THE HOME OWNER'S TREE BOOK

A Plain-Spoken Manual for Non-Professional Tree Lovers

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To my dear and perfect wife, "Miss Bob,"
who has always encouraged young treemen
and put up with this old one.—J.S.M.

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Tree Care, John M. Haller (The Macmillan Co.); *Tree Maintenance,* P. P. Pirone (Oxford University Press); *The Wise Garden Encyclopedia,* E. L. D. Seymour, ed. (William H. Wise & Co.); *Textbook of Dendrology,* W. M. Harlow and E. S. Harrar (McGraw-Hill Book Co.); *Insects and Diseases of Ornamental Trees and Shrubs,* Ephraim Porter Felt and W. Howard Rankin (The Macmillan Co.).

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THE HOME OWNER'S
TREE BOOK

I

HOME IS WHERE YOUR TREES ARE

There they stand, the Trees, by far the largest living things we know, rooted fast in the earth with their heads raised to heaven. And they are there, or so we may tell ourselves, for our special benefit.

Close contemplation of a tall tree can arouse animal awe, if not reverence, in the most heedless mind. Put your hands on the massive bole. Look up through the soaring complex of limbs and fingers stretching aloft and outward for sunlight. Reflect that this is not a cold inanimate object like a stone, but a viable organism quick with protoplasmic life in every part, from the tenderest leaflets in its crown to gossamer filaments in the hidden root system. The ground space that its supporting sinews grip for security and probe for nourishment is even greater than the crown's wide spread of shade. Though it is insensate and—Aristotle notwithstanding—has no consciousness as animals know it, yet a tree has body temperature, circulation, digestion, sensitivities, and a cycle of growth and decline which, while far slower, is no less inexorable than an animal's.

Men are children of the sea, who crept forth and were nurtured by the earth. The earth-rooted trees are their greatest and oldest friends. Men have always known this and, whenever they could do so, have made their homes where trees grew, or have brought trees to their homes. Trees used to mean shelter, food, fuel, and weapons. Later they stood simply for the beauty and love of home.

Such psychological consideration of trees may be thought

farfetched in prefacing a book intended only to render trees more understandable and manageable. It is ventured because people seldom seek to understand or manage anything they don't enjoy. And a great many people don't realize how much they do, or might, enjoy trees until they think into them instead of just looking at them and seeing only woods. In this, the esthetic sense, a tree resembles a work of art. "I like it," a man will say, "but I don't know why."

No reason is necessary. The hieing, the sense of a need being gratified by trees, is enough. But underlying gratification there is always cause, and to catch a glimmering of any cause is to sharpen its effect. When a man says, "I love that tree," he means the same as when he says, "That picture does something for me." He will the more convince himself (as well as you) if he can continue, "Because it seems to buttress my house," or "Because it commands all my grounds," or "It gives us shade in summer and a windbreak in winter." Or he may say, "We often sit out under it and watch the night." Some people personalize their trees: "There's grandpa, there's grandma, and that grove beyond is the rest of the family." Birth, marriage, and death trees are still planted by many families as a matter of course.

In his dawntime, mankind often worshipped trees, inhabiting them with gods or demons which had to be propitiated. Later the health and fortunes of individuals were linked with specific trees. Then a man's tree was protected by his friends to protect his life. Evil spirits could be drawn out of sick persons by splitting a trunk and passing the patient between, or by hanging on the boughs or laying in a crotch something taken from the sufferer, such as clothing or nail-clippings.

The most imposing tree ever imagined was Yggdrasil, the mystic great ash of Norse mythology. It symbolized all existence. Yggdrasil's crown pervaded heaven, with an eagle on the topmost bough. Its trunk supported earth, on which

its sheltering branches shed honeydew. Its roots penetrated the nether realms of the giants, the gods, and of the dragon Nidhug, whose offspring gnawed them incessantly. It is a bit weird to realize that some sequoias and redwoods in their prime today were mature monarchs a millennium and more ago when Yggdrasil and other dream-trees first sprouted in the minds of men.

Yggdrasils, sequoias, and sorcerous trees have place in the daily lives of few people nowadays. But though fashions change, trees retain their hold on men's hearts and imaginations. And with trees as with other treasures, possession is nine-tenths of enjoyment's law. One of the happiest facts about trees, great and small, is that they are a myriad times more plentiful than most other forms of wealth, and much more public. For every feature tree that the richest of men may own in his walled estate, there are at large in public parks and unfenced forests countless trees equally magnificent, to be seen and enjoyed by all men. Better still, no man with any fair part of one acre is so poor or so unlucky that he can't grow as glorious a tree, of almost any species he chooses, as ever grew in Eden.

The poet Joyce Kilmer averred that "only God can make a tree." But the god of trees is benevolent. He approves the burgeoning of die ailanthus, "Tree of Heaven," even in Brooklyn and other asphalt jungles. In the suburbs, in exurbia, at a new homesite carved into the wildwood or out of barren countryside, the dendrological deity is open-handed to any degree a patient man may ask. And this benevolence extends not only to new trees started from saplings. It applies also to mature trees whose growing needs were neglected by early owners but which are not too far deteriorated for revival. Giving older trees a new lease on life can be even more satisfying than planting and cultivating youngsters. The latter process is uneventfully natural. The former often borders on the miraculous.

Over the past fifteen years this writer has watched, as a

practicing tree lover and consultant, a special aspect of the U.S. population explosion. More and more people are being forced out of their cities and strewn among the suburbs or beyond—into rural villages, old farmsteads, or brave new diggings miles from nowhere.

Many of these human transplants become, for the first time in their lives, the owners of trees.

Land, grass, shrubbery—these the newcomers can understand and evaluate. Trees of their own are something else-possessions entirely new in kind and caliber. Most new householders value the trees that came with their real estate. How could they fail to when they see so many other sites being stripped of every stick and stump? But they haven't the foggiest notion which of their species are which, or in what condition, or whether anything should be done to improve and preserve them.

Offered here is a non-technical handbook for tree owners, new and otherwise, setting forth the rudiments of tree physiology, growth, care, culture, and values. The chapters are so arranged and developed as to benefit—it is hoped—all degrees of experience. A certain number of people think they know all they need to know about their trees and what can and should be done for them. For such this book is not designed. Many more people regard their trees, like their children, as fond objects of continuing interest and concern, whose needs change with the seasons, the passing years, the vicissitudes of nature. For these this book is designed to:

State simply the facts of tree life.

Reduce to reasonable limits the cost of tree care.

Insulate the inexperienced tree owner against the alarums and excursions of high-pressure "experts" and "dendricians."

Tree care is not an exact science. But there is in it more basic method than inspired art. A substantial amount of "expert" care can be administered quite as well by an attentive novice as by pontifical professionals. By no means

all tree owners have proclivities to do-it-yourself. But perhaps twice a year, which is enough, most healthy persons who have secured their treasure in the good earth will feel an urge to help good things grow therefrom. If their own hands and backs are not up to it they will hire common labor and, out of their own reading, get the work done on an intelligent boss-it-yourself basis.

It is this book's aim to help along these lines, with basic "show how" text and illustrations on such elementals as tree feeding, light pruning, cavity and flux treatment, the relief of girdling roots. It surprises lots of people to learn that a hundred pounds of good tree food properly installed by themselves can save a $25 bill from the "surgeon/' Or that a few inches of pipe or tubing correctly inserted can deter heartwood decay.

For the higher mystique and techniques of treating trees, advice is offered on how to pick and pay tree experts, what to tell them, what to ask them, how to check on their work. True practitioners of tree care are among nature's noblemen, to be trusted and cherished. But the woods are full of cynical, piratical frauds and gypsy butchers.

Because fresh arrivals at the status of tree ownership—and experienced ones as well—find themselves in a variety of locales and ground conditions, typical combinations of these are prescribed for under separate headings. The tree problems of an owner sandwiched in suburbia will differ greatly from those of a settler in the wildwood. But the theme throughout remains the same: home is where your trees are.

Giving them care is as worthwhile as keeping your house in repair; in fact, even more so. Trees grow in value. Houses can only obsolesce. When you renovate your house it remains impassive. It will look and function better for a while, but it offers no active response, and soon resumes its decline.

In contrast, try feeding your hungry trees generously.

Relieve their self-strangulating roots. Give them a "hair-do" by raising droopy branch levels, pruning out deadwood, thinning overgrowths. Treat their scars and sores with edged tools and wound dressing. And what do you get? Young or old, your trees will respond with surges of new life and energy, silent and slow as is the way of trees, but nonetheless visible, grateful, and rewarding.

II

A CLEARING IN THE WILDWOOD

Trees acquired just as they grew are most
truly your own, when you know them

As this book is begun, across the writer's memory passes a panorama of American homes from New England to California and from the Adirondacks to South Carolina. Six have been his own homes, three suburban, three truly rural. Most belong to people who have sought professional advice about their trees, in grounds ranging from segments of raw "developments" to expansive, manicured estates laid out in unspoiled countryside. Regardless of size or pretensions, the central questions have always been the same and always should be: "What, if anything, do our trees *really* need? How can we preserve and improve them most prudently?"

Every one cherishes his trees to some degree, but no one really thinks money grows on them. Between the most affluent, experienced owner and the most modest and inexperienced, prudence is a common denominator. What the former well knows, the latter fears: tree care can be overdone as well as underdone. Each seeks a happy medium where overhead will not outrun psychic income and real value in the property.

As with any other performance, some familiarity with the cast of characters is essential to directing and enjoying tree care. Happiest are those people who can recognize and

understand all the trees they own. It is not within the scope of this book to provide a catalog of species, but careful thought has been given to a list of guidebooks appended to this chapter. Manuals that cover all sections of the country have been chosen, and also books of appreciation—good writing about trees by authorities who love their subjects as well as they know it.

Having acquired or planned a home with trees, an owner should, before he goes in for any planting, make the most of what he finds growing wild on his site. Later chapters will discuss grounds long since built on and planted, and naked acres where a start must be made from scratch. Considered in this chapter will be virgin land more or less wooded and not yet trammeled by the bulldozer; or, if building and grading have begun, not yet treescaped. Trees never before touched by man give their first possessor a sense of receiving gifts straight from nature, entirely his own.

Tree guide in hand, walk your property—purchased or prospective—when the country is in full leaf. If you can inspect it during spring bloom, so much the prettier; but later on, when all the leaves are out, even in summer's heat when some trees are suffering, your view of shading, crowding, and moisture conditions will be much clearer.

What you want to know first is what species you have got. Then: Where stand the finest specimens? Are there many more of some species than of others? How do your trees compare in kind and condition with the trees on neighboring land? How is their water table? Their drainage? The answers to these questions may have strong bearing on whether or not you buy. If you have already bought, the bearing will be on how you handle your investment.

After you have identified and sized up your trees in a general way, start thinking about the position of your new house in relation to feature trees, the finest specimens. These are not necessarily the largest ones. Kind and shape are what count, and promise for the future. Close proximity

to the house is not an important criterion either. Looking from a little distance at trees is often more satisfying than seeing how they flatter the architecture. Fine outpost trees will enhance your grounds as a whole, and your sense of space.

Where conflicts threaten between valued trees and the building, driveways, or pipelines, make early decisions and avoid compromise. If a tree must go to make way for a wall or footing, take it out promptly and forget it. Later this would cost you much more, with the finished work in the way. If you really do want a tree that "interferes," change the blueprints.

Architects have some feeling for trees. Many builders have none. Most of the men on bulldozers and back-hoes develop definite blind spots, if not visible horns. If the earth-moving and fine-grading are within your control, mark the trees you want to save with bright tags or rags. Baffle or board up the trunks of those near work traffic. When your house is staked out, stake out your best trees also. The stakes should be driven and stringed out around each tree beyond its crown area, where its roots run. (See Chapter III.) Have it understood with the contractor that no rapacious jaws or blades are to invade these areas, or any heavy machine treads. Impaction of the soil can damage roots, by suffocation, as badly as cutting or exposing them will. So can piling earth over them more than three or four inches deep, even temporarily. Graders have a way of piling earth against tree butts and then leaving it there on the theory that the fine-grading, by hand, will be done soon enough. It seldom is, and those pile-ups can be fatal after just a few weeks.

Where fill is unavoidable, have spacious stone or cinder-block wells laid up quickly around buttress roots, and a scattering of drain tiles—up-ended and filled with small rock—embedded over root systems to provide ventilation

and irrigation. Contractors are perfectly able to do these things, if you insist.

Where roots must be cut, or are damaged regardless, feed these trees and have their tops pruned, to compensate, as soon as possible. Equally prompt should be repairs to torn limbs, butt scars, and bark wounds. (See Chapters V and VI.)

In deciding which trees to retain and feature in your new grounds, be practical. Some softwoods like silver maple, the willows, and poplars make a pretty show, but are short-lived. If they do not interfere with hardier species, well and good. Otherwise give preference to more durable stand-bys—the oaks, beech, ash, sugar maple, tupelo, honey locust, sassafras, shagbark hickory (but not the smoothbark, or pignut, which has small character).

Sycamore, sweet gum, horse chestnut, and black walnut are all hardy species, but you will like them better away from your house than near it. They drop fruits that can be bothersome underfoot.

All flowering trees you will favor as a matter of course-dogwood, redbud, hawthorn, shadblow, and any of the wild-grown fruits like apple, pear, and cherry (but not chokecherry, in which tent caterpillars spawn). Locust and catalpa are attractive in flower but are better kept toward the property's edges for they are shedders too, the one of deadwood, the other of elephant-ear leaves and trashy bean pods. Lindens (basswood) and mulberries are more welcome: they bring bees and birds, respectively. So are the paper and gray birches: their graceful white stems are like dancing girls.

The soft maples—silver, Norway, boxelder, and sycamore —present problems. All the maples cast grateful shade with their broad leaves, but these four kinds are brittle, hence hazardous. They tend to overgrow, and their resistance to ants, borers, and decay is low.

Nothing is more lovely than a feature elm, standing off

by itself so that its palmate or lyre shape and spread can be fully appreciated. Nothing could be more trouble, either. If there is any Dutch elm disease in the vicinity—and there probably is nowadays—you will never know from one year to the next when your tree may be attacked by it. Spraying, feeding, and pruning out the deadwood are imperative safeguards, and not cheap for any elm large enough to deserve them. If your grounds contain no rapturous old elms, perhaps you are not exactly to be envied, but over your head will hang no season of heartbreak. If your grounds contain young elms competing with sounder species, blaze them first of all when you mark your grove for thinning.

Wherever evergreens stand behind birches or white-flowering species like dogwood, consider yourself blessed by Nature. The contrasting effect is one for which tree-scrapers strive. Among the evergreens that you may find in your wildwood, commonest will be the cedars, spruces, white pines, and hemlocks with maybe some firs in northern latitudes. All these are hardy varieties but should not, just by that token, be taken too much for granted. Evergreens are more easily replaced than most deciduous trees, but not in the large sizes that show the best and give grounds grandeur even in winter. So check the health of your needly old-timers as carefully as you do the rest. Their greenness when other trees are bare can be deceptive. But if large evergreens stand close to where the house is to go, have this in mind: their shade can be as gloomy in winter as it is cooling in summer.

When you mark your trees for thinning, take a leaf from the Stout study of forest root systems. (See Chapter IV.) Remember that, in a wild grove, each tree has been competing with three or four of its neighbors for nourishment and light. The trees you wish to keep can use all the elbow-room you will give them. Shade-grown trees tend to be spindly, but given air space and root room they can fill

out almost like field-grown specimens. Spare the saw and spoil your specimens. As they are spaced, so will they flourish.

When your thinning is undertaken, don't let the bulldozer do it. That blade, those heavy treads, will do more underground damage than you know when they knock the marked trees over and push away the stumps. Do it or have it done by ax and chain saw. Cut the stumps flush to the ground, where they will rot away soon enough. You can speed their dissolution by boring holes and putting in saltpeter or waste crankcase oil and then burning them out. If you are in no hurry to get your final effect, your thinning can be done piecemeal, and often it is better done so. You will not have to find shelter for all the firelogs at once, or burning space for all the brush. If you girdle (ring-cut) one year the trees you plan to take out the next, you can be just as sure of an immediate root-kill—to unshade wanted trees—as if you felled the trees at once. Also, you can thus season your firewood right on the stump instead of having to stack it, which rots the bottom logs.

Vines growing wild on trees will strangle or smother them eventually. Cut them at their roots and they will fall away in time. Not harmful are morning glory, an annual, and trumpet creeper, which climbs free, without throttling, and whose deep-necked blooms the hummingbirds love. If you value the trees you find them on, show no mercy to wild grape, honeysuckle, woodbine, poison ivy, or wisteria (which you can cut back partially and then train to a support all its own). The evergreen ivies—English, American, Boston—are decorative on tree trunks but should not be allowed to grow much above the first main crotch.

An advantage that woods-grown trees have over their cousins in fields and lawns is that they were nourished from infancy by leaf mold, which is organic. Remember this when you decide about lawning around your selected trees. They will appreciate your not raking away all their

fallen leaves every autumn. Lots of people let their power mowers chop the leaves into mulch and leave it lying to benefit grass and trees alike. If you are going to insist on raking, have the bulldozer do one last thing for you before it departs: scoop out a leaf pit, like a small trench silo about 8'Xi5'X4[7], off in some corner where your annual leaf harvest can be dumped to rot and disintegrate for use another year. If you have oaks, try to save their leaves separately. Any broad-leaved evergreens you may want to cultivate, especially hollies, will thrive on oak-leaf mulch, which is strongly acid.

So far, only that situation has been considered where a new home owner has control of his trees from the beginning. But the suggestions offered above apply with equal force when the new home you are buying or debating has already been started, or even completed, by a builder-developer. Knowing what to look for, you can tell whether he has conserved or laid waste the tree values in the property. If he has any tree sense, chances are that he has conserved values and will co-operate with you in improving them while there is yet time. If he has massacred the trees, sheer off and buy elsewhere.

A sure key to a developer's tree sense, apart from his placement of the house and the care shown in grading, is his treatment of the driveway. Pennies pinched by slamming a driveway in on the shortest course, without regard for good trees, are dollars thrown away. Roots ripped or hacked off to let in concrete or blacktop could just as well have been pruned carefully and the trees' necessity for food and top-pruning recognized. The writer has vivid memory of four fine oaks in front of a $55,000 "development" home near Princeton, N.J., which were plainly slaughtered by such thoughtlessness. Not far from that house is another new one where a dozen tall hardwoods in the front grounds are now grisly skeletons just because

about eight inches of soil, excavated from the cellar hole, were spread over their roots instead of being hauled away.

In the *Saturday Evening Post* (January 28, 1961), Charlton Ogburn, Jr., estimated that the nation's metropolitan population will increase by sixty million in the next year, of which twenty-five million will move into new houses in suburbs. Mr. Ogburn, a park commissioner of Virginia's fast-growing Fairfax County, across the Potomac from Washington, canvassed a lot of land planners, architects, and builders with this question in mind:

"Will the land for the oncoming developments be scalped and flattened, or will the new dwellings be fitted into the existing terrain with minimum destruction of trees and undergrowth? . . . The answer will make an important difference in the kind of country we have to live in—and in the kind of people we are. . . . When . . . our dwellings seem to belong where they are, to be parts of their surroundings rather than invaders, we ourselves seem to gain a sense of belonging, of having roots. We even gain some of the serenity which is apt to be the scarcest commodity of all in the abundant life."

Mr. Ogburn found that the more intelligent—and successful—builders have learned to care for trees because it pays off. Added expense is more than returned in their properties' saleability. The Federal Housing Administration promises maximum evaluations to tree-saving builders. One subdivider even "located every major tree on a big topographical map and cranked them all into the plan." In another development the builder put up signs reading:

NOTICE TO ALL TRADES
TREES ARE SACRED
Trees Must Be Kept in Perfect Condition. Do Not Destroy Unless Construction "Super" Gives Approval. Anyone Guilty of Damaging Trees Will Be Put Off the Job.

Homes in new sections usually have to have the utilities brought to them—power and telephone, at least, if not water and sewer as well. It is wise to find out just where your trees stand in relation to these welcome but sometimes reckless arrivals. The workmen who clear the right-of-way and run in your service *lines* are not interested in saving trees, only in getting wires up or pipes down. Here again your builder is responsible, but keep an eye cocked over his shoulder, and get repaired promptly any tree damage he fails to forfend. In the end you will be glad you did, when other buyers' trees go to pot and yours are the nicest in the neighborhood.

One other thing the bulldozer can do for you before it departs: clear a strip of ground for your tree nursery. Put it in a sheltered spot, below a slope, and don't let them scrape away all the topsoil. In the course of events you may be wanting replacement trees or added starters for empty spots. There is no better time or place to collect and start some specimens than right on your own ground, to which your species are already accustomed. Your woods will be full of sprouts and switches which can be moved with little more effort than it takes to destroy them. The rudiments of transplanting are described in Chapter VIII. Here it is simply suggested that, while an unkempt tract is being tailored, future additions to its wardrobe can be provided for on the spot, to avoid expensive trips later to commercial tree farms.

Before passing on to the physiology, care, and culture of trees, let new home owners introduce themselves to the great Tree family through some of the following books:

Pocket Field Guide to Trees, William Carey Grimm (The Stackpole Co.); *Handbook of the Trees,* Romeyn Beck Hough (The Macmillan Co.); *Introduction to Trees,* John Kieran (Doubleday & Co.); *Our Trees: How to Know Them,* Arthur I. Emerson and Clarence M. Weed (J. B. Lippincott Co.); A *Natu-*

ral History of Trees of Eastern and Central North America and A *Natural History of Western Trees*, Donald Culross Peattie, ed. (Houghton Mifflin Co.); *Illustrated Manual of Pacific Coast Trees*, Howard E. McMinn and Evelyn Maino (University of California Press); *Trees and Shrubs of the Southwestern Deserts*, L. D. Benson and R. A. Darrow (University of New Mexico Press).

III

ALOFT

A *tree is a pump, and a fountain*

That fifty-foot tree that stands in your front lawn—you think of it as a hard column of wood with rigid limbs branching into flexible boughs and finer twigs, from which the leaves stem out more or less toughly. It is, in short, a large and intricate complex of cellulose fibers.

Your picture is perfectly correct so far as the structural solids of your tree are concerned. But to comprehend the tree more fully, another picture is necessary. What you are looking at also is an invisible column of water. This column is moving constantly upward, dividing and subdividing as it rises into smaller streams and threads until, in the leaves, a continuous nimbus of moisture meets the atmosphere. The tree's whole structure is composed of roughly fifty per cent water, always in motion. During the growing season your tree is actually an unfailing fountain.

For the fountains that men contrive, an external force is needed to send the water up and throw it outward. This force can be gravity—the water being piped from a source higher than the jets—or it can be a pump which gives the water a pressure greater than gravity. Trees are so constructed that their pumping force is internal. They have no hearts, in the organic sense that animals have, to impel their circulations. What is called a tree's heart, the dense

wood at its center, is inert. Like an animal's bones, its prime function is to support. Nevertheless, a tree has powerful inner pumping action: in fact, except for its inert heart and outer hide, the entire tree *is* a pump.

From its hairy feeder roots below, up through its trunk to topmost twigs and leaflets, its cells are so arranged that they imbibe moisture and, by *osmosis* (diffusion through membranes), elevate it from the ground to the crown, where air and light can act on it in the system's upper terminals. Evaporation from the leaf pores supplies an added pull to overcome gravity. The action is microscopic in its parts, but it proceeds so fast and constantly, with trillions of cells incessantly functioning as a bucket brigade, that the water pumped up by a good-sized tree may exceed 200 gallons a day.

The water is not put forth at the tree-fountain's top in fluid form or even, except momentarily on the leaves' surfaces, as a detectable vapor. Upon arrival in the leaves' external cells the droplets combine with carbon dioxide in the air to form carbohydrates—sugars and starches, which the leaves absorb as nourishment—and oxygen, much of which is released into the air. Oxygen is as vital to fauna as carbon dioxide is to flora. Thus, like all other plants, trees are potent aids to the health of the animal kingdom. They actually filter and enrich our very breath. This service, apart from the fiber and food and fuel that trees supply, may well have been suspected by primitive man and led him to such worshipful imaginings as Yggdrasil, the earth-sheltering, dewdropping Tree of All Existence. Modern man's understanding of plants as air conditioners is more practical. When he ventures away from earth in spaceships he plans to take along some tiny vegetable organisms called algae, to help purify his air supply and solve his food problem. These little "trees of existence" will ride and grow in tanks of water, every drop of which will have to be recaptured and recycled within the sealed vehicle.

Trees' tropism for water is one basic law of their lives (others are for air and light), since all their food must be in aqueous solution. Species vary widely in their need for moisture, from desert cactus to pondside willow. Some will go to extravagant lengths to slake their craving. The most impressive case of tree thirst I ever saw was a ninety-foot Carolina poplar, eight feet through the butt, whose owner sorrowfully called us in to take it down. This tree's enormous, brittle head towering over his house was a dire menace in every windstorm, but that was the least of the client's worries. Trouble was, he explained, that the giant had drunk dry not only his own well but also the wells of his neighbors.

The nearest neighbor's well was more than 200 feet from the condemned tree. Unbelieving, we investigated. Sure enough, the well was dust dry and the invading poplar roots that had sucked it so had formed a matted plug that choked the well-spring shut. When we cut the huge bole and counted its annual rings we found that this tree was only forty-seven years old instead of the century or more that it looked. We learned that it had been bought for twenty-five cents from an itinerant peddler of poplar "whips" and planted for future shade as a quick-growing yard tree. Through its lust for water and aggressiveness in finding it, the supposed blessing had become a curse on its vicinity.

A case where the merits were reversed was that of a patriarchal horsechestnut which shaded another client's south terrace. When he built a flagged patio there, he "potted" the tree with a low retaining wall a dozen feet out around the buttress roots. Within this wall he sprinkled topsoil, planted ivy, and diligently watered and fed his tree to keep it flourishing. All went well with the horse-chestnut, apparently, for several years. Then it began to die back throughout its whole crown. What had happened was not obvious, but our explorations exposed it.

Unable to find moisture beneath the heavy flagging, the tree's outer roots had atrophied while inner ones had multiplied and massed under the "pot' Here they became self-constricting, and entirely dependent on artificial drink and food, which were not enough. The solution: to drill holes and insert short lengths of pipe down through the flagstones, spaced widely around the "pot"; then, by frequent watering and feeding, to coax the horsechestnut's root system back outward to a normal pattern. (This system, with sieve caps over the pipe inserts and a cutting tool to clear the pipes when rootlets clog them, as they will, can be used to preserve feature trees rooted where a driveway must go.)

In the tree's ascending column of water are dissolved minerals from the soil. Chief of these are nitrogen, phosphorus, and potassium, which the tree must have, besides sugars and starches, in forms synthesized by leaf chemistry. At this peak point, in the leaves, the tree's water content becomes enriched sap. Now it must be redistributed downward to impart growth, energy and tensile strength to all parts of the tree. To see how this is done we must reexamine the tree's water column, and now we find that it is a two-way affair.

On the way up, the moisture takes an inner course through deep layers of *xylem* or sapwood cells, just outside the heartwood (which is old xylem cells grown inert). Surrounding this thick cylinder of sapwood is a thin outer one composed of tubular *phloem* cells through which the enriched sap is conducted earthward. Where the two parts of this pipe-within-a-pipe touch is called the *cambium* (exchange) layer. From it extend lateral fissures called *medullary rays,* through which both water and sap are transferred inward. This dual circulatory system *(See Fig.* i.) is present all the way from the slimmest leaf stem down through twig, branch, limb, and sturdy trunk into

the tree's subterranean anatomy, the outbranching roots and rootlets.

Outside the cambium and phloem layers grow two layers of bark, the inner one corky and porous for air-breathing, the outer one also porous and fissured but hardened for protection. The bark layers are capable of expanding, sometimes by flaking off (as in sycamores and birches), to accommodate the tree's growth, which is in its girth as well as at its extremities. The tree swells by annual production of new xylem layers. These new cells are large in spring, becoming smaller toward autumn until growth pauses during winter dormancy. Each year's growth can be traced in the sapwood "rings" thus formed, marked off by the darker autumn cells. Darker also, as a rule, are the heartwood cells formed by aged sapwood. *Fig. 1* shows in cross-section a tree's structure, which is continuous through all its members.

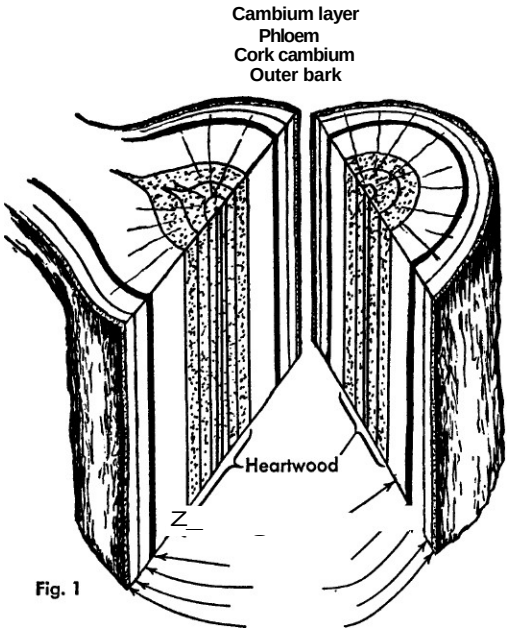


Fig. 1

When growth stops for the winter, contrary to popular belief the tree's sap does not "go down into the roots/' It stays right where it is, stored in every part except the leaves of deciduous (shedding) trees, which wither and break off at the stem ends, where buds remain for new leaves next year. In fiercely cold winters, the moisture in a tree's extremities and outer tegument may freeze, with consequent damage to the containing cells. Roots suffer most in winters of deep frost under a scant snow blanket. Twigs and branches get hurt and frost cracks may open on limbs and trunks during cold snaps that follow "false spring" thaws. But as a rule trees have the hardihood to withstand the rigors of their accustomed climate: their sap stays fluid and viable, and is there to restart growth—in many species to put out blossoms—before the new leaves appear.

The greater importance and vulnerability of the downward flow of enriched sap, as contrasted to the upward water flow, are apparent. The phloem conduits are much thinner than the xylem conduits, and more exposed. Their burden is richer, containing all the tree's elaborated food, not just raw materials, as in the water column. External injury to the tree's cambium layer is thus much more serious than internal injury, to sapwood or heartwood. Trees even lightly "girdled"—cut or constricted all the way around—will die, not from the tops down, but from the bottoms up. Deprived of nourishment from above, the roots wither and cease sending up water to start the alimentary process.

Exceptional in this respect are palm trees, whose trunks can suffer circumference damage up to their breaking point without the trees' health diminishing. This is because the palm family's phloem conduits are arranged in scattered bundles throughout the stem instead of in a circle around it.

None of the moisture carried downward in the sapstream to the roots is returned into the soil. But in nature's economy, trees do reciprocate earth's gift of water by holding

soil, and thus moisture, in place with their root meshes, and by lessening ground evaporation with their shade. This is why trees are planted around reservoirs, to check erosion and parching. Evergreens are most used for this purpose because they will grow fastest and densest with the least water requirement for themselves, and their roots run nearer the surface, where erosion begins.

Watershed plantings do not add to the water table through their upper parts except during fogs, when their contribution can be considerable. Gilbert White, England's first literary botanist, wrote as early as 1770 about the alembic action of trees in his own misty Hampshire. He noted that the best condensers are trees festooned with ivy, whose broad and evergreen leaves will drip puddles while the ground around stays powder-dry.

The next chapter, dealing with root systems, will make clear how to feed ailing trees, but your first concern should be with their water supply. Repeated droughts such as the East experienced in the 1950s can set trees back so severely that the effects persist for years. Even when a good growing year like i960 does come around, root systems may be so discouraged and stunted that your trees will respond slowly unless watered on a continuing basis. To safeguard species requiring ample moisture, like the maples and elms, a simple precaution is to set drainage tiles endwise into the ground, five or six around each sizeable tree, well out from the trunk. When the countryside starts to brown, fill these drinking tubes twice a week with the hose or watering can. Around younger trees, grade up a rim to retain the water as in a saucer when you sprinkle them. To do this for larger trees is laborious and unsightly, but a comparable effect can be obtained by putting shallow transverse dips across a tree-bearing slope when your grounds are graded. These will retard runoff water in times of plenty, and check erosion.

Too much water is as fatal to trees as too little. But if you have a chronic wet spot in your grounds, don't fill it, drain it. The effects on tree roots under it are suffocation and rot, which filling would only aggravate.

IV DOWN

UNDER

To keep a tree fit and stable, its roots
must be visualized and tended

The upper parts of a tree inevitably monopolize our attention. The trunk and crown, the leaves, flowers and fruit, are what we can see and enjoy. When they think about their trees' care, owners are prone to ignore the root systems—out of sight, out of mind. And this imbalance of emphasis is not confined to laymen. The scientific study of roots has lagged far behind other branches of dendrology.

A few years ago an important but not widely publicized contribution on root systems was made by Benjamin B. Stout, now on the Rutgers forestry faculty. He and two assistants spent the summers of 1951-52 in Harvard's Black Rock Forest near Cornwall-on-Hudson, N.Y., laboriously exploring trees down under. Mr. Stout selected twenty-five typical specimens representing nine deciduous species, all growing in light, comparatively shallow highland soils, and ranging in age from 17 to 104 years, in height from 21 to 67 feet.

The digging was to be done hydraulically, with strong jets of water to unearth and gentler streams to wash clean every part from deep taproots to the hairy tips of long laterals. So trees on sloping sites were chosen, to let the hose-water and soil drain away. This also made it easier

to photograph the naked root systems in profile. (*See Photo.* 2.) Before its roots were laid bare, each tree was felled and its upper parts laid by for correlative study.

Mr. Stout's measurements, ring counts, and other data were illuminating not only to dendrologists. They also contained broad hints for home owners. Most importantly they revealed that the average tree's root-spread is far wider than had been supposed. Instead of approximating their crowns' spread, the roots of Mr. Stout's trees reached out into areas 3.4 to 40.7 times as great as the ground-space under the crowns. *(See Photo. 2 and diagrams following p. 48; also diagrams pp. 15Q, 160.* Dotted lines show crown areas, as contrasted with root reaches in solid line. Graphs give stem (—0—) and root (—x—) growth data in feet and years. Circles initialed CO, WO, RM, etc., denote neighboring chestnut oak, white oak, red maple, etc.) Eighteen of the trees appeared to have normal root systems; for these, the root-crown ratio averaged 4.5 to 1. Since the Black Rock trees had grown under forest conditions, with their crowns touching, this meant that each tree was competing for sustenance with at least three of its neighbors.

Where adjacent trees had been removed by natural death or foresters' thinning, in known years, the trees under study had responded, as shown in growth rings, by quickly extending their roots as well as their branches.

Roots were found to vary surprisingly in age. And some of the younger ones were among the longest.

"The many-aged nature of the roots," wrote Mr. Stout, ". . . suggests that throughout the life of a root system there is a continuous process in which the old roots die off and new roots emerge. If this is the case, then there would be, coming from the stump and major laterals, waves of new roots that would occupy and reoccupy the soil."

Mr. Stout ventured no scientific generalizations from his limited study, but two conclusions for home owners seem fairly dependable:

Roots reach out much farther than you think, as much as twice the reach of the crowns.

Mature trees keep growing new roots, and this process can be encouraged.

These aspects of subterranean structure and behavior are important to have in mind when trees are fed, as they must be to keep them fit. It has always surprised me to find how few tree owners, new ones especially, truly realize that trees feed just as other plants do. Under lawn conditions, where dead leaves and even grass cuttings are removed from the natural organic supply, substitute food must be made available if a tree is to live its full, vigorous life. To keep them in prime shape, normal yard trees should be fed every two or three years, weaklings annually until they flourish.

The feeding of trees has long been standardized by the tree-service profession, of whose annual income it provides a large part. Their techniques will be described, adapted to home practice. But Professor Stout takes exception to some "expert" practices, and his thinking will also be explained. Perhaps the best way lies somewhere between.

Most experts believe that broadcasting fertilizer to trees, except to the shallow-rooted evergreens, is a waste of time and money, a fine way to grow grass, weeds, shrubs, and unwanted tree seedlings. By thickening the turf, surface fertilizing also tends to lessen the tree roots' water and air supply, it is said. The usual professional method of tree-feeding is to thrust food down to where the roots run, or even lower to attract roots downward and improve their grip on the ground.

For home owners, one of the handiest tools for feeding trees is the injector probe or "needle." This is a hollow steel rod three or four feet long, sharp and perforated at the business end. It has a glass or plastic chamber at the top, under the handle, to contain a cartridge of food concentrate. It attaches to your garden hose. It costs up to eight dollars, the cartridges about twenty-five cents each. One

cartridge will dissolve in and sufficiently enrich about 100 gallons of water, enough to invigorate a twenty-inch diameter tree. (The approximate diameter is one-third of the length of a string that will encircle the trunk, breast high.) With forty pounds of pressure on your water line, in moderately loose soil, one hundred injections of about a gallon each can be put down in less than an hour. Your hired man can easily "needle" a dozen average trees in a day, or you can do as much yourself over a lazy weekend without blisters or a sore back.

Liquid feeding by injection is a short-range method. Its effects are quick but transient. It is valuable for trees needing a prompt shot in the arm, since the nutrients are immediately available, in aqueous solution. But much virtue may leach away before the tree has imbibed all its needs.

After anemic trees are thus invigorated, the experts recommend a lasting supply of solid food, such as suffices for non-critical cases. The home tool for this is a punch-bar, pointed at one end, wedge-shaped at the other. Any schoolboy of moderate strength can learn to drive the wedge into turf at an angle, to raise and lay back a broad divot. From the opening thus made, a pound or so of soil is scooped out and piled nearby for replacement later. The bar's sharp end is now plunged into the hole repeatedly, deeper and deeper. Work the buried point back and forth on each stroke to loosen the subsoil and at the same time ream out the hole's mouth. Rocks and hardpan permitting, the holes are driven 18 to 24 inches deep.

Dip a pound or two of tree food from the bag or pail you carry it in and funnel it down the hole, making sure it reaches the bottom. Don't fill the hole with food to the very top. Leave room for your pile of loose soil, with the divot replanted over it. Tamp down the divot and you would never know your lawn had been punctured. You wouldn't, that is, if your top fillers of loose soil were thick

enough. If they weren't, a handsome "cow's tail" of lush grass will rise over each feeding spot.

Perfectionists at tree feeding sometimes employ the round "cookie cutter" used to incise putting holes on golf greens. With this tool the turf divot and replacement soil-plug can be controlled precisely. But, as with an earth auger, this technique is tedious and it leaves you with an overage of displaced soil to carry away.

The approved pattern for feeding a tree by needle or punch-bar is a series of concentric circles around the trunk, beginning halfway out to the crown's perimeter and extending as far beyond it. Space the circles two feet apart and the insertions along them a like distance. Slant the tool inward toward the tree to increase the food's coverage. Figure five pounds of dry food for each inch of trunk diameter. For trees under eight inches, halve this ratio. Where obstacles like buildings or pavement limit your pattern, follow it as far as you can, but don't overload it.

Professor Stout's objections to the orthodox tree-feeding techniques thus summarized are based on the very simple fact that fertilizer placed on or in the ground can go nowhere but straight down. Aqueous food solutions fed under pressure by needle may diffuse sideways somewhat, but dry deposits put down by punch-bar will only sink vertically as they dissolve. Except where the needle or bar happens, by blind chance, to strike into roots or to stop just above them, the fertilizer misses its mark.

There is no evidence to suggest that tree roots have the faculty of searching out food deposits in the same way as they will grow toward a continuing source of moisture. Even if they had such a faculty, Mr. Stout argues, it would not be good for them to exercise it, because they would then concentrate root growth at the points of feeding, which are only temporary. This is exactly what takes place when you do happen to hit a root with a food deposit. The dense feeder ganglia that form, at the expense of root

growth elsewhere, give the tree an abnormal root pattern, vulnerable to drought.

Moreover, Mr. Stout claims, sod does not restrict the air and moisture of tree roots. On the contrary, sod breathes better than baked bare ground and it slows the evaporation of moisture from beneath it. As for competition for nourishment between surface growths and tree roots, Mr. Stout believes the latter can more than hold their own. This has been shown by experiments in dense woodland where the absence of grass and weeds from the forest floor might have been supposed to be caused by shading. Ten-foot squares between groups of trees were trenched around to a depth well below the tree roots, which were all cut off as encountered. The trees' heads were left untouched, their shade unbroken. Within a year, each square filled up with surface vegetation, flourishing in the forest gloom wherever it had no tree roots to contend with.

Experts to the contrary notwithstanding, Professor Stout believes that broadcasting dry fertilizer to trees is surer, sounder, more economical practice than punching it down. He concedes that where tree food is broadcasted, spike-rolling the sod might be wise to speed the fertilizer's movement downward, and that when the needle or punch-bar methods are used, their efficacy can be improved by doubling the points in the usual pattern—i.e., putting them only one foot apart instead of two—and halving their depth, to nine to twelve inches.

Mr. Stout believes that most tree feeding is more arbitrary and haphazard than it might be. He recommends that before any feeding is done in their grounds, home owners dig some test holes to find out just how their soils lie and their tree roots run, then serve them accordingly.

No matter how food is administered to it, on the ground's surface or down under, a tree's alimentary process remains the same. Like native minerals in the soil, the water-borne nutrients of fertilizer do not go directly into the tree's

tissues. They must first be imbibed by rootlets, then carried aloft by the pumping system to the leaves, to be transformed and elaborated by photosynthesis. The three prime nutrient minerals are nitrogen, phosphorus, and potassium.

Nitrogen plays the leading role in forming chloroplasts, the green bodies that change sun energy into chemical energy. Phosphorus is ingested by the leaves in such a way as to stimulate flower, seed, and root growth. Potassium (potash) adds tensile strength to wood cells and, in the leaves, it catalyzes the formation and movement of sugars and starches, formed by carbon, hydrogen, and oxygen from the tree's air and water.

In selecting a manufactured fertilizer for trees, the ordinary commercial brands made for farm use will serve, but some of the mixtures prepared expressly for shade trees are better, and probably worth the difference in price. The nitrogen-phosphorus-potassium ratios are usually printed on the bags in bold figures. Most formulas meant for crop tillage (5-10-5, 6-8-6, 10-10-10, and the like) are lower in nitrogen than are most tree formulas, which will run 10-8-6,10-6-4,[or] maybe 8-6-8. Most field f ertilizers come as finely divided powders intended to dissolve rapidly. Tree foods are milled in coarse granules for a slower, longer lasting effect. The better prepared tree foods incorporate at least some of the trace minerals, such as boron, magnesium, and manganese, which trees are now believed to require.

Coming out of dormancy in the spring, a tree puts most of its energy into growth through all its upper parts. As summer wanes, energy is transferred to extending and strengthening the roots and to storing up a reserve to start new growth in the spring. Hence autumn feeding and spring feeding have different effects. On the whole, and especially for trees whose size is satisfactory, autumn feeding is best, from the September rains until hard frost. For trees whose size it is desired to force, or whose vigor was low last growing season, spring feeding is preferable, from

mid-March to mid-June in temperate America. In the deep South and arid West, variations will be dictated by expectancies of heat and rainfall.

Old trees are sometimes likened to freight trains for the *momentum* of their growth or decline. When a thriving old tree suffers hardship in its roots, such as disturbance by bulldozing, or successive years of drought, or a severe and snowless winter, the effects may not show up for some time, and then only gradually. The tree's stored up energy, like a freight's ponderous headway, keeps it "coasting." Signs of decline to watch for, apart from obvious die-back and deadwood aloft, are decreases in the length of annual twig growth, and in the size and greenness of the leaves. But after the occurrence of a hardship, it is better not to wait for trouble signs. Feed the tree and fend them off.

Bulldozing has been mentioned as a threat to tree roots. Not only the blade and crushing treads are to be feared. The machine's mere weight can so impact the soil that it becomes impervious to air and moisture. And in grading, any overlay of soil more than three or four inches deep is likely to suffocate the sturdiest root systems.

A Canadian doctor named Locke used to ascribe most human ailments to deformations of the feet, brought on by wearing badly designed shoes. Some dendrologists similarly believe that more tree ailments than we suspect are caused by root deformations. Commonest of these, and easiest to discover and correct, are so-called "girdling" roots, where one crosses and constricts another close to the trunk, or constricts the trunk itself. The effect on the tree's circulation is precisely that of a tourniquet around your leg, or a noose at your neck. Any home owner with a pick and shovel can expose such conditions for himself. When they are not visible above ground, their presence can be suspected wherever one side of a trunk comes up straight out of the ground without the flare of buttress roots. For a typical case of detection and exposure, *see Photos.* 3, *4,* 5.

Without benefit of a trained tree surgeon, the offending root can simply be dug around and cut away from its victim for several inches on both sides of the stricture. If it is a big root, six inches or so in diameter, the operation is best performed in two stages to lessen shock to the tree. The trick here is to use a chisel instead of saw or ax. First cut away the *under half* of the constrictor, to relieve its pressure yet let some of its own sap supply continue. (*See Fig.* 2.)

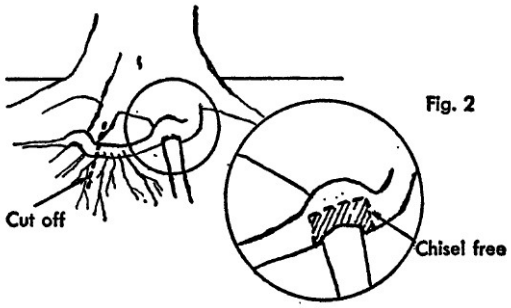


Fig. 2

Complete the operation a couple of seasons later, meantime stimulating an adjusted root growth by well-placed feeding.

PRUNING YOUR SHADE TREES

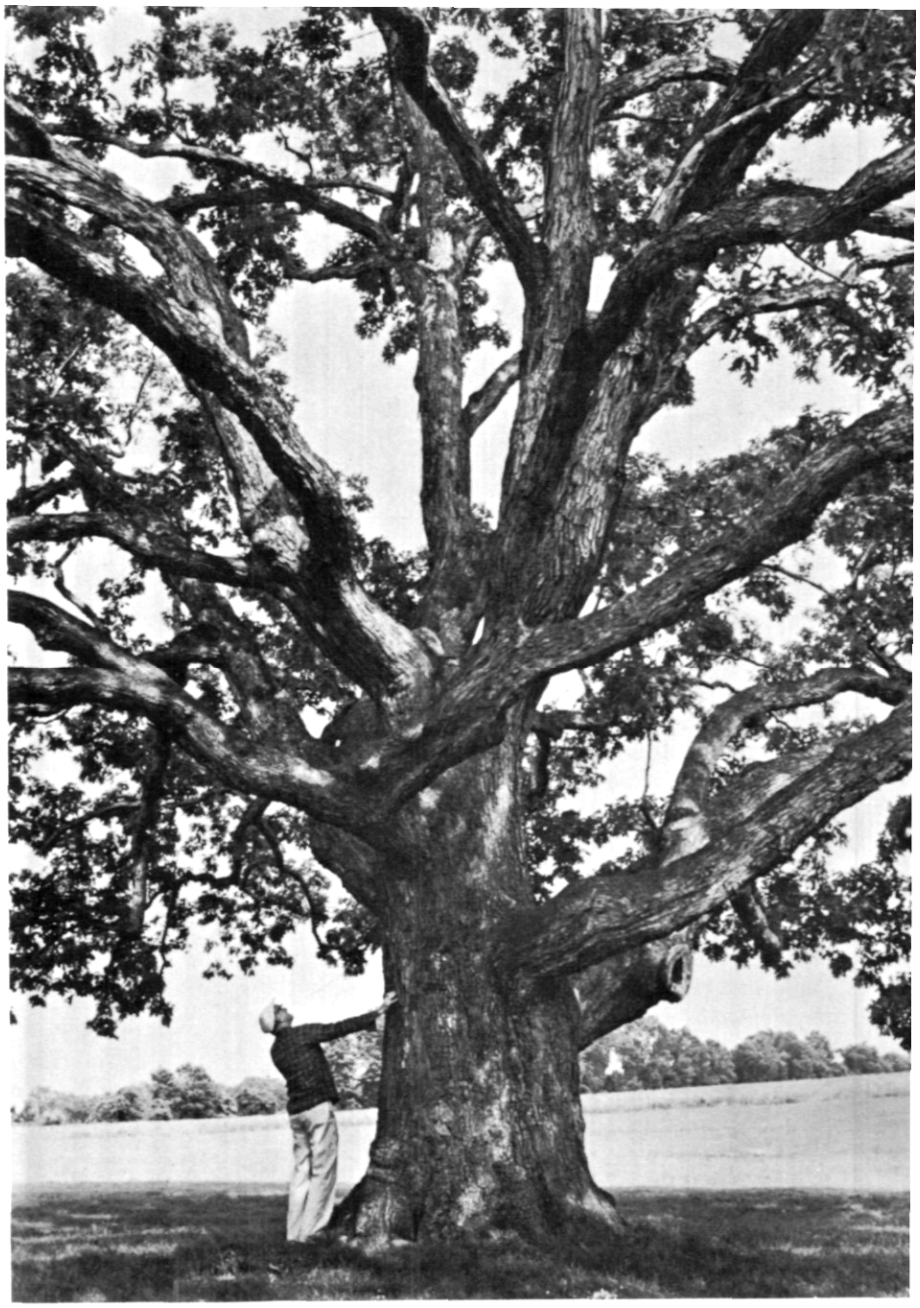
With a little understanding and fond effort,
man can improve on Nature

"Prune my yard trees?" the old fanner snorts. "Heck, they prune themselves!"

And it isn't just one old farmer. Lots of heedless home owners take the same view. Of course, they are quite right, too. Nature does see to it that trees shed members that have become excessive or shaded out or badly damaged. The forest floor is strewn with kindling wood. But the very fact that Nature does so provide only proves that pruning is necessary. Without question, man can do a better job.

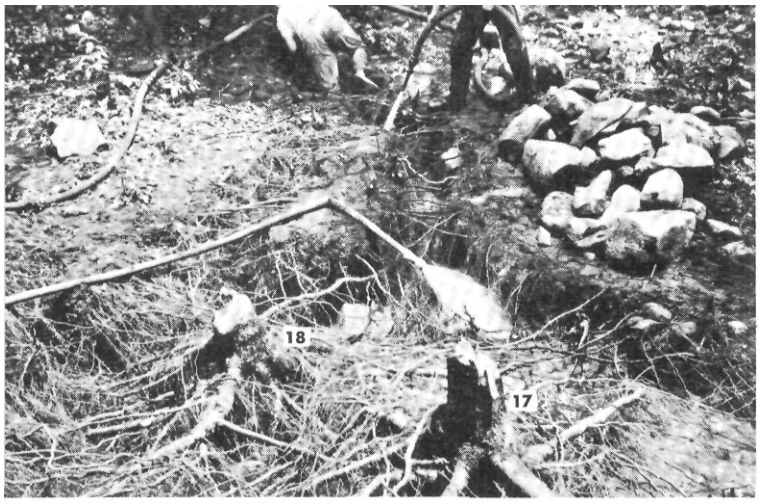
When a tree "prunes itself the resultant stub, or an open scar on the parent member, seldom heals entirely unless it is quite small. Left as an entry for insects or fungus is an exposed area of inner tissues through which invasions will spread for years to come. Through such lesions the tree loses moisture by evaporation, or takes in water where it does not belong, causing decay. The only perfect seal is scar tissue, called *callus* in trees, put out by the cambium layer. Man's surgery can help callus growth close over more quickly and surely than in Nature's casual sloughing-off process.

To some people unfamiliar with them, trees are mysteri-



1

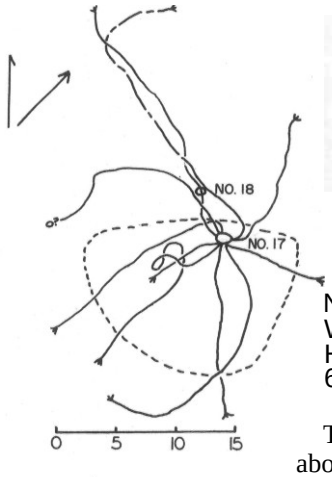
"Close contemplation of a great tree can arouse animal awe, if not reverence__" (The author contemplates the Mercer Oak on the Prince ton battlefield.)

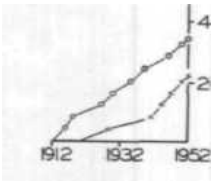


2

EXPOSING ROOT SYSTEMS

White Oak Root Systems. Two small specimens (Nos. 17 and 18) in Professor Benjamin B. Stout's root study at Harvard's Black Rock Forest. Note the fierce competition between close neighbors. The workmen with pressure hoses are tracing out some of the longest lateral roots to see how far they *did* reach. *(Photograph by Benjamin B. Stout)*

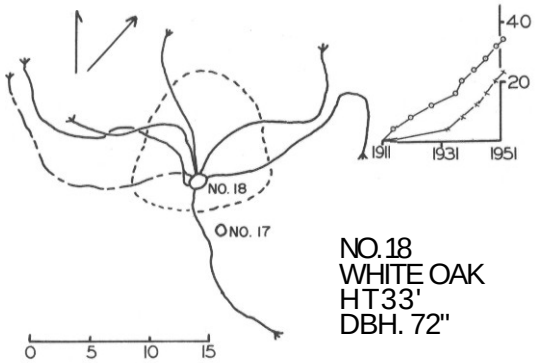




1912 1932 1952

NO 17
WHITE OAK
HT 33' DBH.
6.5"

The diagrams above and below show (in solid line) major roots traced to their ends and (in dotted line) the trees' crown areas. Graphs show stem (—0—) and root (—x—) growth data in years and feet.



NO. 18
WHITE OAK
HT 33'
DBH. 72"

Trouble Aloft. Though contemporaries, and enjoying identical conditions, these two white pines contrast sharply in their crowns. Something must be radically amiss with the right-hand one.

A GIRDLING BOOT EXPOSED

A Clue Below, The puny pine's trunk comes straight up out of the ground on one side. Diagnosis: Its buttress roots there are probably constricted.

4

5

The Trouble Exposed. One errant root has strangled its neighbors and the tree, killing itself in the process. One cut, at the base of the constrictor, will relieve pressure. Water was used to lay bare this girdling.

A Tree that "Has Everything" wrong with it, that is: faulty fork, bleeding borer damage, atrocious pruning. Some surgery below, two rods and a cable above, can preserve this otherwise fine old cherry.

ous to the point of being untouchable. Many a new owner, aware that his tree is a living organism, flinches from cutting any part of it as he would from operating on his child or even his dog. Trees are much more rugged than dogs or children. They feel no pain, and they will survive a few mistakes. Coupled with some understanding of tree physiology, good intentions can soon be translated into good results.

It is not suggested that home owners go up into their big trees with ladders and ropes. Leave the high work to professionals. But by learning, with your feet on the ground, to prune your young trees and mature ones of the smaller species—say, up to fifteen-footers—you can increase and insure your property's value at small cost. All your trees will take on new interest and meaning for you. A light labor of love today will reward you through many tomorrows. If wielding tools does not suit you, study the art and teach it to a helper. Plenty of people "prune" their own trees with a bamboo pole for a pointer.

Let proper tools be the beginning of your new wisdom. Unless you mislay them or let the neighbors borrow, one set can last you a lifetime. You may as well start with the best.

Item one is *pruning shears,* the kind with heavy-duty blades so opposed that they cut closer on one side than the other. They should be at least eight inches long over-all, with broad handles for a firm grip. Ladylike "snips" are only frustrating. If your arms and fingers are short, get shears with long wooden handles. Take a fair-sized branch with you into the store and settle for no shears that will not make a half-inch cut without effort. The kind without reopening springs is least prone to rust shut. Painted red or orange rather than green, your shears will be found sooner when you drop them into grass.

Tastes differ in *handsaws*—straight-blade or curved—but one rule prevails for all pruning saws: at least six teeth to

the inch. Coarser gauges tend to rip and tear on cuts of less than four inches, which is what most of yours will be. The so-called "speed" saws are for professionals in a hurry. For home-owner use, a 15-inch curved blade with metal or plastic grip is ideal. The curve is helpful on cuts that must be made overhead or reached out for, with reduced wrist pressure. Also, it is handy for hooking free the cuttings that hang up. If you decide you prefer a straight blade, don't get one with teeth on both edges. These look like laborsavers, but they do a lot of inadvertent damage. The upper curf hits unintended targets.

Polesaws, with teeth slanted toward you for pull-cutting, have curved blades that fit into "heads" socketed for 8- to 16-foot handles. Blade and handle are replaceable. When the one wears dull it is not worth resharpening. The other, being of light, brittle wood, has a way of breaking when you drop or step on it. The expense of keeping on hand a spare blade and pole is not exorbitant. The most important and expensive part of your polesaw is its head. Avoid the kind where the blade is fastened in by a wing nut, which a knock can loosen. Better are flat nuts or heavy cotter pins or countersunk screws. Be sure your head has a slot in the back to hold your paint brush. A lot of reaching and clambering is saved by pole-painting your high cuts.

Pole-pruners, like shears, should be selected for ruggedness and for having the cutter so offset that it will slice flush when laid on properly. The kind operated by a Ianyard through screw eyes along the pole will stand up longer and repair more easily than the more expensive type on which a hand-lever actuates a rod to the cutting head.

Tree paint (wound dressing) has in recent years become handily available to home owners. It even comes now in handy aerosol cans, for spraying on. The different brands vary little in composition. An asphaltum base with turpentine or mineral oil added is standard. Keep it thinned with linseed oil or it will blister on the wounds. It does not speed

callus growth, but it protects wounds until callus covers them by keeping out the fungi of decay. Don't try to "make do" with lead or copper house paints. They peel, and may poison tender tissues. Shun creosote and roofing tars.

Orange shellac, brushed over the bark and sapwood around the edges of a cut before covering the whole wound with tree paint, is desirable but not essential.

The question of when to prune trees is moot even among treemen, but their differences are largely quibbling. In a general way all will accept the classic rule, "Prune when the tool is sharp," which has few exceptions.

Some people think it is perilous if not criminal to prune a tree in bud or leaf. Such dogmatism is absurd and it ignores the advantage to be gained, whether pruning for health or appearance, by distinguishing clearly between dead and live members. Spring pruning gives wounds the benefit of spring growth to quicken healing. "Bleeders" like most of the maples, boxelder, linden, walnut, yellow-wood, and the willows and birches are best left untouched until after their leaves are well out—more because their copious sap is messy to work in than because the trees may "bleed to death." Sugar maples tapped year after year live to ripe old ages.

Trees pruned young, to shape their lasting characters, will bear fewer lasting scars than trees shaped late in life. But as with repentance, better prune late than never.

Let the home owner approach his first pruning job—a deciduous 15-footer—with this framing thought in mind: in what ways would this tree look different if it were in perfect condition?

Obvious at once are any broken or dead branches. Questionable are branches that look crowded or are actually touching one another. More puzzling are a lot of branches and twigs and shoots each of which may have good right to be there but all of which, in the most un-

tutored eye, add up to unhealthy overgrowth and confusion. How to proceed?

Begin with your handsaw on the breakage and deadwood. Lay on the teeth at the member's basal swelling, on the upper side, and saw downward flush to the trunk or parent member. Go slowly at first, until you learn your tool's balance and reach.

Branches more than an inch thick, and bearing some weight, will tend to sag and tear away before you finish your downward cut. *(See Fig.* 3.) Prevent this by steadying the branch with your free hand. Or, before you start cutting down, make first a shallow upward cut into the

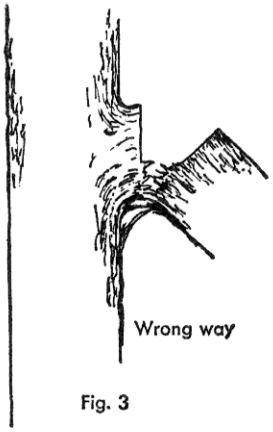


Fig. 3

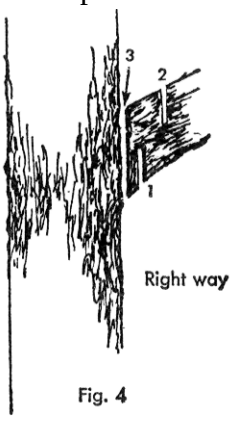


Fig. 4

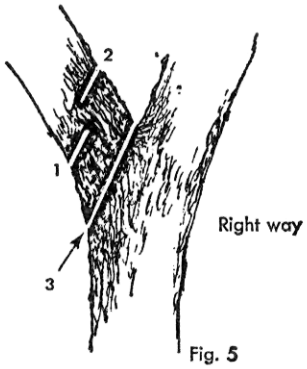


Fig. 5

underside of the branch's base. On branches two inches thick or more, take this precaution by making three cuts: one from below, a few inches away from the base; the next close above, down from the top until the branch snaps off; the last, down through the base to flush off the stub *(Fig. 4)*. If a forking branch is pruned, make the trial cut upward to come flush (Fig, 5).

Among the dead branches that you prune, there may be some whose bases have rotted back into the parent member. For now, leave these lesions alone except for painting them over. They may require some knife or chisel work, which will be described in a later chapter.

Among the breakage there may be some branches damaged only out toward their ends, leaving sound parts that you may want to save. Cut these back for now to the nearest good fork or shoot. Such truncated members can be reconsidered when you prune the tree's other live parts.

With breakage and deadwood out of the way, next stand off and squint at your tree through half-closed eyes. Perceive its "habit"—how its members grow to give it characteristic outer shape and inner pattern. Identify the main members and keep them in mind to preserve and accentuate. Against their basic symmetry, superfluous members will stick out like extra thumbs. Don't hesitate to lop them. Some trees are more prone than others to proliferate interfering branches, including linden, dogwood, hawthorn, hackberry, mulberry, boxelder, and many of the maples. All these trees will stand a lot of "tailoring."

Where a young tree has a main fork low in its stem, steel yourself to amputate one leader or the other so that the survivor can take command. A close look at how the competing leaders grow will tell you which to condemn.

Direct your attention next to sucker growths. These are straight, unbranching shoots that you don't want to become important members. They only consume energy and clutter form. They may come up from the tree's roots or

out of its trunk or off main members. Prune suckers ruthlessly, using your shears and pole tools. There will be more suckers next year in case you need any to fill out a pattern.

As you work upward and outward after clearing the tree's inner air space, room for the secondary branches and twiggy terminals increases. Your object here is only to lessen interference, without creating gaps in the tree's spread and crown. Gaps are not only unsightly: they expose interior stems to sunscald. Take it easy as you go and stand off frequently to study your progress. Remember, there is no fixed rule for the shape or density of any tree, unless it is this: after you have pruned, your efforts should not, like a "plumber's haircut," be too obvious. A properly pruned tree has an airy, graceful wholeness that persuades the beholder it grew just that way all by itself.

If the tree is too wide or too tall to suit you, or is threatening to become so, do not shear or head it back as you would a hedge. Single out the too long or too high members and lessen them one by one by drop-crotching—that is, cutting back to a fork where the abbreviation will look natural. (This overhead work will perfect your handling of the pole tools.)

Finally, if the tree stands where traffic or mowing machinery must pass, eye it for ample clearance and prune accordingly. Better a few less branches than any bruised ones.

Thus far we have generalized about pruning small deciduous trees. Evergreens call for different treatments, which will be discussed below. Pruning fruit trees, too, has special rules, which appear in a later chapter. Here it would be well to draw some distinctions about the pruning of deciduous species with various habits.

The leafy sucker growths on elm trunks and branches, also called "hairs" or "feathers," are somewhat necessary to these water-loving trees, especially aloft, to keep them from dehydrating. They should be pruned sparingly. But

all elms should be watched closely for deadwood, which invites the bark beetles that carry dread Dutch elm disease.

Plane trees are vulnerable to cankerstain, a fungoid disease that is highly infectious, but less so in dead of winter. That is the only time planes should be pruned; and even then, disinfect the tools.

Pin oaks put out laterals so closely spaced sometimes as to look overgrown, but these should be thinned with much caution. This tree's branches support each other under loads of rain and snow.

Willows, poplars, Russian olives, and some other softwoods can be headed clear back to their main stems, where they will bush out. This is called "pollarding" and is commonly done for decorative effect.

Small species which flower early are best pruned after petal-fall. This gives them time to form new flower buds for next year. It holds good for shadblow, redbud, dogwood, fringe tree, hawthorn, magnolia, sorrel (sourwood), and mountain ash.

Locusts are an example of trees that flower late and can be pruned in dormancy or after. Since they tend to spindle up and die in the tops, it is well to head back locusts—but not honey locusts—when young. In heading or topping any tree make a slanting cut, to promote healing and shed water.

Gardenias and camellias can be kept under control just by cutting their blossoms. But your poinsettias will sprawl up out of hand if you fail to whittle them back two or three times between flowering and early autumn.

Palms are pruned simply by removing dead fronds; bananas, after fruiting, by cutting the stalks to the ground, whence sprouts will produce the next crop.

Evergreens (the narrowleaf varieties) up to fifteen feet seldom require pruning except for removal of breakage and deadwood, which is done at the trunk. Cuts on evergreens mostly heal themselves with the trees' own resins, but it

does no harm to paint them anyway. Top and side trimming, to keep young evergreens in hand, is done by lopping terminals selectively, not shearing to a line. Such trimming will help spindly, shade-grown evergreens fill out, especially if it is done in spring when the foliage is soft. Firs, pines, and spruces are best pruned in late spring after they have made most of their annual growth. Arborvitae, cedars, juniper, hemlocks, cypresses, and yews (including Taxus), which all grow continuously, can be pruned any time except winter, when cut ends may dry out or freeze north of Maryland and through the Plains States. When evergreens suffer winterkill, wait until new growth can be distinguished before pruning out the damage. If damage is severe, wait until the new growth provides shade against sunscald. Whitewash on the exposed stems, too, will turn off the heat.

Mid-December is the happiest time for pruning hollies: they take it kindly then, and you can use the cuttings for Christmas greens. Prune to branch junctions or the foliage will densify and suppress next year's gay red berries.

VI

REPAIRING WOUNDS; BRACING WEAKNESS

Great sores from little lesions grow, but the home owner can soon learn minor surgery

Like light pruning, the repair of wounds and cavities, and the bracing of trees' weak spots, are good things for the home owner to practice on a small scale, or to study and supervise, if only because they will help him to recognize the larger needs of his major trees when he does call in professionals.

What a scalpel is to an M.D. a jackknife is to a tree owner: his tool for preliminary work on wounds of all degrees. Pocket arsenals can be bought which contain every weapon from a can opener to a farrier's awl, but for tree repair only two knife blades are needed. One should have a long, narrow "toad-stabber" point for probing and picking out. The other should be short and sturdy with a more rounded end and a fine-honed cutting edge, for tracing and carving.

Tracing is when you incise around a wound to cut back to undamaged bark, and bevel its edges down to the juicy cambium layer. From those juices will grow the *callus* that is a tree's scar tissue for healing its wounds. Basic to the repair of all tree wounds is remembering that a tree's sap circulation is longitudinal, not lateral, throughout all its members. To help any wound heal you must shape it at

both ends into points, like the ends of an ellipse. This lets the cambium channels merge again after having been separated by the wound's width. Within these rejoining points callus will form evenly, without interruption, about a half inch each growing season.

No abrasion or slashing of the bark deep enough to damage the cambium layer should be ignored, especially in young trees. Bark lesions are just like bleeding cuts in your own skin. Great sores from little lesions grow, or *can* grow, and they are a pleasure for any tree lover to mend when he finds how simple it is.

Right after tracing and shaping any wound, shellac its edges to protect the newly exposed cambium. Then take your time carving and scraping smoothly off the wound's surface all shredded, dry, or discolored fibers down to solid sapwood, and apply a neat dab of tree paint. Do the same wherever a branch has been recently torn off its parent member, before decay can set in. *(See Fig.* 6.)

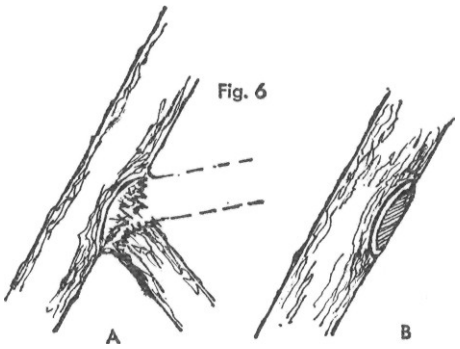


Fig. 6

A form of damage that often puzzles new tree owners is when bark, usually on lower trunks or limbs and especially in young maples, splits open and separates from the wood for no apparent reason. This is caused by frost action, after a midwinter or "false spring" thaw. It can injure trees severely. The thing *not* to do is peel off the loose bark, thus

exposing bare wood, until callus growth at the edges of the wound is well begun, in late spring or summer. Then chip away the flaked bark, shape the lesions (with pointed ends) and paint them up, taking care not to paint the new callus.

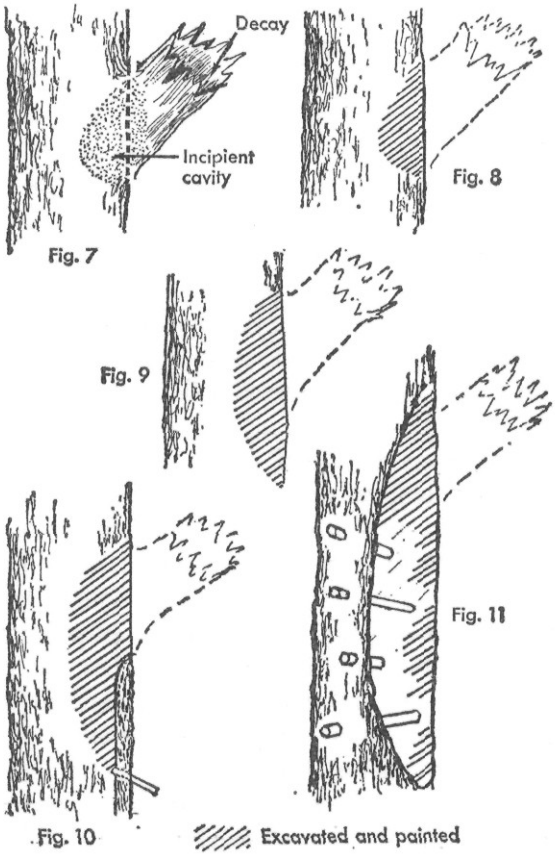
When you pruned your first tree (Chapter V) you cut off some dead branches and stubs whose decay had progressed into the branch bases, penetrating beyond the cambium to form an incipient cavity. (*See Fig,* 7.) One of these lesions, at a handy height, is a good place to try your hand at cavity repair. Besides your knife you will need for this work a 3/4-inch gouge (curved) chisel and a wooden or hard-rubber mallet. The object of your work will be, after pruning the stub *(Fig,* 7), to trace and shape the wound with your knife, to cut away all dead tissues in and around the lesion so that callus can roll in and make a healthy seal. *(See Fig. 8.)* Use your chisel, tapped by the mallet or the heel of your hand, to chip and shave away all discolored material down to living wood. Slope and smooth the excavation as you go and don't worry if, on this first attempt, you go deeper than you wish you had. Shape, smoothness, and perfect drainage are the important results. Careful painting and the healing process will in time take care of your slips.

Decay progresses in wood at about the same rate as growth, going chiefly in and down instead of out and up. When its invasion at a stub lesion has gone past the sapwood into heartwood, you will not only have to gouge out the decay's top and back limits but also follow its inroads downward to their bottom, which may be surprisingly deep. That is where little stub lesions deceive us. In trying to heal shut at their original openings, they conceal their true depth and thus escape or postpone attention.

To find out how deep the decay has gone, enlarge the original opening enough to let you probe downward with your knife or chisel. If you still can't find hard bottom, take

test borings from the outside with a quarter-inch auger, slanting the bit upward so that the hole will drain when you do get a bottom one. What you do next will depend on several things, but your main objects will stay the same: to clean out all the punky wood possible, paint all the exposed good wood that you can reach, and establish free drainage of the cavity.

If the decay goes back into heartwood only a short distance and downward no farther than your chisel can reach, you may elect simply to cut open an exterior V channel through which you can be sure of excavating and painting



thoroughly. *(See Fig.* 9.) If the cavity's vertical depth is great, you may decide to establish drainage by enlarging your test hole and inserting a tube (copper or galvanized), meantime carving back the cavity's upper wall surfaces as best you can. *(See Fig. 10.)* Often this compromise is best, to avoid an ugly gape in the tree and conserve the sapwood shell. The decay remaining within can be slowed by flushing out the cavity with disinfectant (copper sulphate or mercury bichloride solution), and this process will give you a check on your drainage, through the tube. A dry hole rots much more slowly than a damp one.

It does not take many years for a cavity the size of the one in Fig. 7, which started from a small branch stub, to enlarge to one the size shown in Fig. *11.* Here the heartwood has been invaded so far as to cause structural weakness. When such a cavity has formed in a branch or minor leader, the simplest procedure is to amputate the whole member below the cavity. In a main leader or trunk, salvage is still possible by full excavation of the decay, through a frontal channel down its whole length (which matters much less than its width), followed by the installation of internal iron bracing rods. *(See below.)* These are criss-crossed, at different levels, at spots where the cavity's sapwood-and-bark shell affords good purchase.

Tree "surgery" as it was first sold years ago consisted largely, and more truly, in tree "dentistry": plugging up cavities with a variety of fillers, chiefly concrete, which were supposed to arrest decay and strengthen the tree. Seldom did cavity-filling do any such thing for trees. Unless a perfect seal is achieved, decay persists more surely in a "filled" cavity than in one left open, well drained and periodically painted. Structural strength is as often lessened as it is increased by the filler's inert, non-integral bulk, against which the tree's living tissues weave and chafe. Nowadays, cavities are seldom filled except for appearance's sake; and this work, which is at once the most expensive and

least important aspect of tree surgery, should be left to experts only. With this exception:

Where a cavity extends down a trunk into the root-crown, it often pays a tree owner—after he has cleaned out, painted, and rodded the hollow above-ground—to excavate the decay downward as far as he can, then lay a base of small stones and pour filler (an asphalt-sawdust mix) into the hollow until its surface rises a few inches above ground level. When it hardens, this fill by its weight alone may improve the tree's balance and anchorage. The top of the fill can be kept sloped and moisture-sealed against the tree's butt shell with thick tree paint or a plastic.

Besides butt cavities and the girdling roots mentioned in Chapter IV, other troubles in his trees' lower extremities that a home owner can spot and attend to are burns, root scars, and cavities, animal damage (gnawing by rabbits, rubbing by horses and cows, antler-raking by deer), and insect invasions (ants, grubs, borers). Against these latter, potent poisons now come in aerosol form. A few squirts from the can's nozzle and you fill the beasties' tunnels and galleries with lethal DDT vapor—much more effective than the pastes and slurries we used to mix up and poke in.

Sometimes trees "bleed" persistently from old wounds that appear to be almost, but not quite, healed. The exudate smells foully and it discolors, even kills, all bark that it oozes down over. This is called "slime flux" and it comes from high sap pressure in poorly conditioned trees. Actually it is of two kinds, "brown" and "alcoholic." The former is a leakage of xylem (heartwood) sap from the root system, darkened by fungi and bacteria. It may be checked (but seldom cured) by boring holes into the heartwood at intervals directly below the old, fluxing wound, and inserting pipes, which should be long enough to carry the drip out away from bark and roots. The more curable "alcoholic" slime is just that—a leakage of phloem (outer layer) enriched sap from the tree's crown, in which sugars and

starches are fermenting. This kind, white and bubbly, comes out low on the tree as a rule. It can usually be stopped by retracing and redressing (with shellac) the old wound that is exuding. All trees showing slime flux should be generously fed.

Crotch hollows also come under the heading of wound repair. Many otherwise well-formed trees (particularly yellowwoods) develop deep pockets where their leaders, especially large multiples, branch out from the trunk. In these hollows, which resemble inverted armpits, not only water but fallen bark and wind-blown soil can accumulate. Often parasite plants or seedlings from the tree itself will start growing there. Danger arises from wet-rot and frost pressures. Averting such pockets early in a tree's life or altering them after they have developed is not difficult. The problem involved is purely one of drainage. An open channel can be gouged, or a tube inserted, to the crotch hollow's lowest point. To keep the pocket from collecting debris, fit a sheet-metal cap over it. This can be done also over cavities, to keep out squirrels and such. The tree will accept the shield, with a callus roll, as part of itself if you trace back the bark to open a ledge of wood and tack the metal to it.

Crotches forming a wide angle are always stronger than acute-angle or V crotches. Often the latter *look* strong because they appear to be reinforced by a roll of callus. But that roll was formed, on the outside only, after that crotch was cracked or actually sprung open some time ago by heavy pressure, as of wind or snow, applied to the member aloft. Unlike a metal joint mended by arc welding it is not "stronger than ever" after its healing, but highly prone to refracture in another big blow or snow. It is particularly important to inspect trees near architecture or over driveways for V crotches, callused or otherwise, for they are inherently weak and hazardous. In trees small enough to handle himself, the home owner can reinforce a faulty

crotch in one of two ways, or both; rodding and/or cabling.

The rodding mentioned above for reinforcing deep cavities is called "wood screw" and it comes in various diameters up to two inches. It is iron bar, threaded its whole length, which is screwed through opposed holes in the hollow tree and sawed off flush to the bark, which will grow over the ends. When wood screw is used to reinforce a weak crotch, the crotch should first be drawn together tightly by a "come-along" (interlooped rope sling, or noose) rigged high up in the members forming the crotch. This is necessary because the bar's threading, being continuous, has no pulling power. Turned with a pipe wrench through holes bored slightly smaller than its own diameter, the rod only holds fast in whatever position it is left. More positive in their action, but more expensive, are bolt-and-nut assemblies which must be measured, cut, and threaded to fit each situation. And the nuts, with elliptical or diamond-shaped washers, must be countersunk into the bark to get them healed over properly. But bolts are best for mending split limbs, which they can draw together.

The optimum position for rodding is about twice the smaller member's diameter above the weak crotch. In case of dire weakness, put one or even two more rods a like distance farther up. (Always coat with tree paint any metal put into living tree tissues. This goes for drain tubes or pipes, too, which need not be driven more than three or four inches into their holes.)

Cabling to support weak crotches, or to brace any of a tree's upper parts by fastening them to other parts, is done with galvanized twist wire in gauges that run from ^4- to %-inch. The cable is fastened to hooks or eyes that may be of the lag (screw-in) or bolt-and-nut type. Loops in the unraveled cable's ends are fashioned by wrapping its separated strands back around itself with pliers. Cables should be installed while trees are in leaf, so that tensions can be properly adjusted, again using the "come-along" to ensure

tension enough. The hook or eye should be placed at one-half to two-thirds of the weak member's length above the crotch. The cable should run upward at about forty-five degrees to another hook or eye in the supporting member. (In cabling a tree's tops together for mutual support, this angle can be much less, or even horizontal, the main thing being to oppose weights and stresses judiciously.)

A composite of noosing, cabling, and rodding a weak-crotched tree is shown in Fig. *12*.

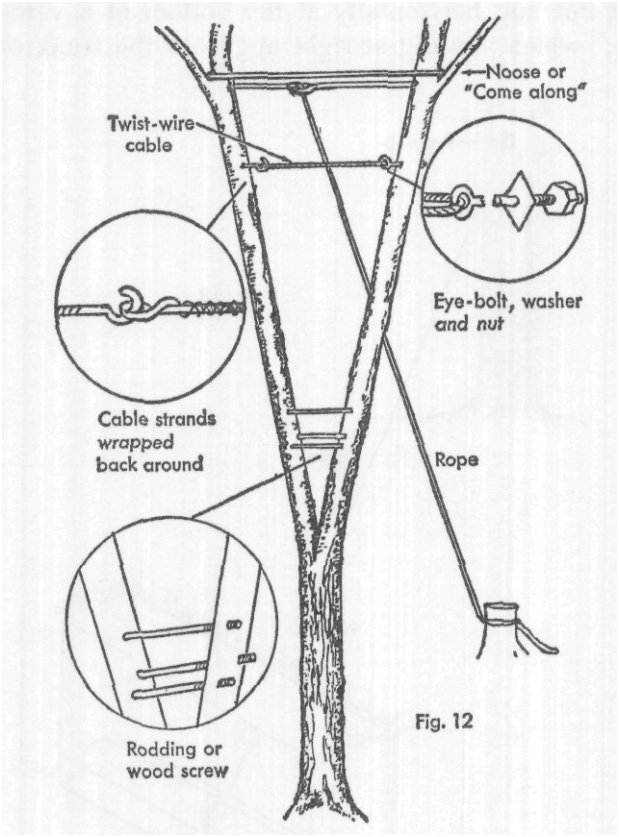


Fig. 12

Under no circumstances should trees or their members be braced by passing wires, cables, or chains *around* them.

No matter how you stuff or baffle the collars, sap circulation will suffer. When a small tree blows over, you can pull it erect with a rope and prop it there temporarily, to keep its roots underground, with a padded board nailed atop a post. To fix it permanently erect, don't use the time-honored makeshift of guy wires passed through hose. Put a screw hook or eyebolt into the trunk about halfway up and run a cable down at forty-five degrees to a "dead man" buried in the ground. This is a heavy pipe or post, not driven at a slant but laid horizontally at the bottom of a yard-deep "grave," which you dig at right angles to the trunk on the

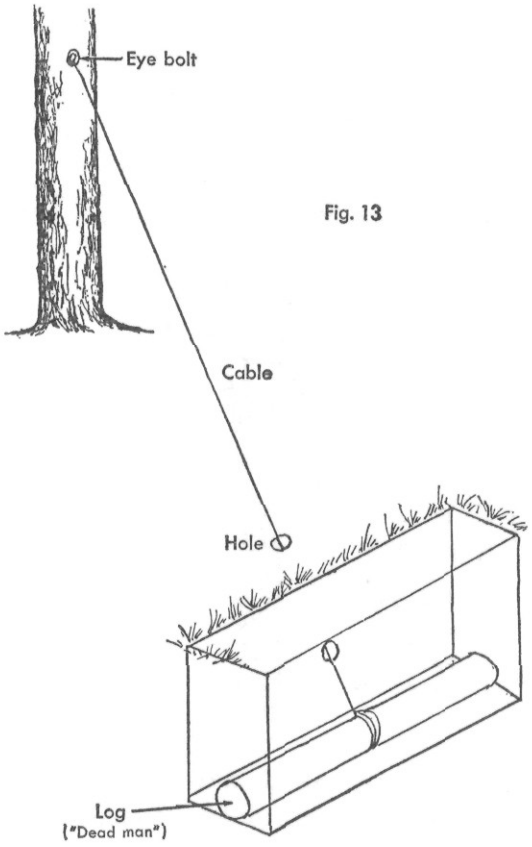


Fig. 13

windward side. Pass the cable to the "dead man" through a slanting hole which you poke with your punch-bar, to avoid loosening the earth between tree and grave. *(See* Fig- *13-)*

Once they have been blown over, resurrected trees are likely to go down again if another blow comes before they are securely rerooted. To guard against this, in case the next gale should come from a new angle, put in two or three cables to buried anchors.

VII PESTS AND PARASITES

The war between trees and their enemies is natural and unending. Man can decide it

Within the wonderful world of trees lies another world—that of the organisms which harbor in trees as pests and parasites. Of these there is no end in numbers or variety. New home owners are scarcely to be blamed for becoming dismayed, as they often do, upon encountering one invader after another for the first time. This writer's counsel to clients undergoing such baptism has always been: Cheer up, few kinds of attack on trees are fatal. Study of the trees' foes-learning to anticipate and counteract them—is a sporting proposition in itself. You may lose a few skirmishes, but there is a great deal that you yourself can do to win this war. Only occasionally will an owner, particularly of young trees, have to call in a tree-service task force.

The trees' invaders are from two kingdoms—the animal and the vegetable. The former are insects (and one bird) ranging from king-size larvae of the big moths down to microscopic mites, mini-wasps, and scale organisms no bigger than a pin point. The vegetable hordes are fungi, bacteria, and viruses. These are all primitive plant forms, but there is one plant parasite that is anything but primitive except in its role, assigned by mankind, as a love symbol. This is mistletoe, one of the deadliest invaders of all.

Mistletoe might well be spelled "missile toe," for its first

tiny rootlets have the power to insinuate themselves into the host tree's living tissues like the fangs of a vampire. Its pallid, waxy berries, resembling seed pearls, are carried by birds and dropped into bark crevices where they germinate under protection of their own gum.* Mistletoe cannot live in soil but must steal its nourishment from a host tree's sap veins. Where it fastens on, grotesque swellings ensue and the host's deformed members writhe away from the vampire as if in horror. No amount of chopping-out short of limb amputation will eradicate the mature bushes. Fortunately for trees, and for the human kissing custom, and for Oklahoma whose State "flower" mistletoe is, the deaths it inflicts are slow and painless. Its glaucous clumps aloft even confer a macabre beauty upon the elms, hackberries, walnuts, gums, pecans, mesquites, and (rarely) oaks which it reduces to skeletons.

Mistletoes abound from lower New Jersey to Key West, all across the South, and up the west coast into Oregon. In much of this range they are accompanied by an even more picturesque growth called Spanish Moss, a member of the pineapple family. This stringy, grayish stuff hanging from trees, making them look like shaggy Arthur Rackham wizards, is not a true parasite. It is a typical air plant, of which lichens and orchids are other examples. Air plants do not suck a tree's life-juices but can, like the vines mentioned in Chapter II, smother it to death if allowed to run rampant.

Another conspicuous parasite, this a true one, is called witches'-broom. It shows up as dense, deforming twig clumps in hackberry, larch, and honey locust. It is caused by the sting of gall mites or by spores of a mildew fungus—maybe by both. Pruning is the only cure, if there is any.

Pruning or tissue surgery can sometimes head off one other class of parasite—the canker-forming fungi. Whenever

* Curiously, both mistletoe and the other Christmas evergreen, holly, yield viscous exudate called "lime" (from the Latin "limere," to smear), which was used immemorially by men to snare birds.

such mechanical aids are attempted they should be followed up by feeding, usually with a high-nitrogen, to help the tree quickly seal off its canker lesions with healthy new cells before remnant fungoid mycelia (thread-roots) can spread, as in animals' fibroid tumors.

But chemical rather than physical warfare is necessary to combat the vast majority of tree pests and parasites. It is not within the scope of this handbook to describe all the thousand-odd kinds, symptoms, and treatments of such troubles. Some standard works on the subject are listed at the end of this chapter for readers who, grasping here the strategic outlines, may wish to arm themselves in depth to defend their trees.

"Chemical warfare" is meant literally. With ever-increasing success, men have learned to poison their trees' foes, at least in those years when the counterattacks are properly timed. How important timing is can be seen in two cases of some prevalence.

One is the poisoning, through its stomach, of an adroit one-inch herbivore called the bagworm, which spins and carries around with it a conical sack of silk and chewed-up plant material. After only a few days of foliar feeding, this creature attaches its bag to a twig and sacks in, to sleep until emerging as a moth. The only time you can hope to make it eat poison is during its brief browsing period. Otherwise it is sheathed against any attack you may make short of picking off all the bags and destroying them, which is no small task in an arborvitae hedge or a grove of maples.

Exact scheduling is necessary to suppress *Diploctiapinea,* a fungus which becomes destructively endemic in conifers, especially Austrian pine. It blights and browns-off twig tips, which must be pruned in cold weather and carried away together with all old cones, on which diplodia's dormant fruiting bodies show like black pepper. The first eruption of new spores will occur on that warm, humid spring day (but which one?) when the pine's young "candles"

burst their husks. Right then you must hit diplodia with a copper or mercury spray, and hit it again at short intervals (but how short?) twice or oftener (but how much oftener?). If the weather continues mild and damp, about ten days is the interval and thrice more, the frequency. But once it has taken hold, don't expect to get rid of diplodia permanently. You will be lucky if you keep it under control. This is why Austrian pine, and to a less degree the Scotch and red, are less popular than formerly in what has become diplodia territory.

These examples of ticklish timing are extreme. They are cited early in our account of anti-parasite strategy to emphasize that, in this warfare as in any other, timetables are critical. The seasons govern the foes' behavior and therefore our own.

RIGS

Successful chemical warfare in trees consists in getting there at the right time with the right material. For not to exceed $25 the home owner can acquire hardware that will deter any invasion up to fifteen feet (add a stepladder for five feet more). To protect his natural pump-fountains he needs only a mechanical pump-fountain through which his arm can supply about twenty pounds of pressure to a column of liquid nozzled into a rain or mist.

Some one-man sprayers are designed with a tank of up to five gallons that sits on the ground while you pump up pressure. Another type rides on your back with shoulder straps and lets you pump as you walk. Since fifteen-foot trees, in leaf or dormant, require two or three gallons of material each for a thorough spraying, these small rigs take a lot of refilling. The next-largest size is a 20-30-gallon tank which you trundle in a barrow or on wheels of its own, still pumping up pressure by hand.

After that you get into motored sprayers, whose costs rise with the tankage and power. Where true neighborliness and enough trees warrant, owners sometimes club together and, for a total outlay of perhaps $600, jointly buy a 300-gallon spray-rig capable of hitting anything up to forty feet at about 200 pounds of pressure. Beyond this caliber, where strong spray materials may get out of hand and real hosemanship is called for, calling in professionals is recommended. If you have done some spraying for yourself, you will know what more you need, when you need it, and what to pay for it.

Most tree services have high-powered rigs carrying 500-600 gallons. Charges must vary with mileages and materials but they should not run above twelve to fifteen cents per gallon applied. Companies with mist-blowers can make you the best prices, if your trees are accessible.

Before defining spray targets, let us dispose of that "one bird" mentioned above. This is the sapsucker. He is the one feathered thing who is truly a tree miscreant. About half his diet, especially during migration, consists of bark, cambium, and sap. He literally taps into them with his sharp bill and licks them out with his brushlike tongue. Except when excavating nest holes, all other members of the woodpecker family perforate trees only in search of insects, which they spear with tongues like barbed nutpicks. The sapsucker's depredations are unique and, when sap has fermented, sometimes comical. (Sapsuckers are often followed on their rounds by migrating Hummingbirds, but these fleet and magical jewels are mainly seeking sap-attracted insects, not drink, and should not be criticized for the company they keep.) No spray known, only wrappings, will stop sapsuckers from drilling their neatly spaced holes into young apple, birch, beech, and other thin-barked bleeders. But shoo, don't shoot them. Like their beneficent kin, the sapsuckers also extract many borers and beetles.

What **One** Man **Did in** Seven Years. This owner collected, planted, and reared all his new trees himself for a total outlay of less than $100. He has spruce, pin oak, birch, willow, crimson maple, and several more species.

Top view shows the house sitting back in its grounds against native wild wood.

Bottom view, looking from back to front, shows how this owner thinned his wildwood selectively, intelligently. In row of trees on right are sassafras, then tulip poplar; on the left are older hardwoods, mostly oaks, ash, and maples.

Photograph by B. F. Shepherd

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Photograph by B. F. Shepherd

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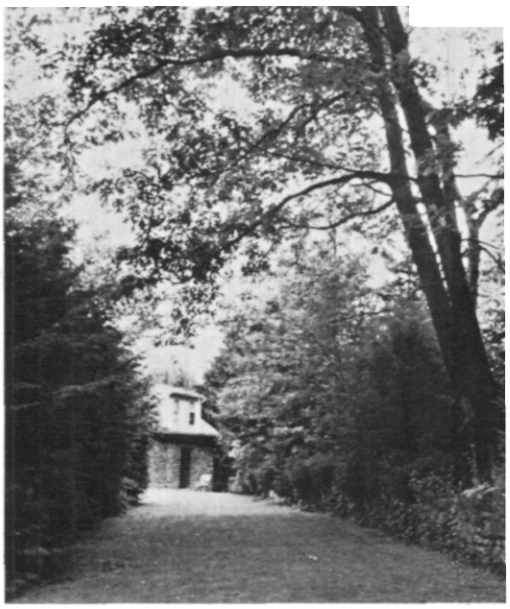
What Another Man Did in 23 Years. The three pictures on the opposite page show (top to bottom) an old grist mill in bare grounds when it was being remodeled, then four years later, then as it looks today. The owner, though strictly an amateur, planted, shaped, and cultivated all the present trees with his own hands.



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The old dam and millstream were screened with maples, spruce, and dogwood.

Along the old flumeway, a hemlock aisle.

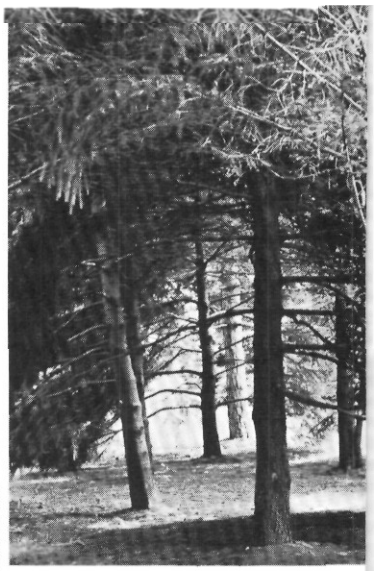
14

Looking from the dam toward the house.

15

How to Overplant and get a stifling, confused effect. About fifteen years ago some nurseryman sold these kind people a fat bill of goods.

Top shows the front grounds, bottom shows the back. Detail in between shows what happens to overcrowded evergreens.



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INSECTS

Insects occur among trees as naturally as leaves and, in Nature's code, just as rightfully. By no means all of them are harmful. Some insects are positively benign and should be recognized as such before you take spray gun in hand.

All the bees help the plant world as pollen carriers. All the larger wasps and hornets are strictly insectivorous and only one—a giant from Europe which occasionally strips twigs for nesting material—has any bad habits other than stinging savagely in self-defense.

The spiders prey on all manner of flies, bugs, and grubs without themselves ever harming plant life. (The tiny "red spider" that infests cedars, boxwood, and other plants is really a mite.) The daddy longlegs or harvestrnan is, despite his alarming physique, the meekest of spiders.

Ladybugs, shiny red or brown with dainty spots, are almost entirely non-vegetarian. They consume amazing quantities of aphids and scales. When our American orange-growers found this out they sent to Australia for more and hungrier ladybugs.

A most ferocious-looking insect in size and posture is the mantis. His first name is spelt "praying," for the way he holds up his forelegs, or "preying," for his predations of other insects. The Japanese keep mantes on long silken leashes near their beds to devour mosquitoes. There is in the United States a mantis industry, run by people who collect the gall-like egg-masses off shrubs and weeds and sell them to horticulturists for hatching where needed.

The big, black sexton beetle or undertaker, with huge frontal nippers, is another denizen of everyone's grounds that is horrendous to behold—but its diet is strictly carrion.

The insects injurious to trees fall into four main categories: Gnawers (borers, beetles, weevils), Chewers (worms, caterpillars, beetles), Suckers (aphids, scales), and Stingers (mites, minute wasps).

Gnawers. The larvae of many species which later become beetles or moths start life as vermiform borers, like the three-inch pink and brown grub of the leopard moth, largest of the lot. Unless the parents of such invaders have the habit of feeding on foliage (which few do) before laying their eggs (which are difficult to destroy), no spray can check them unless it is shot directly into their bores from a DDT or carbon disulfide pressure can, and the holes plugged. Often their entrances are invisible, being started as tiny perforations where the eggs hatch in bark crevices. Fortunately, most destructive borers advertise their presence by putting out frass (sawdust) or, in the cases of peach and pine borers, by masses of gum which ooze out behind them. When thus detected, boring grubs can be crushed in their tunnels by a wire probe, or fetched out with a crochet needle or straightened fishhook.

The gnawing beetles trace labyrinthine patterns through inner bark and cambium, but most of them emerge to breed and are then vulnerable to stomach or contact poisons. Weevils are specialized beetles which, both as larvae and adults, feed on tissues usually shallow and tender enough for penetrant poisons to reach.

Various ants gnaw wood, but only after it has begun to decay. Winged termites and long, black carpenter ants are the worst offenders because they eat on past the dead wood into live and are so voracious they can weaken trees, and even houses, structurally. Ants swarming up and down the *outside* of a tree are not cause for alarm. They are doubtless only tending their flocks of aphid on the leaves aloft, which you can dispatch with one spraying. Certain ants "milk" aphids just as we do cows, and even move them about to fresh pastures. The ant-aphid symbiosis (life partnership) is most damaging to the roots of corn and strawberries, not to trees.

Chewers are the most obvious of plant pests since they feed on leaves, where their inroads are quickly visible. Most

such creatures bite through the whole leaf and hence can be poisoned by chemicals laid down, with some sticker like soap or a household detergent, on either surface. But some skeletonize the leaf by chewing only from the underside, where the spray sticks least well. And some go an insidious step further and chew *between* the leaf surfaces, eating the inner tissues. These last are called "miners" and their work eviscerates leaves to near transparency. It takes a potent dual-purpose poison—stomach and contact—to get through to them.

Suckers are insects whose feeding organs are probes which they thrust into tree tissues to extract the juices. No poisons spread in wait for them will enter their systems. Their bodies must be hit with chemicals that kill on contact. Aphids or plant life are vulnerable to such treatment, being soft-bodied, but many of the scale insects have hard shells as adults and can be shriveled by contact poisons only in their unarmored crawler stage. Knowing their life cycles is necessary to control the scales called terrapin, oyster shell, lecanium, and San Jose. In general, the scales' vulnerable moment comes in early spring, which adds importance to so-called "dormant" spraying, the year's first.

Stingers are flies, mites, mini-wasps, and some aphids which puncture leaves and twigs with their ovipositors, to insert eggs which form galls as they develop. Witches'-broom has been described. Some other galls caused by stingers are of various shapes and sizes on oaks, bladder gall on maples, flower galls on ash, cockscomb gall on elms, club gall on dogwood, Sitka gall on blue spruce, cone gall on other spruces.

FUNGI

Fungi, the chief vegetable parasites, have symptoms, life cycles, and remedies quite different from the insect pests. They become active about the same time in spring, for the

most part, but most of them reproduce and attack far oftener than the insects. In some, new crops of spores can ripen just a few days apart and require only a spell of damp warmth to trigger a fresh outburst. When the outbursts occur, the spores literally explode from the fruiting fungus bodies and are air-borne for long distances. They thrust their mycelia into healthy parts of trees, from leaves to roots, as well as entering lesions to attack exposed tissues. Because of their virulence and the tininess of their infesting particles, fungicidal spraying is to be thought of as fumigating, to kill germs. If they could be controlled as well as liquids or dusts in the open air, gases would make the best fungicides, to penetrate and permeate as the spores do. Many fungicides are formulated so that they give off gases on the trees and are hence most effective on still days.

Symptoms of fungoid infestation can be schematized as follows:

On leaves—spots, blotches, blisters, curling, wilting, powdery deposits (mildew).

On twigs—pustules, cankers, rusts, molds, blighting, clumping.

On branches and trunks—decaying cavities, fluxing lesions, cankers (dry or bleeding), bracket mushrooms.

On roots—cankers, molds, blighting, decay lesions, threadlike appendages and interconnections, stemmed mushrooms or toadstools.

Below the fungi on plant life's ladder, *bacteria* and *viruses* cause diseases by what might be called simple infection. Crown gall in the rose family (apple, pear, cherry, almond, etc.) and in many other trees is caused by a bacterium which, entering a lesion, causes overgrowth of woody cells, resulting in rough swellings, sometimes huge, usually on the tree's base or roots but also well aloft in

poplar and willow. One of the few ailments suffered by sassafras is an incurable virus called yellows, which bunches the twigs, blanches and dwarfs the leaves.

SPRAYING

The above account of tree parasites is necessarily oversimplified. Readers are again referred to the definitive literature listed on a later page. Besides describing symptoms and their causes, the best pest books carefully specify remedies, which can be summarized here, to give the reader a base of spray knowledge to build on.

Spray materials have long been used to achieve five main effects: 1) When trees are still dormant in spring, to "burn" off by oxidation many nascent or emergent organisms; 2) to poison insect parasites internally; 3) to kill them by contact; 4) to combine effects (a) and (3); 5) to suppress fungi by poisoning their fresh spores.

In the old tree-spray pharmacopoeia, standard materials for the purposes thus listed were: 1) Miscible oil, a petroleum fraction close to kerosene, for dormant sprays; 2) Arsenate of lead, for stomachs; 3) Lime sulfur, for contact; 4) Nicotine sulfate ("Blackleaf 40"), for contact-and-stomachs (some old-timers made it by soaking their cigar butts in a tub); 5) Copper sulfate and lime ("Bordeaux mixture"), as a fungicide.

Pyrethrum, an extract of chrysanthemums, was long used with a light grade of miscible oil as a stand-by stomach poison less dangerous to warm-blooded animals than lead arsenate.

If your garden supply store is not up with the times, it may still carry all these remedies tried and true, and there is nothing wrong with any of them. But on modern shelves there is now a wide assortment of brave new formulations, of higher and often more specific potency. These change from year to year, as do the experts' opinions of them. DDT,

an all-purpose killer, enjoyed a fifteen-year vogue which has now somewhat waned since its ill effects on unintended targets—birds, mammals, fish—became manifest and many of its insect targets developed immunities. Parathion too proved all too potent and is used now only by professionals. As of spring 1962 an adequate home arsenal of reliable, manageable spray materials might include the following:

Miscible oil for early dormant sprays. Stomach or contact poisons can be mixed with it for delayed dormant use when a lighter "summer" grade of the oil is used. Never put oil sprays on beech, walnut, hickory, or maple: you may burn their leaves. Such sprays may discolor but will not harm blue spruce.

Sevin is a carbamate stomach poison, developed for fruit trees, which is now considered right for shade trees.

Rotenone, Chlordane, and ***Undone*** are all dual-purpose sprays combining stomach and contact effects, for use against adult chewing insects, including the leaf miners. Rotenone is highly toxic to fish.

Kelthane—a good miticide non-toxic to bees.

MaUithion—a versatile contact spray for obdurate aphids, mites, beetles, weevils, caterpillars, soft-shelled scales. It has low toxicity to warm-blooded animals.

Dieldrin—a. good specific for soil-infesting insects including ants, termites, nematodes, and the grubs of the Japanese beetle.

Puratized Agricultural Spray (mercuric) and *Captan* (chloric) are two of the latest and best fungicides to replace copper sulfate, which is less potent. They leave less unsightly residue.

Some basic ground rules about spraying are these: *Do no spraying* when the temperature is below 40^0 or above 8o°F.

Spray materials can sometimes be mixed to obtain multiple effects with one application, but this should never be attempted without first checking that the materials are com-

patible. Manufacturers' charts will tell you about this. Wash out your rig after every use, to avoid an incompatibility next time.

If you use any weed- or brush-killers (2-4-D; 2-4-5-T) on your grounds, apply them with separate equipment, not your tree-spray rig. Beware tree damage through root absorption or atmospheric drift of these killers, which overstimulate broadleaf plant life into "growing itself to death."

SYMPTOMS AND TREATMENTS

Several tree ailments have so far been generalized about, by way of examples. Now described and prescribed for specifically will be a baker's dozen of afflictions commonly encountered, and serious enough to merit real concern. The troubles listed are by no means the only ones these species suffer. They are chosen with the thought of teaching the new owner some *kinds* of symptoms to watch for, and some *typical* methods of treatment.

Spruce, Inch-long spiny growths appear on twig tips of the blue spruce, and half-inch spiny growths at twig forks of other spruces. These are not cones. They are galls caused by aphids. Control: Dormant spraying with malathion just before new growth starts; pick off all the old galls possible.

Lower branches of the blue and Norway spruces brown-off and die, progressively upward. Pitch exudes and cankers appear at the edges of dying bark, where small black fruiting bodies can be seen. This is Cytospora canker. Control: Prune all affected branches when weather is dry; spray repeatedly in spring with a fungicide.

Choke Cherry and cultivated fruit trees. When leaves are scarcely half grown, white webs appear at branch and twig crotches, growing in size daily. Look closely and

you will see masses of baby tent caterpillars inside. They defoliate the trees by day, return to the webs every night. Control: Blast the webs with a strong stream and drench the leaves with a mist of strong stomach-contact poison; early next spring look for this caterpillar's cylindrical egg-masses wrapped on twigs and twist them off between thumb and forefinger.

Flowers, leaves, and twig tips suddenly wilt and turn black, as though scorched by a blowtorch. Open, oozing cankers appear on the branches and trunk. Bark blackens and peels. This is fire blight, a bacterial disease. Control: Prune all affected members drastically, trace around and excise smaller cankers, remove and burn all cuttings, paint the wounds with cobalt nitrate, and disinfect tools with bichloride of mercury. Spray infected and neighboring trees repeatedly during early and full blooming with an antibiotic such as agrimycin.

Oaks. Twigs and small branches start dying. Look closely for tiny pits on the deadwood and yellowish or dark-gray round scabs, about 1/16 to 1/10 inch in diameter, on the live bark. These are golden oak scale and obscure scale. They occur separately and can be fatal. Control: Dormant spray with miscible oil, followed by malathion in mid-spring.

Leaves wilt and branches die, their sapwood darkly discolored. Within a year the whole tree may be dead. This is oak wilt, so far uncheckable and incurable. Trees dying of it should be removed and burned promptly. This wilt is caused by a fungus called *Ceratocystis fagacearum* which enters through lesions, maybe also through the roots. It is earned by flies, beetles, and borers, and maybe is also air-borne. If you hear of oak wilt in your vicinity, repair your oaks' wounds promptly. Spraying with fungicides may help. Ceratocystis can also attack apple, birch, dogwood, sassafras.

Sycamore and *Planes.* Singly or in clusters, leaves brown,

curl, and die. Angular blotches appear on other leaves, and dark patches on their stems, which break. The whole tree may become naked, but will grow a new suit later. This is anthracnose, a disease caused by a fungus that overwinters in fallen leaves and in cankers on twigs or branches. Control: A mercuric or copper fungicidal spray when buds are swelling, and twice again ten days apart if the weather is damp. Rake up dead leaves, prune infected members.

Birch, Elm, Holly, Lilac. Lacy patterns appear in the leaves, where their green cells are chewed out by leaf miners. On the thick holly and lilac leaves these patterns will look like opaque blotches. Split the leaf membranes apart and you can see the tiny worms through a hand lens. Control: Anticipate the adults early in May with a stomach poison; hit the second generation in July with chlordane, lindane, or dieldrin.

Pines. Colonies of inch-long green or yellow worms with black or brown heads appear, chewing off needles at a great rate. When you poke at them they rear up indignantly and stiffen to simulate needles. These are sawfly larvae. Control: Any strong stomach-contact poison.

Ash. The blossoms wither and become dark clusters which stay on all winter. These are flower galls, caused by a mite. Control: Spray with malathion and a good sticker in the spring when buds are swelling.

Dogwood. New leaves are small and pale, turning red prematurely. Twigs and whole branches die. Examination of the inner bark and sapwood low on the tree will show discolorations. This is crown canker, caused by a fungus called *Phytophthora cactorum* which attacks through lesions in the trunk and roots. Control: Trace the lesions well back, excavate them thoroughly, and apply shellac; feed the trees to help them resist further invasion, and spray early with a fungicide.

Elm. Parts of the crown suddenly wilt and wither. Terminal

twigs bend upward like shepherds' crooks. Examination of the sapwood in dead members will show brown striations. This is probably Dutch elm disease, identifiable positively only in the laboratory because other, less lethal wilts closely resemble it. The causative fungus is transmitted by a small, dark-brown bark beetle which breeds in dead or dying elm wood, all of which should be removed (including old brush or log piles) and burned, or debarked and sprayed with lindane. The bark beetle's presence in elms will be signaled by bird-work on invaded branches. Some trees die quickly, others linger. There is no cure, only prevention by pruning and well-timed spraying, which should aim also to control the greenish elm leaf beetle whose defoliation weakens the trees. Feeding, and keeping their soil's pH high, may raise the trees' resistance to Dutch elm disease.

Reliable textbooks on tree pest, parasites, symptoms, and control measures include the following:

Tree Maintenance, P. P. Pirone (Oxford University Press); *Tree Care,* John M. Haller (The Macmillan Co.); *Insects and Diseases of Ornamental Trees and Shrubs,* Ephraim Porter Felt and W. Howard Rankin (The Macmillan Co.); *Diseases and Pests of Ornamental Plants* (Third Edition), B. O. Dodge, H. W. Rickett, and P. P. Pirone (The Ronald Press Co.); *The Wise Garden Encyclopedia,* E. L. D. Seymour, ed. (William H. Wise& Co.).

VIII

THE NAKED ACRE

When you start trees from scratch you have
only yourself to praise

To everyone their own Eden. People who carve their home into a wildwood will feel like pioneers. Those who begin from scratch on a naked lot will, when they have brought their own trees there and reared them to a design, feel like creative artists. Each specimen will be theirs by choice, not chance, and they may feel more free than the wildwood folks to alter their composition as it develops: to erase mistakes and improve improvisations. All its parts will be beholden to the owners for their presence, not vice versa. From the very start the owners will have full control of, and responsibility for, all their trees' well-being.

Awareness of this last may weigh on new owners' consciences, like the future of their children, but in the end a pardonable pride will make up for growing pains. Curiously, more people have qualms about raising trees than worry about reproducing and rearing their own kind. They seem to think that luck has a lot to do with trees, or that you need a green thumb to ensure tree health and beauty. In comparison with children, trees are far more amenable, and hardy. Firmness of hand and purpose, and a cheerful patience, are all that you really need if you observe from the outset the basic needs of tree life, which are three: moisture, nourishment, and air space.

The first two are of course controllable through the soil. Less obviously, so is the third. When a young tree is transplanted, air for its roots is just as important as for its upper parts. Infant mortality among trees in new grounds results more often from suffocation than from any other cause. There is a sorry tendency, even among tree merchants who should know better, to plant young stock too deeply or in ground not loosened widely enough around the questing new roots. Worried that their plantings may blow over, people plunk them into narrow, hard-walled holes and pound them tight. Then they drench them with too much water, stuff them with too much food, fuss over them and peek at the roots to see "how they are doing." The time to peek at roots is when you buy the tree, or dig it afield yourself. But let us come to that phase of treescaping a naked acre after considering the over-all plan.

One of the first and most talented Americans to be called "landscape architect," the late great Frederic Law Olmsted, was irritated by the title. He said: *"Landscape* is not a good word; *architecture* is not; the combination is not. *Gardening* is worse. . . . The art is not gardening nor is it architecture. . . . It is the sylvan art, fine art in the distinction from Horticulture, Agriculture, or the sylvan *useful* art." He defined his work, which was usually on the grandest scale, in terms too sweeping to apply to our small naked-acre problems. Olmsted cleared headlands to display their lofty contours. He felled whole woods to reveal distant mountain heights or valley depths. He restored the natural sweep of watercourses, adjusted the sites of ugly structures "with a motive to avoid unnecessary jar upon the foreground of a soothing prospect." And yet his catalog of work elements ends in "fixing . . . the position and outlines of a stable . . . the course of a walk . . . or the height of a fence or of a hencoop . . . the answer in one word is—design."

The average practitioner of Olmsted's art today is perforce more tradesman than maestro. He is reduced to carving

walnut shells instead of panoramas. He is scarcely needed by the home owner whose problems this book approaches. Too much good money changes hands in return for piddling professional preciosities, when anyone with half an eye for form and perspective can lay out his own modest green spot unaided. Within the limits here contemplated—an acre, more or less—the essence of good taste will be good sense. And in the smallest frame, there is always room for that personal touch which, however invisible it may be to others, will spell out self-expression. The Japanese in their huddled culture found this out and perfected it some centuries ago.

Full as the phone books are of landscapists, the house-and-grounds periodicals are even fuller of planting suggestions for new home owners. Many of these run to fancified effects, but invariably they show pictures of how different species look when grown in various combinations. If there is in your family no talent for sketching, amuse and instruct yourselves by playing with cutouts from magazines and catalogs superimposed on blown-up photographs of your house and lot.

As a matter of duty, not presumption, some basic suggestions are offered herewith. What you are likely to be after will come under four headings: warmth, shade, beauty, and privacy.

By warmth is meant a visual, not a physical, effect—a sense of the house and any outbuildings having come to dwell in, not just on, the site. Planting around the foundations is the answer to this need, but the commonest mistake that warmth seekers make is to overdo such planting, to swaddle the architecture so thickly with growths that in a few short years it is stifled. Most new houses nowadays are low in profile, and so should be their foundation planting. Evergreens give a warm look all year round, but beware of species that will spindle up, like spruce, cedar, arborvitae and cryptomeria. Low-growing by habit or easily kept so by trimming are mugho pine, pfitzer juniper, most

forms of Taxus (yew), and such other stand-bys as box and prostrate Euonymus.

Solid banks of evergreens can become troublesome. A plague of scale, weevils, or nematodes can deform or wipe out the lot. Spaced apart by deciduous shrubs they are less care and, to most eyes, less trite. On a north side the deciduous species may not do so well and will perhaps be omitted, but still don't overcrowd the evergreens.

Shade can be as important for people indoors as out, but no tree planted for shade should be put closer than twenty feet from your house. Besides affording room for roots and branches you must think ahead to the time when too much canopy may bring dampness as well as coolness to your rooms. Repeated pruning of a tree to keep it from moldering or thrashing the architecture is a two-way nuisance—to yourself and the tree. Any shade tree ordained by Nature to grow much higher than your house is best planted, to start with, toward a border of your property. In per-acre terms, ten "big" trees will be found a great plenty, particularly if twice as many "small" trees, and some shrubs and flowers, need to be given living space.

The larger species like oaks, maples, ash, sycamore, and the major evergreens will start adding beauty to your grounds about half way to their maturity. Until then you will depend on dwarf or medium varieties, especially those which flower gaily, to dress up the place without delay. Most of the fruits will do this, and yield other returns as well. Their planting and culture will be dealt with in a separate chapter. Here, only a few reliable flower-bearers need be mentioned. First to mind come dogwood, redbud, hawthorn, fringe tree, goldenrain, mimosa, magnolia. In this category, variety is wide, and by consulting guides and catalogs a progression of blooms can be planned. As a general rule fruits and flowering trees will do best when planted where other trees cannot steal their sunlight. Be

sure you know your compass points, and lay out a plat before you dig any holes.

Privacy is a desideratum of modern living not craved by all people. The last thing in the world that some ex-urbanites want is to be shut away from their neighbors. They want to see and be seen by their fellow beings. Togetherness is denied by hedges or bowers, they feel, and people who put up fences are egocentrics. Still, the desire for some privacy in at least part of the grounds is justifiable, and can be achieved without ostentation. Low-growing evergreens, again, are an easy solution around a cook-out fireplace or—be it ever so humble—to screen a pool. If you decide on some hedging, make it hemlock or Taxus, which respond well to feeding and clipping, rather than juniper or arborvitae, which may go out of hand. Barberry is a durable alternative, and in winter its merry berries make up for its fallen leaves. Spirea gives a lacy display in its spring season and can be grown densely without much trouble.

Collecting and planting one's own shrubs and trees are found by real converts to countrified life to be much more fun than calling up a nursery and ordering the whole job done at one masterful stroke, out of a catalog. Most fun of all is collecting over the years, like stamps or butterflies, either exotics from the nurseries or native wildlings scouted out afield. For wildlings you must first find good hunting grounds, then beg or buy permission, spot and prepare your prizes, and finally fetch them home. The process takes anywhere from a day to two years per specimen, but to the thrill of discovery is added a tang of the unpredictable, and often of instructive failure. It is better not tried by beginners before they have bought a few standard, cultivated trees at a commercial establishment and watched the whole transplanting process done by the book.

Before it is brought to your grounds, young stock should have been root-pruned at least once. At any good nursery you can be sure that this has been done. The effect is to

condense the transplant's alimentary system and anchorage. After root-pruning, the feeder roots multiply in a bundle small enough to be lifted out whole, yet their filaments are long enough in totality to buffer the tree's vigor against the shock of uprooting. At the nursery, if you take the trouble to watch from start to finish, you will see how the tree is pruned topside (twenty per cent or more) and trussed up. Then it is trenched around at a radius of roughly five times the trunk diameter. The largest roots are lopped cleanly and the tree is gently tilted to be cut clear underneath, a yard down if there are taproots. The earth-ball is wrapped firmly in burlap and hoisted or skidded into a truck. *(See Photo. 33.)*

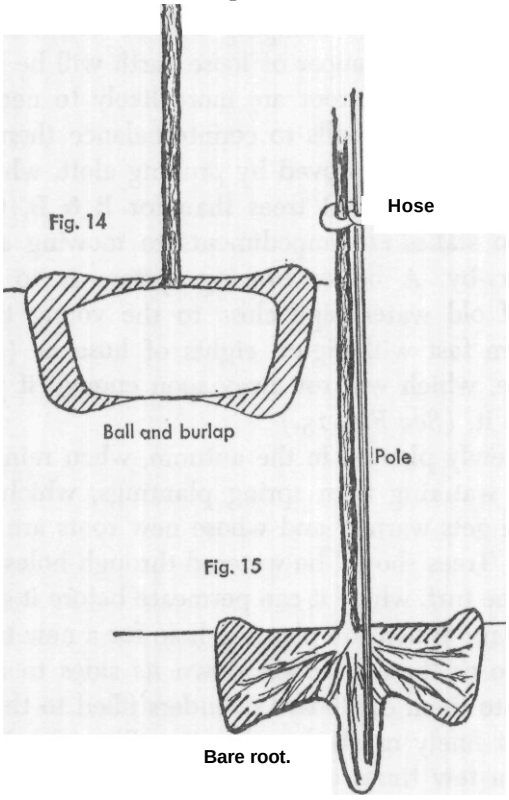
If your nurserymen are what they should be, you will next discover that more pains go into replanting the tree than into getting it out. The new hole should be dug half again or even twice as wide as the earth-ball. Topsoil will be set aside, subsoil discarded and replaced by other topsoil, or thoroughly mixed with old manure or a mulch. All the earth that is to go back into the hole will be made ready before planting is begun.

The hole will *not* be filled with water just before the earth-ball is lowered into it. The tree will be oriented as it grew (north side north) and its new depth will be matched carefully to its old one by setting the trunk's soil-line flush to the top of the hole. While one man steadies the tree vertically, another will start shoveling and packing earth in around it. When its position is precise and firm will be time enough to cut the bindings and lay back the burlap, which can be left in the hole to rot. As the filling-in is completed, water may be used to wash it down and settle it, but not to flood it. A raised rim of loose earth will be left around the tree for a water-catch through its first few months. *(See Fig. 14.)*

If the transplanting is bare-root instead of B & B (balled and burlapped) the procedure will be different. When the

specimen is trenched around, its longer roots will be cut off evenly as before; but now, as the trenching progresses, they will be "combed" free of earth, from the trunk outward, with a spading fork or by hand. Great care will be taken not to damage any tendril feeder roots. As the whole spidery system is exposed, each main member and its feeders will be wrapped in damp burlap (old feed bags will do). In bare-root transplanting, elapsed time from combing the roots to reburying them is kept to a minimum. Roots out of earth are like fish out of water: even though you keep them doused they quickly parch.

When the bare-root tree is set up in its new stance, with wraps removed, it will be poised on a cone or mound of



Bare root.

soil to receive its root-crown and let the roots run downward at their natural angles. If there is a taproot, a hole for it will be provided down through the mound, by punch-bar. *(See Fig.* 25.) If there is not room for all their ends, the roots must not be bent around or doubled back; they must be shortened, or the hole widened to fit. Great care will be taken, as before, to set the tree's depth correctly: better a mite too shallow than too deep. When the soil fill-in is begun it will be done slowly, thoroughly, by finger-work if necessary, to eliminate all possible underground air pockets. As soil is added it may be sprinkled with a hose or watering can *(not* drenched) to settle it closely and shut crevices. But too much water will create clods, which pack unevenly. Tamping will be continuous to the top, where again a saucer of loose earth will be formed.

Trees planted bare-root are more likely to need bracing than those with soil-balls to counterbalance them. Balance will be somewhat improved by pruning aloft, which should be more severe for B-R trees than for B & B. Guy wires running to stakes are impediments to mowing and snares for passers-by. A better bracing system is to drive tall lengths of old water pipe close to the young trunks and make them fast with figure eights of hose or (better) of clothesline, which will rot away soon enough if you forget to remove it. *(See Fig. 15.)*

Trees newly planted in the autumn, when rains increase, need less watering than spring plantings, which get drier as the sun gets warmer and whose new roots are sooner on the move. Trees should be watered through holes put down through the turf, where it can permeate before it evaporates. A good plan: When the planting hole for a new tree is dug, trowel two or three channels down its sides to root depth and set into them cardboard cylinders filled to the top with pebbles or finely crushed rock. *(See Fig. 16.)* Flooded to the brim a few times each week, such drinking tubes will

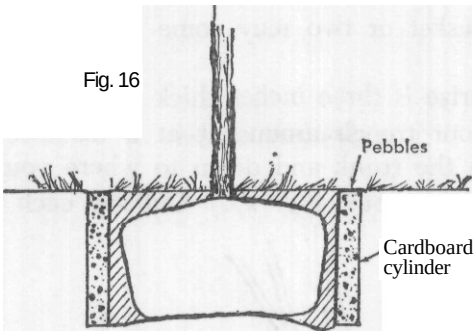


Fig. 16

offset the direst drought; through them, too, you can give the tree liquid feedings if necessary.

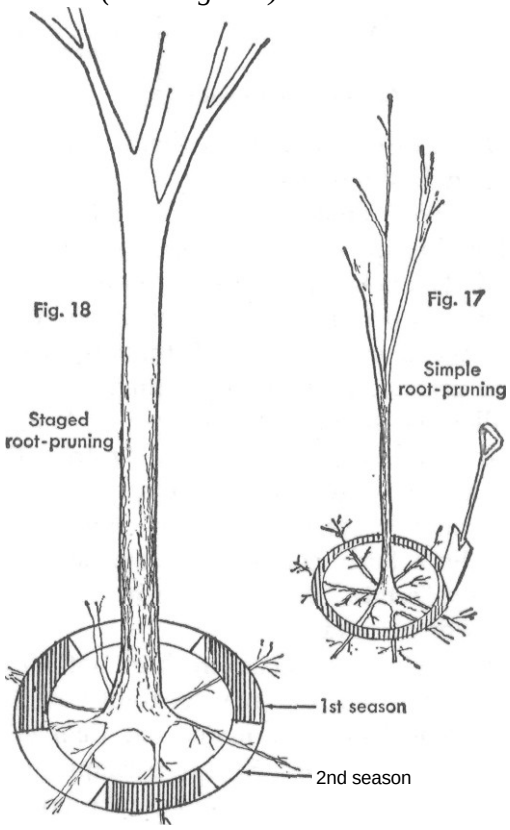
After you have watched professionals transplant "material"—as they brusquely call it—from a nursery, you can save many dollars below list prices by doing the same yourself, where this is permitted to the customers. When you go foraging for specimens in the wild, the only new work you will have to practice is the root-pruning.

The smaller the saplings you choose at first, the better success you will have, but after a few tries there is no reason why an able-bodied man with a halfway able helper should not collect trees at least three inches in diameter. That would be a fairly considerable oak, ash, or dogwood for the family "estate." It would be a very fine cedar or spruce, birch or sassafras.

Field-grown wild specimens are best not only for their filled-out tops but for the manageability of their roots, which will likelier run only under sod than among rocks or the roots of other trees. Except perhaps for a few experimental "switches" which you may take home bare-root, your quest on a first field trip will be to locate and root-prune some sizable specimens for moving much later. Besides your topside pruning equipment, including tree paint, the tools you will need are a mattock (broad-bladed pick-ax), a "round-pointed" shovel, and perhaps your punch-bar to take strain off the shovel's handle in case of rocks.

A bushel basket or two may come in handy, as will be explained.

If your prize is three inches thick at the height of your hip, sink your trench around it at a distance of fifteen inches from the trunk and down to where you encounter no more roots. *(See Fig. 17.)* Cut off each large root



cleanly. If it is an inch or more thick, paint its raw end. Remove all removable rocks that you come to and when you have the tree standing clear in its little island, prepare to refill your trench with soil and some kind of mulch.

If you are in pastureland, your mulch problem is soon solved. One basketful of dried horse or cattle droppings

will be ample. Or gather a couple of basketfuls of leaves or grass, dead or alive, and churn them into your loose soil as you refill and tamp the trench. Now, with your shears and pole-pruner, give the tree a going-over aloft to compensate for the feeders you carved off its bottom.

Give it a year to grow a new, concentrated root-ball and your tree will be ready to go home with you. If it is much larger than a three-incher, take its preparation in two bites. This year trench only halfway around, in three equal sectors equally spaced. Next year dig the other three sectors, and take up the tree on your third visit, two years hence. *(See Fig. 18.)*

When you do take the tree, follow the balled-and-burlapped or bare-root routine you learned at the nursery, with this addition: to make the newcomer feel more at home in your grounds, fetch with it a couple of basketfuls of the topsoil to which it is accustomed. Whichever of the two digging systems you use, don't try it without a station wagon or a pickup with a tailgate. Make yourself a skid of planking, up which to slide your load aboard, roots first. Earth-balls weigh about 100 pounds per cubic foot, and the finest tree that ever grew is not worth a hernia.

Some of the thriftiest trees one sees at homes are specimens of which the owners say with fond surprise, "That one started growing all bv itself out back. So we moved it up where it would show, and just look how well it's doingl"

Such trees are called "volunteers" and there seems to be something special about them. Out of the thousands of "flyers" sent off by a maple, or acorns from an oak, a few seem to have extraordinary vigor or to land in most favorable spots. Like stray kittens or puppies they will thrive where pampered thoroughbreds have pined away. This is natural selection ("survival of the fittest") at work—the principle put to work by the nurseryman when he culls seedlings to produce a strain with desired characteristics. The home owner, in a nursery plot of his own, can similarly play

games with baby trees. He needs very few of the very best to supply his needs, and the effort involved is insignificant. To render his infant specimens more fit for moving in their second or third year, he can raise them in sunken cans or cartons, to get compact roots. (When they are transplanted, such roots should be separated and spread to keep them from "girdling.") Evergreens are easiest of all to bring along, as will be detailed later in some paragraphs about raising Christmas trees. When evergreens are moved, it should always be with an earth-ball, and they need no pruning above.

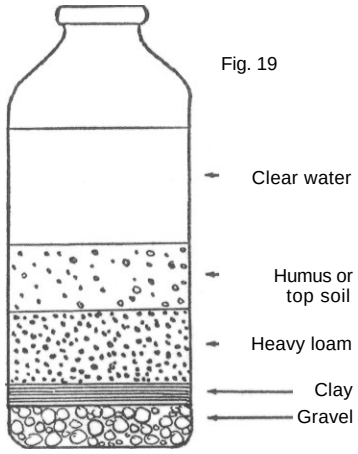


Fig. 19

Knowledge of what the soil in your grounds is like can be obtained very simply. Fill some milk bottles half full of water. Trowel into them samples of soil taken down to the two-foot level at various spots. Shake well. Let the bottles stand a day or so. Out will settle your soil's components—gravel at the bottom, then clay, then the loams, then the humus or topsoil, then a layer of clear water. *{See Fig. 19.)*

Before any planting is done, the chemical character of your ground should be determined and adjusted. Soil

chemistry is for the farmer, not the home owner, except in one important particular: the pH index. This refers to the amount of free acid (H) or alkaline (OH) molecules in the soil. At pH 7 the soil is said to be neutral. The acid scale runs down to pH o, the alkaline up to pH 14, each degree in the scale indicating a tenfold change. Most trees like slightly acid soils ranging from pH 5.5 to pH 7. Above pH 7 most trees have difficulty absorbing some of the trace minerals they need—iron, manganese, zinc, copper, boron. A few species are acid-lovers, like sourwood and yellowwood. To find out what your soil reads, get your County Agent to test it, or test it yourself with a cheap litmus kit which your drugstore will sell you, with directions for its use. If the pH of your soil reads low, raise it by spreading lime. Where it is too high, lower it with aluminum sulfate.

IX

TREES AS FUTURES

Better a living monument, which you enjoy,
than a posthumous headstone

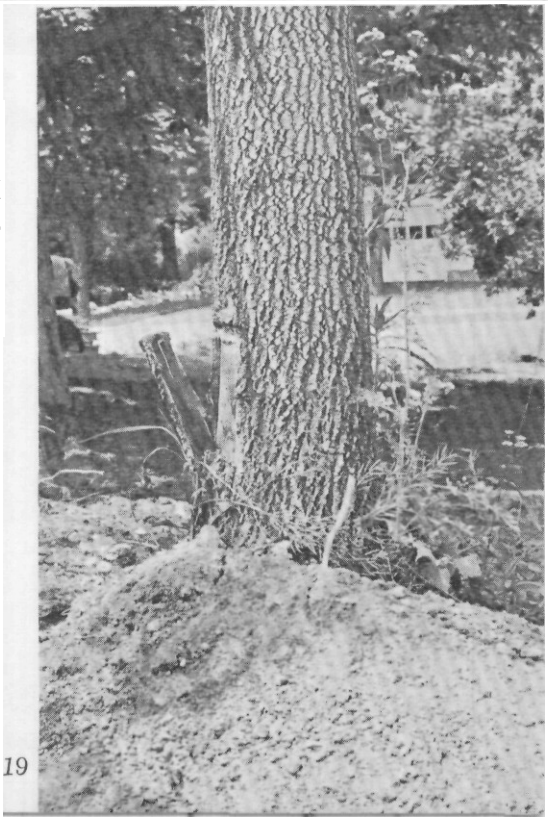
Twelve years is a ripe age for a dog or cat, eighteen for a cow, twenty-five for a horse, thirty for a mule, sixty for an elephant. Modern medicine has extended man's life expectancy to about seventy-five years. Certain parrots, tamed wild geese, and snapping turtles are said to have lived 150 years and more. In comparison to such brief life spans, many trees are "immortal."

It took Donna in September 1960—one of the worse hurricanes in recorded U.S. weather history—finally to lay low the Thorndale Oak, a red giant at Millbrook, N.Y., measuring 24 feet 9 inches in girth, whose age was gauged at 353 years. The acorn whence this tree grew apparently sprouted some seasons before the Dutch first sailed up the nearby Hudson River in 1610.

The Thorndale Oak was rated in 1941 by the American Forestry Association as the largest of its species in the United States, and at 353 years it may also have become the oldest. Even so, as trees go, it was but a middling oldster. Red oak is a comparatively short-lived species, about in a class with sugar maple, tulip, live oak, and sweet gum. The expectancies of some other species, calculated by dendrologists from ring-counts in many specimens, are these:

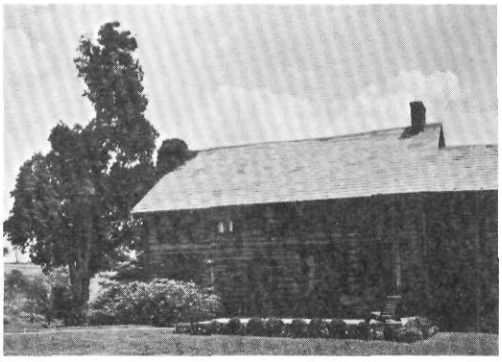
8

Beware the Bulldozer. Impossible to show by camera is the compaction of soil over tree roots which those clanking treads inflict. Clearly shown is the heaping of earth over roots, which will soon smother them. The lower picture shows a typical bulldozer trunk wound.



19

Preserving the Important. Clearly apparent is the importance of an old arborvitae, its one feature tree, to the remodeled farmhouse shown below. Decay in its trunk threatened this tree, but careful excavating and rodding preserved it—a professional job (shown at left) well worth its cost. The bottom picture shows how multiple cabling was used to safeguard an old apple tree, important for its decorative position at a front entrance.



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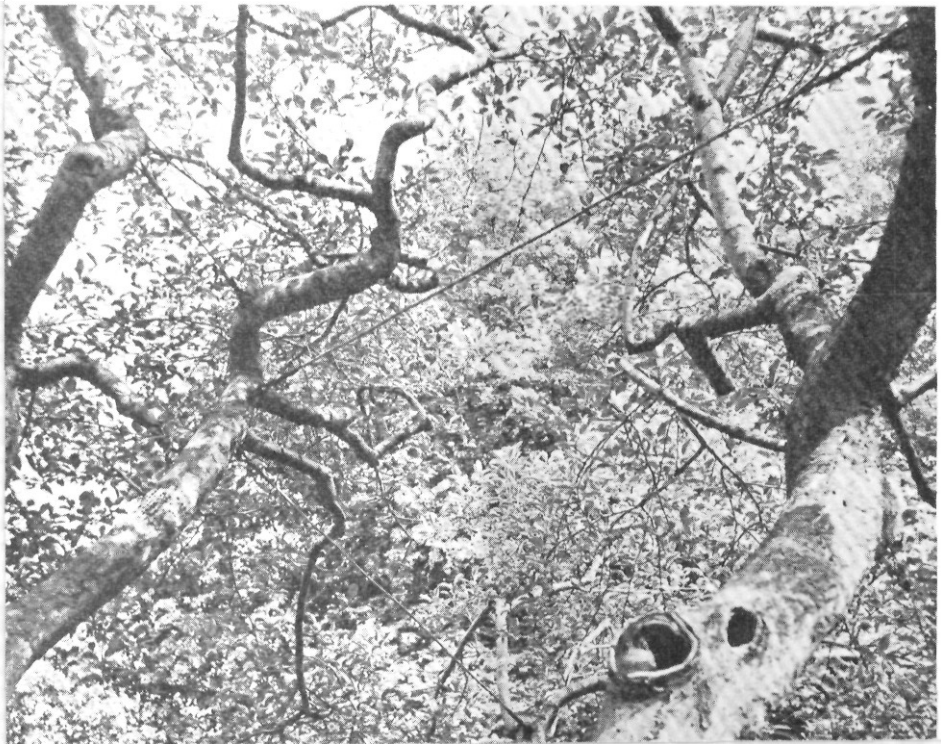

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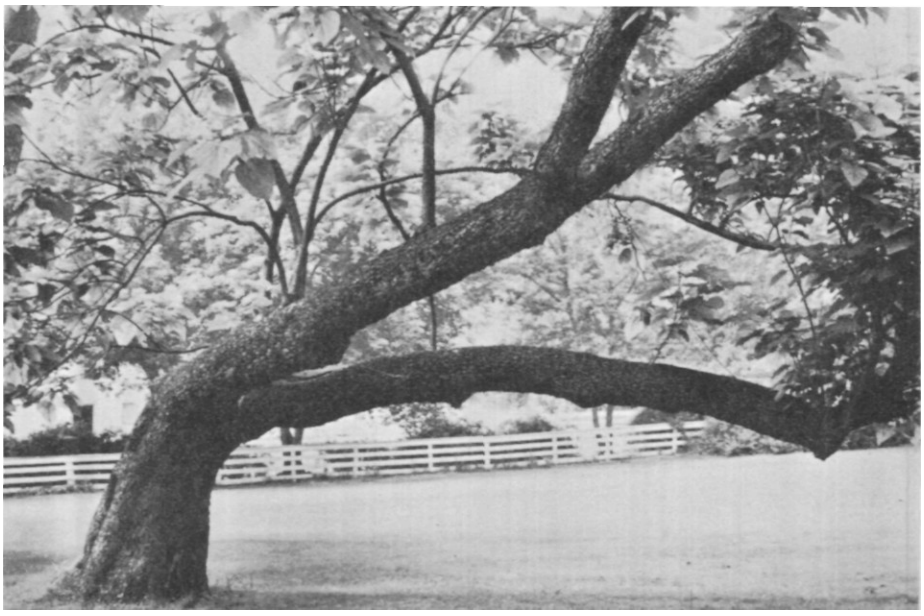
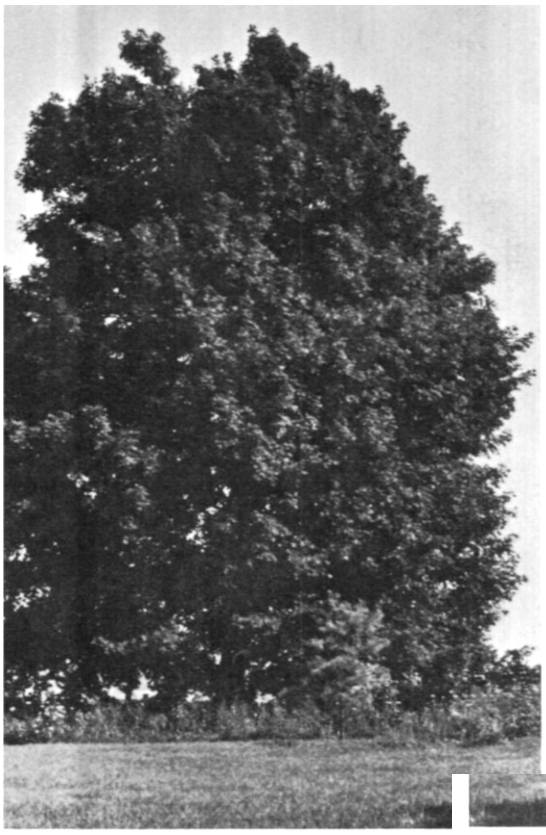


23

Charm in the Grotesque. Would you remove this deformed old catalpa? It looks like (and perhaps was) an Indian trail-marker. Its owners cherish it as warmly as other, more orthodox feature trees in their handsome grounds—a good example of charm in the misshapen.

Charm in Perfection. It to this Japanese dogwood thi years to reach its prese perfection. Specimens so fine a valued at many hundreds dollars. *(Photograph: Princet Nurseries)*

24



Before Pruning. This sugar maple, perfect specimen though it is, obscures the vista.

IMPROVING THE VIEW

After Pruning. The same maple reveals and frames the distant countryside. About two tons of low-hanging branches and excess overhead were removed, at a cost of $15.

White Pine—450 years
White Oak, Sycamore, Ponderosa and Sugar Pines—500 years
Eastern Hemlock—6oo years
Western Larch—700 years

In the great rain forests of our Pacific slopes grow the oldest trees on our continent—old as botanical forms as well as individually. Douglas firs with 700 annual rings are not uncommon and at least one with 1375 rings is recorded. The age of redwoods has sometimes been exaggerated. In a thirty-acre plot containing 567 redwoods, one careful investigator found only seventeen over 1000 years old. Elsewhere, he found one that was nearly 2000.

Oldest and largest of all are the giant sequoias, some of which antedate man's recorded history. They were perhaps 2500 years old when Christ was born, and may well live many more centuries if left untampered by man. A peculiar stunted native of the southern Rockies called the bristlecone pine is also known to have lived four millennia.

Only to a few is it given to own trees of such ages. But contemplation of the two- and three-century types can impart to any of us a curious kind of elation. The treelet we plant this year could, and it just might, survive until Peace reigns on earth and men are commuting to Venus. Viewed subjectively, to plant and cultivate a hardy tree in one's lifetime is to project one's humble and mortal personality far into the future.

By the same token that some old trees have historical associations, new ones can have future meaning. As a monument—to yourself or to an event of your time—a hardy tree which you rear and enjoy is more considerable than a stone memorial erected posthumously. An engraved metal plate explaining the tree's significance, placed there by you or your descendants, is in taste quite as good as the legends men carve in granite or marble.

One of the most touching moments in this reporter's tree

career came when he paused to admire four magnificent roadside trees—a white pine, sugar maple, hemlock, and white oak—fronting a modest rural homestead. An old gentleman came around the corner of the house with his lawnmower, and presently explained: "My grandfather planted those trees the day he heard President Lincoln was assassinated."

Though they live so much longer than we do, most trees mature quite as rapidly, and some much more so. A number of kinds are capable of reproducing at a fraction of our potential age for parenthood. Yet their increase in size can continue almost indefinitely whereas our measurements reach definite limits (except perhaps in girth) and then slightly shrink. Tree growth appears to decelerate with age but, under favorable circumstances, it does not actually do so. After its first spurting years from seedling to sapling to young maturity, a normal tree in normal years adds at least two inches of twig length and one or two inches of trunk girth. As height, spread, and girth increase, the tree's enlargement becomes *relatively* less but stays specifically about the same. An inch or two of girth added to a 48-inch diameter bole just shows less than when it is added to a 12-incher.

Palm trees, whose immunity to trunk injury has been noted, are immune also to obesity, and for the same reason that renders them so durable. Having a diffused, internal vascular system instead of an integrated, peripheral one, they do not add annual outward growth rings. Instead, after attaining their mature girth, in bundles instead of layers of tissue, they thereafter grow only upward, at that fixed girth.

These thoughts are set down here by way of framing for reference some answers to the kind of question new home owners ask about the futures of the trees they plant: "When will they really give us shade?" "How long before they grow high as the house?" "How big, how old, *can* they get?"

Growth rates naturally vary with soil, moisture, and climate, as well as with species, but here are figures for some cultivated species under optimum conditions (compiled for this book by Princeton Nurseries, one of the country's oldest and wisest shade-tree concerns):

I. Rapid (2'~3' per year their first 10 years)

Locust, Shademaster	Plane, London
Maple: Silver	Poplar, Carolina
Summershade	Sycamore
Oak, Pin	Tulip
Willow	

II. Medium Rapid (1'-2,' per year for their first 10 years)

Ash	Maple: Norway
Elm, Chinese	Red
Gum, Sweet	Sugar
Linden	Oak: Red
Locust, Honey	Scarlet

III. Slow (6"-1' per year for their first 10 years)

Cherry, Flowering	Hackberry
Coffee, Kentucky	Maple: Crimson
Cork	Schwedler
Ginkgo	Oak, White
Goldenrain	Sophora

Big nurseries like Princeton quote no retail prices (they sell to dealers only), but figures for what first-class stock like theirs should cost from local outlets can be arrived at by adding to catalog prices a fair markup. For typical items from the lists above, here is a retail buyer's yardstick:

	8-10 ft.	**12-14 ft**
Ginkgo	$24	$29
Gum, Sweet	12	27
Linden:		
American	9	24
European		42

	8-10 ft.	*12.-14 ft.*	
Locust. Honev	$17	$34	
Maple:			
Crimson	16	45	
Schwedler	12	36	
Oak:			
Pin	12	36	
Red	13-50	40	
Scarlet	14	36	
White	10	25	(if available)
Plane, London	10	35	
Tulip	8	12	
Willow	6	7.50	

Planting charges are usually forty per cent additional for shade trees but should carry a replacement guarantee good for one year.

From the above figures it can be seen that ten assorted specimens three to five years old, planted by a nurseryman, might represent an investment by the new home owner of $200—500. At the growth-rates indicated, all but the slow-growers in Class III would be giving considerable shade by their tenth year, some as early as their fifth. Supposing all do well, what real value might they be forecast as having one human generation (twenty years) hence? For such a calculation there is a formula which is widely accepted by insurance companies, courts, and even by the Bureau of Internal Revenue. It was worked out for the National Arborist Association and National Shade Tree Conference by a committee under Norman Armstrong of Chapel Hill, N.C.

Three prime factors are used: the kind of tree, its size, its condition. Size is measured not by height or spread but by the area of trunk cross section breast-high, to which a value of five dollars per square inch is assigned. To find this area the diameter is squared and multiplied by .7854

(one-fourth of Pi). Thus a top-value tree twelve inches thick in perfect condition would be evaluated at

But not all trees are top value, nor in perfect condition. The Armstrong committee laid it down that appraisers should rate trees in five grades of perfection, twenty per cent off for each lower grade; and it similarly divided all the familiar trees into five descending classes of value. These grades vary and shift according to where the trees are grown, in seven regions of the United States and Canada. Thus in New England, the East, the Central States, and Midwest the hardy sugar maple ranks in Class 1 (100%); in the South and Far Northwest it is relegated to Class 2 (80%); in California it vanishes from the list. In nearly all regions the lowly ailanthus and boxelder rank only in Class 5 *(2.0%).**

Evaluating your trees in dollars can come in handy when pricing a property for sale, or when damage by a storm or errant vehicle makes you feel like claiming a loss. To make your appraisal stick, it should be made, for a modest fee, by a Certified Tree Expert. To be realistic he will take into account the position of the tree in your grounds as well as the prime factors.

For a hypothetical case, suppose a runaway truck were to shatter irremediably a fifteen-inch willow oak standing in your Ohio back yard. In Ohio, the willow oak is Class 1 (100%). Suppose this tree had one moderate cavity but no other blemishes. The evaluation equation on it would look like this:

15x15x.7854x$5=$883.58
less 20% condition=$706.86
less 40% position=$424.12 appraised value.

[0] Copies of the booklet *Shade Tree Evaluation* can be obtained from the National Arborist Association, Wooster, Ohio. A condensed version of its listing appears in an Appendix to this book on page 138.

If the smashed tree had been only a twelve-inch sycamore maple (Class 3: 60%), but in perfect condition and standing prominently in your front lawn, the calculation would be:

Some shade-tree men think that the Armstrong formula should use a higher factor than five dollars for valuable low trees with slender trunks. Present practice is to appraise small trees, especially ornamentals, at actual replacement cost.

Translating their trees into dollars is purely academic for most people most of the time. But there are circumstances in which the home owner can well think of trees primarily as future cash, and convert them into it quite profitably. Often the specific purpose served is quite literally academic. Many a foresighted parent puts Junior through college by growing Christmas trees.

For this ploy, at least one acre of ground not otherwise used is needed. Better are five acres, and if you have ten acres some states, like New Jersey, will supply you with seedlings for a song, provided you let half your crop grow on up into saw timber.

A nice thing about all the conifers used as Christmas trees is that they will grow on land that is not much good for growing anything else. Worn-out pastures, thin-soiled barrens, and north slopes unblessed by warmth or water will yield quite well with just a little fertilizing. Three negatives define the requirements better than any set of positives: no swamp, no shade, no livestock.

Tastes in trees for Christmas vary surprisingly in different sections of the country. Largely preferred in New England and New York are balsam fir and white or Norway spruce. In New Jersey and Pennsylvania, the spruces used to lead in popularity, but the aristocrat now is Douglas fir. In Michigan and Ohio, the long-leafed pines—Scotch, red, and

Austrian, in that order, trailed by white—now outsell the firs and spruces.

Thus one of the first things to do before you go into Christmas trees is to check your regional markets and learn which kinds to plant. Besides salability, there are differences too in growth rates, care, and price.

Douglas fir takes ten to fourteen years to reach six feet but fetches about $2.50 per tree at that size, on the stump. *Norway* and *white spruce* bring only half as much but reach market size two to four years sooner. *Scotch pine*, where it is salable, is in the $1.25 bracket for trees that take only six to eight years to grow, but the pines are prey to sawfly and pine-shoot moth and require watchful spraying. The spruces' enemies are aphids, weevils, and mites, not quite so destructive. Of them all, the fir is hardiest as to climate and parasites. All types need some pruning or shearing to perfect their shapes.

A rough idea of how many Christmas trees one acre of ground can carry is conveyed by the following table;

Spaced 4 ft. each way 2720 (table trees)
Spaced 5 ft. each way 1740 (6-footers)
Spaced 6 ft. each way 1210 (8-footers)

Often there is also a market for the boughs from cut trees or misshapen ones. These bring as high as four dollars per hundred pounds.

Christmas tree crops are planted in early spring, usually in generations a year or two apart. Be sure to heel-in your hundreds of seedlings as soon as you get them home, and water them well. Carry into the field, with their rootlets kept soaked in a bucket, only as many as you can plant on that trip.

The quickest way to open the ground is to plow spaced furrows, but doing so may provide rodents with runways, which you will regret. More laborious but safer is to "scalp"

your planting spots with a mattock, cutting out sods at least six inches square.

After their first year, be prepared to weed around your seedlings; after their fourth, to shear and prune them; after their sixth, eighth, and tenth years to spray, and to "finish" them with more shaping.

Pamphlets on the culture and care of Christmas trees are among the most popular publications of the Conservation departments of States where they can be grown. From which fact, take this warning: almost everywhere the markets are glutting, or soon will be. In Michigan, for example, as against 1,205,000 trees sold in 1957, about 30,000,000 were reported maturing for 1962. Perhaps only half of these will reach market, and only the best half of that half actually be sold. More than in most tree lines, and nowadays increasingly, in Christmas trees only top quality pays off.

X

YOUR OWN FRUITS AND NUTS

Besides providing shade and beauty, some trees will reward diligence with table delicacies

For new home owners, some of their happiest dreams and saddest disillusionments have to do with food trees. On the land they have bought will stand some specimens which, as a rule, are alleged to bear bounteously. Or in the warm glow that comes with planning and planting their first home grounds, the newcomers will set out young stock, usually fruit trees, and sit back with every expectation of luscious harvests to come. When blossoms appear, hope soars. When fruits fail to follow, or they come off scabby and rotted, Nature's broken promise seems rank betrayal.

The purposes of this chapter are to assure the inexperienced: 1) that the growing of palatable fruits of any kind, on trees young or old, is a chancy business; 2) that it is, however, quite possible to weight the chances in your favor, provided that you are prepared to cultivate, prune, spray, and otherwise pamper your trees with unremitting diligence.

Since trees already grown present the new owners' most immediate problem, these will be discussed first. Exceptional are fruit trees which, when inhabited land changes hands, have been properly cared for over the past year or two. In most cases their pruning will have been neglected, their spraying and feeding omitted entirely.

Improving the structure and vigor of such mature trees will be your first concern. If they are badly overgrown, this must be gone about in easy stages or, instead of fruiting wood, your pruning will produce chiefly sucker growths. Besides repairing wounds and cavities as best you can, your first efforts should focus on removing deadwood, stubs, and obviously extraneous whole branches. Leave your thinning and shaping of sound branches until you have seen the trees through one summer and autumn. Meantime break up the ground around them, feed them, mulch them for the winter, and get ready to spray in earnest the following spring.

Fruit trees tired and neglected beyond a point can never be brought back into full bearing, but that point can be surprisingly far along in their lives. And even if you fail to revive its yield after a couple of years of trying, an old fruit tree will reward you with blossoms and shade until you decide to replace it.

Two factors have basic bearing on fruit production. One is chemical. All tree fruits grow best in soil just slightly acid, from pH 5.5 to 6.5. (Some bush fruits, such as blueberries, require pH 4.8 to 5.0.) Testing your soil's acidity and adjusting it with lime or aluminum sulfate is thus a must for fruit culture.

The other basic factor is germinal. Some trees are *self-fruitful;* that is, their own pollen can fertilize their own pistils. Nearly all the citrus fruits, most peaches, nectarines, and figs, and all the sour cherries, quinces, apricots, and European plums are self-fruitful. All they need is bees to help them bear.

Most apples and all the pears, sweet cherries, and Japanese and American plums are *self-unfruitful.* They require the proximity of another variety from their family, and not just any variety will do. For example, Bartlett and Seckel pears cannot pollinate each other. Winesap, Baldwin, and

Northern Spy apples are poor pollinators of other varieties as well as impotent among themselves.

These intimate relationships oblige new home owners to have an orchardist identify their mature fruit trees at the outset. In most communities, a county agriculture agent is at your service, free. He may find that an old Macintosh or Jonathan that used to pollinate your other apple trees has died or been cut down, and you need a new one. Your Bartlett and Seckel pears may be fruitless because they never did have a Gorham, Bosc, or other good pollinator to help them out.

Two other causes of fruit trees failing to bear are effects of temperature and timing. If the thermometer drops to the lower twenties after blossoms open, expect no fruit. Contrariwise, without passing through at least 700 hours of weather colder than 45^0 F. in the course of a winter, hardy fruit trees will lack the stimulus to break out of dormancy. Their spring growth, blossoms, and fruit will be delayed and irregular. This accounts for northern fruits doing poorly below Mason and Dixon's line except at high elevations. Fine apples are grown around Winchester, Virginia, elev. 725 ft., but not around Annapolis, Maryland, at sea level.

Once they are brought into or restored to bearing, the pruning, feeding, and spraying of fruit trees vary little with their age. Hence our further discussion of fruit production will apply to all ages. So let us begin with the selection, planting, and rearing of young stock, which is what determined owners will come to eventually. And, since this book seeks to serve primarily those new owners whose land is limited, let a distinction be drawn between standard-size and dwarf trees, in favor of the latter.

Standard-size apple and pear trees must be spaced 30 to 40 feet apart. Dwarf apples and pears can be grown at half those intervals or even less, as close as 6 or 8 feet in

rows spaced 15 feet. Standard trees take from four to seven years to start bearing. Dwarfs take only two or three years. The standards are hard to keep less than twenty feet high, with consequent difficulties in pruning, spraying, thinning the fruit and harvesting it. Dwarfs are easily kept within arm's reach.

Apples and pears are the fruits chiefly grown as dwarfs in America. Peach, plum, cherry, apricot, and nectarine are less available in dwarfed sizes, but standard trees of these stone fruits (except sweet cherries) can be kept semidwarf by watchful pruning. Apart from its handiness and economy of space, a strong attraction of dwarf culture is the decorative function to which dwarfs can be put. They can be grown "cordon" (single stem with spurs but no branches) in a close line to form a hedge; or formed in "espalier" patterns, flat against a trellis or wall.

The only drawbacks to dwarfs are that they cost about twice as much as standards and bear about half as long.

Creating tiny fruit trees by grafting or budding desired species onto dwarfing rootstock is a fascinating and not difficult hobby for people with the patience to undertake it. Instruction on how it is done is contained in some of the textbooks on fruit culture listed at the end of this chapter. But beginners would do well to familiarize themselves first with dwarfs bought from nurseries. For such purchases a few guidelines will be useful.

Dwarf apple trees used to be created in America (and still can be) by grafting thrifty scions (segments of one-year wood, with buds) to rootstock found stunted naturally in the wild. The Paradise and Doucin, grown to type in England and France, were considered the best wild stocks for dwarfing. Nowadays a strain called East Mailing, perfected in England, is preferred. The EM types are numbered to distinguish their characters. EM II grows a semi-dwarf about three-fourths standard size. EM VII is two-

thirds standard, little larger than a standard peach tree. EM VIII is widely used as an interstem piece (grafted between a root and scion of the desired species) to produce a full dwarf, sometimes called Clark. EM IX, a rootstock, is considered the best EM dwarfer of all. It produces a tree that will not, with proper pruning, exceed six or eight feet in height after twenty years and will bear a bushel a year.

Since 1952, American nurseries have sold dwarf apple trees called Mailing Mertons—obtained by crossing EM strains with the Northern Spy. MM strains are pest-resistant, well anchored. They yield early and heavily. They are numbered from 101 to 115, with Nos. 104, 106, 109, and 111 so far the most promising.

All dwarf pears are grown on quince roots, preferably the Angers quince, but the popular Bartlett pear needs a Beurre Hardy interstem below its scion for best results.

Dwarf peaches and nectarines are grown on roots of the smaller plums. Americana and myrobalan are the usual plum rootstocks. St. Julien or mazzard are even better if you can find a nursery that uses them.

Dwarf plums are worked on myrobalan stocks. Americana dwarfs plums smaller than myrobalan and transplants better, but since the scion tends to overgrow the rootstock it becomes top-heavy and blows over more easily. Sand cherry, a wild plum, produces the smallest dwarfs of all.

Planting fruit trees, standard or dwarf, begins with the careful selection and preparation of their ground. Full sunlight and adequate space are the prime requisites. Next come proper soil acidity, reasonable fertility, good drainage. Organic material (manure or sod) should be worked into the ground a year before planting. Weeds or cover crops should be turned under in subsequent spring cultivations.

Do not put manure or fertilizer into the holes at planting time, which comes in October-November or before growing time in spring. All fruit stock is planted bare-root as whips

one or two years old. Dig a hole overlarge for the root system and plant to the same depth as the tree grew in the nursery, making sure that the graft union is above ground. Put topsoil in the bottom of the hole, sift more in over the roots, and fill with a mixture of topsoil and manure or compost. Gently soak the soil over the roots (don't sprinkle the tree) and keep it moist through the first growing season. A saucer depression around the trunk will help keep moisture in place through the summer, but mound the soil for winter, adding mulch, to guard against deep frost and heaving.

To help young fruit trees reach maturity, in March-April broadcast a "complete" fertilizer (5-10-5 or 8-8-8) two feet away from the trunk and well out beyond the branch spread. On poorer soils, repeat this in June-July. One pound of fertilizer per year of tree age, up to five pounds, is your rule of thumb. A supplementary ration of high-nitrogen may be given if the tree's new growth is much less than twelve inches by August. But too much nitrogen will make fruit trees grow more wood than fruit, and it causes dwarfs to overgrow. Good mulching materials (to be turned under or raked away in spring) are straw, sweet or salt hay, lawn clippings, leaf mold.

Pruning of *apples* and *pears* begins on the branchless whips you buy at planting time. Cut these back to about 36 inches and remove any injured roots. If your whips are two-year-olds they may have started branching. Retain and shorten the best sideshoots. Leave a single top leader untouched. After the first growing season, in late autumn or just before spring, take off all spurs and branches below 24 inches. Remove also any branches angling upward from the trunk at less than sixty degrees. At the top, retain only one central leader, removing any that form Y's.

After the second growing season, prune only for structural correction. Upon your moderation will depend the

arrival of fruit. When it does arrive, its weight will open and spread the tree's top, especially in apples. Pears are more upright in habit, so don't try too hard to make them expand. After bearing has begun, annual growth will lessen and with it the necessity to prune. Taking off whole branches to prevent too-dense heads is better than fussy twig-whittling. A trick to hasten bearing in woody branches is to girdle them with a knife-cut about one-eighth inch wide, made full-circle or spiral around the branch. This impedes the downward flow of enriched sap, forcing it back into outer fruit wood instead of deeper xylem.

Yearling *peach, nectarine,* and *apricot* whips will already have small branches. Cut all these to spurs^ leaving only two or three buds on each. After this an open-center "wine glass" habit will develop naturally, which you can encourage by removing any suckers or branches that grow inward. These stone fruits produce on wood that grew the previous season. They therefore can and should be cut back, after their third year, more severely than apples or pears. Standard trees should be kept below fifteen feet in height. Dwarf peaches can be kept below six feet.

Sour cherries are pruned like peach trees except that some side branches are left on yearlings to become permanent, and the lowest tier, of three or four limbs, should be eighteen inches or less above the ground. They grow slower than peaches, taller and more twiggy. These characteristics call for corrective pruning, but, on the whole, far less work than peaches require. A main object is to keep sour cherries' heads open so that fruit will ripen.

More than any other fruit, cherries are stolen by birds. The lower you keep your trees, the more easily you can protect them with netting.

Sweet cherries tend to grow big and upright. Prune them as you would apples or pears, but let the lowest branches start at eighteen inches from the ground, the

highest at not more than four feet. Remove all central verticals except the main one, which you can keep heading back to fifteen feet or less.

Plums grow upright or spreading, according to variety, and can be pruned like peaches in general.

The stone fruits need more careful cultivation around them than the pomes do, but *never use weed killers near them* (or near any valued tree).

All young fruit trees are prey to mice, rabbits, and other *rodents.* Screen them around with hardware cloth reaching four inches underground and up to the lowest branches, two inches away from the trunk.

Thinning their fruit is necessary on all hardy (northern) fruit trees except the cherries to obtain the best size and texture. This should be done after the trees have made their own natural drop of excess immature fruit. Thin plums to four inches apart, peaches and nectarines to six inches, apples and pears to eight inches.

Spraying fruit trees is the most arduous, exacting part of their care. The list of insects, fungi, and bacteria that beset them is interminable. In some years, commercial growers have to spray fifteen or twenty times to save their crops. Home owners can "get by" with an all-purpose fruit spray from the hardware store, but cannot expect presentable yields without putting on, at the right times, a minimum of eight applications for pomes and nine for some stone fruits, using ingredients designed for definite purposes. Fortunately, the chief damage to different fruits is wrought by the same or similar pests, and at about the same times. Thus the moments and types of mandatory sprays can be condensed for thorough-working amateurs, in tabulations as follows:

TOMES

APPLES, PEARS

Times	*Materials*	*Targets*
Dormant (buds not yet green)	Dinitro cresol	Aphids
Delayed Dormant (buds green)	Miscible oil	Scales, mites, red bugs
Delayed Dormant plus one week	Captan	Scab
Petal-Fall	Lead arsenate plus captan	Codling moth, circulio, leaf roller, scab
Petal-Fall plus one week (first cover spray)	Lead arsenate plus captan	Codling moth, circulio, leaf roller, scab, caterpillars
Seventeen, 31, and 41 days after Petal-Fall	Lead arsenate plus captan	Codling moth, circulio, leaf roller, scab, caterpillars, sooty blotch, fruit spot

STONES PEACHES, NECTARINES

Dormant (before buds swell)	Ferbam	Leaf curl
Pink-bud	Sulfur	Brown rot
Blossom	Sulfur	Brown rot
Fruit-husk split	Sulfur plus malathion	Brown rot, circulio
Ten days after Fruit-husk split (first cover spray)	Sulfur plus malathion	Brown rot, circulio, scab
Fifteen days later (second cover spray)	Sulfur	Brown rot, scab

Times	*Materials*	*Targets*
Ten days later (third cover spray)	Sulfur	Brown rot, scab
A week or so later, or just after a heavy rain (two final cover sprays)	Sulfur plus DDT	Brown rot, scab, Japanese beetle, Oriental fruit moth

CHEBRTES AND PLUMS (also Nut Trees)

Dormant (before buds swell)	Ferbam	Black knot
Fruit-husk split	Ferbam or lead arsenate and captan	Circulio, brown rot, leaf spot
Ten days after Fruit-husk split	Ferbam or lead arsenate and captan	Circulio, brown rot, leaf spot
When fruit colors	Ferbam or captan	Brown rot, leaf spot
Quickly after harvest	Ferbam or captan	Leaf spot
Harvest plus 18 days	Ferbam or captan	Leaf spot

Note: The last two sprays are not essential for plums or for nut trees.

CITRUS FRUITS

All the citrus fruits came from the Orient by way of Asia Minor, the Mediterranean, and Spain-Portugal. Columbus took them to the West Indies whence munching Indians spread them wild, and sweating settlers cultivated them, clear across the warm zones of the Americas. Crossbreeding has evolved many hybrids with exotic names and characteristics, some of them hardy enough to be grown as far north as Wilmington, Delaware; Memphis, Tennessee; and Riverside, California. Home owners south of these points and in Hawaii have a wide range of species to

experiment with, and vast stores of local lore to draw on for advice.

Growing one's own oranges, limes, lemons, and grapefruit (so called because they grow in clusters) is a pastime throughout the sunshine belt almost as popular as golf, shuffleboard, and girl-watching. Embraced in the modern citrus spectrum are such surprise fruits as the "tangelo," a cross combining the tangerine's loose skin with much of the grapefruit's size, and the tastes of both. The "limequat" is a lime-kumquat mongrel that is delicious raw or in marmalade.

As a group, the citrus fruits are easy to plant and cultivate under average conditions of soil moisture and fertility. Once shaped as youngsters, they require little pruning throughout their lives which can outrun their owners'. The bacteria, fungi, and insects which attack the citrus families are more easily controlled by spraying than is the case with pomes and stones. Fumigation with hydrocyanic gas (under tents, at night) can give protection for up to three years, but this had best be done by professional operators, and supplemented by sprays to combat certain insects ordinarily controlled by beneficent agents which the fumigant wipes out.

NUT TREES

Almost what coconuts are to the tropics, *Chestnuts* used to be to the United States east of the Mississippi—an abundant, never-failing sweetmeat growing wild throughout the land. Their verdant, prickly burrs in clusters of three would ripen to gold in autumn, and the first frosts would split them open to spill out plump brown kernels, two and four to a burr. Chestnut timber, close-grained and durable, was valued highly in building and for fenceposts.

About fifty years ago a virulent, fungoid bark disease called *Endothia parasitica* swept through the chestnut

stands. Remaining today of this once great species are only isolated survivors and, here and there, stubborn offshoots of the old rootstocks which struggle into bearing and then die off again, blighted by endothia, for which no control has been found.

Preserving the American chestnut by nursing along its few blight-resistant remnants and creating hardy hybrids on exotic rootstocks is a continuing crusade among U.S. arborists. The introduction of European and Oriental substitutes has also been undertaken, with more success. New home owners hankering for a nut crop in their grounds will not go wrong in planting young Chinese chestnuts, of which most varieties will yield in their sixth or seventh year. The nuts are slightly larger and less flavorful than our old Americans were, but they improve on the huge, mealy, somewhat cloying Italian and Spanish types that people use for turkey stuffing.

The second most satisfying American nut was and remains the *black walnut*, but not every one has the fortitude to crush off its juicy rind, which stains indelibly, and then crack and pick the convoluted meat out of the rough, ironhard shell. Walnut fanciers are better off buying young English (actually Persian) walnut stock and cultivating it to fruition in eight or ten years. The rinds are less troublesome, the shells papery in comparison with wild walnuts, and the fat meats easier to extricate.

A close and prolific wild cousin of the black walnut is the *butternut*, but finding this species in your new grounds is no cause for excitement. The nuts are inferior, the trees short-lived softies and slow to bear.

The *hickories* are a third walnut relative, deliciously flavorful. Their rinds split off handily in sections, but the meat in their dense, tight shells is almost impossible to pick out whole. The shagbark fruit is bigger than the smoothbark, which is deprecated as pignut. As shade trees, native hickories deserve ground-space for their rugged sym-

metry, but they are not worth buying or cultivating. Only squirrels, and epicures of utmost patience, truly enjoy hickory nuts.

Pecans are one more member of the walnut family, indigenous from lower Indiana to Mexico. In Texas they grow as forests. Pecans have been extensively refined and cultivated throughout the South, where they are an important money crop. Long-lived and vigorous, pecans want rich soil and lots of growing room—sixty feet between trees.

Hazelnuts (Filberts) grow on a bush or small tree, akin to the birches. Unsuccessful commercially except on the northern Pacific Coast, hazel is hardy and fruitful enough to be a desirable addition to private collections anywhere. The nuts, which have a faintly aromatic taste like no other, crack neatly and store well.

Almonds are of two kinds, flowering and nut-bearing. They belong to the plum tribe, and the flowering types are hardy as far north as Massachusetts. Nut-bearing almonds do well in California but scarcely anywhere else in the United States.

Coconut palms are limited on the north by the latitudes of Charleston, Dallas, and Los Angeles, parallels 33^0 and 34^0. They need rainfall or irrigation of more than three feet per annum to round out and fill with "milk" their familiar fibered fruits, big as the head of a chimpanzee after you chop off the three-sided husk.

Coconuts are a unique species and hence, necessarily, entirely self-fruitful. No other nut is dependably so, and two or more varieties of each should be planted together to ensure pollination.

Nut trees are subject to the same types of parasites as cherries and plums and should be similarly sprayed. *(See table, p. 114.)* Chewing insects do not attack the nuts proper, but by defoliating the trees they rob the nuts of nourishment and stunt the meats. Walnuts are susceptible to

several leaf spots but to none that cannot be controlled easily with fungicides. The pruning of nut trees is about the same as for cherries and, similarly, you need not thin off their crops.

Dependable texts on fruit and nut culture include:

Fruits for the Home Garden, U. P. Hedrick (Oxford University Press); *Modern Fruit Science,* Norman Franklin Childers (J. B. Lippincott Co.); *Dwarf Fruit Trees,* Lawrence Southwick (The Macmillan Co.); *Cultivation of Citrus Fruits,* H. Harold Hume (The Macmillan Co.); *Evergreen Orchards,* William Henry Chandler (Lea & Febiger); *Nut Grower's Handbook,* Carroll D. Bush (Orange Judd Publishing Co.); *Subtropical Fruit Pests,* Walter Ebeling (University of California Press).

XI

ARBOREAL GERIATRICS

Like old soldiers, ancient trees never say die
and they fade away even more slowly

When people buy a run-down rural or suburban dwelling, usually at much less cost than building for themselves, they derive a special kind of satisfaction from renovating their old "bargain," or so remodeling as to make it truly their own, not just a hand-me-down. Money and effort so spent seem to them doubly creative, as indeed they are. In proportion as the house is ancient, the newcomers are preserving history, and converting to their own comfort a valid remnant of human experience.

Hand in hand with an old house usually come old trees — mute but vital witnesses to the thought and feeling that made this place a home. Restoring these remnants too will help the newcomers to express and establish their own home-love, and more profoundly. The old house could be replaced by a new one in a matter of months. To regrow the old trees might take a century.

The question of what to do for old trees, and when to do it, is never so pressing as questions about an ancient house. This is a large part of old trees' charm. There they have stood for generations, while people came and went; and there, though they may be infirm and slowly dying, they will continue to stand for some time to come. Like old

soldiers, old trees never say die, and unless they are hit by a sure killer such as Dutch elm disease or chestnut blight, their fadeaway is slower and more gradual than most humans'. Resuscitating them can wait at least until the old house's new roof is paid for.

But don't postpone a survey of your old trees: an analysis of their condition and needs, and a reliable idea of what their repair will cost. To get these, there is no middle way. You need a professional. The sooner you call one in, the more the trees will mean to you from then on. For such a survey there is, or should be, no charge. Free estimates, and fair ones, are a hallmark of sincere tree service.

Safety is your first concern in this scrutiny. Your own eye can tell you if a heavy limb or broken peak hangs perilously over architecture, walk, or driveway. But experience is needed to spot a faulty crotch, a critical cavity, a trunk more "dozy" than it appears from the outside, or a tree whose imbalance is precarious because of the place it stands and the prevailing winds. Such structural dangers had better be faced and fixed than ignored and regretted. "Extended coverage" for storm damage is a term which most insurance companies construe loosely. It may cover the havoc wrought by a wind incontestably high, but not what an old tree wrecks when it collapses under heavy rain or snow. Even if you do collect on such damage, the inconvenience you suffer can be more grievous than a tree surgeon's bill for measures of prudence.

After they have been made safe, the next thing to do for old trees is renew their vigor. Enough has been said above (Chapter IV) about tree feeding to provide guidance for doing or bossing this work yourself. To recapitulate:

Your soil strata and the levels at which your trees' roots run can be determined by digging a few test holes.

If the root systems are predominantly shallow, simple broadcasting, and spiking the turf, may be the soundest way to reach them with fertilizer.

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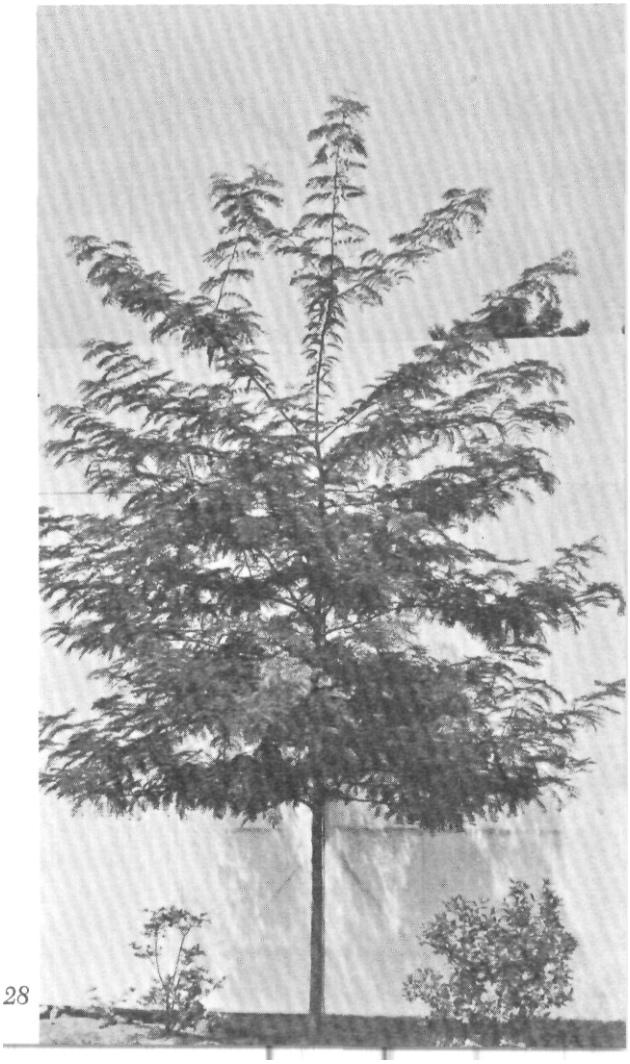
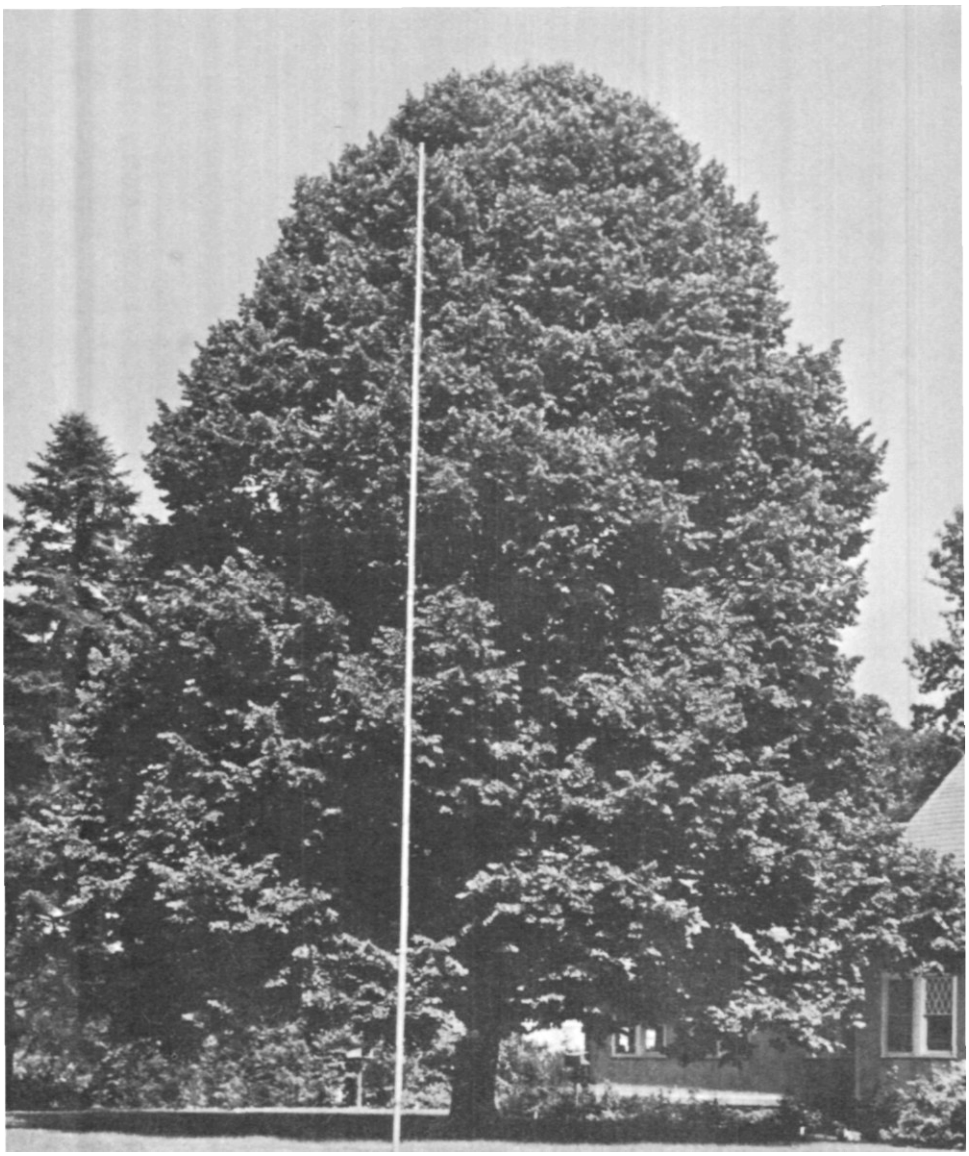
"How Long Must We Wait for Shade?" One quick answer to the new home owner's most pressing question is provided by Princeton Nurseries' new strain of locust called the Shademaster. The stock in rows above are only three years old. At right, a specimen of the same strain after three more years. The backboard is eighteen feet high.



28



Mature at Forty. Within two human generations this silver linden has reached its present splendor. The flagpole is fifty feet high. *(Photograph: Princeton Nurseries)*

Balling and Burlapping by professionals at Howe Nurseries, Pennington, N. J, Such work goes rapidly with many hands in the act. One man can get the same results if he takes his time. Nursery trees like these have been root-pruned in previous

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The spades go down around.

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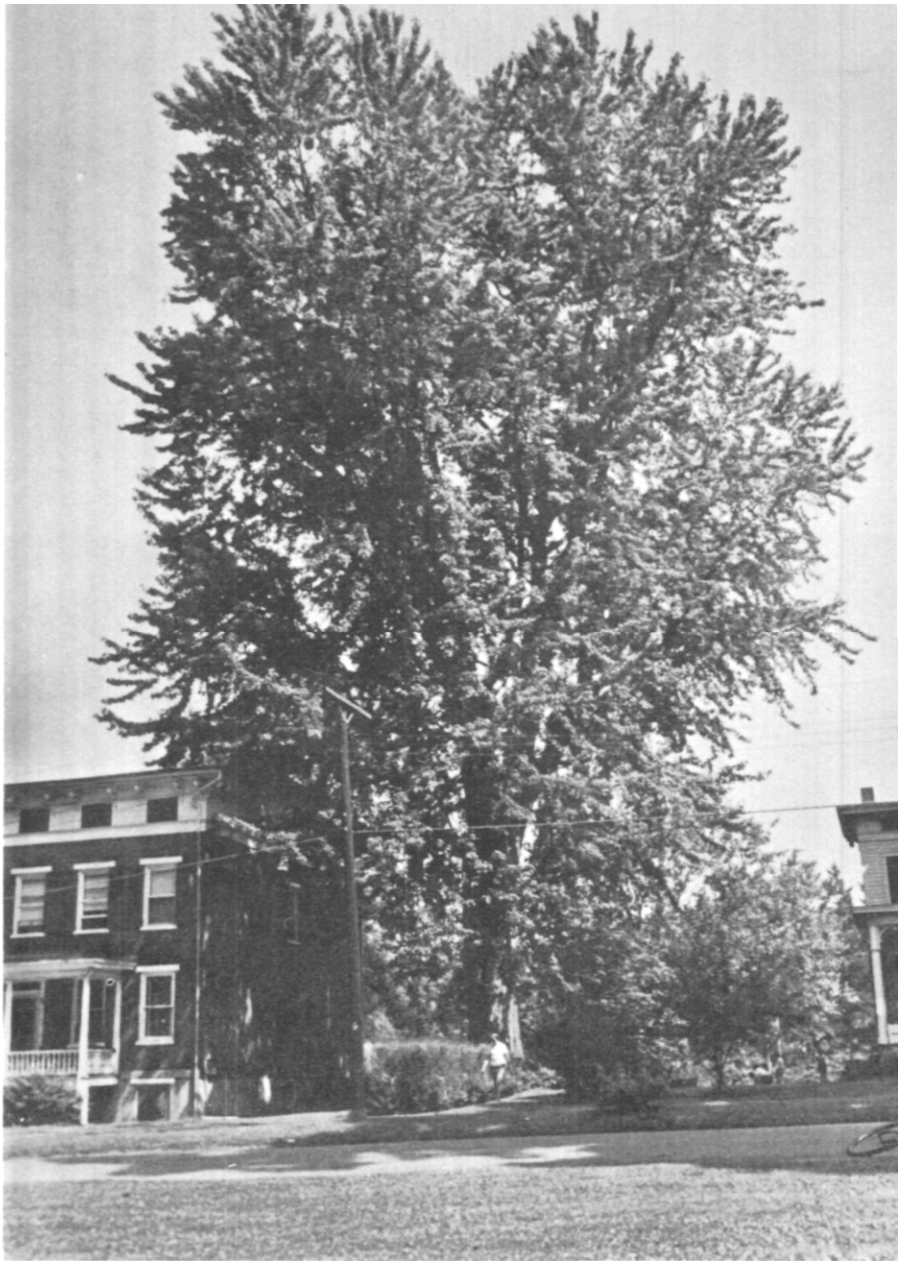
The root-ball comes out.

The burlap bag is formed.

A row of London planes ready to move.

33



A Neighborhood Menaced. Full of faulty crotches and trunk cavities, top-heavy with overgrowth and lush foliage, this silver maple nearly a hundred feet high menaces life, limb, architecture, and traffic. Huge yard trees, especially of such brittle species, should be severely topped and pruned, and multiple cabled. Note how this treacherous monster dwarfs the human lives beneath it.

If they root deeply, and the punch-bar or injector-needle methods of feeding are used, put the food insertions much closer together, more shallow, and extend them much farther beyond the branch spreads than most "experts" recommend.

Give up to five pounds of well-balanced dry fertilizer, or five gallons of dissolved, for each inch of trunk diameter breast high.

If an old tree seems in dire condition, and its special character impels you to give it special treatment, there are measures which the expert can take that have not been mentioned. One of these is foliar feeding—spraying the leaves with a solution containing freely available nitrogen, for quick assimilation into the sapstream. This procedure, which resembles putting a human patient under an oxygen tent, can be combined with an attack on the immediate cause of the tree's trouble, such as an insect (like gall mite) or a fungus disease (like anthracnose). A specific control agent for the parasite is sprayed on along with the nutrient solution.

Another procedure parallels intravenous feeding. An invigorator is put directly into the ailing tree's sap channels through holes bored at intervals around the trunk, where bottles with feeder tubes are hung.

Neither of the remedies just mentioned is inexpensive, and they should be bought only from practitioners of the highest repute. But sometimes one or both will work wonders, and well repay you.

It has been pointed out that, often as not, the basic cause of trouble aloft in an old tree lies down in its underpinning, *(See Photos.* 3, *4,* 5.) In finding and relieving "girdling" roots, your own efforts can match the experts'. But when severe restriction of moisture and nutrients has been of such long duration as to cause major dieback in a tree's head, much pruning will be needed aloft, of wood alive as well as dead. For this part of a salvage job it is folly not to hire

professionals. Ladders, ropes, and sharp tools up old trees are not for the novice.

Beyond such suggestions it is no more possible to generalize about treatment for infirm old trees than for infirm old people. Individuals alter cases, no two are just alike. More helpful will be some particularizing, from specific case histories:

On its savage transit in 1960, Hurricane Donna laid low a certain magnificent white oak—almost the peer of the Mercer Oak on the Princeton battlefield *(See Photo. 1)* or the Joyce Kilmer tree at New Brunswick. When we were asked to appraise its value for insurance purposes (our figure was about $1800, for, though the tree was faulty, a guesthouse had been sited expressly to enjoy it), we were also asked if anything might have been done—years ago—to safeguard such a monarch from such a fate. When we knocked the clinging sod and soil off its upturned roots, the great oak's Achilles' heel came immediately to view. Three main roots had been crossed and strangled by a fourth of equal size. The damage had been done right where the tapering of the killed roots should have gripped the ground most strongly. Whether or not timely excision of the constrictor root would have saved the rest, and judicious feeding on that side have improved the tree's anchorage, was of course problematical. But certainly, had its weakness been known, the tree's safety could have been secured by installing support cables.

The same hurricane leveled a huge and gorgeous English walnut around which the owner had focused all her garden planting and pleasure, including a swimming pool. This tree's massive roots were snapped like fiddlestrings, but they all appeared to be in perfect health. The fact was, their very health had helped bring about the tree's downfall. In that well-watered and fertilized site they had produced such a luxuriant crown that the walnut, for want of thinning aloft—and carrying a full September load of

nuts, too—was top-heavy. Drenched by Donna's downpour, blasted by her gusts like a tall schooner under full sail, the tree had capsized despite its splendid root system—or because of it. Here lay a lesson in few words: it is possible, through fondness, to grow "too much tree."

A case where ounces of prevention probably averted tons of woe was that of a lofty sycamore, one of those commanding, brightly mottled specimens sometimes called sachem. It stands close to a couple's cosy farmhouse, in the front lawn, where its position is such that a gaping hollow in its lower trunk, caused long ago by fire, presented an eyesore to the front porch and living room. We were asked to fill that cavity, for appearance's sake. We demurred, citing the cost, and persuaded the owners to let us remove about six truckloads of topside deadwood, caused by the damage below. We traced, rodded, and painted the cavity, making it almost as presentable as an expensive filling would have done, and even safer and healthier. Then we told the owners that, when next they fertilized their peach orchard, they might feed their old sycamore a few hundred pounds. This they did, and when a big blow knocked down several much younger, untended trees in their grounds a few seasons later, the sachem stood unscathed, and still so stands.

Another couple called us in to look at their feature black ash, a mastlike forty-incher. After long years of flourishing, the tree's head was now dying back on two sides and such new growth as it did make was coming out puny. Some one had told the owners that the tree was obviously blighted and had best be taken down, while the sawlogs were still good, before it died and fell. The tree stood in a corner of the clients' property, enclosed by a privet hedge on the same two sides that looked so sickly aloft. We asked how long the privet had been there. They said four years. With this as a clue, we dug down beside the privet and, at three feet, came to a thick layer of shale, on top of which

ran the ash roots. Any shallower-rooted tree might have obstructed, or prevented, the privet's planting. As it was, the privet—a growth as greedy as ash—was robbing its big neighbor and starving it out. The solution: deep-feed the ash, and remove the hedge at its corner.

As you drive through the countryside looking at other people's trees, notice that some of the most picturesque and interesting ones are the most imperfect. They are veterans whose characters are accentuated if not entirely imparted by their scars, deformities, or malignancies. To mind comes many a storm-tattered white pine, towering above its surroundings with what look like wild pennons of courage still flying high. Such landmarks can be preserved for generations by keeping their stubs trimmed, their diet ample, and by getting an electrician (a tree expert will be higher priced) to install lightning protection.

To mind comes an ancient catalpa, in a fine New Jersey lawn, which is bowed over so far that its trunk is horizontal, its branches vertical. *(See Photo.* 23.) Many people might have removed such a freak long ago, but the owners of this one cherish it. It looks like—and perhaps it is—an old trail-marker of the Delaware Indians.

On a back road in the Watchung hills stand four ancient red oaks, all much squattier than is their species* habit and each with grotesque lumps and knobs where the main lower limbs should be. Perhaps they were amputated in their youth by some woodsman, clearing a tote road, who was too busy to fell the trees entirely. Then cankers set in which deformed but failed to kill them, so that they have aged like a quartet of gnarled gnomes crouching at the roadside. To worry about the health of such a group, if they lived in your grounds, would be silly. To remove them in favor of more graceful trees would be to compound the woodsman's felony.

Most country dwellers are charmed and flattered when wild creatures take up residence in their grounds. An old

tree with otherwise deplorable dead stubs and cavities extends a warm invitation to wrens, bluebirds, woodpeckers, sparrow hawks, and the smaller owls, saw-whet and screech. Squirrels—red, gray, and flying—which might otherwise invade your attic will be content if they have a derelict tree to nest in. If rowdy starlings or English sparrows move in, there is one sure cure: a swab of kerosene.

The fondest possession of one gracious lady who wanted us to manicure all her other trees was a disreputable old silver maple close to her front patio. This one we were forbidden to touch, for in it, in a major cavity, lived a family of raccoons whose matriarch led forth her brood in the summer dusks and marched them across the lawn, down the driveway, for their fishing lessons at the creek.

If the old rampike that you leave standing for wild guests really disfigures its setting, plant trumpet-creeper or wisteria at its base and turn it into a showpiece. Against the day when it must fall down, plant a replacement tree nearby, but not too near.

A curious thing about some old trees is this: when they never looked better, they may be approaching their worst. A superannuated apple tree, for example, after years of steady decline will suddenly surprise you one spring by bursting into exaggerated bloom. Though it has borne little or no fruit for the longest time, this year it will produce quantities. Then, within another year or two, the tree is dead or next thing to it.

Authorities vary in their explanations of such behavior, which of course is variously caused. But in a general way there seems to be truth in the old saying, "That's Nature's way of perpetuating the species." Old trees with new troubles or an accumulation of chronic ones sometimes react with a burst of energy, as if trying to save themselves or their kind, and then give up trying.

The phenomenon is mentioned in this discussion of arboreal geriatrics because another fact about it is this; such

dying-gasp or death-throe activity will appear in old trees that have been entirely neglected, whose trouble is truly mortal, but seldom in trees that you have tried to help. If your feeding, root relief, and topside pruning have started an old tree on a new lease of life, you are not likely to see quick, dramatic results. Leaf color and annual growth will improve, dieback will lessen, but any stimulation provided by you should not produce suddenly a cloud of dogwood blossoms or a copious crop of spruce cones. If you do get such results, you are probably overdoing something, or doing something wrong.

For people of modest means, self-service to their trees is less a matter of choice than of necessity. The surest way for them to avoid mistakes, of omission or commission, is (to repeat): call in a professional. If he is half the man he should be, he will, in appreciation of such paid work as you really need and can afford, be glad to lay out a program for you to follow by yourself, and to see that you follow it. Some of the happiest clients are those who, with several old trees that need skilled attention, have their treeman arrange these in priority order and then budget their therapy piecemeal over the years until all are rehabilitated.

XII

PIRATES, GYPSIES, AND NOBLEMEN

In hiring professional tree care, write your own ticket, and focus on the foreman

I well remember my boyhood introduction to tree surgery.

Father had bought a few wooded acres on the outskirts of Winnetka, Illinois, our native heath, and there built a modest home. Mother now had happy scope for her love of gardening and of wild flowers, birds, and trees. We boys helped dig beds, plant borders, cut paths, and thin out the wild shrubbery.

With or without Father's knowledge, Mother called in a company then newly and widely advertised throughout the Midwest, to come and trim her trees. They were mostly elms, oaks, ash, thorn apples, and hickories, none of imposing size or character, but Mother thought them too shaggy for her taste and their own good.

I can still see the men in high laced boots with curved saws and pruning hooks on long poles. They dangled on ropes aloft in the trees, whittling stubs and overgrowth. They painted the cuts out of little cans slung from their safety belts. Tree techniques and equipment haven't changed much in half a century.

I also remember the piles of brush the "tree surgeons" left for us boys to pick up and burn, and the strange new look our trees now had—too tame to suit a pair of teenage

hunters and birds-eggers. In our private opinion Mother and her "surgeons" had just about ruined the Martin grounds, that is, made them less inviting to squirrels, crows, hawks, and other varmints. But we had to admit that the place looked much more civilized, more like the fine estates of richer families down along the lake front.

And then one evening Father got the bill. His single expletive was unforgettable: "Pirates!" Never thereafter would he call tree surgeons anything else, and "tree pirates" the whole breed remained for me for years to come.

When the hurricane of 1938 flattened dozens of trees and disfigured scores more in an acreage I then owned on Long Island, our one groundsman definitely needed professional help to clean up the shambles. With Father's epithet of long ago still in mind, I dealt warily with the tree service we engaged. This was my first experience as a client. I must say that the treatment both I and the trees got was as reasonable as it was expert. In five days a crew of nimble buckaroos brought order out of a chaos that had looked hopeless. Besides clearing the wreckage they shaped up and salvaged many partial casualties: took off torn limbs and hangers, pruned damaged tops back into balance, smoothed over angry wounds with their chisels and tree paint. My bill was considerable but, I felt, well earned by the skills applied. I gained a new respect for the "pirates" and thereafter, wherever I saw a crew of them at work, took new interest in watching them.

My own entrance into tree service as a proprietor was fortuitous. One day soon after World War II, having left weekly journalism in the big city for the less hectic life of a free-lance writer in rural upstate New York, I boarded a train at Albany and took a table seat in the club car. With me I had a manuscript just back from the typist which I wanted to check while I lunched. Into the seat opposite dropped a chunky, rosily handsome chap of about my age. We smiled and nodded, and I went on correcting copy.

"That looks like a movie script," ventured my vis-a-vis.

"Well, it is," I conceded, without looking up.

"Humph," he said, "I never saw a movie about *my* profession."

So I had to ask, "And what is *your* profession?"

Smiling happily he replied, "I'm a tree surgeon. And oh, boy! Could I tell you some stories that would make a heck of a movie!"

And he did, too. My manuscript lay untouched the rest of the way to town while I listened to escapes and escapades—some harrowing, some comical, all exciting—of the fearless fraternity called tree skinners.

My informant explained that any man content to earn his livelihood by climbing trees has to be a little bit "tetched" to start with. He has to be lean, muscular, nerveless, and somehow persuaded that trees are challenging. He must want to climb and conquer them no matter how tall and perilous. Finns, French Canadians, Scandinavians, and boys of German extraction—in that order—make the best tree workers, I was told. Due to their concentration on survival, and their pride of prowess, all of them tend to be prima donnas; sensitive to criticism, quick to anger, devil-may-care in their fun and games. I heard about ax fights on the ground and knife fights aloft; about nicking a braggart's rope "to see if he could take it" when he fell; about accidentally dropping heavy wood on a hated foreman's car, with him in it. And so on.

Actually, as I was to learn later when he became my valued friend and teacher, my voluble new acquaintance, whom we can call Rivers, was a conscientious, thoroughly informed student of trees and their therapy. He had been graduated by one of the big-company training schools and now had a thriving organization and practice of his own near Albany. At this first meeting of ours, he played up the picaresque just to get his profession some public notice. As

things turned out, instead of a screen drama, what he got was a disciple.

It so happened that just when Rivers entered my life I had been casting about to find a new story-line for one of the more two-fisted, daredevil screen actors of that day. As Rivers talked I formed this wondrous thought: why not, in a first act, send our Hollywood he-man up into the trees, keep him there for three acts, chucking rocks at him, finally let him down into the heroine's arms. In such a novel setting, with a lot of unfamiliar tools, rope tricks, and lingo, and any quantity of scary, offbeat camera angles, the picture would be sure-fire.

To be able to write such a scenario, I would first have to learn all the techniques and vernacular of tree-skinning. Before we parted at Grand Central, the robustious Rivers had promised to see to that. I could come and live with him awhile, go out on jobs with his men, learn the whole tree game from the ground up, as high as I cared to go.

On my return to Cooperstown, I learned that right there in our neighborhood was a perfectly good little tree service, highly esteemed for skill and integrity. Further inquiry brought to light a distressing fact: the owner-operator of this local concern had just met with an accident. It was his first serious mishap in thirty-five years of tree practice, and it was fatal.

It would not be fair to his widow to say that she cried on my shoulder and sold me the business. More accurately, I had by this time become so fascinated by tree work that, when I found the deceased had taught his young foreman just about all he himself had learned in a long and diligent career, I decided to combine enterprise with my research. I bought the business to learn by doing, and, by doing well, perhaps make some money, or not lose too much. The young foreman would be my teacher on the spot. The obliging Rivers would come over from Albany as our consultant.

My predecessor's foreman did not belong to any of the breeds recommended by Rivers. His name was Bob O'Brien and his boyish face did not bespeak rugged talents. When I learned that he had lugged heavy BARs and chauffeured Sherman tanks for General George S. Patton, I understood better how this cherub tackled the hugest trees and handled the toughest crewmen with smiling equanimity. His touch with tender young growths was as deft, as gentle, as it was commanding on big timber or a balky winch-truck. He had a true treeman's fondness for fine specimens and concern for ailing ones. Besides working under a master craftsman he had read the right books, and he continued to read more as Rivers assigned them to us.

With Rivers supervising our diagnoses and performance, we kept our local clientele happy and soon expanded widely. To our maintenance contracts around Cooperstown homes and country estates we added work on golf courses, cemeteries, the park and street trees of several towns and villages. We did roadside clearance for new highways and hazard removal throughout three counties. We had our own spray rig for pest control and with it we experimented —but only briefly, for the two don't mix—on brush control. In snowy winter we kept our men off the relief rolls by cutting and skidding sawlogs for lumber mills, pulpwood for paper companies, even elm planks for a casket factory out in Oneida which had "rough box" contracts for the war in Korea. Our proudest moment came when we were put in charge of the trees at General Electric's home plant in Schenectady, where the late Dr. Charles Steinmetz had planted many exotic species. (The little wizard used to do a lot of his best thinking up in a tree-house at his home.)

Through such varied experience I could hardly escape becoming familiar with a broad spectrum of other tree-service practitioners, our competitors. They ranged from district crews of the biggest, nationally advertised companies, to the itinerant, unschooled "gypsies" who roam

the land seasonally picking up small jobs from town to town. (As a regional representative in later years for one of the leading companies I learned that all too often there is little to choose between a "gypsy" and some of the boys the big advertisers hire but fail to train.) Companies doing line-clearance for public utilities—power and telephone-make a practice of paying their men minimum wages but letting them use the company trucks and tools to "buck" work over weekends for their own accounts. Trained only to hack trees back from poles and wires, most such operatives are strictly tree butchers, not surgeons, yet people will hire them just for their cheapness. Like the "gypsies," they are to be side-stepped if only because, despite what they will tell you, they can have no liability or compensation coverage.**

My arboreal screen epic never did get written, but not the least reward from my years with the trees was the opportunity to write this book. Its advice to readers on hiring professional tree care is derived from both sides of the fence, as client and as "expert."

My first suggestion is this: don't wait for a tree-service salesman to send you his literature or ring your doorbell. Beat him to it. Send for him.

This has the dual virtue of putting you at once in command of the interview and lessening your caller's anxiety about getting an order. He knows you are interested and so can concentrate on hearing your problems instead of describing—or inventing—problems for you. Take him out on your grounds and show him, from a written list in your

* Here involved are considerations of grave importance to the home owner. There are two kinds of "liability": 1) for damage to property by the worker, and 2) for damage to himself while working. If treemen are not insured against the former, you may have difficulty collecting from them after they knock a hole in your roof. If you or they are not insured against the latter (bodily injury), you may have difficulty resisting heavy claims for a broken leg or neck. Many prudent home owners carry general policies that protect them against injury to anyone working on, or even visiting, their grounds.

hand, just what you have in mind—this pruning, that bracing or cabling, some topping back here, some raising of branch levels there. When you have finished, let him have the floor. You will soon learn what manner of tree expert you have to deal with.

The high-pressure type will at once start calling your attention to conditions you failed to mention. He will dart away to examine trees you passed by, shaking his head solemnly. He may produce a knife and fall to probing a butt discoloration, looking for decay. A pocket microscope is also part of his equipment. This he will whip out to show you perilous scale on your rhododendrons, or spider-mites in the arborvitae. Before you know it he will outline a spraying and feeding attack on your entire grounds. Because you sent for him, and are admittedly a novice where trees are concerned, he regards you as a soft touch.

A more sincere and reliable type of salesman will take an opposite tack. After noting your instructions, he will begin his survey by asking you basic questions. How long have you lived here? What do you know of your trees' history? What has been done for them lately? He will ask if you have a groundsman or garden service, and if so how good they are. If you have already done some pruning he will notice and comment on it. He may ask if you have in mind a limit on what you want to spend on your trees. (By all means, give him a figure.) Equipped with all this information he will likely tell you he wants to go back over your trees by himself, with his field pad. He will give you his recommendations, with cost estimates, after that. Get these in writing.

Because you sent for him and had some clear ideas of your own, this man respects you and values his chance to get your business, not just for now but into the future. Chances are he will come up with a step-by-step, long-range plan for putting your trees into shape, calibrated to fit your budget. He may suggest deferring some of the

items you specified in favor of others he considers more pressing. He will be happy to help you help yourself on such items as minor surgery and feeding. This is a salesman to trust and cherish, one of Nature's noblemen.

Customarily, no charge is made for such a preliminary survey. If any salesman tries to bill you for it, write him off as a high-binder.

But the primary question remains: what tree service to call in? The yellow pages are full of such listings. The Buffalo and Philadelphia directories, for example, each carry three columns of them, St. Paul-Minneapolis seven columns, Denver eight columns, Boston nine, Chicago eleven, Pasadena and Washington, D.C., no less than sixteen columns each. Almost every smalltown directory contains at least a half-dozen names. How to pick and choose?

One way is to ask your County Agent, or the borough engineer. Better still, ask a neighbor whose trees look thrifty and show the marks of recent work. Rest assured that, having spent his money, your neighbor will readily applaud his own judgment, or lament it.

Often as not a well-recommended small company will prove as knowledgeable as one of the majors, and usually will be more prompt and economical. But you have nothing to lose, and maybe much to gain, by inviting a survey also from a company that advertises regionally or nationally. These people have big investments and reputations to protect. Their local representatives are prone to be just as hungry for business as the lesser operators, and therefore inclined to high-pressure you, but they can be assumed to be better informed, especially as to parasites and diseases for which remedies change from year to year. Also, local agents of big companies are strictly accountable. If you give them your work and later have complaints, you can get redress from higher authority.

When you make known your wishes—and may this book help you define them—be sure the salesman knows you are

going to compare his recommendations and prices with those of at least one other "expert." At the same time let him know you are not bargain-hunting. As in buying a car or painting a house, you cannot expect to get any better tree service than you pay for. Money spent on cheap tree work is money wasted.

Good tree service has to cost good money. Much more is involved in it than meets the eye. The workmen's wages may not average more than two dollars per man-hour, but before he profits the employer has many other costs to cover: compensation and liability premiums, outlay and maintenance on vehicles and tools, warehousing, office overhead, selling expenses, training time, supervision, advertising.

A not unreasonable rate for a two-man crew with truck and tools is around $12 an hour. Add at least four dollars an hour labor charge for each additional worker above two. Add specific material costs such as cable, eyebolts, wood screws, wound dressing, cavity fill. It follows that you cannot expect to get a day's tree work done—good work, that is—for less than about $60 per operative on the job.

An important fact to remember is that, except where the tree company proprietor is his own salesman and foreman, the man who takes your order is not the man who will do your work. The salesman will lay it out, price it, inspect it when finished, but he turns over its actual execution to a crew foreman. Some information about this important character will not come amiss, and your asking for it should not be so taken.

A foreman can make or break a salesman, by performing good jobs or botches for the prices set. (Fairest to both parties is a "not to exceed" price in which the company has some leeway but passes any savings back to the client.) In looking over your trees and estimating the time and materials they require, the salesman must translate in terms of a given crew's work capacity. This will vary directly with

the foreman's ability, his attitude, and his men's attitude toward him. When you are satisfied that the salesman knows his business, means well by you, and has written up your order fairly enough, ask him about the foreman he plans to assign to your job. How long has he had this foreman? Where are he and his men working now? May you visit and watch them at work? If there is any question about a foreman's quality, this line of questioning will soon smoke it out. Good foremen are the backbone of all tree service, and good salesmen are delighted to show them off.

The best foremen are workers who have come up through the ranks in the same company, and not too quickly. They are not men who have switched around from company to company to get higher pay, or young fancy Dans promoted early just because the companies were shorthanded. You can usually spot a first-rate tree foreman by his economy of motion and of words. He keeps an eye on his men's work as it goes along, and keeps them moving. Before his juniors come down from their trees he makes sure all their cuts are properly made and painted so that time will not be lost sending a man up again. He handles the most ticklish operations himself. His men don't hesitate to ask his help or instruction, because they trust his leadership and he has given them crew spirit.

If such a foreman comes to you with questions or suggestions after the salesman has gone, he may not strike you as being a brilliant conversationalist, but listen to him carefully. He is up in the trees every day. He can see much more up there than can ever be seen from the ground. Even if his ideas differ from yours and the salesman's, unless they are miles out of line, accept them.

In a like way, the best salesmen are those who came up from foreman. They are taken out of the trees, put into business suits, and promoted to a drawing-account-plus-commissions basis primarily because of their thorough know-how, not their persuasiveness. I am speaking now of

big-company salesmen. From the client's viewpoint, former foremen are the best. They are the least likely to be high-pressure artists.

Big companies must have volume to meet their overhead. They have to support a hierarchy of high brass, promotion hotshots, cost accountants, billing clerks, and laboratory and research staffs which give the company prestige but serve the customers very vaguely. Throughout the organization there is harsh emphasis on sell, *sell,* SELL. To put firecrackers under the salesmen's coattails, meetings are held at which the most unblushing Babbittries are enunciated. Contests are conducted, with prizes for the fiercest go-getters. Lectures and literature analyze the prospects' sales resistance, and how to break it down. A favorite theme is snob appeal—keeping up with the Joneses.

This type of training produces glib spielers who have learned their tree patter in the company's sales seminars. They might as well be selling automobiles or brushes door-to-door. Nowadays the big companies hire all too many of this type in their frantic pursuit of business volume. But for treemen tried and true, fancy sales techniques have no charm. Short of the direct question to men who solicit your business, "Have you yourself worked in the trees?" a sound rule for judging them is: the less they talk, the more you can believe them.

APPENDIX

SHADE TREE VALUES

Without expanding this book beyond a size proportionate to its purpose it was impossible to deal at any length with the special tree problems and tree values of special regions like Florida or Southern California. It would have been nice to include mention of Alaska's graceful and valuable balsam poplar and yellow cedar, and of sandalwood in Hawaii and experiments in those islands with English oak and other exotics as sources of lumber. But there simply was not room for such tempting frills.

However, to augment the book's range and usefulness, space has been made in this Appendix for "Shade Tree Evaluation," the authoritative listing and grading of North American home-grounds species, published jointly by the National Shade Tree Conference and the National Arborist Association, with whose permissions it is presented here. The lists have been rearranged for the convenience of non-professionals by alphabetizing the English names and italicizing their Latin names in parentheses. For explanation of how the "Shade Tree Evaluation" formula is applied, see Chapter IX.

The authors of "Shade Tree Evaluation" currently contemplate a revision of their lists, but this will not importantly affect the present scales except to raise the values assigned to certain of the smaller, ornamental species.

States and Provinces included in each of the regions in the lists of trees are:

I. New England: Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont. II. Eastern: New Jersey, New York, Pennsylvania. III. Southern: Alabama, Delaware, District of Columbia, Florida, Georgia, Louisiana, Maryland, Mississippi, North Carolina, South Carolina, Tennessee, Texas, Virginia, West Virginia. IV. Central: Indiana, Kentucky, Michigan, Ohio. V. Midwestern: Arkansas, Colorado, Illinois, Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota, Oklahoma, South Dakota, Wisconsin. VI. Western: Arizona, California, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, Wyoming, British Columbia. VII. Eastern Canada: Ontario and Quebec.

REGION I-NEW ENGLAND

Class No. 1—100%

Beech, American *(Fagus grandifolia)*
Birch, European White *(Betula pendula)*
Hemlock, Canada *(Tsuga canadensis)*
Locust, Common Honey *(Gleditsia triacanthos)*
Maple, Sugar *(Acer saccharum)*
Oak: Eastern Red *(Quercus borealis maxima)*
Pin *(Quercus palustris)*
Scarlet *(Quercus coccinea)*
Swamp White *(Quercus bvcolor)*
White *(Quercus alba)*
Pine, Eastern White *(Pinus strobus)*
Serviceberry, Shadblow *(Amelanchier canademis)*
Tulip tree *(Liriodendron tulipifera)*
Tupelo, Black *(Nyssa sylvatica)*

Class No. 2-80%

Apple, Common *(Malus pumila)*
Ash: Black *(Fraxinus nigra)*
European Mountain (*Sorbus aucuparia)*
Green {*Fraxinus pennsylvanica lanceolata)*
Red (*Fraxinus pennsylvanica)*
White *(Fraxinus americana)*
Birch: River *(Betula nigra)*
Sweet *(Betula lenta)*
Hickory: Bitternut *(Carya cordiformis)*
Mockerrmt (*Carya tomentosa)*

Pignut *(Carya glabra)* Shagbark *(Carya ovata)* Maple, Red *(Acer rubrum)* Oak, Chestnut *(Quercus montana)*
Fear, Common *(Pyrus communis)*
Pine, Red *(Pinus resinosa)*
Sassafras *(Sassafras albidum)*
Spruce, Black *(Picea mariana)*
Walnut, Black *(Juglans nigra)*

' Class No. 3-60%

Ash, American Mountain *(Sorbus americana)* Aspen, Quaking *(Populus tremuloides)*
Birch, Yellow *(Betula lutea)*
Horsechestnut, Common *(Aesculus hippocastanum)* Linden, American [Basswood] *(Tilia americana)* Oak: Black *(Quercus velutina)* Swamp Chestnut *(Quercus prinus)* Plane, American [Sycamore] (*Platanus occidentalis)*
Poplar: Balm of Gilead *(Populus candicans)* Eastern (*Populus deltoides)*
Spruce, White *(Picea glauca)*
Willow: Babylon Weeping *(Salix babylonica)* Black ***(Salix** nigra)* Brittle *(Salix fragilis)* Shining *(Salix lucida)* White *(Salix alba)*

Class No. 4—40%

Aspen, Big-tooth *(Populus grandidentata)*
Birch, Gray *(Betula populifolia)*
Cherry, Wild Black *(Prunus serotina)*
Elm: American *(Ulmus americana)* Rock *(Ulmus thomasii)*
Fir, Balsam *(Abies balsamea)*
Larch, Eastern [Tamarack] *(Larix kiricina)*
Locust, Black *(Robinia pseudoacacia)*
Maple, Silver *(Acer saccharinum)*
Mulberry: Red *(Morus alba)* White *(Morus alba)*
Pine, Jack *(Pinus banksiana)*
Poplar, White *(Populus alba)*
Spruce, Red *(Picea rubens)*
Tree-of-heaven [Ailanthus] *(Ailanthus altissima)*

Class No. 5—20%

Boxelder *(Acer negundo)*
Butternut *(Juglans cinerea)*
Catalpa, Northern *(Catalpa speciosa)*
Elm, Slippery *(Ulmus fulva)*
Pine, Pitch *(Pinus rigida)*

REGION II-EASTERN

Class No. 1—100%

Beech: American *(Fagus grandifolia)* European *(Fagus sylvatica* var.)
Crabapples, Flowering (*Malus* sp. and var.) Cypress, Common Bald *(Taxodium distichum)* Dogwood, Flowering (*Cornus fiorida)*

Elm, American *(Vlmus americana)*
Ginkgo *(Ginkgo biloba)*
Hawthorn; Pauls Scarlet (Cra*taegus oxyacantha paulii)*
Washington *(Crataegus phaenopyrum)*
Hemlock, Canada *(Tsuga canadensis)*
Holly, American *(Ilex opaca)*
Hornbeam, American *(Carpinus caroliniana)* Katsura tree *(Cercidiphyllum \aponicum)*
Locust, Moraine Thornless Honey *(Gleditsia tnacanthos moraine)*
Magnolia, Cucumber-tree *(Magnolia acuminata)* Maple: Erect Norway *(Acer platanoides erectum)* Red *(Acer rubrum)* Sugar *(Acer saccharum)* Oak: Eastern Red *(Quercus borealis maxima)* Pin *(Quercus palustris)* Shingle {*Quercus imbricaria)* Shumard (*Quercus shumardii)*
White *(Quercus alba)* Willow *(Quercus phellos)* Sourwood *(Qxydendrum arbo-reum)*

Class No. 2-80%

Ash, Green *(Fraxinus pennsylvanica lanceolata)* Cork tree, Amur *(Phellodendron amurense*) Goldenrain tree, Panicled *(Koelreuteria paniculata)* Hawthorns *(Crataegus* sp.) Hickory, Shagbark *(Carya ovata)*
Horsechestnut: Common *(Aesculus hippocastanurn)* Red *(Aesculus carnea)*
Linden, Little-leaf {*Tilia cotdata)* Maple: Norway *(Acer platanoides)*
Schwedler Norway *(Acer platanoides schwedleri)*
Oak: Overcup *(Quercus lyrata)* Scarlet *(Quercus coccinea)* Swamp Chestnut *(Quercus prinus)* Swamp White *(Quercus bicolor)* Pagoda tree, Japanese *(Sophora japonica)* Pine, Eastern White *(Pinus strobus)*
Plane: American [Sycamore] *(Platanus occidentalis)* London (*Platanus acerifolia)* Serviceberry, Shadblow *(Amelanchier canadensis)* Sweetgum (*Liquidamber styracif.ua)* Tulip tree *(Liriodendron tulipifera)* Tupelo, Black [Blackgum] *(Nyssa sylvatica)*
Walnut, Black *(Juglans nigra)*
Yellowwood *(Cladrastis luiea)*

Class No. 3-60%

Birch: Gray *(Betula populifolia)* Yellow *(Betula lutea)*
Buckeye, Ohio *(Aesculus glabra)*
Coffee tree, Kentucky *(Gymnocladus dioica)*
Elm, English *(Vlmus procera)*
Hackberry, Common *(Celtis occidentalis)*

Hickories *(Carya* sp.)
Hophornbeam *(Ostrya virginiana)* Linden, American [Basswood]
(Tilia americana) Locust, Common Honey *(Gledltsia triacanthos)* Maple, Sycamore *(Acer pseudoptatanus)*
Oak: Bur *(Quercus macrocarpa)*
Chestnut (*Quercus montana)*
Post *(Quercus stellata)*
Upright English *(Quercus robur fastigiata)*
Persimmon, Common *(Diospyros virginiana)* Pine: Austrian *(Pinus nigra)*
Red *(Pinus resinosa)*
Redbud, Eastern *(Cercis canadensis)* Sassafras, Common *(Sassafras aU bidum)*
Spruce, Blue Colorado *(Picea pungens glauca)*

Class No. 4—40%

Locust, Black *(Robinia pseudoacacia)*
Maple, Silver *(Acer saccharinum)*
Mulberry *(Moms* sp.)
Osage-Orange *(Madura pomifera)*
Pawpaw, Common *(Asimina triloba)*
Spruce, Norway *(Picea abies)*
Willow, Babylon Weeping *(Salix babylonica)*

Class No. 5—20%

Boxelder *(Acer negundo)*
Catalpa, Northern *(Catalpa speciosa)*
Elm, Siberian *(Ulmus pumila)*
Poplar: Eugene *(Populus canadensis eugenei)*
Lombardy *(Populus nigra)*
Tree-of-heaven [Ailanthus] *(Acanthus altissima)* Willows *(Salix* sp.)

REGION III-SOUTHERN

Class No. 1—100%

Beech: American *(Fagus grandifolia)*
European *(Fagus sylvatica)* Dogwood, Flowering *(Cornusftorida)*
Ginkgo *(Ginhgo biloba)* Holly, American *(Ilex opaca)* Locust, Moraine Thornless Honey *(Gleditsia triacanthos moraine)*
Magnolia, Southern *(Magnolia grandiftora)*
Maple, Red *(Acer rubrum)* Oak: Bur *(Quercus macrocarpa)*
Laurel *(Quercus laurifolia)*
Live *(Quercus virginiana)*
Overcup *(Quercus lyrata)*
Scarlet *(Quercus coccinea)*
Shingle *(Quercus imbricaria)* Shumard (*Quercus shumardii)*
White *(Quercus alba)* Willow *(Quercus phellos)* Pine: Loblolly *(Pinus taeda)*
Long-leaf *(Pinus palustris)*

Class No. 2-80%

Cypress, Common Bald *(Taxodium distichum)*

Ekn: American (*Ulmus americana)*
Cedar *(Ulmus crassifolia)* Rock *(Ulmus thomasii)* Winged *(Ulmus alata)* Goldenrain tree, Panicled *(Koelreuteria paniculata)* Hemlock; Canada *(Tsuga canadensis)* Carolina *(Tsuga caroliniana)* Locust, Thornless Honey *(Gleditsia triacanthos inermis)* Maple: Florida *(Acer floridanum)* Sugar *(Acer saccharum)* Oak, Swamp Chestnut *(Quercus prinus)* Pecan *(Carya illinoensis)* Pine, Eastern White *(Pinus strobus)* Sweetgum *(Liquidambar styraciflua)* Tulip tree *(Liriodendron tulipifera)* Tupelo, Black [Blackgum] *(Nyssa sylvatica)* Walnut, Black *(Juglans nigra)*

Class No. 3-60%

Ash, White *(Fraxinus americana)*
Buckeye, Ohio *(Aesculus glabra)*
Cedar: Atlas *(Cedrus atlantica)* of Lebanon *(Cedrus libani)*
Hickories *(Carya* var.)
Hophornbeam, American *(Ostrya virginiana)*
Hornbeam, American *(Carpinus caToliniana)*
Horsechestnut, Common (*Aesculus hippocastanum)*
Magnolia, Sweetbay *(Magnolia virginiana)*
Maple, Norway *(Acer platanoides)*
Oak, Southern Red *(Quercus fatcata)* Plane, American [Sycamore] *(Platanus occidentalis)* Sassafras, Common *(Sassafras albidum)* Serviceberry, Shadblow {*Amelanchier canadensis)* Sourwood (*Oxydendrum arboreum)* Willow, Babylon Weeping *(Salix babylonica)* Yellowwood, American *(Cladrastis lutea)*

Class No. 4—40%

Ash, Green *(Fraxinus pennsylvanica lanceolata)* Hackberry, Common *(Celtis occidentalis)* Linden, Little-leaf *(Tilia cordata)* Magnolia, Cucumber-tree *(Magnolia acuminata)* Oak: Blackjack *(Quercus marilandica)* Post *(Quercus stellata)* Water *(Quercus nigra)* Osage-Orange *(Maclura pomi-fera)*

Class No. 5—20%

Boxelder *(Acer negundo)*
Catalpa, Southern *(Catalpa bignonioides)* Cherry, Carolina Laurel *(Prunus caroliniana)*
Chinaberry *(Melia azedarach)*
Elm, Siberian *(Ulmus pumila)*
Locust, Black *(Robina pseudoacacia)*
Maple, Silver *(Acer saccharinum)*
Mulberry, Red *(Morus rubra)*
Oak: Eastern Red *(Quercus borealis maxima)* Pin *(Quercus palustris)*

Persimmon *(Diospyros virginiana)*
Pine, Short-leaf *{Finns echinata)*
Poplar: Eugene *(Populus canadensis eugenei)* Swamp [Swamp Cotton-wood] *(Populus hete-rophylla)*
Kedbud, Eastern (*Cercis canadensis)* Tree-of-heaven
[Ailanthus] *(Ailanthus altissima)* Willow, Black *(Salix nigra)*

REGION IV-CENTRAL

Class No. z~ioo%

LARGE TREES—*Mostly 60 feet and above*

Elm: American *(Ulmus americana)*
Sarnia Smooth-leaf [Wheatleyi] (*Ulmus carpinifolia sarniensis)*
Locust, Moraine Thornless Honey *(Gleditsia triacanthos moraine)*
Maple: Norway *(Acer platanoides)*
Sugar *(Acer saccharum)*
Oak: Eastern Red *(Quercus borealis maxima)*
Scarlet *(Quercus cocdnea)*
Schneck *(Quercus shumardii schneckii)* Shingle (*Quercus imbricaria)*
White *(Quercus alba)*
Sweetgum, American *(Liquidambar styracifiua)*
Tupelo, Black [Sourgum] *(Nyssa sylvatica)*

MEDIUM TREES—*Mostly 30 to* 45 *feet*

Cork tree: Amur *(Phellodendron amurense)*
Sakhalin (*Phellodendron sachalinense)*
Ginkgo, Sentry *(Ginkgo biloba fastigiata)* Hophornbeam, American *(Ostrya virginiana)*
Linden, Little-leaf *(Tilia cordata)*
Maple, Erect Norway *(Acer platanoides erectum)* Oak: Sawtooth *(Quercus acutissima)*
Willow *(Quercus phellos)*
Yellowwood, American *(Chdrastis lutea)*

SMALL TREES—*Mostly 2,0 to 30 feet*

Crabapples, Flowering *(Malus* sp. and var.) Dogwood: Flowering (*Cornus florida)*
Japanese Cornel *(Cornus officina-lis)* Goldenrain tree, Panicled *(Koelreuteria paniculata)* Hawthorn, Washington *(Cratae-gus Phaenopyrum [cordata])*
Hornbeam, Pyramid European (*Carpinus betulus fastigiata*)
Magnolia, Saucer *(Magnolia soulangeana)* Maple: Mono *(Acer mono)*
Tartarian *(Acer tartaricum)*

Trident *(Acer buergerianum)*

Class No. 2-80%

LARGE TREES—*Mostly 60 feet and above*

Beech: American *(Fagus grandifolia)* Cut-leaf European *(Fagus sylvatica heterophylla)* European *(Fagus sylvatica)* Coffee tree, Kentucky *(Gymnocladus dioica)* Elm, English (*Ulmus procera [campestris])* Ginkgo *(Ginkgo biloba)* King, Crimson See MAPLE Linden: Crimean *(Tilia euchlora)* Silver *(Tilia tomentosa)* Silver-pendent *(Tilia petiolaris)* Magnolia, Cucumber-tree *(Magnolia acuminata)* Maple: Crimson King Norway *(Acer platanoides)* Red *(Acer rubrum)* Schlesinger Red *(Acer rubrum schlesingerii)* Oak: Black *(Quercus velutina)* Chestnut (*Quercus mon*-tana)* Pin *(Quercus palustris)* Pagoda tree, Japanese *(Sophora japonica)* Plane, London *(Platanus acerifolia)* Tulip tree *(Liriodendron tulipifera)*

MEDIUM TREES—*Mostly 30 to 40 feet*

Birch, River *(Betuh nigra)* Elm, Chinese [Asiatic] *(Ulmus parvifolia)* Eucommia *(Eucommia ulmoides)* Goldenlarch, Lovely *(Pseudolarix amabilis)* Hornbeam, American *(Carpinus caroliniana)* Horsenut, Ruby Red *(Aesculus carnea brtotii)* Katsura tree *(Cercidiphyllum japonicum)* Magnolia, Large Kobus *(Magnolia kobus borealis)* Maple: Column Red (Acer *rubrum columnare)* Hedge *(Acer campestre)* Upright Sugar *(Acer saccharum columnare)* Oak: Chinkapin *(Quercus muhlenbergii)* English *(Quercus robur)* Pyramidal English *(Quercus robur fastigiata)* Sassafras, Silky *(Sassafras albidum molle)* Zelkova, Japanese *(Zelkova serrata)*

SMALL TREES—*Mostly 20 to 30 feet*

Cherries, Flowering *(Prunus* sp, and var.) Dogwood, Pagoda *(Cornus alternifolia)* Euonymus, Maack (*Euonymus maackii)* Hawthorn, Fleshy (*Crataegus succulenta)* Lilac, Japanese Tree (*Syringa amurensis japonica)* Magnolia: Kobus *(Magnolia kobus)* Purple Lily *(Magnolia liliflora nigra)* Sweetbay (*Magnolia virginiana)* Maple: Amur *(Acer ginnala)* Devil *(Acer diabolicum)*

Paperbark *(Acer gri-*

Tschonoski *(Acer tschonoskii)*

Vine (Acer circinatum)

Redbud: Eastern (Cercis canadensis)

White {Cercis canadensis alba)

Serviceberry, Alleghany (Amelanchier laevis)

Class No. 3-60%

Large Trees—Mostly 60 feet and above

Ash: Blue (Fraxinus quadrangulata)

Green (Fraxinus pennsylvanica hnceohta)

White (Fraxinus americana) Cypress, Common Bald *(Taxodium distichum)*

Elm, Rock *(Ulmus ihomasii)*

Hackberry: Common *(Celtis occidentalis)*

Sugar *(Celtis laevirgata [mississippi' ensis]*)

Kalopanax *(Kalopanax pictus)*

Larch, Japanese *(Larix leptolepis)*

Linden, Big-leaf *(Tilia platyphyllos)*

Maple, Sycamore *(Acer pseudophtanus)*

Oak, Laurel *(Quercus laurifolia)*

Willow, Thurlow Weeping *(Salix elegantissima*

MEDIUM TREES—30 *to 45 feet*

Ash' European *(Fraxinus excel, sio)*'

Birch, Paper (Betula papyrifera)

Cherry, Sargent (Frunus sargentii) Chestnut, Chinese (Castanea mollissima) Evodia, Hupeh (Evodia hupehensis) Hemiptelea, David (Hemiptelea davidii) Silverball,

Mountain (Halesia monticola)

Small Trees—20 to 30 feet

Euonymus, Yeddo yedoensis)

Lilac, Pekin (Syringa pekinensis)

Class No. 4—40%

No Large Trees in this class.

Medium Trees— Mostly 30 to 45 feet

Birch, Cut-leaf European White *(Betula pendula gracilis)*

Class No. 5—20%

LARGE TREES—*Mostly 60 feet and above*

Elm, Siberian *(Ulmus pumila)*

Maple, Silver *(Acer saccharium)*

No Medium or Small Trees in class.

REGION V-MIDWESTERN

Class No. 1-100%

Beech, American *(Fagus grandifolia)* Hophornbeam, American *(Ostrya virginiana)* Locust, Moraine Thornless Honey *(Gleditsia triancanthos moraine)* Maple: Norway *(Acer platanoides)* Red *(Acer rubrum)* Sugar *(Acer saccharum)* Oak: Bur *(Quercus macrocarpa)* Eastern Red *(Quercus borealis maxima)* Pin *(Quercus palustris)* White *(Quercus alba)*

Class No. 2-80%

Ash: Green *(Fraxinus pennsylvanica lanceolata)* White *(Fraxinus americana)* Ginkgo *(Ginkgo biloba)* Hackberry, Common *(Celtis occidentalis)* Hickory, Shagbark *(Carya ovata)* Linden, Little-leaf *(Tilia cordata)* Locust, Thornless Honey *(Gleditsia triacanthos inermis)* Walnut, Black *(Juglans nigra)*

Class No. 3-60%

Buckeye, Ohio *(Aesculus glabra)* Cherry, Black *(Prunus serotina)* Elm, Slippery *(Ulmus fulva)* Horsechestnut, Common *(Aesculus Hippocastanum)* Plane, American [Sycamore] *(Phtanus occidentalis)*

Class No. 4—40%

Cherry, Pin *(Prunus pennsylvanica)* Elm: American *(Ulmus americana)* Moline *(Ulmus americana molinensis)* Linden, American [Basswood] *(Tilia americana)* Poplar, Bolleana *(Populus alba bolleana)*

Class No. 5—20%

Ash, American Mountain *(Sorbus americana)* Boxelder *(Acer negundo)* Catalpa, Northern *(Catalpa speciosa)* Elm, Siberian *(Ulmus pumila)* Locust, Black *(Robinia pseudoacacia)* Maple, Silver *(Acer saccharinum)* Poplar: Eastern [CottonwoodJ *(Populus deltoides)* White *(Populus alba)* Tree-of-heaven [Ailanthus] *(Ailanthus altissima)* Willows *(Salix* sp.)

ROCKY MOUNTAIN SHADE TREES FOR IRRIGATED AREAS 4000 TO 6000 FEET

LARGE TREES

Class No. 1—100%

Buckeye, Yellow *(Aesculus octandra)* Coffee tree, Kentucky *(Gymnocladus dioica)*

Elm, American *(Ulmus americana)* Hackberry, Common *(Celtis occidentalis)* Horsechestnut, Common *(Aesculus hippocastanum)* Linden: American *(Tilia americana)* European (*Tilia europaea)* Locust, Thomless Honey *(Gleditsia triacanthos inermis)* Maple, Silver *(Acer saccharinum)* Oak, Bur *(Quercus macrocarpa)*

Class No. 2-80%

Ash, Green *(Fraxinus pennsylvanica lanceolata)* Birch: Cut-leaf European White *(Betula pendula graci-lis)* European White *(Betula pendula)* Gray *(Betula populifolia)* Paper {*Betula papyrifera)* Buckeye, Ohio *(Aesculus glabra)* Catalpa, Northern *(Catalpa speciosa)* Elm, English *(Ulmus procera)* Maple: Cut-leaf Silver *(Acer saccharinum laciniatum)* Norway *(Acer platanoides)* Schwedler Norway *(Acer phtanoides schwedleri)* Sugar *(Acer saccharum)* Oak: English *(Quercus robur)* Pin *(Quercus palustris)* Southern Red *(Quercus falcata)* Walnut, Eastern Black *(Juglans nigra)*

Class No. 3-60%

Ash, White *(Fraxinus americana)* Cherry, Black *(Prunus serotina)* Elm, Siberian *(Ulmus pumila)* Larch *(Larix* sp.) Maple, Sycamore *(Acer pseudoplatanus)* Mulberry: Red *(Morus rubra)* Russian *(Morus alba tatarica)* Oak: Scarlet *(Quercus coccinea)* White *(Quercus alba)* Plane, American [Sycamore] *(Platanus occidentalis)* Poplar, Plains *(Populus sargen-tii)*

Class No. 4—40%

Boxelder *(Acer negundo)* Butternut *(Juglans cinerea)* Ginkgo *(Ginkgo biloba)* Poplar: Andrews *(Populus andrewsii)* Bolleana *(Populus alba bolleana)* Eugene *(Populus canadensis eugenei)* Lombardy *(Populus nigra italica)* Narrow-leaf *(Populus angustifolia)* Simon *(Populus simonii)* Southern [Balsam] *(Populus deltoides missouriensis)* White *(Populus alba)* Tulip tree *(Liriodendron tulipifera)* Willows *(Salix)*

SMALL TREES

Class No. 1—100%

Ash: American Mountain *(Sorbus americana)* European Mountain *(Sorbus aucuparia)* Oakleaf Mountain *(Sorbus hybrida)*

Catalpa, Chinese *(Catalpa ovata)*
Cherry, Sour *(Prunus cerasus)*
Crabapple: Dolgo *(Malus* sp.)
Hopa *(Malus pumila)* Kedsilver *(Mains pumila)* Goldenrain tree, Panicled *(Koelreuteria paniculata)* Hawthorn:
Cockspur *(Crataegus crusgalli)*
Washington *(Cratae~gus phaenopyrum)*
Linden, Little-leaf (*TUia cordata)*
Maple, Amur *(Acer ginnala)*
Olive, Russian *(Eleagnus angustifolia)* Pagoda tree, Japanese *(Sophora japonica)*
Yellowhorn, Shiny-leaf *(Xanthoceras sorbifolium)*

Class No. 2-80%

Alder, Thin-leaf *(Alnus tenuifolia)* Apricot, Siberian *(Prunus sibirica)* Aspen, Quaking *(Populus tremuloides)* Crabapple: Bechte] *(Malus ioensis plena)* Eley
Purple (*Malus purpurea eleyi)*
Niedzwetskyana *(Mains pumila)* Prairie *(Malus ioensis)* Siberian *(Malus baccata)* Hawthorn:
Colorado *(Crataegus coloradensis)*
Dotted (*Crataegus punctata)* Pauls Scarlet *(Crataegus oxyacantha paulii)* Lilac, Japanese tree *(Syringa amurensis japonica)* Locust, New Mexico (*Robinia neomexicana)* Mulberry, Weeping *(Morus alba pendula)* Walnut, Texas Black *(Jughns rupestris)* Willow, Laurel *(Salix pentandra)*

Class No. 3-60%

Birch, Water *(Betula fontinalis)*
Crabapple, Japanese Flowering *(Malus floribunda)*
Hawthorn, Willow (*Crataegus soligna)*
Maple, Hedge *(Acer campestre)*
Plum, Newport American *(Prunus americana)*
Redbud, Eastern (*Cercis canadensis)*
Yellowwood, American *(Cladrastis lutea)*

Class No. 4—40%

Alder, European (*Alnus glutinosa)* Beech, European *(Fagus sylvatica)* Catalpa, Southern *(Catalpa bignonioides)*
Crabapple: *(Malus* sp. and var.)
Arnold *(Malus arnoldiana)* Carmine (*Malus astrosanguinea)*
Parkman Halls *(Malus haUiana parktnani)*
Hickory *(Carya* sp.) Hornbeam, European *(Carpinus betulus)*
Tree-of-heaven [Ailanthus] (*Ailanthus altissima)*

FOR HIGH ALTITUDES, MOUNTAIN AREAS, 6000 TO 9000 FEET

In many very high towns, the native evergreens are the only street trees possible.

LARGE TREES

Class No. 1—100%

Poplar; Lance-leaf *(Populus acuminata)* Narrow-leaf *(Populus angustifolia)*

Class No. 2-80%

Fir, Alpine *(Abies lasiocarpa)*
Pine: Bristlecone *(Pinus aristata)*
Limber *(Pinus flexilis)*
Lodgepole *(Pinus contorta latifolia)* Poplar: Eugene *(Populus canadensis eugenei)* Southern [Balsam] *(Populus deltoides missouriensis)*
Spruce: Colorado *(Picea pungens)* Englemann *(Picea englemanni)* Willow:
Sharp-leaf *(Salix acutifolia)*
Yellow-stem White *(Salix alba vitellina)*

SMALL TREES

Class No. 1—100%

Aspen, Quaking *(Populus tremuloides)*

Class No. 2-80%

Aspen, Big-tooth *(Populus grandidentata)* Willow, White *(Salix alba)*

FOR DRY PLAINS AREAS, 3500 TO 5000 FEET

LARGE TREES

Class No. 1—100%

Elm, Siberian *(Ulmus pumila)*
Hackberry, Common *(Celtis occidentalis)* Locust, Common Honey *(Gleditsia triacanthos)* Poplar, Plains *(Populus sargentii)*

Class No. 2-80%

Ash, Green *(Fraxinus pennsylvanica lanceolata)* Elm, American (*Ulmus americana)* Maple, Silver *(Acer saccharinum)*

SMALL TREES

Class No. 1—100%

Olive, Russian *(Eleagnus angustifolia)*

Class No. 2-80%

Mulberry, Russian *(Morus alba tatarica)*

REGION VI-WESTERN

FAR NORTHERN SECTION (BRITISH COLUMBIA)

Class No. i~ioo%

Beech, European *(Fagus sylvatica)* Dogwood, Pacific (*Cornus nuttalln)* Elm, American *(Ulmus americana)* Hawthorn, English (*Crataegus oxyacantha)*
Maple: Hedge *{Acer campestre)*
Red *(Acer rubrum)* Vine *(Acer circinatum)* Oak: Northern Red *(Quercus borealis)*
Pin *(Quercus palustris)* Scarlet *(Quercus coccinea)* Sweetgum *(Liquidambar styraciflua)*
Tulip tree *(Liriodendron tulipifera)*

Class No. 2-80%

Ash, Flowering *(Fraxinus ornus)*
Cedar, Eastern Red *(Juniperus virginiana)* Fir, Common Douglas *(Pseudotsuga taxifolia)*
Holly, English *(Ilex aquifolium)*
Horsechestnut, Red *(Aesculus earned)* Locust, Black *(Robinia pseudoacacia)* Maple: Norway *(Acer platanoides)* Silver *(Acer saccharinum)* Sugar *(Acer saccharum)*
Plane, London (*Platanus acerifolia)* Plum: Blireiana *(Prunus blireiana)*
Purple-leaf Myrobalan (*Prunus cerasifera pissardii)*

Class No. 3-60%

Ash *(Fraxinus* sp.)
Birch, European White *(Betula pendula)*
Cypress, Lawson False *(Chamaecyparis lawsoniana)*
Ginkgo *(Ginkgo biloba)*
Laburnum, Goldenchain *(Laburnum anagyroides)*

Class No. 4—40%

Boxelder *(Acer negundo)* Linden *(Tilia* sp.) Poplar *(Populus* sp.)
Willow, Babylon Weeping *(Salix babylonica)*

NORTHERN SECTION (OREGON-WASHINGTON)

Class No. 1—100%

Maple: Montpelier *(Acer monspessulanum)* Schwedler Norway *(Acer platanoides schwedleri)*
Plane, California [Sycamore] *(Platanus racemosa)* Tulip tree *(Liriodendron tulipi-jera)*

Class No. 2-80%

Birch, Cut-leaf European *(Betula pendula gracilis)* Cedar: Blue Atlas *(Cedrus atlantica gkiuca)*
California Incense *(Libocedrus decurrens)*
Cherries, Oriental *(Prunus serrulata)* Chestnut, Japanese (*Castanea crenata)* Cypress, Hinoki *(Chamaecyparis obtusa)* Hawthorn, Washington *(Crataegus phaenopyrum)* Hornbeam, American *(Carpinus caroliniana)* Horsechestnut, Red *(Aesculus carnea)* Laburnum, Scotch *(Laburnum alpinum)* Magnolia, Kobus *(Magnolia kobus)* Maple: Hedge *(Acer campestre)* Japanese *(Acer palmatum)* Norway *(Acer platanoides)*
Red *(Acer rub-rum)*
Sycamore *(Acer pseudoplatanus)*
Oak, English *(Quercus robur)*
Plane, London *(Platanus acerifolia)* Plum: Blireiana *(Prunus blireiana)*
Purple-leaf Myrobalan (*Prunus cerasifera pis* sardii)*
Spruce, Blue Colorado *(Picea pungens glauca)*
Sweetgum *(Liquidambar styraciflua)*

Class No. 3-60%

Ash, European Mountain *(Sorbus aucuparia)* Beech, Purple European *(Fagus sylvatica atropunicea)* Birch, Yellow *(Betula lutea)* Boxelder, Silver-leaf *(Acer negundo variegatum)* Cedar, Deodar *(Cedrus deodara)*
Cryptomeria *(Cryptomeria japonica)*
Cypress: Lawson False *(Chamaecyparis lawsoniana)* Sawara False (*Chamaecyparis pisifera)*
Dogwood, Pacific *(Cornus nuttallii)* Hawthorn, English *(Crataegus oxyacantha)*
Laburnum, Goldenchain *(Laburnum anagyroides)* Locust: Black *(Robinia pseudo-acacia)* Honey *(Gleditsia triacanthos)* Madrona, Pacific *(Arbutus menziesii)*
Oak, Scarlet *(Quercus coccinea)*
Pine, Austrian *(Pinus nigra)*
Sassafras *(Sassafras albidum)*

Class No. 4—40%

Araucaria, Monkey-puzzle *(Araucaria araucana)* Arborvitae, Giant *(Thuja plicata)* Catalpa, Southern *(Catalpa bignonioides)* Fir, Common Douglas *(Pseudotsuga taxifolia)* Horsechestnut *(Aesculus hippocastanum)*
Ivy, English *(Hex aquifolium)*
Willow, Babylon Weeping *(Salix babylonica)*

Class No. 5—20%

Ash, Oregon *(Fraxinum oregona)*
Maple: Big-leaf *(Acer macropkyllum)* Silver *(Acer saccharinum)*

NORTHERN CALIFORNIA COASTAL SECTION

Class No. 1—100%

Beech, Purple *(Fagus sylvatica atropunicea)* Cedar, California Incense *(Libocedrus decurrens)* Ginkgo *(Ginkgo biloba)* Hawthorn:
English *(Crataegtis oxyacantha)*
Lavalle (*Crataegtis lavallei)*
Washington *(Crataegus phaenopyrum)*
Hornbeam, American *(Carpinus caroliniana)*
Horsechestnut *(Aesculus carnea)*
Linden, Little-leaf (*Tilia cordata)* Lyon tree, Fern-leaf *(Lyonothamnus asplenifolius)* Magnolia, Southern *(Magnolia grandiftom)* Oak: Holly *(Quercus ilex)*
Pin *(Quercus palustris)*
Plum, Blireiana (*Primus blireana)* Sweetgum, American *(Liquidambar styradflua)* Tulip tree *(Liriodendron tulipijera)* Yew, Irish English *(Taxus baccata fastigiata)*

Class No. 2-80%

Ash, Velvet *(Fraxinus velutina)*
Birch, European White *(Betula pendula)* Cajeput tree *(Melaleuca leucadendron)*
Carob *(Ceratonia siliqua)* Cedar:
Atlas *(Cedrus atlantica)*
Deodar *(Cedrus deodara)* Date,
Canary (*Phoenix canariensis)*
Elm, Chinese *(XJlmus parvifolia)*
Eucalyptus, Scarlet (*Eucalyptus ficifolia)* Goldenrain tree,
Panicled *(Koelreuteria paniculata)* Holly,
English *(Ilex aquifolium)*
Madrona, Strawberry *(Arbutus unedo)*
Maple, Red *(Acer rubrum)* Pine:
Canary *(Pinus canariensis)*
Italian Stone *(Pinus pined)*
Plane, London *(Platanus acerifolia)* Plum, Purple-leaf Myrobalan *(Prunus cerasifera pissardii)*
Privet, Glossy (*Ligustrum lucidum)*
Redwood *(Sequoia semperoirens)*
Sequoia, Gaint *(Sequoia gigantea)* Tea tree, Victoria *(Leitospermum laevigatum)*

Class No. 3-60%

Camphor-tree (*Cinnamomum camphora)*
Cherry, Cataline *(Prunus lyonii)*
Elm, American (*Ulmus americana)*
Eucalyptus, Tasmanian Blue (*Eucalyptus globulus)*
Grevillea, Silk-oak *(Grevillea robusta)*

Hakea, Sea-urchin (*Hakea laurina)* Madrona, Pacific *(Arbutus menziesii)* Maple, Big-leaf *(Acer macrophyllum)* Palm: California Washington *(Washingtonia filifera)* Washington (*Washingtonia* sp.) Pepper tree, California *(Schinus molle)* Pine, Monterey *(Pinus radiata)* Pittosporum, Orangeberry (*Pittosporum undulatum)* Spruce, Blue Colorado (*Picea pungens glauca)* Willow, Babylon Weeping *(Salix babulonica)*

Class No. 4—40%

Acacia, Bailey *(Acacia baileyana)* Draecena, Giant *(Cordyline australis)* Locust, Black *(Robinia pseudoacacia)* Palm, Fortunes Windmill (Trachy carpus fortunei)

Class No. 5—20%

Acacia, Blackwood *(Acacia melanoxylon)* Boxelder *(Acer negundo)* Poplar, Lombardy *(Populus nigra italica)*

NORTHERN CALIFORNIA INLAND SECTION

Class No. 1—100%

Albizzia, Silk-tree *(Albizzia julibrissin)* Carob *(Ceratonia siliqua)* Cedar, Blue Atlas *(Cedrus atlantica glauca)* Cherry, Holly-leaf *(Prunus ilicifolia)* Eucalyptus, Pink Mulga Ironbark *(Eucalyptus sideroxylon rosea)* Ginkgo *(Ginkgo biloba)* Hackberry: Chinese *(Celtis sinensis)* European *(Celtis australis)* Hawthorn: Pauls Scarlet *(Crataegus oxyacantha paulii)* Washington *(Crataegus phaenopyrum)* Laurel, Grecian *(Laurus nobilis)* Locust, Thornless Honey *(Gleditsia triacanthos inermis)* Loquat *(Eriobotrya japonica)* Magnolia, Southern {*Magnolia grandiftora)* Mayten, Chile *(Maytenus boaria)* Myrtle, Common Crape *(Lagerstroemia indica)* Oak: California Live *(Quercus agrifolia)* Canyon Live *(Quercus chrysolepis)* European Turkey *(Quercus cerris)* Holly *(Quercus ilex)* Interior Live *(Quercus wisHzeni)* Shumard *(Quercus shumardii)* Olive, Common *(Olea europaea)* Pagoda tree, Japanese *(Sophora japonica)* Pecan *(Carya iUinoensis)* Pine: Aleppo *(Pinus halepensis)* Italian Stone *(Pinus pinea)* Pistache, Chinese *(Pistada chinensis)* Pittosporum, Willy *(Pittosporum phillyraeoides)*

Podocarpus, Yew *(Podocarpus macrophyllus)* Privet, Glossy (*Ligustrum lucvdum)* Redbud, Eastern *(Cercis canadensis)* Tulip tree *(Liriodendron tulipifera)*

Class No. 2-80%

Apricot, Japanese *(Prunus mume)*
Ash, Velvet *(Fraxinus velutina)*
Birch, European White *(Betula pendula)* Camphor tree (*Cinnamomum camphora)*
Cherry: Catalina *(Prunus lyonii)*
Higan (*Prunus subhirtelto)* Oriental *(Prunus serrulata)* Yoshino *(Prunus yedoensis)* Crabapples, Flowering *(Mains* sp.) Elm: Chinese *(Ulmus parvifolia)*
English *(Ulmus procera)*
Siberian *(Ulmus pumtla)*
Smooth-leaf *(Ulmus carpinifolia)* Eucalyptus:
Moitch *(Eucalyptus rudius)*
Pink Mulga Ironbark (*Eucalyptus sideroxylon rosed)*
Ribbon *(Eucalyptus viminalis)*
Goldenrain tree, Panicled *(Koelreuteria paniculata)*
Horsechestnut, Red *(Aesculus carnea)*
Laburnum, Waterer *(Laburnum water eri)*
Locust, Decaisne Black *(Robinia pseudoacacia decaisneana)*
Maple, Trident *(Acer buergerianum)* Mulberry, White [Fruitless] *(Morus alba)*
Oak: Bur *(Quercus macrocarpa)*
California White *(Quercus lobata)*
English *(Quercus robur)*
Peach, Flowering *(Prunus persica)* Persimmon, Kaki *(Diospyros kaki)* Pine: Canary *(Ptnus canariensis)*
Coulter *(Pinus coulteri)*
Plum, Flowering *(Prunus triloba)*
Sweetgum, American (*Liqui<-dambar styraciflua)* Tanoak *(Lithocarpus densifhrus)* Thorn, Jerusalem *(Parkinsonia aculeata)*
Walnut, Persian *(Juglans regia)*
Willow: Babylon Weeping *(Salix babylonica)* Yellow-stem Weeping *(Salix alba vitellina)*
Zelkova, Japanese *(Zelkova serrata)*

Class No. 3-60%

Almond *(Prunus amygdalus)*
Arborvitae, Oriental *(Thuja orientalis)* Bottle tree, Kurrajong *(Brachychiton populneum)*
Buckeye, California *(Aesculus calijornica)* Cedar, California Incense (*Libocedrus decurrens)* Chestnut, European *(Castanea sativa)* Cypress, Common Bald (*Taxodium distichum)* Elm, American *(Ulmus americana)*

Grevillea, Silk-leaf *(Grevillea robusta)* Rackberry, Common *(Celtis occidentalis)* Horsechestnut, Common *(Aesculus hippocastanum)* Jujube, Common *(Zizyphus jujuba)* Maple: Big-leaf *(Acer macrophyllum)* Silver (*Acer saccharinum)*
Mulberry, Black *(Morus nigra)*
Oak, Pin *(Quercus palustris)*
Palm, California Washington *(Washingtonia filifera)*
Papermulberry, Common *(Broussonetia papyrifera)* Paulownia, Royal *(Paulownia tomentosa)* Plum, Pissard Purple-leaf *(Prunns cerasifera atropurpurea)*
Redwood, Dawn *(Metasequoia glyptostroboides)* Walnut, Hinds Black *(Juglans hindsii)* Wing-nut, Chinese *(Pterocarya stenoptera)*

Class No. 4—40%

Catalpa, Northern *(Catalpa speciosa)* Laurel, California (*Umbellularia calif ornica)* Pepper tree, California *(Schinus moUe)*
Plane: American [Sycamore] *(Platanus occidentalis)* California *(Platanus racemosa)* London *(Platanus acerifolia)* Poplar, Lombardy *(Populus nigra italica)* Redwood *(Sequoia sempervirens)*

Class No. 5—20%

Chinaberry *(Melia azedarach)*
Date, Canary *(Phoenix canariensis)*
Fig, Common *(Ficus carica)*
Osage-Orange (*Madura pomifera)*
Pine, Digger *(Pinus sabiniana)*
Tamarisk, *Aiihel(Tamarixaphtjlla)*
Tree-of-heaven [Ailanthus] *(Ailanthus altissima)*

SOUTHERN CALIFORNIA SECTION

Class No. 1—100%

Ash, Shamel *(Fraxinus uhdet)*
Carob *(Ceratonia siliqua)* Cedar, Deodar *(Cedrus deodara)*
Magnolia, Southern *(Magnolia grandifiora)*
Oak, Holly *(Quercus ilex)* Palm, Mexican Washington *(Washingtonia robusta)*
Pittosporum, Orangeberry *(Pittosporum undulatum)*
Podocarpus, Yew *(Podocarpus macrophyllus)* Sweetgum, American *(Liquidambar styraciflua)*

Class No. 2-80%

Ash, Velvet *(Fraxinus velutina)*
Camphor tree (*Cinnamomum camphora)* Date, Canary (*Phoenix canariensis)*
Elm, Chinese *(Ulmus parvifolta)*
Eucalyptus, Pink Mulga Ironbark *(Eucalyptus sideroxylon rosea)*
Ginkgo *(Ginkgo biloba)* Myrtle, Common Crape *(Lagerstroemia indica)* Pepper tree, Brazil *(Schinus terebinthifolia)*

Pittosporum, Diamond-leaf *(Pittosporum rhombifolium)*
Privet, Japanese *(Ligustrum japonicum)*

Class No. 3-60%

Chestnut, Cape *(Calodendrum capense)*
Eucalyptus: Lehmann *(Eucalyptus lehmanni)*
Scarlet (*Eucalyptus ficifolia)*
Goldenrain tree, Panicled *(KoeUreuteria paniculata)* Pepper tree, California *(Schinus molle)*
Pine: Canary *(Pinus canariensis)*
Italian Stone *(Pinus pinea)*
Pistache, Chinese *(Pistacia chinensis)*
Tulip tree *(Liriodendron tulipifera)*

Class No. 4—40%

Acacia, Cootamundra-wattle *(Acacia bailey ana)* Alder, Sierra *(Alnus rhombifolia)* Cedar, California Incense *(Libocedrus decurrens)* Cherry, Carolina Laurel *(Prunus caroliniana)* Clethra, Lily-of-the-valley *(Clethra arborm)*
Oak, California Live (*Quercus agrifolia)* Palm: Fortunes Windmill *(Trachycarpus fortunei)*
Queen *(Arecastrum romanzoffianum)* Tristania, Brisbanebox *(Tristania conferta)*
Zelkova, Japanese *(Zelkova serrata)*

Class No. 5—20%

Acacia, Blackwood *(Acacia melanoxylon)* Bauhinia, Purple (*Bauhinia purpurea)* Beefwood, Coast (*Casuarina stricta)* Birch, European White *(Betula pendula)* Bottle tree, Kurrajong *(Brachychiton populneum)* Grevillea, Silk-oak *(Grevillea robusta)* Oak, California White *(Quercus lobata)* Palm, California Washington *(Washingtonia filifera)* Pine, Aleppo *(Pinus halepensis)* Plane, London *(Platanus acerifolia)*

REGION VII-CANADA

FOR ONTARIO, SOUTH OF OTTAWA

Class No. 1—100%

Beech, Purple European *(Fagus sylvatica atropunicea)* Linden, Little-leaf *(Tilia cordata)*
Maple: Norway *(Acer platanoides)*
Schwedler Norway *(Acer platanoides schwedleri)*
Sugar *(Acer saccharum)*
Oak, Eastern Red *(Quercus borealis maxima)*

Class No. 2-80%

Ash: European Mountain *(Sorbus aucuparia)* White *(Fraxinus americana)*
Beech, European *(Fagus sylvatica)*
Elm, American *(Ulmus americana)*
Hickory, Bitternut *(Carya cordiformis)*
Hornbeam, American (*Carpinus caroliniana)*
Locust, Thornless Honey *(Gleditsia triacanthos inermis)*
Oak, Pin *(Quercus palustris)*
Plane, American [Sycamore] *(Platanus occidentalis)*
Walnut, Black *(Jughns nigra)*

Class No. 3-60%

Birch, European White *(Betula pendula)*
Ginkgo *(Ginkgo biloba)*
Horsechestnut, Common *(Aesculus hippocastanum)*
Magnolia, Cucumber-tree *(Magnolia acuminata)*
Maple, Silver *(Acer saccharinum)*
Tulip tree *(Liriodendron tulipifera)*
Yellowwood, American *(Cladrastis lutea)*

Class No. 4—40%

Catalpa, Northern *(Catalpa speciosa)* Coffee tree, Kentucky *(Gymnocladus dioica)* Elm, Siberian *(Ulmus pumila)*

Class No. 5—20%

Boxelder *(Acer negundo)*
Poplars *(Populus* sp.) Tree-of-heaven [Ailanthus] *(Ai-lanthus altissima)*

FOR VICINITY OF MONTREAL

Class No. 1—100%

Elm, American (*Ulmus americana)*
Linden: Crimean *(Tilia euchlora)* Little-leaf (*Tilia cordata)* Maple: Norway *(Acer platanoides)* Schwedler Norway *(Acer platanoides schwedlerii)* Sugar *(Acer saccharum)*
Oak, Eastern Red *(Quercus borealis maxima)*

Class No. 2-80%

Ash, White *(Fraxinus americana)*
Ginkgo *(Ginkgo biloba* [male])
Hackberry, Common *(Celtis occidentalis)* Hawthorn, Washington *(Crataegus phaenopyrum)* Hickory, Bitternut *(Carya cordiformis)* Hophornbeam, American *(Ostrya oirginiana)* Lilac, Japanese Tree (*Syringa amurensis japonica)* Locust, Thornless Honey *(Gleditsia triacanthos inermis)* Pine, Scotch *(Pinus sylvestris)* Pear, Callery *(Pyrus calleryana)*
Spruce, Blue Colorado *(Picea pungens glauca)*

Class No. 3-60%

Ash, Green *(Fraxinus pennsylvanica hnceolata)* Crabapple, Siberian *(Malus baccata)* Dogwood, Giant *(Cornus controversa)*

Maple, Silver *(Acer saccharinum)*
Walnut, Black *(Juglans nigra)*
Yellowwood, American *(Cladrastis lutea)*

Class No. 4—40%

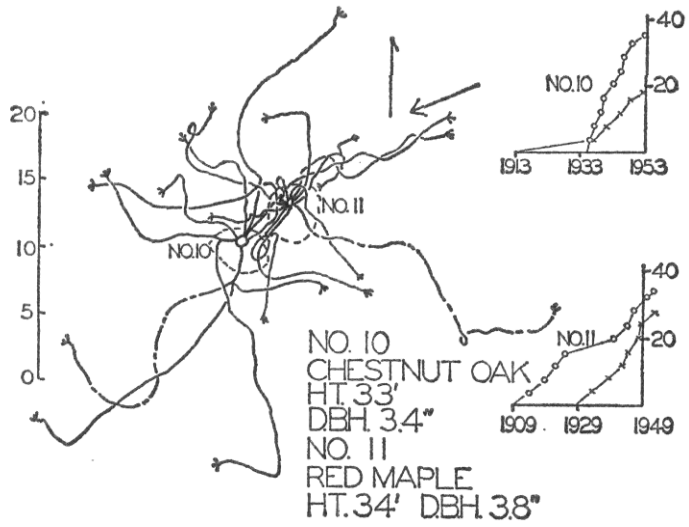
Catalpa, Northern *(Catalpa speciosa)* Coffee tree, Kentucky *(Gymnocladus dioica)* Cork tree, Sakhalin *(Fhettodendron sachalinense)*
Horsechestnut, Common *(Aesculus hippocastanum)*
Willow: Laurel *(Salix pentandra)* Thurlow Weeping *(Salix elegantisdma)* White *(Salix alba)* Wisconsin Weeping *(Salix blanda)*

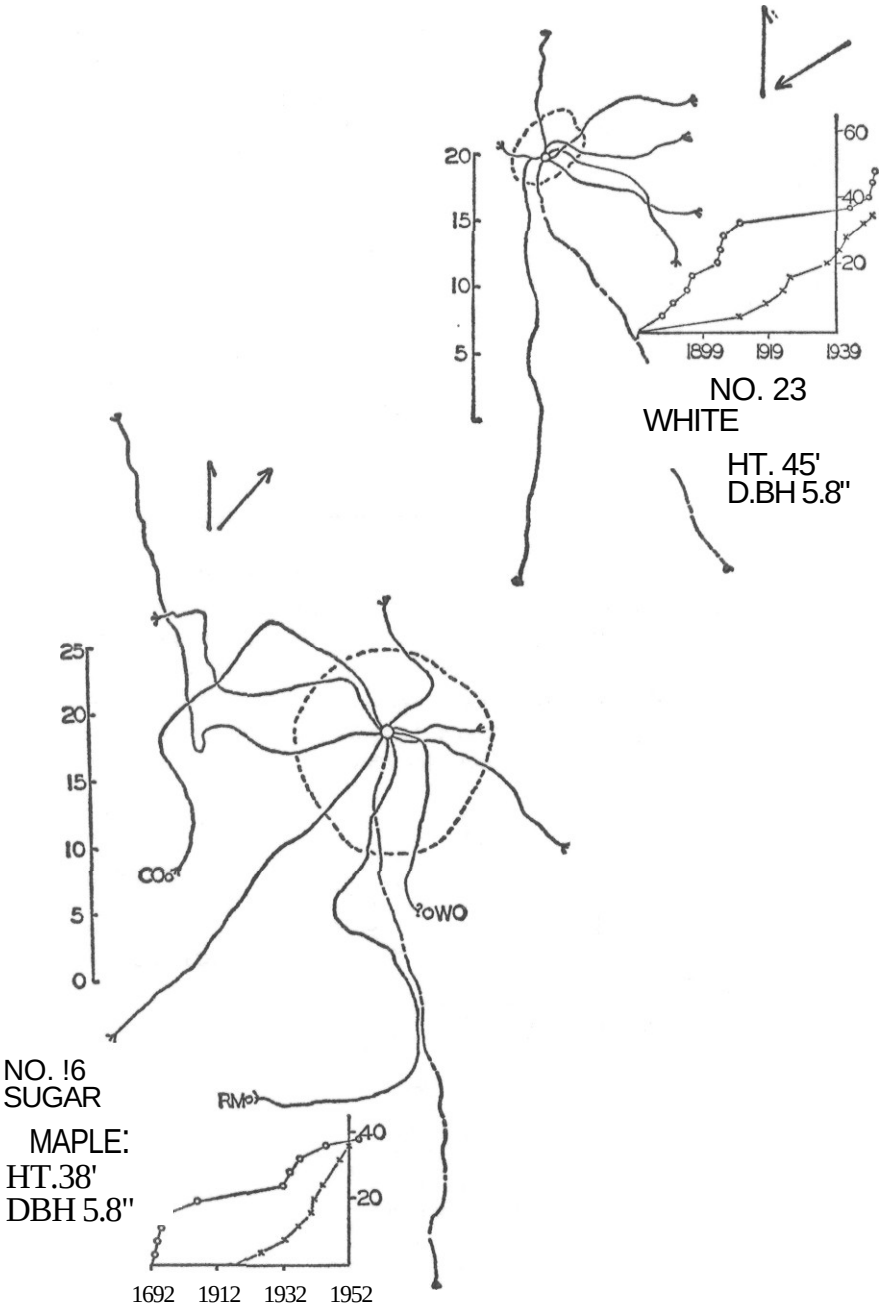
Class No. 5—20%

Birch: Ermans *(Betula ertnani)* European White *(Betula pendula)* Locust, Decaisne Black *(Robinia pseudoacacia decaisneana)*
Poplars *(Populus* sp.)

MORE DIAGRAMS FROM STOUTS ROOT STUDIES

As explained in the text on p. 40, Professor Ben Stout of Rutgers showed, by exposing and tracing out 25 forest trees' root systems, that the latter reached into areas 3.4 to 40.7 times as great as the ground-space under their crowns. In Mr. Stout's diagrams on this and the next page, dotted lines show crown areas, solid lines the major roots. Graphs give stem (—0—) and root (—x—) growth data in feet and years.




20
15
10
5
60
40
20
1899
1919
1939
NO. 23
WHITE
HT. 45'
D.BH 5.8"
25
20
15
10
5
0
CO6
?oWO
RM?
40
20
1692
1912
1932
1952
NO. !6
SUGAR
MAPLE:
HT.38'
DBH 5.8"

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