

# Shade Tree Pruning



TREE PRESERVATION BULLETIN NO. 4

# Shade Tree Pruning

*by A. Robert Thompson*

*Forester*

*National Park Service*



UNITED STATES DEPARTMENT OF THE INTERIOR

STEWART L. UDALL, *Secretary*

NATIONAL PARK SERVICE

Conrad L. Wirth, *Director*

For Sale by the Superintendent of  
Documents, U.S. Government Printing  
Office, Washington 25, D. C.

Price 15 Cents

## Foreword

Over 20 years ago the National Park Service was confronted with the problem of improving and maintaining in good condition thousands of valuable shade, ornamental, or historically significant trees within a variety of areas. In order to guide those who were responsible for this work in park areas, a most complete and useful series of nine Tree Preservation Bulletins was prepared between 1935 and 1940 by the late A. Robert Thompson, forester in the Branch of Forestry, National Park Service. The original Bulletin No. 4, *Shade Tree Pruning*, was one of this series.

Although the bulletins were originally intended for park employees, they received wide use of arborists and this demand has continued. They are being reissued from time to time to meet this need.

The revised series will total seven in number. The original Bulletins 1 and 2, *Purpose and Policy*, which referred to National Park Service practices only, are being replaced by the earlier Bulletin No. 9, now No. 1, *Transplanting Trees and Other Woody Plants* and Bulletin No. 8, now No. 2, *Safety for Tree Workers*. Bulletin No. 6, *General Spraying and Other Practices*, was revised and reissued in 1953 and the new Bulletin No. 1 in 1954.

This bulletin, *Shade Tree Pruning*, remains No. 4 in the series. Except for very minor revisions, it is essentially unchanged from the original, attesting to Bob Thompson's complete and expert knowledge of the subject.

CONRAD L. WIRTH, *Director*

# *Contents*

	<i>Page</i>
Introduction	1
Reasons for Pruning	4
Influence of Light on Growth	5
Best Time for Pruning	6
Essential Pruning Equipment	6
Pruning Procedure	7
Shaping the Cut	8
Removal of Branches	9
Removal of V-Crotches	10
Roping Heavy Limbs	11
Pole Saws and Pole Pruners	14
Dehorning	15
Removal of Old Stubs	16
Suckers and Watersprouts	16
Pruning Transplanted Trees	17
Pruning Diseased Trees	19
Storm-damaged Trees	20
Pruning Conifers	21
Pruning Shrubbery	22
Paints and Wound Dressings	23
Pruning Standards	25

# *Introduction*

L. H. Bailey defines pruning as "the methodical removal of parts of a plant with the object to improve it in some respect for the purposes of cultivation." Proper pruning of trees involves the removal of branches in such a manner that injury to the cambium is minimized, and the wound left in the most favorable condition for rapid healing with the cut surface so treated as to prevent infection. A large percentage of tree cavities which require expensive treatment are the result of careless pruning or lack of periodic applications of a good tree-wound dressing.

Since a tree probably is benefited as much per dollar of cost by efficient pruning as from any other single phase of tree preservation, it is readily apparent that tree workers should thoroughly understand the principles of correct pruning and become skilled in pruning technique.

No attempt can be made in the brief pages of this bulletin to cover all phases of tree pruning, but it is hoped that those who are concerned with preserving trees will gain some measure of benefit from the discussion of the principles and technique involved in pruning shade trees.

Pruning is one of the essential phases of tree preservation and certainly ranks in importance with cultivation, feeding, bracing, and control of diseases and insects. The process of pruning is usually an invigorating one since it allows more nourishment to go to the remaining parts. It is not devitalizing unless carried to excess. It should be realized, however, that excessive pruning of live wood often has a definite stunting effect not only on the appearance but on the life and vitality of the tree.

It should be remembered that each healthy leaf is a food manufacturing plant for the tree wherein the raw materials such as water and

minerals from the soil and carbon dioxide from the air, are converted into plant foods such as sugars and starches. This life process is called photosynthesis and takes place in the presence of sunlight with the help of the chlorophyll in the leaf. A healthy growing tree must have an enormous number of these sources of food if it is to continue in vigor. It is easy to see, therefore, why the removal of an excessive quantity of live wood and leaves is harmful.

In addition to lessening the food manufacturing ability of a tree, the removal of a large portion of the live wood often renders it more susceptible to the attack of various insects and fungi. Every break in the bark of a tree is an open door to the multitudinous fungus spores and insects which are quick to seize the opportunity of entering and becoming established. Breaks and wounds, therefore, must be kept at a minimum and as small as possible to allow rapid healing.

The tree structure normally is protected from most of the direct rays of the sun by a leafy canopy, but when this canopy is broken by excessive pruning, the hot rays may burn the tender bark which is unaccustomed to such heat. This often creates a pathological condition called sunscald which not only destroys the food-carrying structure where it occurs but also creates another "open door" for disease and insect infection.

Whenever it is thought necessary to remove a large portion of the limbs and foliage of a tree, the program should be extended over a period of years, if practical, and not accomplished at one operation. This procedure will allow the tree to recuperate from the physiological shock and to overcome the loss of structure by forming new wood and foliage.

Dead and dying branches often are indications of one of Nature's ways of handling the struggle for existence, since there are more branches in the crown of any tree than can persist permanently. Such branches should be removed periodically to lessen the danger of decay penetrating the rest of the tree and to promote healing of wounds.



*Figure 1.—Typical stagheaded tree with deadwood.*

Deadwood in a tree should be considered a symptom and not a cause of tree decline. The dying of branches usually may be traced to one or more of the following causes:

- Unfavorable soil nutriment conditions;
- Compaction of the soil about the roots;
- Unfavorable weather conditions;
- Insect or disease attack;
- Excessive crown density;
- Lightning injury;
- Loss or injury to roots;
- Sooty or fume-laden atmosphere;
- Inadequate or superfluous water supply;
- Mechanical injury to the limbs or trunk.

Treatment of a tree which contains an excessive quantity of dead wood should not be considered completed when the dead branches have been removed. Proper treatment must also include a diagnosis of the cause of the dead branches after which necessary steps should be taken to correct or ameliorate the harmful condition if correction is practical or possible.



## Reasons for Pruning

The desirability of shade tree pruning may be classified under three main headings: health, appearance, and safety.

**HEALTH.** Pruning for health might include any or all of the following: The removal of dead and diseased branches to prevent the penetration of rot-producing fungi into the rest of the tree; thinning of live branches to permit sun and air to circulate through and under the crown or to compensate for root losses; heading back to revitalize an old tree; removal of intersecting branches to prevent possible future decay problems; and removal of old branch stubs to promote healing and prevent penetration of decay.

Carefully executed pruning often should be considered a preventive rather than a repair measure, since proper pruning and intelligent after-care helps to prevent the formation of nonhealing tree wounds; prevents splitting by removing undesirable limbs and weak crotches when they are small; keeps the root system and crown in balance; prevents the spread of decay by prompt removal of diseased dead wood; and removes or trains rubbing or interfering limbs before they become objectionable. As stated by Fernow, "Real pruning anticipates the death of a branch and removes it before death takes place."

**APPEARANCE.** Shaping to bring a tree into its characteristic form or to balance a misshapen tree often is desirable when dealing with specimen trees or formal groups. It must be remembered that every species has one or more characteristic habits of growth, and no attempt should be made to change this form or habit unless justified by reasons of health or for special aesthetic considerations.

The opening of vistas to expose desirable scenes to view often may be accomplished entirely by judicious pruning, although the removal of entire trees is sometimes necessary to create the effect desired.

**SAFETY.** The danger created by dead limbs and branches over areas where children play and where people walk or drive is apparent; hence, this hazard should be eliminated in such areas by periodic pruning.



*Figure 2.—Effect of light on growth. Contrast between form of trees growing with and without competition.*



## Influence of Light on Growth

The influence of light on the form and health of a tree is a subject of great interest and importance. A tree which is growing in the center of a group or in the forest will tend to grow tall and slender in its efforts to reach upward toward the light, while a single tree growing without competition on a lawn area will tend to be shorter and denser and will have a greater crown spread.

The influence of light on tree growth is especially apparent after a road has been cut through a deciduous wooded area. Under such conditions the forest trees which now become roadside trees tend to develop lateral growth toward the road since they are relieved of the competition of neighboring trees on at least one side. These lateral shoots normally should be allowed to develop since they not only add to the food manufacturing ability of the tree but also because they are

Nature's way of preventing sunscald on the trunk from the unaccustomed direct rays of the sun. They may be modified judiciously from time to time, however, as the necessity arises.

## Best Time for Pruning

Much has been written on the proper time of year for most effective pruning. Someone has said that "the time to prune is when your saw is sharp," meaning, of course, that pruning may be performed at any time. This is believed to be practically the case, although it is realized that wounds heal more readily during the growing season, so that pruning usually is more desirable during the period from April to September. Practical considerations, however, necessitate pruning operations at almost any or all seasons of the year, although it is well to avoid pruning maples, birches, and other "bleeders" during the early spring season when the buds are breaking, even though the actual damage caused by "bleeding" at this time is negligible. The principal damage is done to the feelings of onlookers who see in the sap loss a resemblance to human bleeding. This, of course, is an erroneous comparison.

## Essential Pruning Equipment

Before you attempt to prune a large tree the following minimum equipment should be available:

- 1 Manila climbing rope, one-half inch in diameter, 120 to 150 feet long.
- 1 to 3 Manila ropes, one-half inch and three-fourths inch in diameter, 150 feet long for lowering limbs.

- 1 handsaw about 26 inches long, 6 teeth to the inch, for normal pruning cuts.
- 1 one-man crosscut saw, 3 feet long for large cuts.
- 1 pole pruner, 10 to 14 feet long for pruning small limbs which cannot be reached with a handsaw.
- 1 pole saw, 10 to 14 feet long.
- 2 belt snaps for carrying saws and paintpot.
- 1 paintpot with wound dressing for painting cuts.

In addition to the above minimum quantity and type of equipment, it is desirable to have chisels, gouges, a mallet, and shellac available for use in pointing cuts where necessary and for excavating small decayed areas. When pruning is performed over electric powerlines, insulated tools and gloves are highly desirable equipment.

Shoes with hobnailed or hard leather soles are undesirable for use by a tree worker since these may bruise and injure the bark and cambium. It is better to use boots made with soft soles of rubber, rope, or composition.

## Pruning Procedure

After necessary pruning equipment is available on the job, a careful survey should be made of the tree. This should be done with the foreman, if possible, in order to select the most advantageous point to crotch the safety rope, and to decide what shall be pruned from the tree. The operation is then ready to begin.

Since the subject of knots and climbing is discussed in Tree Preservation Bulletin No. 7, no detailed description will be made at this time on this important subject. However, it is thought well to outline briefly the various necessary preliminary steps to safe and efficient pruning:

1. Check over tools and equipment. Check rope for cuts and abrasions.
2. Throw safety rope through a crotch and climb up.
3. Crotch rope through highest possible safe central crotch.
4. Tie and get into safety saddle and tie taut-line hitch.

In general pruning, the best practice is to start at the top of the tree and work down. In this way any "hangers" may be removed without

retracing movements in the tree. In general, dead wood should be removed first along with small intersecting limbs. No large live limbs should be removed without getting special approval from the foreman, since the removal of such limbs might leave an undesirable hole in the crown. Large intersecting limbs may often be braced apart or bolted together since removing them would cause a break in the canopy and might alter or ruin the form of the tree. Diseased or borer-infested wood usually should be removed whether completely dead or not.

## Shaping the Cut

All final cuts should be made close to the parent limb or trunk and in as near a vertical ellipse or oval shape as possible in order to promote rapid healing. A properly shaped cut is often impossible with just a saw, due to the shape or tightness of the crotch.

Round or heart-shaped cuts should be trimmed to an elliptical shape with a gouge and mallet, and protruding "lips" should be cut off before the wound is completed in order to avoid die-back and water pockets.

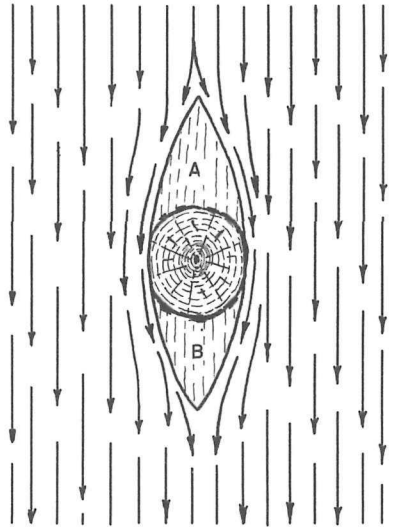


Figure 3.—Sap flow around wound.

The reason for leaving an elliptical-shaped wound is readily apparent when it is recalled that the direction of sap flow is parallel to the limb or trunk. When the flow is obstructed by a wound, the sap is diverted around such an obstruction with the flow assuming an elliptical course around the wound. If, as illustrated in figure 3, the bark areas represented by A and B were left, they would receive little sap and might weaken and die, thus creating a larger unprotected wound. Often it is better, therefore, to remove these roughly triangular sections at the time of pruning so that the entire wound may be dressed and protected.

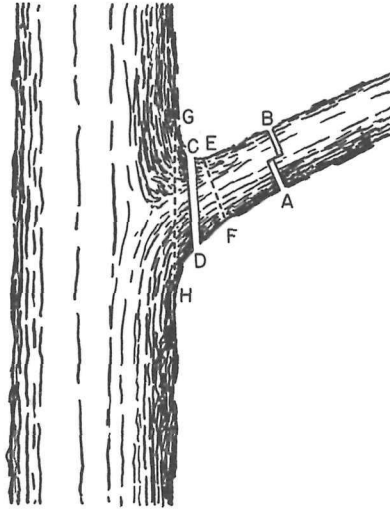


Figure 4.—*Proper pruning cut.*

## Removal of Branches

It is, of course, necessary to remove dead limbs back to a sound crotch so that vigorous cambium tissue surrounds the pruning cut. A medium-sized or large limb should not be removed by a single saw cut as this would probably strip the bark and wood below the cut. The removal of a large limb is best accomplished as indicated in figure 4. A preliminary undercut (A) should be made about a foot beyond the final cut (CD). Sawing at this point (A) should continue until the

saw binds. Then a second cut (B) is made an inch or two beyond the undercut, severing the limb or trunk. When the final cut (CD) is made, the stub should be held with the hand or roped so that there will be no stripping of the bark below the cut. The lines EF and GH indicate improper places to make the final cut. The cut GH would make an unnecessarily large wound and the cut EF would result in a stub which would die and decay or would heal only with difficulty.

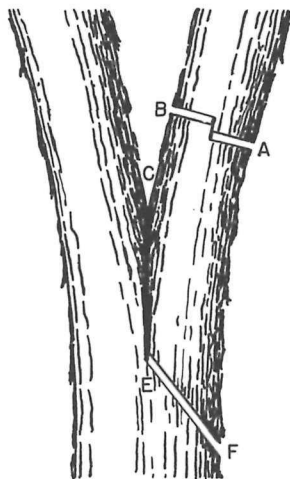


Figure 5.—Pruning a V-crotch.

## Removal of V-Crotches

It is often necessary to remove one of two limbs which have developed parallel to each other in such a way as to create a very tight C-shaped crotch. The apparent junction of such a pair of limbs may be 1 or 2 feet from the real point of intersection. The final pruning cut must, of course, be made at the real intersection to heal properly. Such a crotch is sketched in figure 5. In this case, several cuts and careful work with chisel and gouge are necessary to create a wound that will heal. Preliminary cuts are made at A and B. The line CE represents an area of bark where the limbs have grown together with E repre-

sending the true point of intersection. Therefore, a final cut should be made from point F, sawing toward E. After this cut is made, usually it will be desirable to finish the cut with a sharp gouge or chisel to assure a pointed wound which will heal properly.

## Roping Heavy Limbs

In removing very large limbs, especially in cemeteries and parks, it is often necessary to lower them to the ground in sections by means of a system of support and pull ropes in order to avoid damage to monuments, shrubs, and lawns. Ropes which are to carry heavy loads should be at least three-fourths of an inch in diameter and should be snubbed around a tree so that only one man is necessary to hold one rope. The table on pages 12 and 13 is useful for calculating weights of limbs.

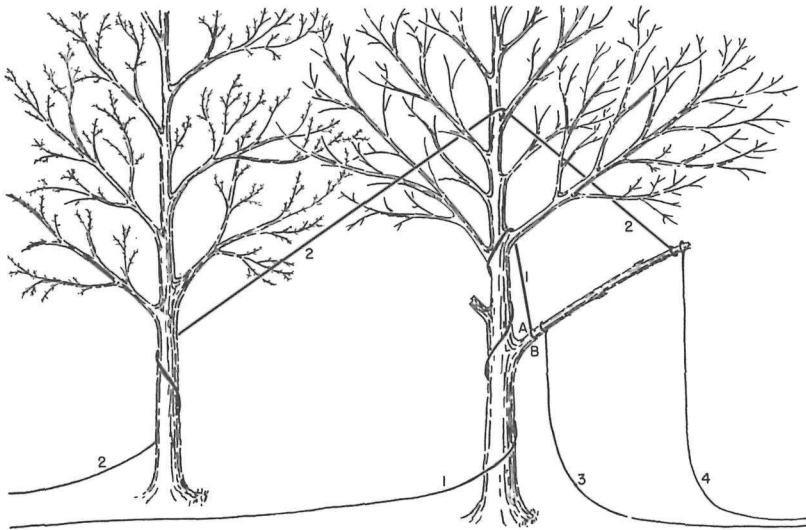


Figure 6.—Roping large limbs.

Figure 6 illustrates a useful roping system for lowering large limbs. Line 1 is the butt rope; line 2 is the top rope; and lines 3 and 4 are



## Weight table for green logs

To use: Multiply length of log in feet by the weight of a 1-foot section, using the mean diameter of the log.

Species	Weight per cubic foot <sup>1</sup>	Weight of 1-foot sections based on mean diameters													
		10 inches	12 inches	14 inches	16 inches	18 inches	20 inches	22 inches	24 inches	26 inches	28 inches	30 inches	32 inches	34 inches	36 inches
	<i>Lbs.</i>	<i>Lbs.</i>	<i>Lbs.</i>	<i>Lbs.</i>	<i>Lbs.</i>	<i>Lbs.</i>	<i>Lbs.</i>	<i>Lbs.</i>	<i>Lbs.</i>	<i>Lbs.</i>	<i>Lbs.</i>	<i>Lbs.</i>	<i>Lbs.</i>	<i>Lbs.</i>	<i>Lbs.</i>
Apple . . . . .	55	30	43	59	77	97	120	145	173	203	235	270	307	347	388
Ash, white . . . . .	48	26	38	51	67	85	104	126	150	177	205	235	267	302	338
Basswood . . . . .	42	23	33	45	59	74	92	111	132	155	180	206	235	265	297
Beech . . . . .	54	29	42	58	75	95	118	142	169	199	231	265	301	340	381
Birch, paper . . . . .	50	27	39	53	70	88	109	132	157	184	214	245	279	317	353
Birch, yellow . . . . .	57	31	45	61	80	101	124	151	179	210	244	280	319	360	403
Butternut . . . . .	46	25	36	49	64	81	100	121	144	170	197	226	257	290	325
Cherry, black . . . . .	45	25	35	48	63	79	98	119	141	166	192	221	251	283	318
Chestnut . . . . .	55	30	43	59	77	97	120	145	173	203	235	270	307	347	388
Cottonwood . . . . .	49	27	38	52	68	86	107	129	154	180	209	240	273	310	346
Elm, American . . . . .	54	29	42	58	75	95	118	142	169	199	231	265	301	340	381
Gum, black . . . . .	45	25	35	48	63	79	98	119	141	166	192	221	251	283	318
Gum, red . . . . .	50	27	39	53	70	88	109	132	157	184	214	245	279	317	353
Hackberry . . . . .	50	27	39	53	70	88	109	132	157	184	214	245	279	317	353
Hickory, shag- bark . . . . .	64	35	50	68	89	113	140	169	201	236	273	314	357	403	452
Honeylocust . . . . .	61	33	48	65	85	108	133	161	192	225	261	299	341	385	431
Magnolia, cv. . . . .	59	32	46	63	82	104	129	156	185	217	252	289	329	372	417

TREE PRESERVATION BULLETIN NO. 4

Maple, red . . . . .	50	27	39	53	70	88	109	132	157	184	214	245	279	317	353
Maple, silver . . . . .	45	24	35	48	63	79	98	119	141	166	192	221	251	283	318
Maple, sugar . . . . .	56	31	44	60	78	99	122	148	176	206	239	275	313	353	396
Oak, black . . . . .	62	34	48	66	86	109	135	163	194	228	265	304	346	390	437
Oak, live . . . . .	76	41	60	81	106	134	166	200	238	280	324	372	424	478	536
Oak, red . . . . .	63	34	49	67	88	111	137	166	198	232	269	309	351	397	445
Oak, white . . . . .	62	34	48	66	86	109	135	163	194	228	265	304	346	390	437
Osage, orange . . . . .	62	34	48	66	86	109	135	163	194	228	265	304	346	390	437
Pecan . . . . .	61	33	47	65	85	108	133	161	192	225	261	299	341	385	431
Persimmon . . . . .	63	34	49	67	88	111	137	166	198	232	269	309	351	397	445
Poplar, yellow . . . . .	38	21	30	40	53	67	83	99	119	140	162	186	211	239	268
Sassafras . . . . .	44	24	34	47	61	78	96	116	138	162	188	215	245	277	310
Sycamore . . . . .	52	28	41	55	72	92	113	137	163	191	222	254	290	327	366
Walnut, black . . . . .	58	32	45	62	81	102	126	153	182	213	248	284	323	364	409
Hemlock, eastern . . . . .	50	27	39	53	70	88	109	132	157	184	214	245	279	317	353
Pine, n. white . . . . .	36	20	28	38	50	64	78	95	113	133	154	176	201	227	254
Spruce, red . . . . .	34	19	27	36	47	60	74	90	106	125	145	166	189	214	239
Tamarack . . . . .	47	26	37	50	65	83	102	124	147	173	200	230	262	295	331

SHADE TREE PRUNING

<sup>1</sup> From *Strength and Related Properties of Woods Grown in the United States*.

L. J. Markwardt and T. R. C. Wilson, Tech. Bul. 479. U. S. D. A. 1935.

the pull ropes for directing the lowering of the limb. The preliminary cut is made at AB after which the stub is removed as described previously. Care always must be exercised that the saw does not accidentally sever one of the lowering ropes or the safety line. Lines 1 and 2 should be passed through different U-shaped crotches so as to avoid binding and confusion in lowering the limb. Figure 6 shows a need for four men for the operation, one man making the cut, one man on each of lines 1 and 2, and one man on lines 3 and 4, directing the fall. Four ropes are not always necessary for this work, however, and often it will be found sufficient to provide simply a support rope near the center of the limb and one pull rope. The man making the cut may assist in freeing the limb if it becomes lodged on another limb or in a crotch, but he should never be used to hold a support rope for reasons of safety.

## Pole Saws and Pole Pruners

Although it is realized that pole saws and pole pruners have their proper uses, it is felt that many persons use these tools where it would be better to climb out a little farther and use a handsaw. A lazy man is a great backer of the pole saw. Since it is often difficult or impossible to make a clean close cut with pole tools, they should be used only for cutting at points impossible to reach with a handsaw or where the diameter of the cut is so small that it offers insufficient resistance to operate a handsaw.

When using a pole pruner, the cut should be made with the blade toward the tree and the support bar resting on the portion being removed. This will avoid bruising the cambium around the cut. It should be an invariable practice to paint pruner or pole-saw cuts as soon as possible. A brush slipped into a holder on the pole saw is useful for this purpose.

## Dehorning

Dehorning, or the practice of severely heading back the main limbs of an old tree, is a procedure which is rarely justified, but since the practice has some merit and may be desirable under extreme conditions, it is thought well to mention the process briefly.

It sometimes happens that an old tree, which may be valuable for historic or other reasons, has been severely weakened by insect or disease attack, environmental disturbances, or extensive decay. For such trees, it is desirable to prune off major portions of large branches to assist the tree in forming a new crown which will have less wind resistance than the old crown and which can be supported by reduced root area. This work must be carefully done by experienced men under competent supervision as it is possible to do more harm than good by the process.

When it is necessary to cut ends from branches in a heading-back process, the cut should be made just beyond a twig or small branch and the last bud should point in the direction where limb development is desired. All branches should rarely be cut back severely the same season; rather, the program should extend over a 3- or 4-year period. In making cuts, it is important that the ultimate desired form of the new crown be ascertained in advance so that dehorning cuts may be made in accordance with this crown plan.

The principal dangers of the dehorning process are found in the decay which is almost sure to follow in the course of time at the dehorning points, and sunscald caused by reduction of the canopy. Species which do not form adventitious buds or suckers readily are rarely benefited by dehorning. Followup treatment and selective pruning of suckers must follow in a complete dehorning. It must be clearly understood that dehorning should be done only as a last resort.

## Removal of Old Stubs

The removal of old partially healed stubs often reveals more or less decay which has resulted from infection by rot-producing fungi. If this decay is very minor in extent and can be quickly excavated, this should be done by the pruning crew as a part of the pruning operation. The wound should be treated as a bark tracing and painted with wound dressing to prevent decay. When extensive excavation and thorough cavity treatment is indicated, however, it is better to leave the wound unpainted and unexcavated so that it may be cared for when and if this type of work is being done. It is, of course, valueless to paint over decayed wood.

## Suckers and Watersprouts

Suckers and watersprouts are sprout growths of twigs or branches (usually vertical) which arise from adventitious buds on trunks or limbs. They are often Nature's indication of changing environmental conditions, structural injuries, or certain diseases, or they may be produced by excessive, incorrect, or ill-timed pruning. The removal of a large limb close to a small branch may result in excessive sprout development near the wound, but cutting limbs near a lateral of about the same size results in little or no sprouting in most species.

Treatment of excessive suckering varies with the position of the growth on the tree, the cause of the phenomenon, the quantity and size of sprouts, the tree species, and the effect desired.

Base suckers are usually of no benefit to an ornamental tree and detract from the appearance of the tree as a specimen. They should be removed, usually, as they develop. Trunk and limb sprouts on some

species such as elm often should be allowed to develop, since moderate suckering on the trunk is a normal development of the species under certain conditions.

If the suckering is an apparent attempt by the tree to provide shade for the trunk or limbs after shading trees have been removed, the suckers should be left (or possibly given a careful thinning) in order to prevent sunscald and as a means of filling out the crown on a weak side.

## Pruning Transplanted Trees

The pruning of recently transplanted trees, or those which are about to be transplanted, is a necessary function if the trees are to thrive. The essential reason for this practice is to compensate for the root loss which the tree always suffers no matter how carefully the moving is done.

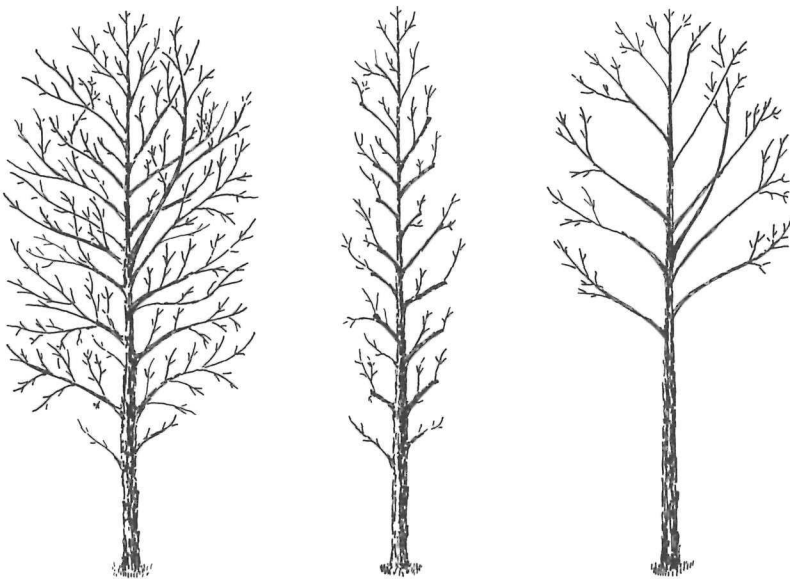


Figure 7.—Pruning small transplanted trees; left, before pruning; center, properly pruned; right, improperly pruned.

The reduction or pruning of the crown of transplanted deciduous trees usually should include the removal of from one-half to three-quarters of the buds. This may be accomplished by thinning and by cutting back the twigs and branches. In deciding how to prune a small tree, it should be remembered that the only branch which has a good chance to persist permanently is the leader. The laterals will die probably by shading, or will need to be pruned ultimately to shape the crown. The shape of the crown of a small tree, therefore, is of negligible importance as contrasted with the necessity of making the tree live.

Before pruning, it is well to examine the young tree carefully to decide what and where the cutting should be done. Unless a very low-headed tree is desired, the leader or tip of a shade tree should never be cut, since such cutting would spoil the ultimate shape of the tree, would detract from a strong branch structure, and might cause a wound which would heal with difficulty.

These objections do not hold true with the lateral branches. Heading back these branches brings the remaining buds closer to the main line of sap flow and provides a slender compact head which will easily branch out when growth starts. These remarks, of course, apply principally to trees up to 3 or 4 inches in diameter, and not to large specimens which have already formed their main scaffold branches.

The importance of leaving "sap lifters" or buds and twigs along the trunks and branches cannot be over-emphasized. One of the common mistakes made in pruning small trees is to prune off these small twigs and buds in the center of the crown and along the trunk and leave a sparse supply of buds on the branch tips. This process makes it difficult for the tree to provide nourishment to these ends; hence the branches often literally starve to death from lack of water and nutriment. It is far better to head back these long slender branches at the time of pruning. As the tree becomes established, later pruning operations may take care of the removal of unwanted growth along trunk and limbs.

Pruning off the lower branches of a young tree should be avoided unless these "sap lifters" can be spared and unless the tree has a very sturdy trunk. Frequently, when trees are received from a nursery where they have been growing too close together, it will be found that the slender trunk is too spindling to support a good head. In addition to staking such trees, care should be taken that the pruning tends to head in the crown to permit the development of a trunk which will be sufficiently stout to withstand the wind.

The pruning of large transplanted trees presents other problems. Here the main structural branches have been formed, and the problem is to save such of these as are desirable in such a way as to prevent the future growth being deformed. Usually such trees will have some excess branches which can be spared. If the tree moving has been carefully handled and the root loss is not excessive, some of these excess branches may be headed back at the time of transplanting and entirely removed in a year or two.

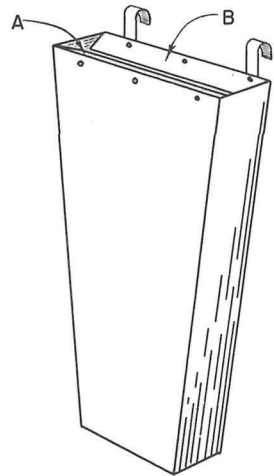
The permanent branches should be handled as if each one were a small separate tree. In other words, the laterals on the branches should be modified by cutting back, but the ends or the leaders rarely should be cut. Tight or otherwise structurally weak crotches and intersecting limbs are better eliminated at this time in order to avoid future trouble. If large trees are handled in this manner, and other transplanting factors are cared for as well, the trees will continue to develop and thrive.

If the tree has been root pruned a year or two prior to transplanting, little difficulty will be experienced in adjusting the root system to the new site. However, this is not always done, and large roots are often broken in moving. These roots and any badly bruised ones should be severed cleanly with root cutters or some other sharp tool to encourage callousing and new root development. The long anchor roots are thought by many to be important and worth saving, but it is usually true that these roots had better be severed before or during the moving as they are difficult to handle and often die anyway. The tree will develop new anchor roots readily, and, until these develop, the tree may be guyed securely with cables or guy wires. The important part of the root system is the mass of fibrous feeding roots.

## Pruning Diseased Trees

It is sometimes desirable to prune a tree which is infected with a virulent disease such as maple wilt, fire blight, or elm wilt in order to arrest the spread of the disease or for general sanitation. Under such conditions, great care should be exercised so that the pruning will not actually spread the disease instead of retarding it. Saws and pruners

used in this work should be dipped in a solution of bichloride of mercury or alcohol, or wiped off with a cloth saturated in one of the solutions between each cut to kill any infection which might be carried on the tool. A metal sheath (see figure 8) slung from the belt and filled with a disinfecting solution will be found useful for this purpose. In figure 8, A and B are rubber flaps or squeegees to remove excess disinfectant from the saw as it is being withdrawn. It is evident, of course, that sanitation pruning should be done far enough back from infected branches as to cut through noninfected limbs. Wood from such pruning should be burned as soon as possible and as close to the site as convenient so as to minimize the danger of spreading the disease.



*Figure 8.—Disinfecting tank.*

## Storm- damaged Trees

The pruning of storm-damaged trees is a problem which often faces the tree worker. The difficulty in this case is that the natural form of the tree is already ruined, and the worker must make the best of an already bad situation.



The first objective, of course, is to remove the broken hanging branches in order to keep them from endangering passersby. Then the remainder of the tree can be studied, and the possibility of reestablishing an attractive crown can be ascertained. If the wrecked tree is believed to have possibilities, a definite plan of rehabilitation should be worked out. Split limbs and crotches that can be saved by bracing should be given this attention. Ragged stubs and branch ends should be pruned back to desirable crotches to promote healing and sprouting, and the crown given some semblance of a shape or outline. Scars caused by splitting limbs should be cleaned of splinters, the wood smoothed, and the bark traced back to an elliptical shape which will heal readily. Feeding with slowly available fertilizers is often beneficial, but quick-acting fertilizers should be avoided, as over stimulation may result in excessive sprouting and development of weak wood.

After-care of a storm-damaged tree is important. In succeeding years the crown should be reworked by removing excess suckers and selecting and modifying the remaining ones so that they are able to replace the broken limbs in time. It is possible by careful and successive treatment to repair a badly damaged tree so that eventually it becomes again an object of beauty and utility.

## Pruning Conifers

As a general rule, coniferous trees do not require periodic pruning to the extent desirable in deciduous species. Even dead wood in conifers does not have the detrimental effect that results from dead branches in deciduous trees. This may be explained partially by the presence of resin in the wood which retards or prevents the action of some rot-producing fungi and hence retards or prevents the spread of decay. However, these remarks should not be construed as an argument against the pruning of ornamental evergreens, should such practice be desirable for reasons of health, appearance, or safety.

The removal of large branches on conifers should follow closely the general pruning procedure mentioned previously. If the species is one of high resin content, however, it is less necessary to paint pruning wounds since the resinous exudation forms a natural protective coating.

When it becomes necessary to modify or thicken the growth of a coniferous tree, one of two main pruning systems may be used, depending upon the leaf and twig structure of the species. The first system involves the use of a pruning saw or short-bladed clippers, and each cut should be made at or just beyond a lateral branch, twig, or bud so as to remove a definite portion of growth. This system should be used on such needled species as pine, spruce, and fir.

The second type of coniferous pruning is commonly known as shearing. This type of pruning involves the use of long-bladed pruning shears and is used to clip twigs and leaves of such species as hemlock, arbovitae, and the retinosporas. The clipping is done to formalize the habit or to increase the density of the foliage when desirable. This type of pruning should be done only by skilled workmen. Evergreens should be sheared just prior to or during the early part of the growing season. Dormant shearing may be harmful.

## Pruning Shrubbery

Pruning of flowering or otherwise ornamental shrubbery is often desirable in order to increase the bloom; to cause the shrub to conform to a desired form; or to remove old, injured, or abnormal growth.

To increase the quantity of bloom on early flowering shrubs, pruning should be done immediately after the flowering period so that the plant has an opportunity to form new wood on which the next year's bloom will appear. Late flowering shrubs on which the bloom will appear later in the season should be pruned during the dormant season so that the plant may produce vigorous canes in the following spring. As a general rule, flowers on spring-blooming shrubs are borne on the vegetative growth formed the previous year, while those on late blooming shrubs appear on the current year's growth.

Pruning a shrub to a definite form, such as in formal hedges or topiary work, is largely a shearing or heading-back process. Such pruning, performed two or three times during a season, will usually result in a compact growth in the form desired.

When the purpose of pruning is to remove injured, abnormal, or otherwise undesirable growth, it should be performed in such a manner

that the natural habit of the shrub will be uninjured. This may be accomplished by entirely removing the old and injured canes, thus allowing the young vigorous shoots more chance for development. If this practice is followed consistently, it is possible to perpetuate a shrub indefinitely in a vigorous natural condition. Occasionally it may be necessary to curb a shoot of especial vigor in order that it may not destroy the symmetry of the shrub. When such work seems desirable, it should be done in such a manner as to avoid an artificial and clipped appearance. The promiscuous heading back of all types of shrubs to a definite outline should be avoided.

## Paints and Wound Dressings

The subject of wound dressings has been a controversial one for many years. There are advocates for several distinctly different types of dressings and there are also others which advocate disuse of any which are available at present. It appears to be fairly well-established, however, that a tree wound should be as adequately protected as possible until healed. An efficient wound dressing should disinfect, prevent checking, prevent entrance of fungus spores, and encourage healing or callus formation. It should also be economical and easy to use and should be porous and thin enough to allow the escape of excessive moisture from the wood.

It appears that the best all-round dressing for general use consists of an asphaltic-base paint which contains antiseptic ingredients and is thin enough to flow freely and allow passage of moisture. Bordeaux Mixture also has been used with linseed oil as a wound dressing with good results. Although the mixture has disinfecting qualities, and in many other ways is satisfactory, it is expensive and needs to be reapplied frequently, and has an unpleasant color.

Commercial tree paints are also available. Ready-made paint to be used in tree work should be selected with care since a few of them are known to be incapable of killing parasitic organisms. Tree workers may actually spread disease through the use of such paints.

Regardless of what brand of tree dressing is used, considerable care should be exercised in its application in order to achieve maxi-

imum effectiveness and a minimum of damage. Although most present-day dressings retard the growth of callus to some degree; it is better to apply the dressing as thinly as possible even though a second coat may be necessary, since excess paint will run down the trunk and spoil the appearance of the work.

It is useless to paint freshly made cuts if the surface is wet, as the dressing will rarely stick, and even if it does, water blisters will probably appear under the surface. Better practice is to wait until the wound is dry before applying the dressing. When redressing old wounds, it is well to scrape the old surface with a stiff wire brush in order to remove loose flakes and air or water blisters before applying the new coat. In painting old cuts, care should be taken to keep the wound dressing off the callus growth so that any danger of retarding growth may be avoided.

There is some evidence that trees form wound gums beneath the surface of wounded wood as a means of aiding healing and preventing or retarding the spread of infection. Research on the subject is not conclusive, but there is some thought that dressings may be delayed for a time after pruning to allow free formation of such protective gums. However, the best practice is to apply a suitable tree paint to pruning cuts as soon as the exposed wood is in condition for treatment.

Occasionally it will be noted that cuts continue to drain after a long period. This condition is often difficult to correct, but it has been found that excessive seepage or fluxing of tree wounds may be locally retarded or stopped by tapping at the tree base to decrease the heart-wood pressure.

## Pruning Standards

The following simple standards should govern all pruning work:

1. All final cuts shall be made flush with the remaining limb or trunk.
2. All cuts shall be painted with a suitable wound dressing.
3. Final cuts on limbs which are too large to hold with the hand shall be preceded by preliminary cuts from 1 to 2 feet beyond the final cut. Such preliminary cuts shall include an undercut to prevent stripping of the bark.
4. Dead wood, unhealed old stubs, and minor interfering branches should be removed routinely from every tree as the work progresses. However, the removal of live limbs, large interfering branches, and suckers should be directed by a trained and experienced tree worker or foreman only after careful survey of the job.
5. Cutting back, shaping, or dehorning are usually done to accomplish a special purpose. These practices require knowledge and skill and should be done only upon specific instruction and under careful supervision.
6. After the safety rope is crotched, men must stay in the safety saddle or bowline with the taut-line hitch kept tied until they are again on the ground. Even while working on a ladder, a safety line must be used.
7. Pole pruners, pole saws, or handsaws which are hung in a tree temporarily must be placed in a safe position. Make sure the branch over which the pruner hook is placed will safely hold the load. Never place pruners on a wire.
8. A cut, or badly worn, rope must never be used as a safety rope.
9. Every rope must be inspected as it is uncoiled.
10. Look below and also give plenty of warning before dropping a limb.
11. All limbs which might do damage if dropped free must be supported by ropes.

