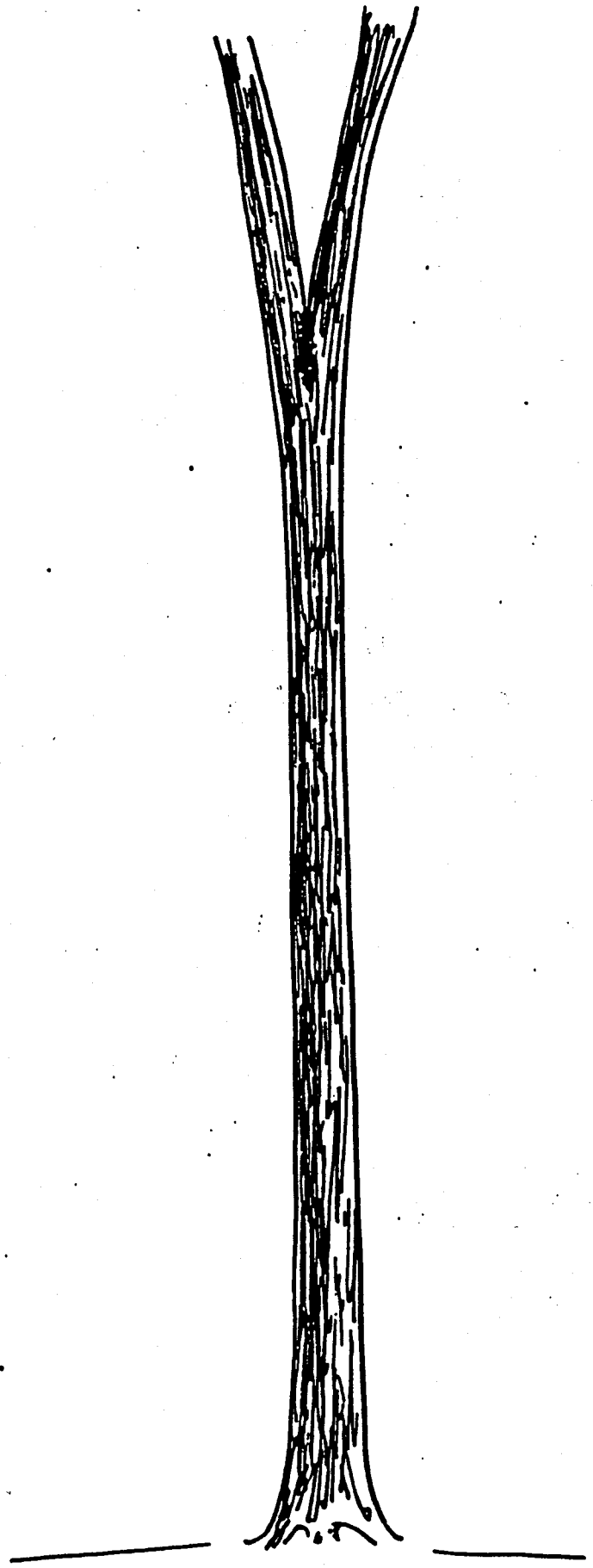
CANKERS

EUTYPELLA

NECTRIA

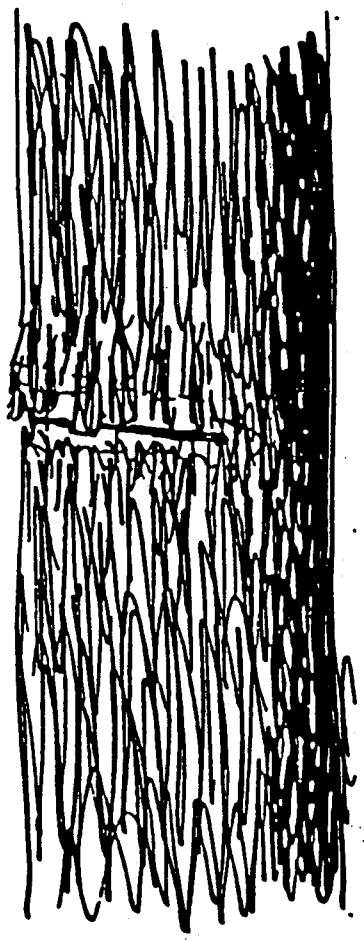
Eutypella and Nectria cankers. All Eutypella must be dropped and preferably removed from the stand. Nectria is a slightly less serious threat, but is an obvious defect, so it, too, should be removed if possible.

V - FORKS



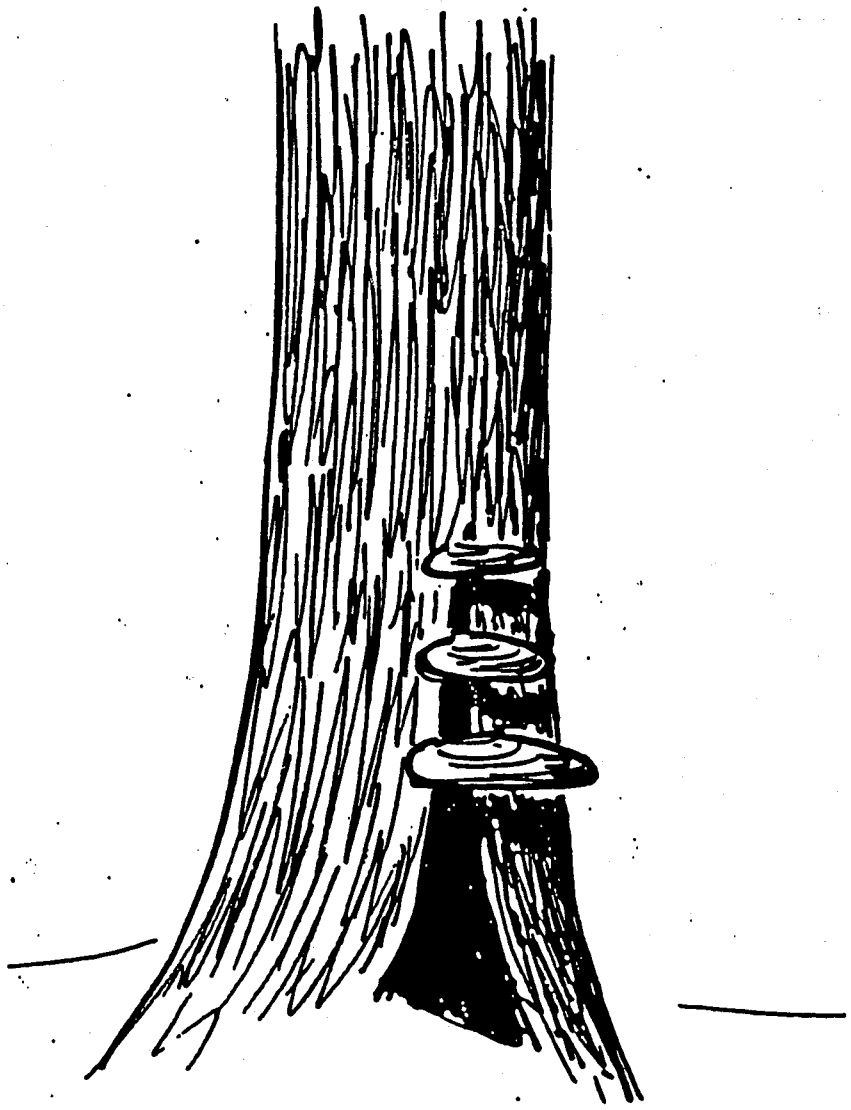
Trees with V-forks are high-risk.
Much center rot results from broken forks.

SUGAR MAPLE BORER



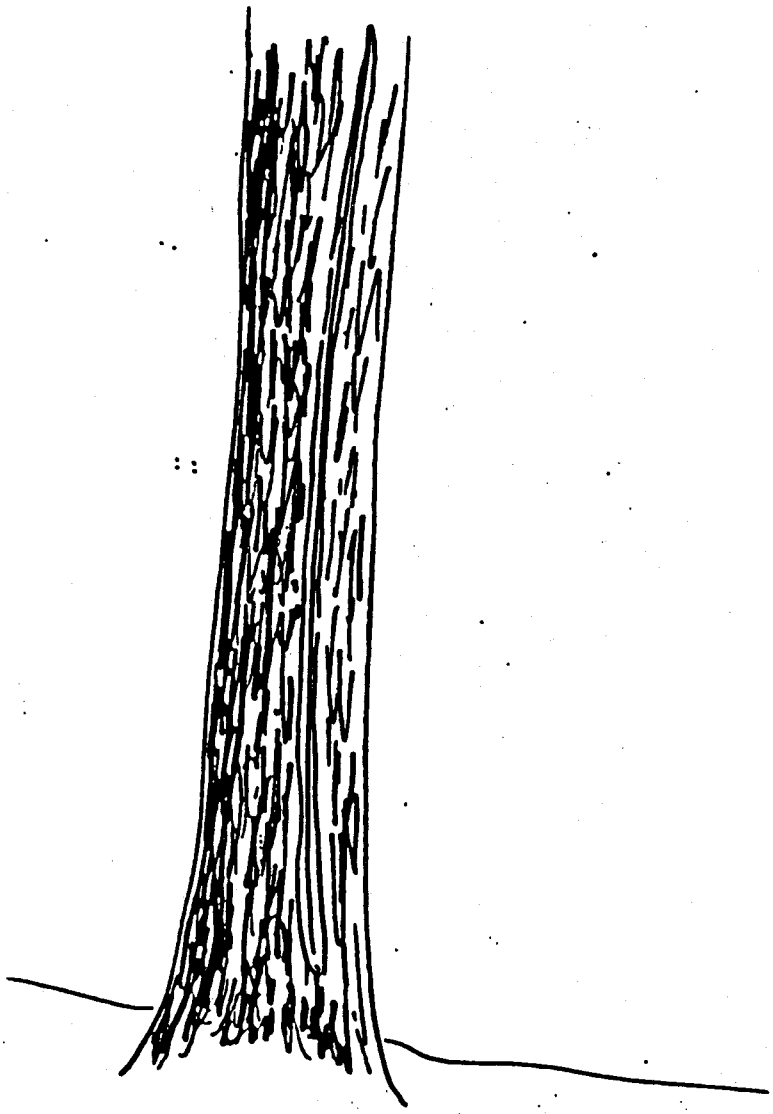
Sugar maple borer causes wounds that often lead to development of galls or cankers. Even when they heal quickly, stain almost always accompanies the injury.

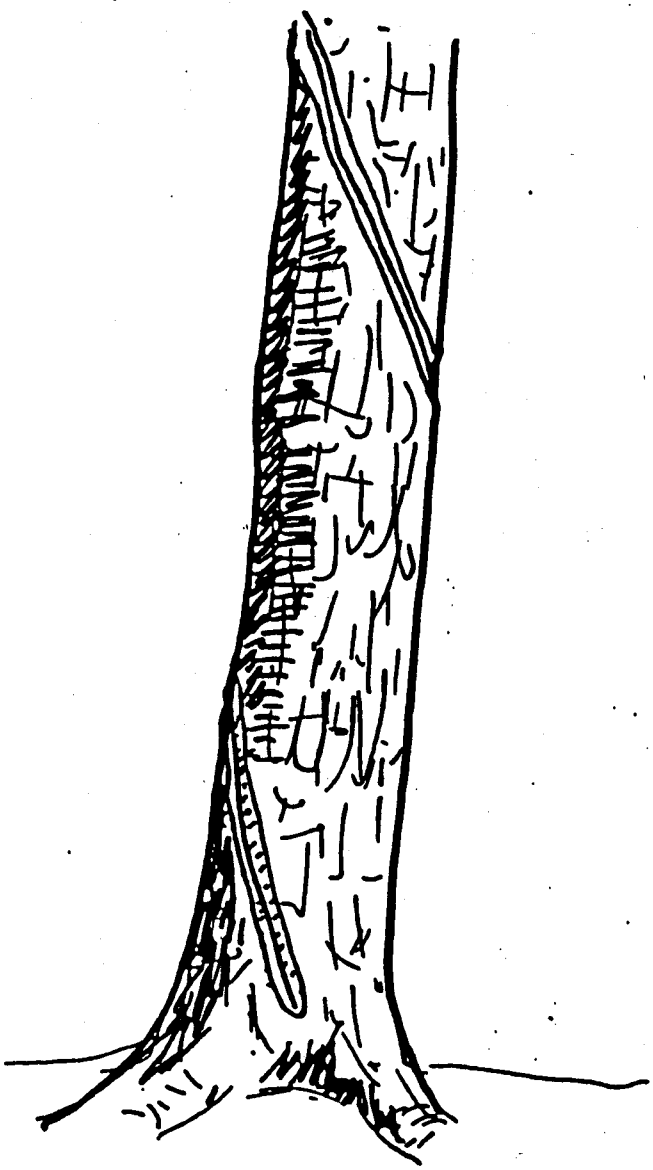
CONKS



Fungus conks are an indication of internal decay.

SEAMS, STRAIGHT & SPIRAL



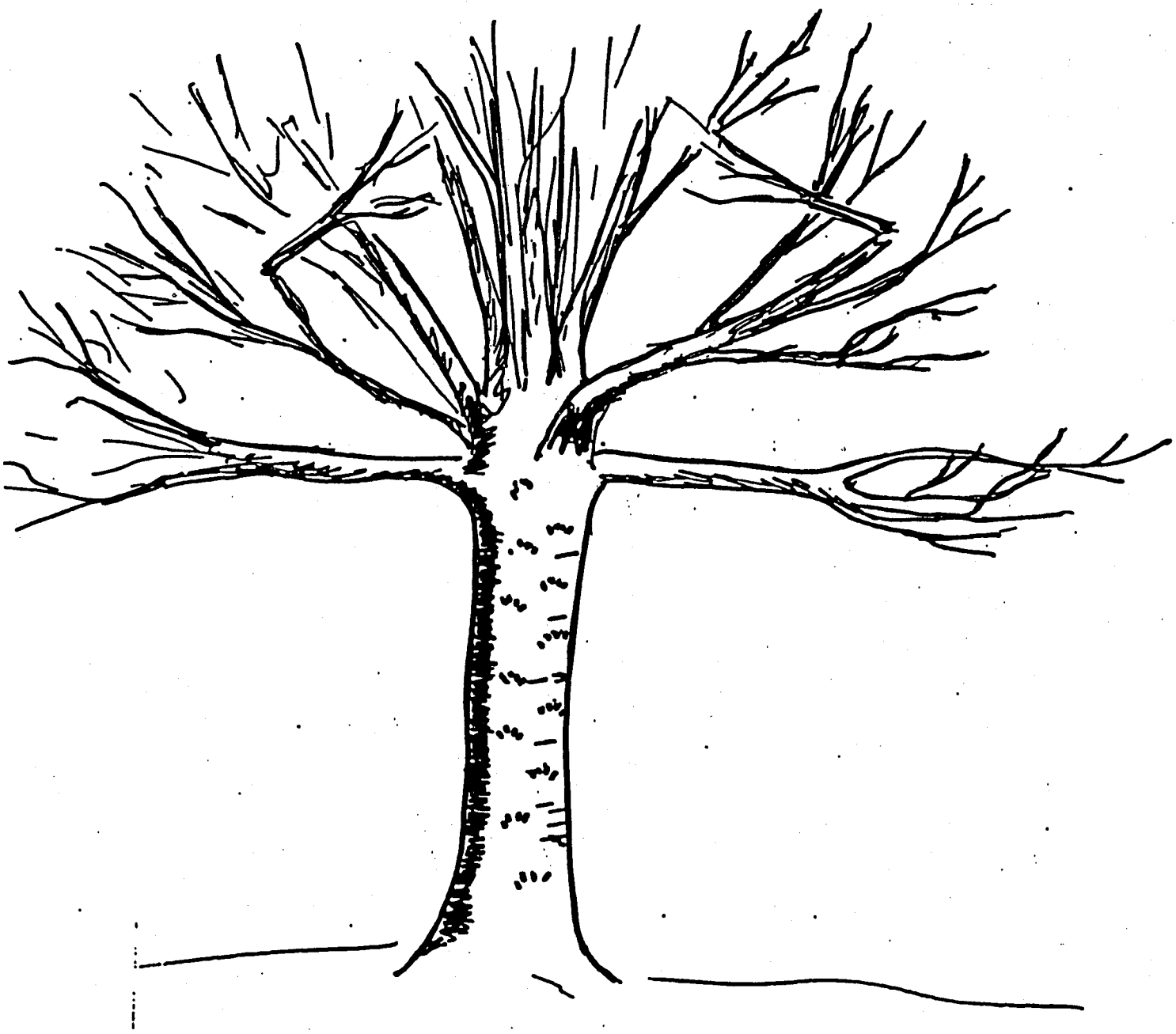


Both straight and spiral seams are defects. Spiral seams cause greater volume loss.

PORKY DEN

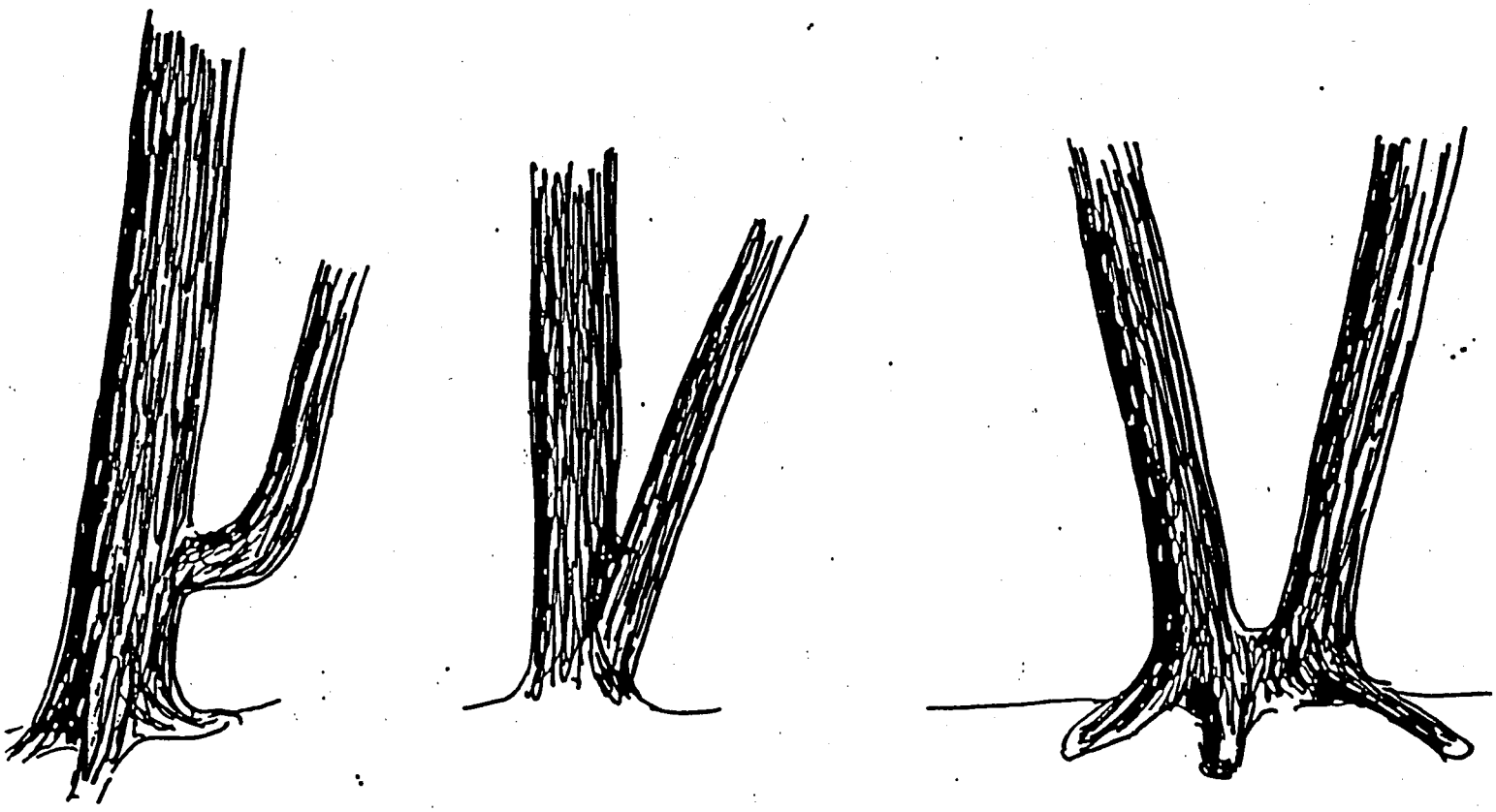
Porcupine dens should be removed from good stands of preferred species such as basswood, but there is no harm in learning them occasionally on a swamp edge or other out-of-the-way place.

MAST TREE



Good mast-producing trees should be retained occasionally as a part of the stand.

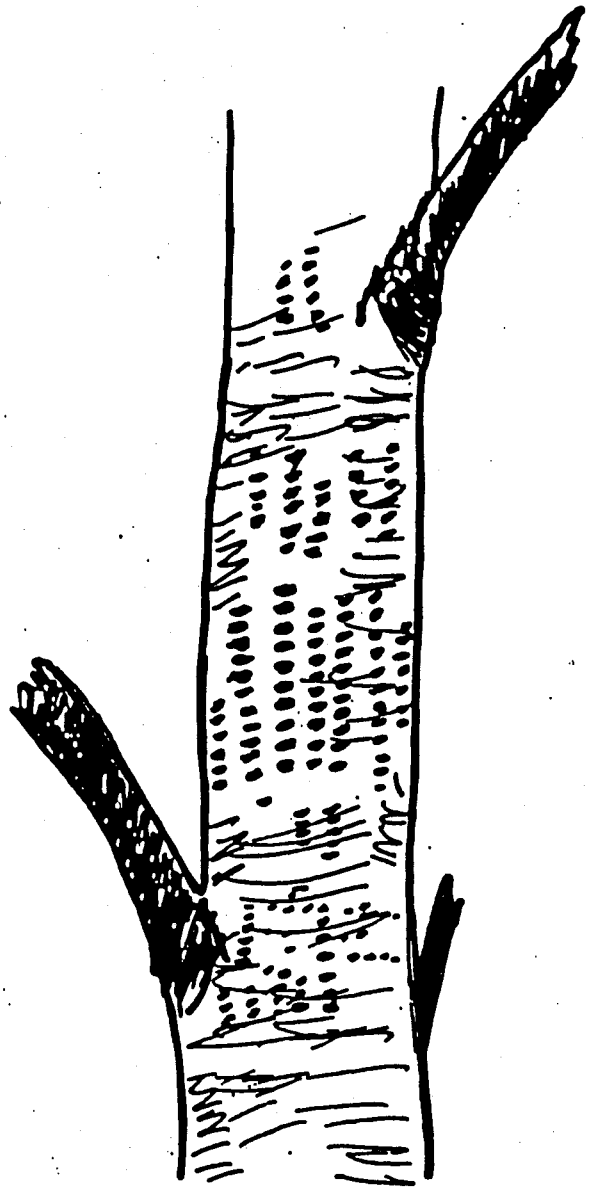
LOW FORKS



A B C

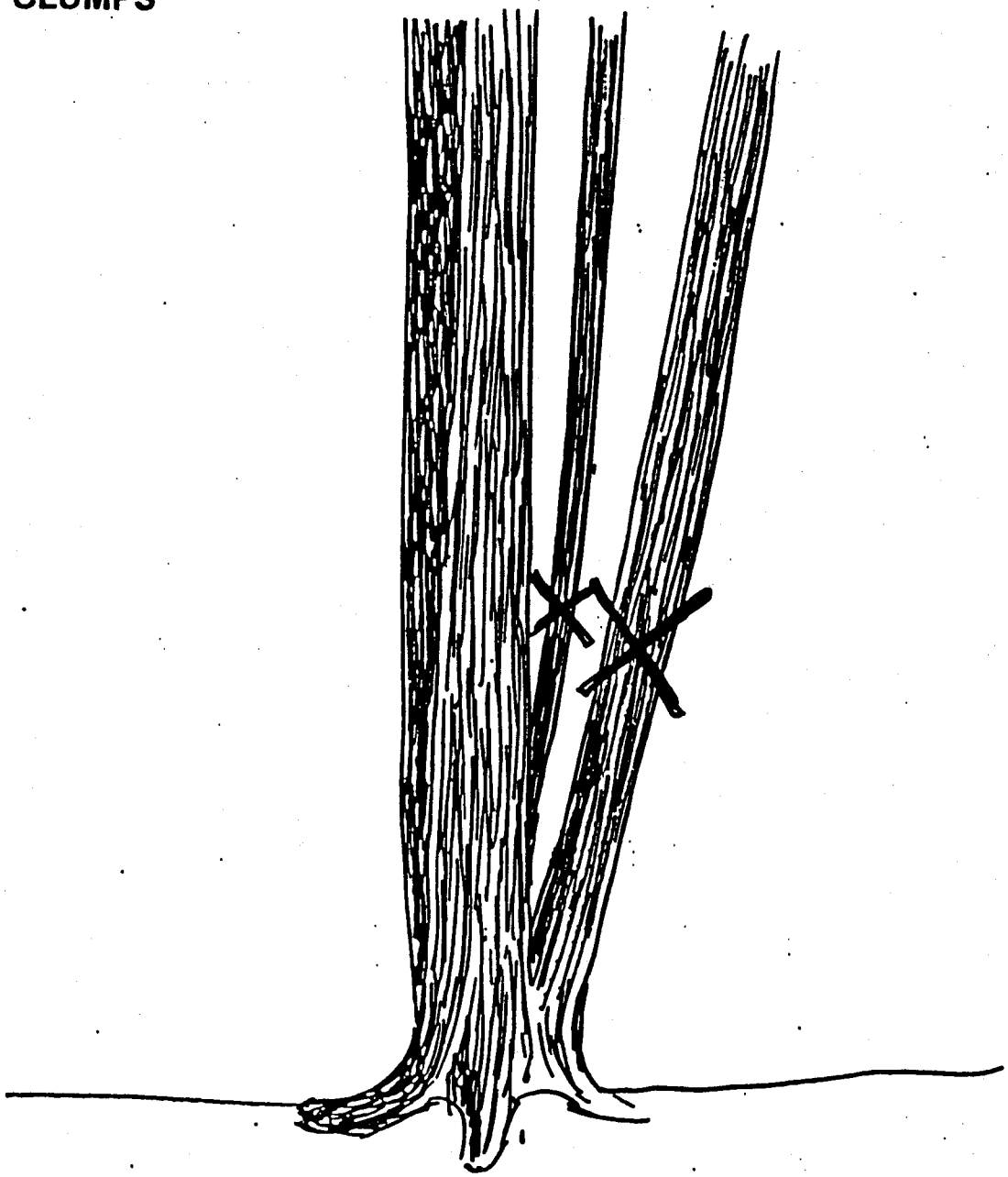
Low forks often pose problems for markers. Decay will probably result in tree A if the low branch is removed. Trees B and C can safely be trimmed.

BIRDPECK



Birdpeck causes serious damage in some species. Sapsuckers often return to the same trees year after year, so an already damaged tree might be left as a decoy. On the other hand, it might also be harvested if there is still some value in it.

BASSWOOD CLUMPS

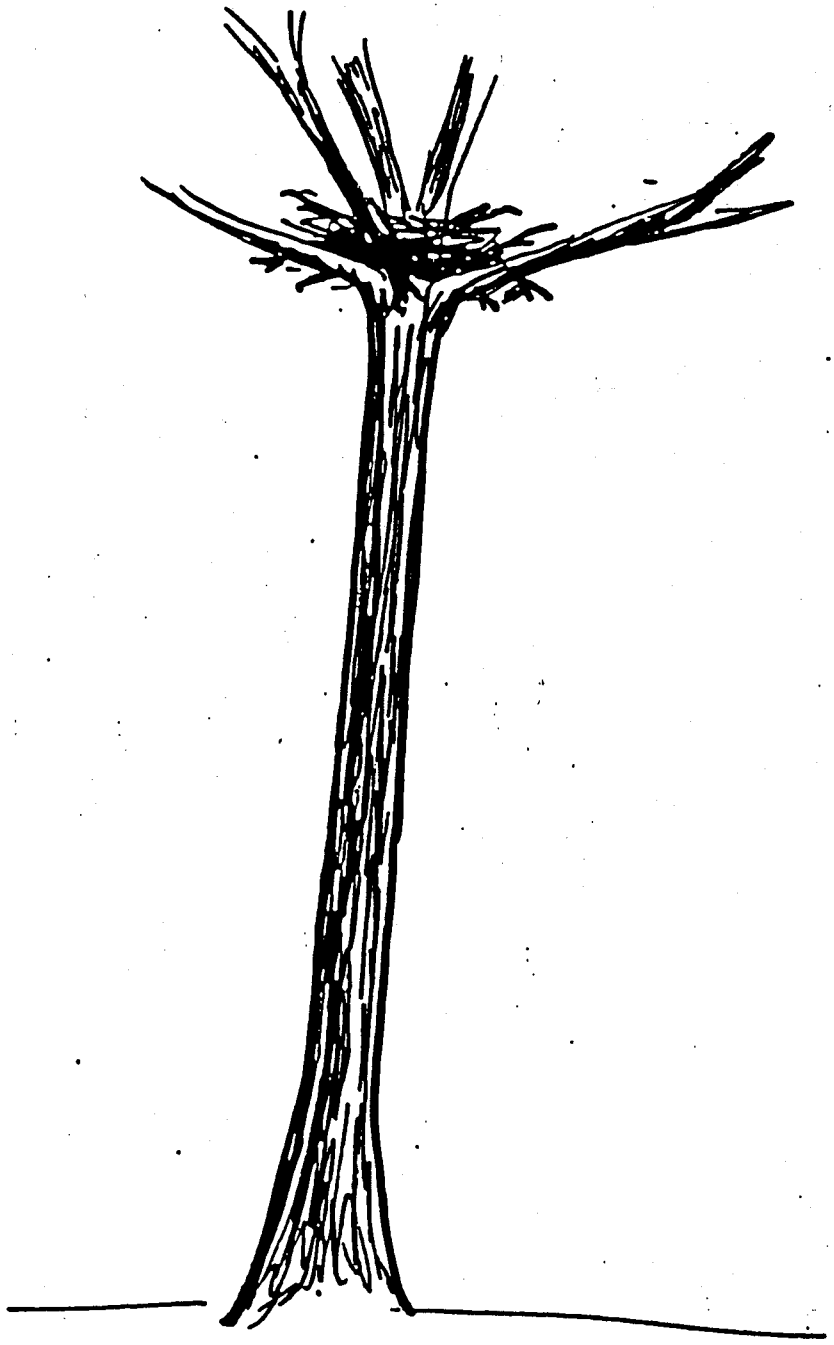


Basswood clumps can be thinned to 2 or 3 stems, but should be considered as one crop tree.

LICHENS

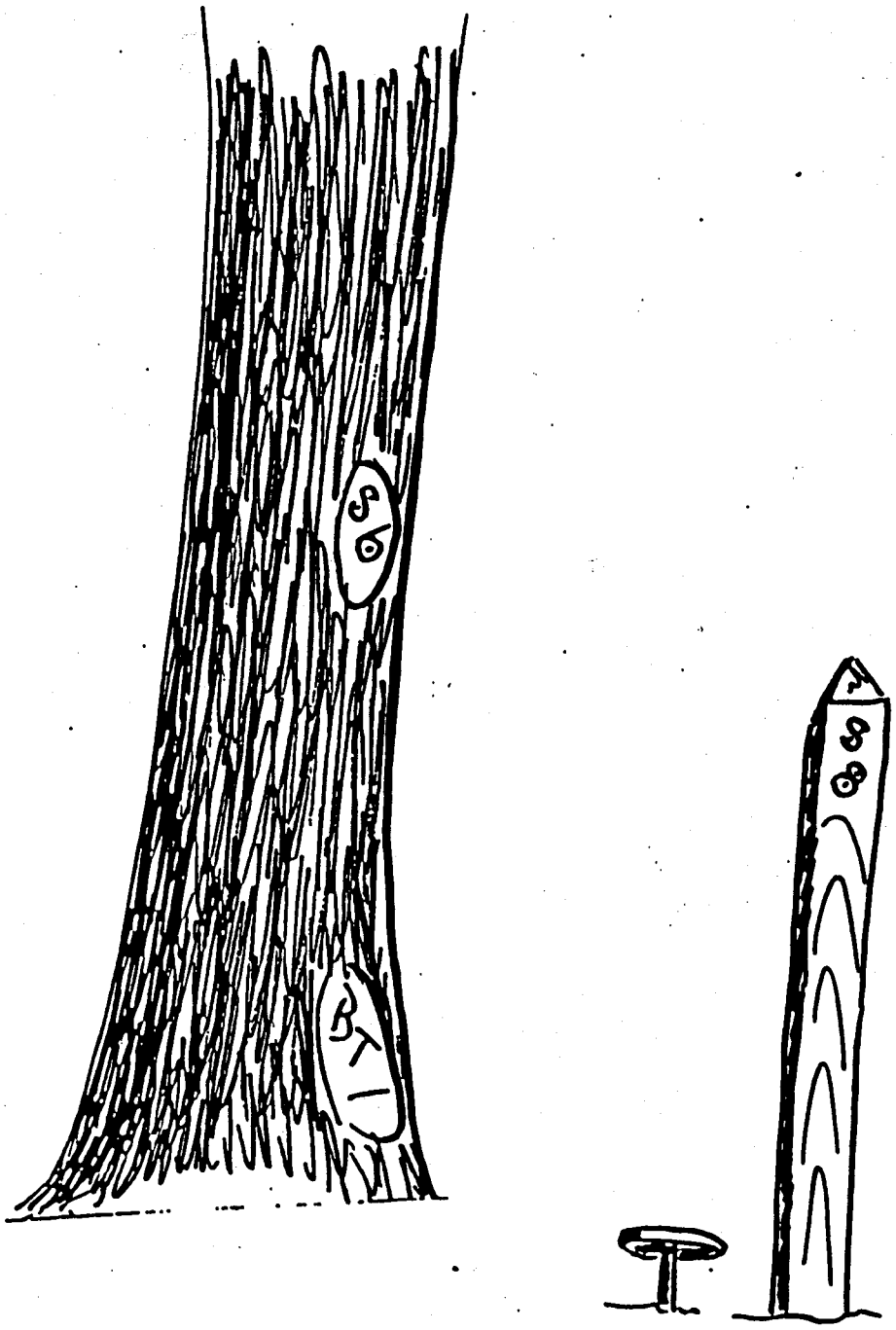
Lichens are not a defect. They attach themselves to rocks and buildings as well as trees; they cause no damage.

RAPTOR NEST



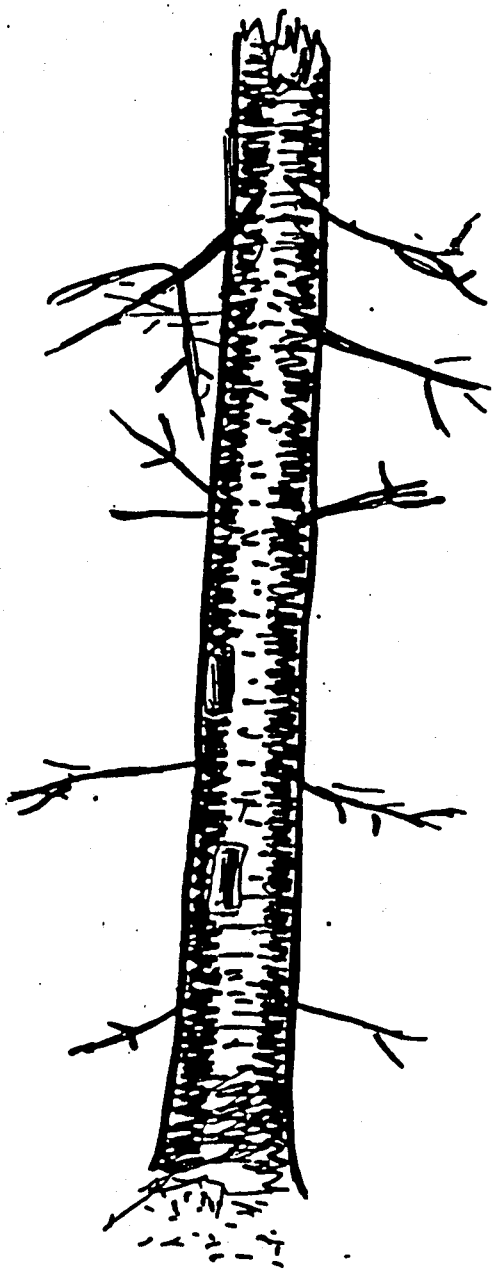
Raptor nests should be retained when possible.

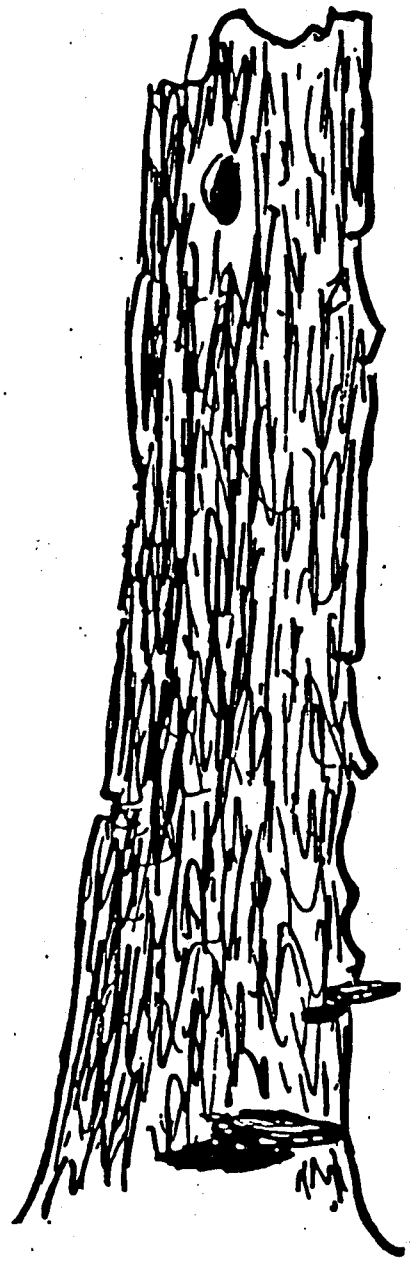
BEARING TREE



State law protects bearing trees. Do not mark them for cutting!

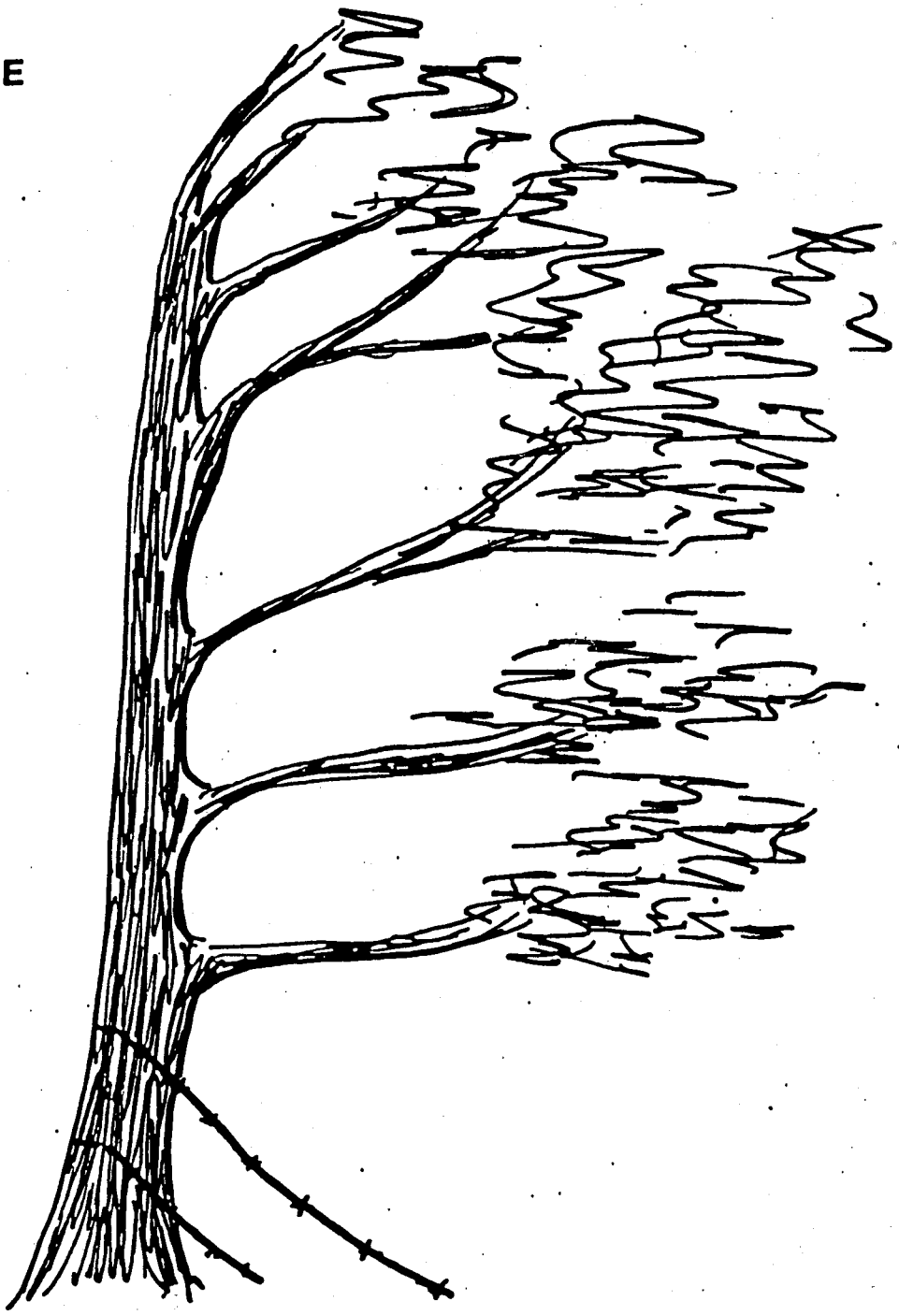
SNAGS





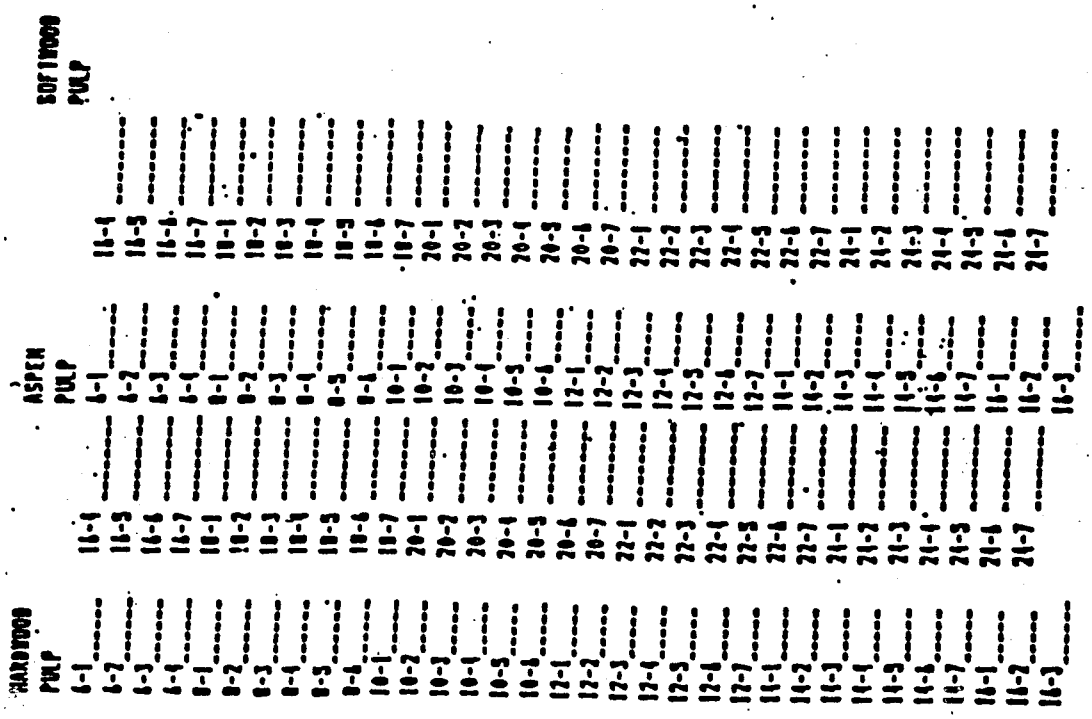
Snags provide wildlife habitat without taking up growing space. They should be a part of our stands.

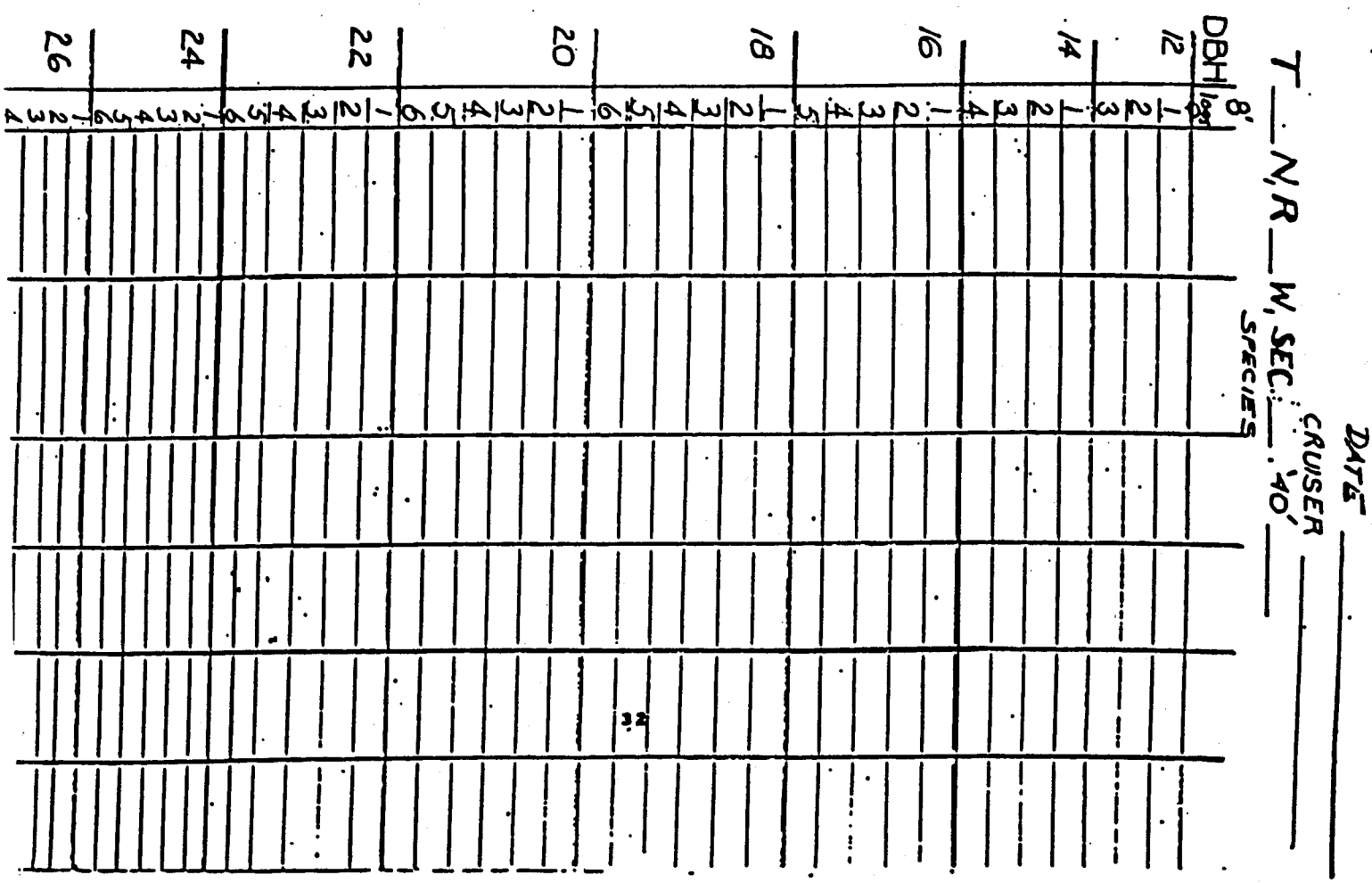
FOREST EDGE



Cutting the limby trees on the forest edge only tends to move the edge inward. These should generally be left.

APPENDIX B. A Tally Sheet with logs & pulpwood back-to-back





ADDITIONAL READING

Carpenter, Roswell D., et. al., Defects in Hardwood Timber, USDA Forest Service Agriculture Handbook No. 678, Washington, DC, 1989.

Crow, Thomas R., et. al., Stocking and Structure for Maximum Growth in Sugar Maple Selection Stands, USDA Forest Service North Central Forest Experiment Station Research Paper NC-199, St. Paul, MN, 1981.

Erdmann, Gayne G. & Oberg, Robert R., Fifteen-Year Results from Six Cutting Methods in Second-Growth Northern Hardwoods, USDA Forest Service North Central Forest Experiment Station Research Paper NC-100, 1973.

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Johnson, James A., Experiences in Thinning, Unpublished, 1981.

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Tubbs, Carl H., Manager's Handbook for Northern Hardwoods in the North Central States, USDA Forest Service North Central Forest Experiment Station General Technical Report NC-39, St. Paul, MN, 1977.

Tubbs, Carl H., Natural Regeneration of Northern Hardwoods in the Northern Great Lakes Region, USDA Forest Service North Central Forest Experiment Station Research Paper NC-150, St. Paul, MN, 1977.