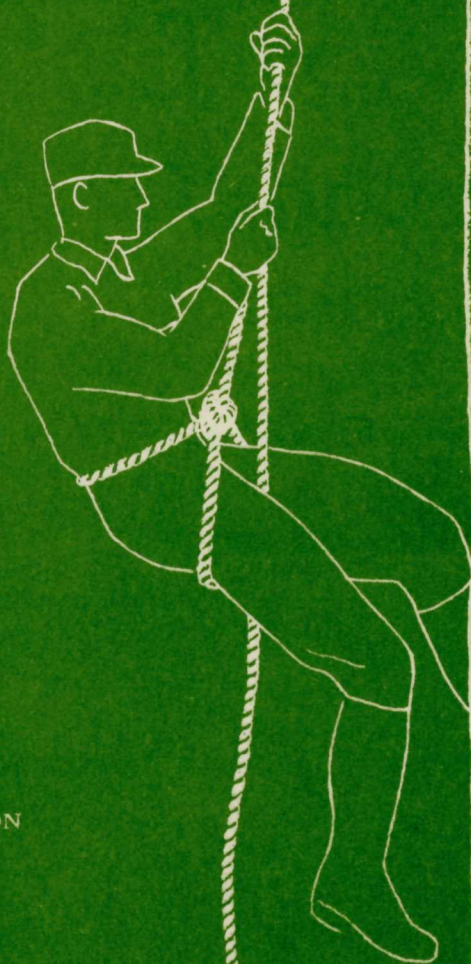


Safety for Tree Workers



TREE PRESERVATION
BULLETIN NO. 2
Revised 1956

Safety for Tree Workers

by A. Robert Thompson
Forester
National Park Service

TREE PRESERVATION BULLETIN NO. 2 • REVISED 1956



UNITED STATES DEPARTMENT OF THE INTERIOR

Fred A. Seaton, *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 20 CENTS

Foreword

The very nature of tree preservation work clearly indicates a need for rules of safe practice in tree work. This need was recognized over 20 years ago when the National Park Service was confronted with the problem of maintaining and improving the condition of thousands of valuable shade, ornamental, or historically significant trees within a variety of areas. In order to guide those who were responsible for tree preservation work in park areas, a most complete and useful publication on safety for the arborist was prepared in 1937 by the late A. Robert Thompson, forester in the Branch of Forestry, National Park Service, entitled *Safety for Tree Workers*. This Tree Preservation Bulletin was Number 8 in a series of 9 bulletins prepared between 1935 and 1940. They were originally intended for park employees. However, requests for copies from both amateur and professional arborists have been great and the demand still continues.

The bulletins are reissued as opportunity permits. Bulletins 1 and 2, *Purpose and Policy*, which referred to National Park Service practices only, are being replaced by the original Bulletin Number 9, now Number 1, *Transplanting Trees and Other Woody Plants*, and Bulletin Number 8, now Number 2, *Safety for Tree Workers*. Bulletin Number 6, *General Spraying and Other Practices*, was revised and reissued in 1953. Other bulletins in the series will be renumbered as issued.

Although the original Bulletin Number 8, *Safety for Tree Workers*, is still a valuable guide for safe practices in this work, some changes during the past 17 years have made certain revisions and additions advisable. Several items of equipment not in existence when the bulletin was written are in common use today. We are particularly indebted to the Safety Committee of the National Arborist Association, composed of Karl Kuemmerling, Edwin E. Smith, C. L. Wachtel, J. Cooke White, John Woodruff, and Oscar F. Warner, for its very thorough review and helpful assistance in making these desirable changes. Except for these additions and other minor revisions, the new Bulletin Number 2 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
Necessity for Safety Rules	1
Benefits of Accident Prevention	2
Safety Program	3
Rules of Safe Practice	4
General	4
Clothing	5
Rope	6
Climbing	10
Ladders	16
Pruning	17
Electrical Hazards	18
Tools	19
Tree Felling	21
Brush and Wood Removal	23
Transportation	24
Spraying	26
Fumigation	27
First Aid and Poisonous Plants	28
Summary	29
Acknowledgments	31
Bibliography	32

Introduction

Until comparatively recent years the toll taken by occupational accidents was thought to be a necessary evil, and few steps were taken to reduce the appalling waste of human life and limb. With the passage of modern legislation, however, which forces the private employer to protect his employees by accident compensation insurance, the enormous cost of accidents was forcibly brought home and organized safety work was begun.

Although an extremely small percent of the industrial accident record is chargeable to tree workers, since the number of tree workers is comparatively small, the accident rate in this field is considerably higher than the general industrial average per worker employed. This is evidenced by the high insurance rates that are required of commercial tree preservation organizations. At the end of the year the outlay for compensation is calculated, and several commercial tree preservation companies, which have found that safety pays, have enjoyed substantial rebates on their premiums as well as a more favorable basic rate for the next year.

Necessity for Safety Rules

Safety rules and regulations are as necessary in industry as civil laws in community life, and, like civil laws, are formulated as the result of violation of basic safety principles or in anticipation of such violation. Safety rules are especially essential in connection with tree preservation activities because of the inherent dangers involved in working off the ground and because constant supervision of every workman is seldom possible.

Rules are also necessary to provide standard methods of performance for various jobs. There is at least one right way and there are almost invariably numerous wrong ways to do every job; these rules are intended to point out and emphasize the proper methods to be employed. They are put in printed form to prevent disorder and misunderstanding, to forestall excuses for not performing a job properly, and to indicate not only to workers, but to supervisors also, the minimum safety requirements for tree preservation work.

Benefits of Accident Prevention

The actual advantages of a safety program are definitely tangible. A well organized and properly executed program not only results in lower operating and compensation costs, better morale, and increased efficiency, but it prevents suffering and loss of earning ability.

LOWER OPERATING COSTS. It has been definitely shown that efforts to improve safe practices do not interfere with production but rather increase and improve productivity. When an operator's mind is relieved of the fear of accidents and he becomes accustomed to performing his work in a safe manner, his production invariably is increased proportionately. This has a direct influence on operating costs as can be readily seen.

LOWER COMPENSATION COSTS. Lower insurance and accident costs are the reward of commercial companies which decrease their accident rate. Although individual Government agencies do not pay compensation costs directly, the total cost is heavy, both by reason of actual cash outlay by the United States Employees Compensation Commission and the indirect cost due to the loss of services by the various departments. An efficient safety program lowers such costs.

BETTER MORALE. An organization known to be safe is one to which its members are proud to belong. This fact is clearly evidenced among commercial organizations which carry on safety programs. Safe practices make for better working conditions, greater self-satisfaction, and better work.

EFFECT ON ASSOCIATES. A man who is safety-conscious and who has been trained to be careful is not easily led into careless ways; rather the effect is reversed. The influence upon future associates of trained tree preservation workers is one of great possibilities since a careful worker is the nucleus of a careful crew.

PREVENTION OF SUFFERING AND LOSS OF EARNING ABILITY. A tree worker will receive more money through regular employment than through the accident compensation payroll; to his family and dependents, he is worth more alive and uninjured than he is crippled or dead. No amount of money can compensate for suffering as a result of an accident, the loss of a life, a permanent disability, or some kind of temporary disability.

Safety Program

A sound and practical safety program as it concerns tree preservation work will consist of five major parts: standards, education, enforcement, accident reporting, and investigations.

STANDARDS. Standards represent the safe ways of doing things. The rules of safe practice presented in this bulletin are based on the accumulated experience of many individuals and organizations over several years and have resulted from demonstrated need.

EDUCATION. Tree workers must be encouraged to form safe working habits. It is the duty of all members of supervisory staffs to encourage safe practices and to promulgate safety in tree preservation work. This may be done by constant encouragement, discussion, and demonstration. Participation in safety meetings should be obligatory.

ENFORCEMENT. Rules of safe practice are made for the protection of workers. Observance of the rules is the duty of every worker engaged in tree preservation work, and rigid enforcement is obligatory on the part of all supervisory personnel. Failure to observe or enforce rules should result in disciplinary action.

ACCIDENT REPORTING. While certain basic safety principles for tree preservation work have been determined, there always will be room for improvement. Tree preservation crews will cooperate with the proper authorities in accurately reporting accidents and keeping statistics. Suggestions to improve safe working conditions should be reported through proper channels in order that all concerned may receive maximum benefit.

INVESTIGATIONS. An investigation of each accident should be made by the person or board appointed for this purpose. The reports of such persons or boards are valuable not only for fixing the responsibility for accidents but for analyzing the causes of accidents so as to eliminate or minimize such causes in the future.

Rules of Safe Practice

The purpose of these rules is to bring out the following facts: (a) The man who is to avoid accidents and reduce loss of life and human suffering must exert every personal effort; (b) all tree workers, especially those who are inexperienced, should be informed of the dangers incident to tree preservation work, so far as it is possible to do so in a set of rules; (c) precautions must be taken by all tree workers, experienced or inexperienced, to reduce the hazards of their work to a minimum; and (d) experience with causes and prevention should be applied to future work.

The rules have been established not from one person's ideas of safety but from the accumulated experience and observations of many individuals and organizations over a period of many years. Each rule without exception has evolved directly from one or more accidents caused by failure to observe proper safety principles. These safe practice rules apply generally wherever tree preservation work is done.

General

Every tree worker should know these safety rules. It is his duty to observe them at all times. He should have a good working knowledge of first aid and resuscitation.

No man shall engage in any phase of tree work until he is able to tie the following knots readily and until he knows when to use them: bowline, bowline-on-a-bight, running bowline, square knots, clove hitch, timber hitch, taut-line hitch, and figure-of-eight knot.

Before any man attempts to do actual work in a tree he must be trained in the use of rope and knots and must spend sufficient time in practice climbing and knot tying to become proficient. (See Tree Preservation Bulletin No. 7.)

Before starting any tree operation, all necessary time should be taken to find out if any local danger exists. Haste causes accidents—take time to be careful.

Except under exceptional circumstances, trees should not be climbed or worked in when wet. It is impossible to get a good foot-

hold on slippery bark, and knots are likely to slip if the rope is wet.

Men should stay out of trees during high winds except in emergencies.

Only men who are physically fit should be allowed in a tree. Men suffering temporary ill health should be sent home.

There is no place for intoxicating liquors on a tree preservation operation. Men suffering from immediate or after-effects of alcohol must not be allowed on the job.

A tree is not the place for a person with an exhibitionist complex. Men who persist in taking unnecessary risks or in showing off should be released from the job.

As a general rule, only one man should work in a tree at a time—especially during pruning operations.

Workmen should request assistance only from men working directly on the job, never from passers-by or casual observers, regardless of the simple type of assistance which may be required only temporarily.

Danger signs and/or red flags should be placed on sidewalks, roadways, or streets where any tree work is to be done. Dangerous areas should be roped off and ground men used to divert traffic when necessary.

The foreman should exercise close supervision over his men at all times. He should satisfy himself that the men working under him are efficient and competent to perform their work with safety. He should outline safe methods and see that his instructions are obeyed implicitly.

The foreman must make a daily inspection of all tools, rope, and other equipment before use, and he will condemn or destroy all tools, etc., which are unsafe in his opinion. Each tree worker must also inspect all tools, rope, etc., before using them.

Foremen are held responsible for enforcing all safety rules.

Clothing

Men who are engaged in tree climbing will find that ordinary street and work clothes are unsuitable for tree work.

A cap is preferable to a hat because it offers less obstruction when passing between limbs and through thick foliage. For ground workers a hard hat is better protection than a cap.

High-topped leather shoes with composition or rubber soles are preferable to ordinary shoes with leather soles. Hobnailed shoes should never be used for climbing, and nailed soles should be avoided. Special tree climber's boots with instep flaps and steel stays are sometimes preferred.

Breeches of strong, dark-colored material are preferable to long trousers which are easily caught and torn. They should be fairly loose in the leg and knee to give freedom in cramped positions.

A long overcoat is unsuitable for tree work. Long underwear and snug-fitting wool or leather jackets or extra shirts are preferable when cold weather requires extra warmth.

An athletic strap with a wide abdominal band should be worn by all men engaged in tree work.

For protection of the hands and wrists, gloves of the gauntlet type are generally considered satisfactory for tree work. Sleeves should be kept rolled down to protect forearms and wrists.

Rope

The standard safety rope for tree work is a first-grade, 3-strand, rot treated, $\frac{1}{2}$ -inch-diameter manila rope not less than 120 feet and preferably 150 feet in length. The $\frac{1}{2}$ -inch nylon rope is coming into wider use and is acceptable as a standard rope where preferred. Standard power rope consists of first-grade, 3-strand, rot-treated, $\frac{3}{4}$ -inch-diameter manila rope in lengths of not less than 150 feet. A number of longer lengths are often desirable. A 1-inch-diameter manila rope is recommended for pulling trees over. Cheap, substitute ropes should be avoided in tree work.

The table on the next page gives the breaking strength and safe loads of different sized manila rope. This table may be used in connection with the table on pages 8-9 in estimating stresses for manila rope used for tree work:

Under average conditions the working load placed on a rope should not exceed one-sixth of the breaking load, but under the best conditions, if the rope is new, the working load may be one-fourth the breaking load. Under unfavorable conditions where rope is used frequently and for indefinite periods, as in the case of a climbing rope, the working load should not exceed one-eighth of the breaking load.

Every rope must be thoroughly inspected for cuts or abrasions before each use. Occasionally the strands should be separated and

Federal Standards for New Manila Rope (3-strand)

Diameter (approx.)	Length of coil (approx.)	Gross weight of coil (approx.)	Weight per foot (max.)	Length per pound (min.)	Breaking strength (min.)	Safe load (1/8 max.)
Inches	Feet	Pounds	Pounds	Feet	Pounds	Pounds
1/4	2,750	55	0.020	50.0	600	75
1/2	1,200	90	.075	13.3	2,650	331
3/4	1,200	200	.167	6.0	5,400	675
1	1,200	324	.270	3.71	9,000	1,125

the inside of the rope examined to see that the yarns are bright and unbroken. There is no positive way of testing a rope by subjecting it to an overload; this may weaken it so that it will soon break under normal use.

If the rope end becomes worn at the knot or where it attaches to the saddle or serves as the saddle, it should be cut off immediately. Don't try to make the rope last too long. A man's life is worth more than the price of a new rope.

Kinking is one of the main causes of injury to manila rope and should be avoided, especially when the rope is wet. To avoid kinks in new rope when uncoiling, uncoil from the inside of the coil, never from the outside.

A rope should not be "burned" by allowing it to run through a crotch too rapidly. Great care should be used to avoid dropping cigarettes on rope. Rope should be kept away from fire, excessive heat, and acids (keep away from storage batteries).

Rope deteriorates rapidly when it is saturated with water and improperly dried, so unnecessary wetting must be avoided and wet ropes dried properly before storing. Rope should not be allowed to freeze after wetting, as frozen rope breaks easily. Rope should not be left in a tree overnight when there is reason to expect a heavy dew or rain or where it might be stolen or injured.

All rope should be kept coiled when not in use. It should never

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	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
		Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
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, shagbark.....	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, evergreen.....	59	32	46	63	82	104	129	156	185	217	252	289	329	372	417
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

WEIGHT TABLE FOR GREEN LOGS—Continued

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

SPECIES	Weight per cubic foot	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
	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
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

be stored or transported where it may be cut by sharp tools. Rope should not be dragged in the dirt, over rough surfaces, or across itself. Avoid sharp bends over unyielding surfaces.

Climbing

All limbs should be inspected before the weight of the body is allowed to rest on them. Do not trust your weight to a dead limb. If possible, all dead limbs should be broken off as the climber comes in contact with them in order that there will be no chance of such a limb being entrusted.

Trees are of varying strengths but it is necessary to remember that no matter how tough the wood of the tree or how large the diameter of a limb, a rotten or decayed limb is never safe. The limbs of old cherry and apple trees are likely to be weak because of heart rot, and black locusts are likely to be weakened by borer attack. All old or diseased trees may have invisible decay which makes them more hazardous than young ones.

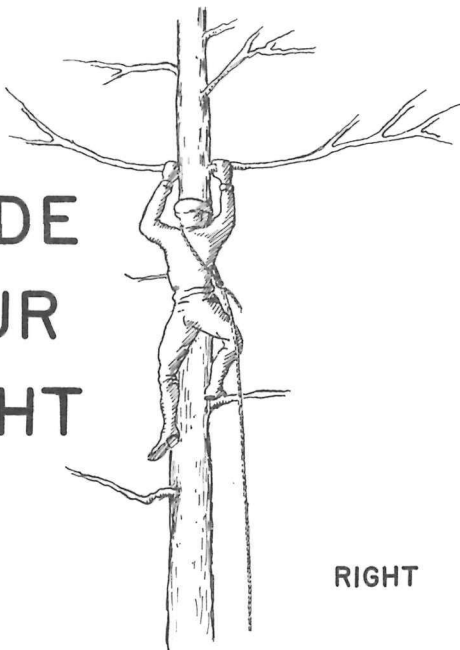
The publication entitled "Tree Trimming Practices" lists the following groups of trees according to strength:

- (a) Very easily broken: Willow, poplar, aspen, box elder, catalpa, ailanthus, soft maple, white pine, and sassafras.
- (b) Split easily: Linden, ash, red elm, persimmon, magnolia, and tuip.
- (c) Rather hard to break: Apple, pear, plum, most conifers, hackberry, birch, oak, walnut, hickory, sycamore, hard maple, American elm, black locust, honey locust, and Osage orange.
- (d) Trees with thorns which not only cut and scratch but which may set up infection are: Honey locust, Osage orange, black locust, and hawthorn.

When climbing without a rope, the climber's full weight should rarely be entrusted to one limb. A better practice is to keep one arm around the trunk or to keep the hands on separate limbs so that if one limb breaks, the body can be supported by the trunk or the other limb. (See page 11.)

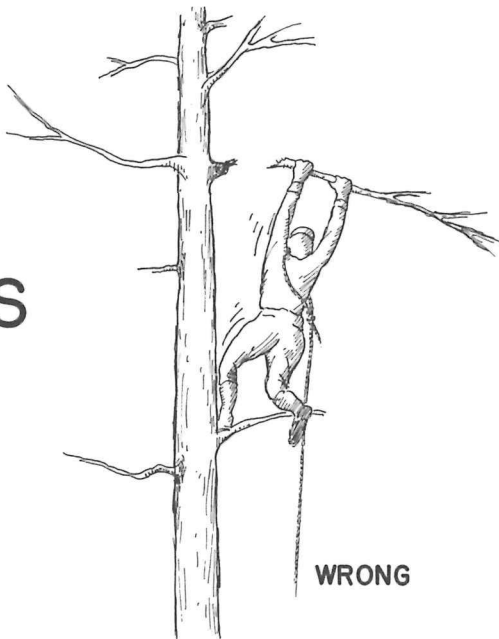
A rope should not be climbed hand over hand without using a footlock or using the legs around the tree. Shinning a tree over 15 feet is an unsafe practice. Climbs over 30 feet should be made by using a safety sling. Fatigue and cramps should be avoided. Feet,

**DIVIDE
YOUR
WEIGHT**



RIGHT

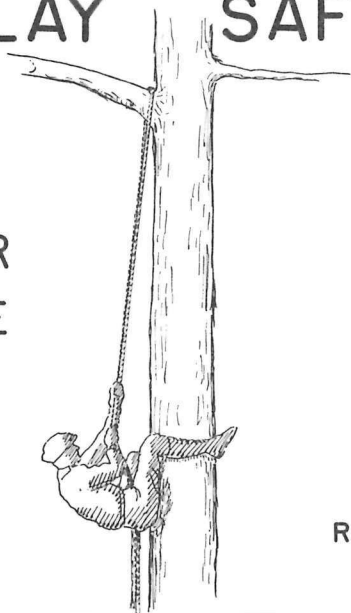
**USE
TWO
LIMBS
NOT
ONE**



WRONG

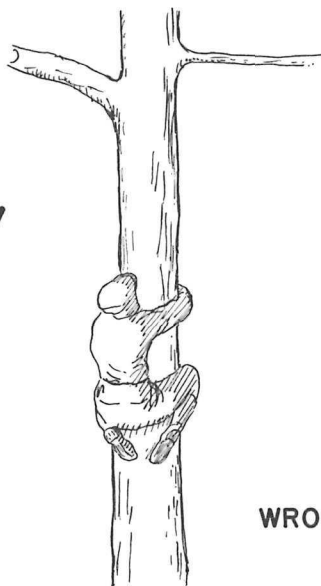
PLAY SAFE!

USE
YOUR
ROPE



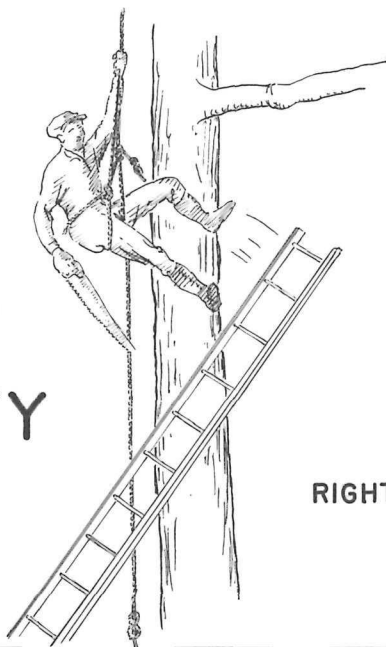
RIGHT

DONT
SHINNY!



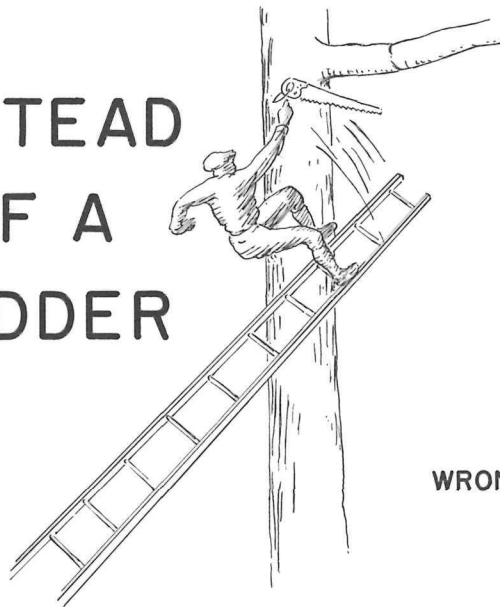
WRONG

RELY
ON
YOUR
SAFETY
ROPE



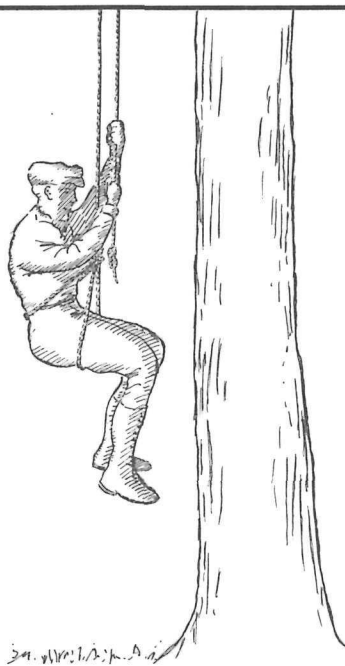
RIGHT

INSTEAD
OF A
LADDER



WRONG

A
FIGURE
EIGHT
KNOT
ON
YOUR
SAFETY
ROPE



RIGHT

MAY
PREVENT
A
BAD
FALL



WRONG

hands, and rope should be kept out of tight crotches. (See page 12.)

A bowline-on-a-bight tied into a safety line, or standard tree worker's safety belt, or saddle with or without separate leg straps, in combination with a taut-line hitch constitutes the safety sling. The saddle is preferred by many because it is more comfortable, and permits free action of the legs. The ordinary lineman's belt and strap are neither safe nor practical for tree work.

The safety sling must always be used while working in a tree, even if a ladder or scaffold is also used. Many men have been injured or killed by failing to observe this cardinal rule. (See page 13.)

The safety sling should be tied immediately after the climber has crotched his rope as high and as close to the trunk as possible. Tight crotches which will bind the rope should be avoided. When practicable, the rope should be crotched on the side of the tree opposite that to be worked so as to avoid accidentally slipping the rope out to a point where the limb cannot support the climber's weight. The climber should check the location of the entire length of the safety sling and the taut-line hitch before swinging free.

A figure-of-eight knot always should be tied in the ground end of a safety rope to prevent accidental pulling of the end through the taut-line hitch when coming down on the rope. If someone else ties the knots, the climber should check them himself before trusting his weight on them. (See page 14.)

The ground end of a safety rope must not be left dangling over roadways or walks, and it must be kept free from obstructions, tight crotches, and fallen brush. All slack must be kept out of the safety rope.

The safety rope may be recrotched whenever it will make the work safer or quicker. To be absolutely safe, the climber should tie himself to a convenient limb while making the change.

The climber should stay in the safety sling until he is again on the ground. Do not release the taut-line hitch before coming out of a tree.

A climber should not slide down a limb or tree trunk without carefully inspecting it for projecting stubs, nails, or loose bark. Severe gland injuries have occurred through failure to observe this rule.

All knots should be removed from a rope at the end of a working day. To leave knots tied for a prolonged period or to tie knots repeatedly in the same point in a rope will cause kinking and undue wear.

Remember: A good safety rope is the tree worker's most important accident insurance policy. Use it!

Ladders

Ladders are used in tree work primarily for climbing into trees. If any trimming or other work is done from a ladder, a safety sling should also be used.

Ladders used in connection with tree work should comply with all of the provisions contained in the "American Standard Safety Code for Construction, Care, and Use of Ladders."

Ladders should not be used in tree work unless the base can be set on a firm foundation. They should never be used in trees with the bottom rung or rail bases resting in a crotch. A ladder should never be set on a truck or other object which can be moved while a man is working on it. If absolutely necessary to place a ladder in a street or on a walk, and no other footing can be obtained, it should be guarded by a ground man and lashed in place with hand lines. The foot of the ladder should be moved out of the perpendicular by one-fourth the length of the ladder; i. e., if the ladder is 12 feet long, the foot of the ladder should be 3 feet from the base of the trunk of the tree, provided the top of the ladder rests against the trunk and the trunk is perpendicular.

Ladders should be frequently inspected to make sure they are sound. Ladders with broken or cracked rungs or rails should be discarded or immediately repaired, and protruding slivers should be removed.

Ladders used against trees where the limbs will not support the weight of the climber should be secured with hand lines. Lashings should pass over the rails and the ends of the rungs, not the center of the rungs.

When a ladder is leaned against a tree, the weight should be distributed equally on both rails and not against the top rung unless this has been especially braced. It should be lashed in place if there is any danger of slipping.

Ladders should be placed in proper racks or on the ground after use and not left leaning against trees or buildings. They should not be left on the job at the end of a working day unless secure from tampering or use by unauthorized persons.

Pruning

(See Tree Preservation Bulletin Number 4)

Tree pruning or other work in the crowns of trees should be performed only when weather conditions are favorable. Branches are more apt to snap off on a cold day than on a warm one. Branches wet by rain or snow or covered with ice are dangerous to the climber.

Before starting any tree job, the program should be worked out carefully with the foreman when possible. This may avoid extra climbing and additional hazards.

Automobiles that are found under trees where overhead work is being done should be pushed clear or the owners asked to move them to a safe place. When possible, "No Parking" signs should be placed in advance of the work.

Warning should always be given when a limb is about to be dropped from a tree. The shouts "timber," "heads up," or "look out below" are common signals for this purpose. The dropping of limbs or stubs should be permitted only when there is no danger to men or objects beneath. Hard hats painted with bright colors when worn by ground men can readily be seen by men in the trees.

A limb which cannot be controlled by hand while being severed from the tree should have a line or lines attached for controlled lowering before it is cut off. The end of the safety sling should never be used for this purpose. In estimating the weight of green limbs and logs, the table on pages 8-9 will be found useful.

Lowering ropes should be snubbed to prevent injury to the holder. It is well to remember that a snubbed rope does not hold as well on wet limbs or trunks as on dry wood. A man should hold only one rope at a time. Never allow ground men to wrap a bull line around their hands or bodies.

The trimmer should never cut a large limb which is above him if it can be avoided.

When large limbs or parts of the trunk of a tree are to be sawed off and no suitable crotch is available for passing the support rope, the limb should be snubbed to the lower portion of the trunk and lowered when completely severed. The climber should be sure that he is in a safe position or on the ground before the stub or branch is finally swung clear. Be sure the bull line being used is large enough to handle the weight of the limb being lowered. A sudden jerk may break the line if it is too light.

Care should be used in pulling branches out of trees by hand or by means of pole pruners as they may fall and strike the tree worker and cause injury. A worker should stand in a place to the side, or if possible above the limb, in order to allow it to fall without striking him.

Never leave "hangers" or anything not securely fastened in the tree. If a tree is not completely pruned at the end of a working day, all "hangers," tools, and ladders should be removed, since they might become dislodged during the night and fall on someone. If necessary to leave a climbing rope in a tree overnight, it should be tied up out of reach.

Electrical Hazards

Special care must be exercised when working closely to charged wires or electrical apparatus. Only men who are thoroughly familiar with the dangers connected therewith should be allowed to do this work. Only insulated tools should be used under such conditions. In manipulating aerial lifts close to limbs and wires the trimmer must be very careful not to bring himself or the equipment in contact with the wires.

Before working in trees that are close to or touching live wires, the power company concerned should be contacted so that they may de-energize and ground the lines locally, if possible. In any event, lines should be declared safe by a qualified power company employee before men are allowed to work in trees touching wires.

Wet materials are conductors of electricity, even those which normally are nonconductors. Trees near or touching wires should not be worked in if clothing, rope, equipment, or the tree are wet or even damp. The use of weatherproof rope and periodic shellacking of poles and other wooden handles are worthwhile practices.

The climber should never pass between wires unless authorized by the foreman and until rubber guards such as hoods, snakes, or blankets are placed on the wires by a thoroughly experienced man. No one should ever stand on wires, either conductors or guys.

Special care must be used to avoid dropping limbs or branches on wires, but if they accidently fall or are resting on wires, they should be removed by means of a dry rope slung over the branch or with a long-handled pruner equipped with a rope pull. Rope or pruner should be handled with rubber gloves.

Fallen wires should not be touched. The power company should be called at once and the wires guarded from passers-by until the company responds to the call. Even if the wires are known to be dead, they should be brushed lightly with the back of the hand before touching them.

In case of contact with live wires do not allow the victim to be touched. The wire may be lifted from him or he may be lifted off the wire by using dry, nonconductive materials such as clothing, rope, boards, or rubber materials. After rescue the back pressure-armlift method of artificial respiration should be applied if the patient has stopped breathing, and a doctor or the emergency squad should be called.

During thunderstorms, trees, especially those standing alone, should be avoided.

Tools

Tools should be raised or lowered by means of a hand line or the free end of the safety rope. They must never be thrown into or dropped from a tree.

Tools should not be left where they may be tripped over or stepped upon, nor in a leaning position from which they may fall. Rope and rope ends should be kept free.

HANDSAWS with teeth on one edge only should be used for general tree work. They should be kept sharpened and properly set so that they will not jump out of the cut and cause injury. Each handsaw and bullsaw and other small handled tools should be provided with a leather or wire loop through the handle.

HANDSAWS should not be carried on the belt or in the hand when climbing. A saw may be attached to the end of the safety line or hand line before the tree is climbed and then pulled up. When temporarily out of use, a saw should not be laid on a limb or in a crotch, but it should be securely hooked on the belt or over a branch of sufficient size to hold it securely. There are scabbards or sheaths which are hooked to the belt into which saws are safely hung when not in use.

POLE SAWS should be as light in weight as possible and of sufficient length to allow the trimmer to reach his work readily. They should be made with a one-piece wooden handle, angular in cross section, and be provided with a hook just below the blade.

POLE SAWS should be raised or lowered by means of a rope tied below the blade. When temporarily out of use in a tree, they may be hooked over limbs of sufficient size to hold the weight. They should never be laid on limbs or in crotches or hung on wires.

POLE PRUNERS should be as light in weight as possible and of sufficient length to allow the trimmer to reach his work readily. They should be made with a one-piece wooden handle and be provided with a rope pull leading from the lever arm to the end of the handle. Poles which are hexagonal or square in cross section are easier and safer to handle than round ones.

POLE PRUNERS should never be raised or lowered by placing a finger in the hook, but by means of a rope tied under the head, never over the jaw, as the cutting edge may close on the rope and cut it. They should never be thrown by a ground man to a trimmer in the tree. A pole pruner temporarily out of use in a tree may be hooked over a limb of sufficient size to hold the weight securely. They should never be hooked over wires, laid on limbs or in crotches, or used for lifting other equipment.

CHISELS AND GOUGES and other sharp-edged tools should never be carried in the boot. A leather kit with a wooden bottom is a convenient way to carry such tools. Chisel kits should be made so as to prevent the tools falling out if the kits are accidentally tilted. When working in awkward or confined places, the operator should use long chisel handles to prevent bruising his hands. When using a chisel or gouge he should keep his head out of the line of swing to prevent possible injury of the face from the rebound of the mallet. Chisel handles should be provided with iron ferrules to prevent splitting. Operators should remember that chisels and gouges are cutting tools and should not be used as levers or wedges. They should be kept sharp.

AXES are, of course, necessary on tree operations for felling and bucking, but they should never be used as wedges or for pruning or trimming shade trees. They should not be used for driving wedges. They should be kept sharp.

SPURS OR CLIMBING IRONS should never be used on live trees except possibly during tree-removal operations. Use of spurs at any time is a questionable practice and should be discouraged since the gaffs are apt to tear out of the bark and cause the climber to slip, fall, or spur himself. The tree climber has so little occasion to use spurs that he rarely becomes expert and consequently should avoid them.

WEDGES should be provided on each felling operation. They should be kept free from burred edges. They should be driven only with a sledge hammer—never with an ax.

TOOLBOXES should provide special places for saws, chisels, and other sharp-edged tools so that they will not come in contact with other tools and rope. After use, saws, rope, small tools, picks, shovels, etc., should be placed inside the toolbox in their designated places. When not in use, tools should be kept covered with light machine oil or other easily removed metal protector to prevent rust.

PNEUMATIC PRUNERS AND SAWS are coming into wider use, particularly with aerial lifts. They should be handled with care. Do not hand the pruner or saw to another trimmer unless it is disconnected from the air hose. The trimmer should not try to catch the pruner or saw if it falls and is connected to the air hose. Do not lay the pruner down with air hose attached, it may be tripped with the foot.

The use of ELECTRIC OR GAS CHAIN SAWS in trees is common but is also hazardous. The trimmer must place himself in the tree so that the saw cannot fall against him. The saw should be suspended from a line crotched at a point other than where the climber's safety line is crotched and, if possible, so that should the saw be released by the trimmer for any reason it would swing away from him. A special carrier is available for use with a chain saw in a tree.

Tree Felling

Before any tree is felled, the crew should be properly instructed by competent authority in the proper manner of notching and wedging so that the tree may fall where desired. Space immediately around the tree should be cleared of all brush so that it does not interfere with the fallers.

Before each tree is felled it should be carefully studied by a competent man in order that the following factors may be taken into consideration: (a) Height of tree, (b) soundness, (c) direction of lean, (d) slope of ground, (e) species of tree, (f) its topheaviness, (g) direction of wind, (h) proximity to other trees, structures, and wires, and (j) dead limbs or stubs which may break off and fall endangering fallers.

If there is danger that the trees being felled may damage property, block and tackle should be used. In most cases in shade tree felling, guide lines will be necessary to avoid damage. Guide lines should

be tied and snubbed around other trees before any cutting is done at the base of the tree. Winch line, block and tackle or pull lines assist in controlling the direction of the fall.

In many cases it will be necessary to fell a tree by lowering it in sections instead of simply cutting it off at the ground. If this is done, careful study must be given to the size and position of limbs, location and order of making cuts, and methods of snubbing and guiding. Great care must be exercised to avoid severing guide or power ropes. Special precautions in roping rotten or split trees are important because they may fall in an unexpected direction even though the cut is made on the proper side.

Not more than two men at a time should be allowed to work on the base of a tree being felled. Both should know where the tree is to fall and where they are to go when the tree starts to fall.

Persons should keep away from the butt of a tree starting to fall. It may kick back or take an unexpected roll.

Just before a tree is ready to fall, the shout "timber" should be given; all who are working in the vicinity should immediately take cover in a place safely out of range.

Felling operations once started should be finished before the crew leaves the job for lunch or at the end of the working day. It is especially important to complete such operations when roots have been excavated or cut, or when the base cut has been started.

Additional precautions are necessary in felling trees with a chain saw. If there is loose bark on the trunk where the cut is to be made, it is best to remove it with an ax so that the saw does not throw it into the face of the operator. An undercut should be made to the proper depth on the side of desired direction of fall and notched out with an ax. All but small trees should be undercut. When trees must be cut flush to the ground, it is safer to make the first cut at a stump height above the swell of the roots and then flush with the ground after the tree is down.

As the cut proceeds, the engine operator should check to see that the cut on the tail-stock end is even with the depth of cut on the engine end. If any binding occurs, wedges may be used, taking care not to drive them in against the chain, or the pull rope may be sufficient to prevent binding. When the final cut is in to the proper depth for felling, the tree should be pulled or wedged over. If there is danger of driving the wedge into the saw, a wooden wedge should be used.

Extreme care must be exercised not to make the final cut too deep and beyond the wood controlling the direction of fall. Because of the speed with which the saw cuts, trees have been cut clear off so that there was no control over direction of fall.

Small brush should not be cut with a power saw as it may either throw the operator or throw the butt of the brush back at the operator. On very steep slopes a one-man saw is much safer because one operator can abandon the saw quickly if the tree should fall in the wrong direction.

Where the tree leans in the opposite direction to that of its intended falling, and where there is not enough room to drive a wedge back of the saw, it is safest and best to go back to the old cross-cut saw.

The operators should be very careful that the hand does not slip over the edge of the outboard handle of most two-man and one-man saws. The hand, especially when gloves are worn, can be very easily pulled into the chain. On one-man saws, this is true when the saw is used in a horizontal position and the guard, where the hand is placed, is on the underside of the saw.

Brush and Wood Removal

Brush and logs should not be allowed to accumulate at the site of the operation but should be cleared away as rapidly as possible. Pending removal, debris should be piled so it will not interfere with the operation or where men might stumble over it. (See page 24.)

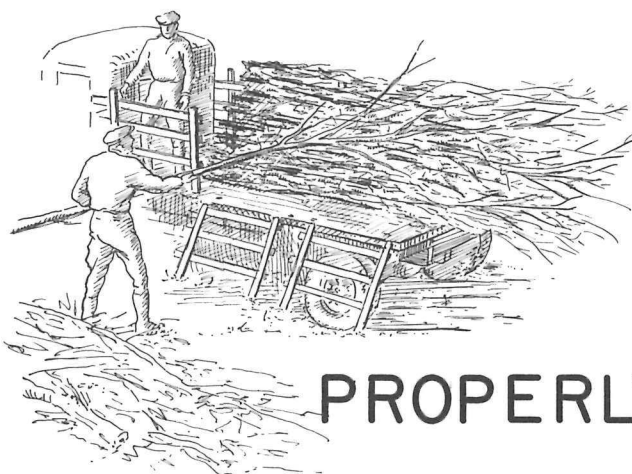
Ground men handling brush should not attempt to pick up the brush or limbwood from under that side of a tree where the climber is working.

A ground man having his attention called by workmen in a tree should first step out from under the tree before looking up in order to avoid falling brush.

Men should not try to lift logs or other loads that are too heavy. A large number of tree accidents result from strains. The loads should be reduced by the use of skids, by cutting logs into shorter lengths, and by use of winch equipment, etc. (See table on pages 8-9.)

The man who is loading the brush on the truck should stand between the brush and the cab—never on or straddling a load of brush. Brush should be kept within the bed of the truck and held down tightly by means of a rope lattice. This gives a better vision

LOAD BRUSH



PROPERLY

KEEP
YOUR
WORK SITE
CLEAN



to cars passing around the truck and prevents the brush from scraping cars or striking pedestrians. Whenever brush extends beyond the confines of the truck, red flags should be placed on the ends. (See page 24.)

When disposing of brush by burning, the truck driver should not back his truck close to the fire but should dump the brush some distance to one side where it may be fed to the fire by hand. Care must be exercised to keep the fire under control. Be sure that there is no chance of fire spreading to fields, fences, woods, or buildings. Fires must never be left unattended, and all fires must be extinguished before the crew leaves for lunch and before the work is finished for the day. Every crew required to burn brush should be equipped with a few suitable fire tools. Fire rakes and swatlers are especially designed for brush, grass, and leaf-litter fires. Fire pumps, which contain 5 gallons of water and are carried on the back, are helpful in putting out fires.

Brush must never be burned except in places that have been definitely designated by competent authority, and then only when burning conditions are satisfactory and safe. Locate the fires in open areas well away from the trees. Why prune the trees only to scorch them later in the burning operation? Ordinarily, poisonous vines should not be burned because the smoke is likely to affect susceptible persons. If absolutely necessary to burn such material, care should be taken to keep out of the smoke which carries the poison.

If brush is piled on a public dump, the foreman should make sure that he complies with all the requirements of that particular dumping ground.

Transportation

Truck drivers should qualify under all rules which apply to licensing, driving, and maintenance of motor vehicles.

All persons should get on and off the truck only on the right or curb side of the truck or the rear. No one should get on or off when the truck is in motion. Before starting the truck, the driver should be the last one to get on and must first make certain that all riders are safely within the truck bed.

No person should be allowed to ride on any part of the truck except within the cab or bed. No part of the body should extend

beyond any part of the truck when it is in motion. Stake sides and tail gates must be in place in trucks carrying persons.

Tools and equipment must not be carried loosely on the truck beds but in proper boxes or receptacles provided for them. All trucks should be equipped with a fire extinguisher and a good first-aid kit properly stocked with suitable materials. Crewmen should be instructed in the use of both.

Spraying

All spray materials must be used with extreme caution. Arsenic in any form is a deadly poison, and serious injury or discomfort may be received from many materials. Before using any commercially prepared spray material, read the cautions and instructions carefully and follow the directions.

Insecticides, fungicides, and their containers must not be left where they are accessible to children or animals. Spray wastes should be buried or drained into a sewer, and containers should be burned or otherwise destroyed as soon after emptying as possible. Sprayer drippings and materials accidentally spilled should be washed off lawns, walks, and roads.

Although it is questionable whether lead arsenate in concentrations normally deposited in ordinary operations is lethal to birds and stock, it is safer to use nonpoisonous substitutes when spraying in or near bird runs and pastures.

Spray materials are especially deadly to fish. Extreme care must be exercised to avoid pollution of ponds, streams, and sources of drinking water.

Stomach poisons, such as lead arsenate, should not be used for insect control on fruits or garden vegetables if there is a possibility of leaving poison residues in harmful concentrations which may remain until the time of consumption.

To avoid the hazards of poisoning from lead, arsenic, and other spray materials, the following rules should be observed:

- (a) If possible, have a medical examination, including a complete blood examination, before working with spray materials. Workers having blood diseases should not work with lead.
- (b) Brush the teeth daily after work.
- (c) Wash the hands and face well before eating and after work.

- (d) Take a shower and change clothes as soon after work as possible.
- (e) Keep and eat lunch away from spray materials.
- (f) When mixing dry spray materials, keep the nostrils and mouth covered with a respirator or wet cloth. Most spray materials are especially dangerous in concentrated form.
- (g) During the spraying season, drink plenty of milk to counteract arsenic poisoning.
- (h) Wear a raincoat, hat, and goggles while spraying, and keep out of the drift as much as possible.

Spray crews using lead arsenate may be subjected to both lead and arsenic poisoning. Symptoms of lead poisoning include headache, dizziness, colic, constipation, loss of weight, convulsions, blood changes, anemia, palsy, neuritis, weakness, blue line on gums, joint pains, twitching, and paralysis. (See Industrial and Safety Series No. 7.) Arsenic poisoning symptoms include skin ulceration; loss of nails and hair; inflammation of the nose, mouth, throat, and lungs; brown discoloring of the skin; perforation of the bonelike part of the nose; muscular weakness; paralysis; and diarrhea. Persons suspecting either type of poisoning should immediately consult a doctor.

Care must be exercised, especially when using a solid stream nozzle, to avoid contact of the spray stream or the nozzle with electric wires.

Spray apparatus should be kept as clean as possible at all times, not only for general reasons of good management, but to avoid falls of persons from slippery surfaces. Cleats should be attached to the floor of trucks on which mist blowers are mounted and sand should be spread on the floor to prevent slipping on slick surfaces. Check and tighten hose connections on hydraulic sprayer before use to prevent blowing. Use extreme care in cranking motors on sprayers. Watch for kickback. There should be no smoking around or on mist blowers when oil solutions are being mixed or used.

Fumigation

Fumigation is the practice of killing pests by means of a gas. The gas may be applied directly from suitable containers or formed from chemicals introduced into the area requiring treatment, which may be tree cavities or soil. Special techniques are required in treatments of this kind.

The chemicals employed are usually very poisonous and should be handled and used only upon the advice of and by persons thoroughly familiar with the individual properties of each.

Operators should make sure that they comply with all local laws and regulations covering fumigation.

First Aid and Poisonous Plants

Each member of a tree preservation crew should be trained in first aid and the back pressure-arm lift method of resuscitation. First-aid kits should be provided for each crew and kept handy for any emergency that may arise.

Small cuts, scratches, and blisters must be attended to immediately. Even the most minor scratch may easily become infected and lead to serious complications.

A common source of "lost-time" accidents among tree workers is contact with poisonous plants such as poison ivy, poison oak, and poison sumac. Susceptibility to the poison varies with individuals, but it is never safe to assume immunity from it.

Learn to know the poisonous plants on sight and then avoid contact with them. If contact cannot be avoided, the hands, arms and face should be washed as soon as possible after exposure with strong yellow soap or washing powder, which will often prevent infection or at least retard it.

There is danger of reinfection through handling or wearing clothes which have been in contact with poisonous species even after the passage of months or even years hence. Susceptible persons should avoid wearing such clothes.

Poison ivy remedies are numerous but most are of doubtful value as a preventive or cure. They may relieve itching and burning but frequently a remedy that will give relief to one person may not help another. Some of the newer treatments are reported to be superior to older remedies. However, avoid promiscuous use, particularly with home remedies as they may tend to spread rather than cure the infection. Persons susceptible should investigate through proper medical channels the latest immunization treatments.

A physician should be consulted in all cases of severe poisoning.

WHAT A FIRST-AID MAN SHOULD DO. The trained man possesses the ability to render first aid and should immediately assume charge of the situation. He should:

1. Keep the patient lying down.
2. Determine the nature and extent of the injuries. Serious bleeding, stoppage of breathing, and internal poisoning demand immediate treatment and take precedence over everything else.
3. Keep the patient warm.
4. Send for a physician or ambulance immediately and don't move the patient unless absolutely necessary in more serious cases. For less serious injuries, prepare the patient for transportation and get him to a doctor.
5. Keep calm.
6. Never give an unconscious person anything to drink.
7. Keep onlookers away from the injured.
8. Make the patient comfortable and cheer him as much as possible.
9. Avoid letting the patient see his own injury.

For details of treatment refer to the American Red Cross First Aid Text Book. Remember it is equally important to know what *not* to do as it is to know what to do in first-aid treatment. Know your first aid.

Summary

Before starting any tree operation, all necessary time should be taken to find out if any local danger exists. Haste causes accidents—take time to be careful.

Every rope must be thoroughly inspected for cuts or abrasions before each use. Do not hesitate to cut off a weak end or to discard an unsafe rope.

The safety sling must always be used while working in a tree even if a ladder is used also. Climbers must stay in the sling until again safely on the ground.

In pruning and tree removal, a limb which cannot be controlled by hand should have an adequate number of lines attached to permit controlled lowering. The end of the safety rope should never be used for this purpose.

Special care must be exercised when working closely to electric wires. Only men who are thoroughly familiar with the dangers connected therewith should be allowed to do this work.

Tools should be raised or lowered by means of a handline or the

free end of the safety rope. They should never be thrown into or dropped from a tree.

Before any tree is felled, the crew should be properly instructed by competent authority in the proper manner of notching, wedging, roping, etc., so that the tree may fall as desired.

Men should not attempt to lift logs or other loads which are too heavy.

No person should be allowed to ride on any part of a truck except within the cab or bed. No part of the body should extend beyond any part of a truck when it is in motion.

All spray and fumigation materials should be used with extreme caution. Certain materials are deadly poisons and serious injury or discomfort may be received from many of them.

Acknowledgments

In the preparation of this bulletin, all available sources were consulted and much valuable information was obtained. Special thanks are due the Edison Electric Institute for permission to use many of the rules contained in National Electric Light Association Publication No. 110, "Tree Trimming Practices"; S. M. Lauderdale, former safety director of the Civilian Conservation Corps; Dr. M. G. Lloyd, chief of the division of Safety Codes of the Bureau of Standards; W. C. Kiplinger, Charles F. Irish, A. W. Dodge, and Karl Kuemmerling, arborists, and members of the National Park Service who kindly reviewed the manuscript of this bulletin and suggested many helpful changes.

Bibliography

AMERICAN ENGINEERING STANDARDS COMMITTEE. *American Logging and Sawmill Safety Code*. U. S. Department of Commerce, National Bureau of Standards, Handbook No. 5. Washington, D. C. 1923.

AMERICAN RED CROSS. *First Aid Textbook*. Blakiston Co., Phila. 1945.

AMERICAN STANDARDS ASSOCIATION. *American Standard Safety Code for Construction, Care, and Use of Ladders*. New York. 1935.

——— *Lead Poisoning; Its Cause and Prevention*. Industrial Health and Safety Series No. 7. Washington, D. C. 1935.

EDISON ELECTRIC INSTITUTE. *Tree Trimming Practices*. Publication No. 110. 1937.

HARLOW, W. M. *Poison Ivy and Poison Sumac*. New York State College of Forestry. Syracuse, N.Y. 1945.

LESUEUR, A. D. C. *The Care and Repair of Ornamental Trees*. Jarrold and Sons, Ltd., Empire Press. London. 1949.

MARKWARDT, L. J., AND WILSON, T. R. C. *Strength and Related Properties of Woods Grown in the United States*. U. S. Department of Agriculture, Tech. Bull. No. 479. Washington, D. C. 1935.

MASON, A. FREEMAN. *Spraying, Dusting and Fumigating of Plants*. The Macmillan Company. New York. 1936.

NATIONAL ARBORIST ASSOCIATION, SAFETY COMMITTEE. *Safe Practices for Arborists*. Trees Magazine, Nov.-Dec., 1953. Olmsted Falls, Ohio.

THOMPSON, A. ROBERT. *Shade Tree Pruning*. U. S. Department of the Interior, National Park Service, Tree Preservation Bull. No. 4. Washington, D. C. 1955

——— *Rope, Knots, and Climbing*. U. S. Department of the Interior, National Park Service, Tree Preservation Bull. No. 7. Washington, D. C. 1955.

PIRONE, P. P. *Maintenance of Shade and Ornamental Trees.* Oxford Univ. Press. New York. 1941.

UNITED STATES DEPARTMENT OF THE INTERIOR, BUREAU OF MINES.
Manual of First Aid Instruction. Washington, D. C. 1940.

WESTER, H. V. *General Spraying and Other Practices.* U. S. Department of the Interior, National Park Service, Tree Preservation Bull. No. 6. Washington, D. C. 1953.

