VOL. 18 JULY 1957 No.

FIRE CONTROL NOTES

A PERIODICAL DEVOTED TO THE TECHNIQUE OF FOREST FIRE CONTROL

FOREST SERVICE • U. S. DEPARTMENT OF AGRICULTURE

FORESTRY cannot restore the American heritage of natural resources if the appalling wastage by fire continues. This publication will serve as a channel through which creative developments in management and techniques may be communicated to and from every worker in the field of forest fire control.

Volume 18 Number 3

FIRE CONTROL NOTES

A Quarterly Periodical Devoted to the TECHNIQUE OF FOREST FIRE CONTROL

The value of this publication will be determined by what Federal, State, and other public agencies, and private companies and individuals contribute out of their experience and research. The types of articles and notes that will be published will deal with fire research or fire control management: Theory, relationships, prevention, equipment, detection, communication, transportation, cooperation, planning, organization, training, fire fighting, methods of reporting, and statistical systems. Space limitations require that articles be kept as brief as the nature of the subject matter will permit.

FIRE CONTROL NOTES is issued by the Forest Service of the United States Department of Agriculture, Washington, D. C. The matter contained herein is published by the direction of the Secretary of Agriculture as administrative information required for the proper transaction of the public business. Use of funds for printing this publication approved by the Director of the Bureau of the Budget (September 15, 1955).

Copies may be obtained from the Superintendent of Documents, Government Printing Office, Washington 25, D. C., 20 cents a copy, or by subscription at the rate of 75 cents per year, domestic, or $1.00, foreign. Postage stamps will not be accepted in payment.

Forest Service, Washington, D. C.

UNITED STATES GOVERNMENT PRINTING OFFICE, WASHINGTON: 1957

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HOW TO USE CFFP MATERIAL

WILLIAM W. HUBER
Director, Cooperative Forest Fire Prevention

The Cooperative Forest Fire Prevention Program will be 16 years old in 1957. The theme of the '57 Smokey program is "Thanks folks for preventing forest fires." The "thanks" are in order too, because forest fires have been reduced from 210,000 in 1942 to less than 145,000 in 1956. During this time the use of our forests has increased threefold. Annual acreage losses due to forest fires have dropped from 32 million to less than 9 million.

Yes, it is timely to thank folks for preventing forest fires and also to thank the Keep Green Associations, the forest fire protective associations, and the many other organizations and industries that have made the reduction of fires and fire losses possible. But the job is not done; there is still much to do, and all CFFP materials must be put to the best use to keep the public alert to forest fire prevention.

The Smokey program is built around cooperation. The more people who help with the program, the more people who will prevent forest fires. Therefore, the program is aimed at mass education of the public by seeking all the help possible. Foote, Cone and Belding, Inc., of Los Angeles, Calif., is the advertising firm that is the task force for The Advertising Council, Inc., forest fire prevention campaign. This firm actually handled the program even before it was one of their regular accounts, since the plan to initiate a national-forest fire prevention program was written by Don Belding before CFFP was organized. We have some of the best help in the advertising business.

We have excellent distribution of material by T.V., radio, newspapers, magazines, bus cards, post office trucks, subway posters, and movies. This is made possible as a public service by The Advertising Council, Inc. But there is a weakness, and that is in the proper point-of-sale use of the material in localities where prevention is most needed. The printing of millions of Smokey posters, bookmarks, stamps, and booklets does not get the job done. This material must be displayed in the right places or put in the right hands and in such a way as to stimulate interest and respect.

Some ways to use CFFP items most effectively:

1. *Posters.* The posters are printed on paper and waterproofed cardboard. They are printed for use and not storage. The paper posters are printed for use indoors or where they have protection from the weather. The cardboard posters are used either inside or out. All posters should be replaced or taken down when weathered or torn.

The Government Printing Office prints the year for which the material is intended as follows: '57-CFFP-4a. There will also be ☆ U. S. Government Printing Office: 1957-O-367345, etc. The ☆=outside contract, not printed by U. S. G. P. O.; 1957=year printed; O=offset printing; and finally jacket or file number; but the main thing to look for is '57-CFFP-4b. This gives the year of

the CFFP program and the 4a or 4b stands for the item, number 4 being the rules poster and "a" meaning paper poster, "b" meaning waterproofed cardboard poster.

Display the paper posters prominently in all forestry buildings, and on bulletin boards, as well as in store windows, meeting halls, and under shelter on recreation areas. The rules poster for 1957 (fig. 1) has special appeal to conservation groups and school

FIGURE 1.—Rules poster.

groups and teachers. Put cardboard posters on panels and mount them on forest fire equipment or on outside poster mounts. But be sure to obtain permission to put up the posters on private property. This is also a good time to talk forest fire prevention. Posters are ideal for fair booths, exhibits, window displays, etc. Put them up carefully and take them down timely!

2. *Bumper strips* are for use on car and truck bumpers. Forestry agencies are encouraged to use them on all vehicles fore and aft. When sufficient supply is available, State police, game wardens, county agents, and county health people can be asked to use the bumper strips.

3. *Bookmarks, stamps, and calendars.* These items are termed handouts and as such do an important job. They are made for use by school teachers, business offices, banks, and store counters, and for mailing. The calendar fits desks in motels, hotels, offices, and schools. All letters mailed from forestry offices to the public should have Smokey stamps. Other conservation agencies and organizations should be encouraged to use the stamps. The bookmarks in '57 are larger and fit 9½x4-inch envelopes; they can be given to libraries and schools for use. Banks, churches, and places of business can be asked to distribute bookmarks.

4. *Easels and wobblers.* The easel should be used in Chamber of Commerce offices, airports, railroad ticket offices, school principals' offices, and forestry and other resource offices both public and private. Offices in county courthouses should have either the easel or wobbler. The wobbler (fig. 2) is smaller than

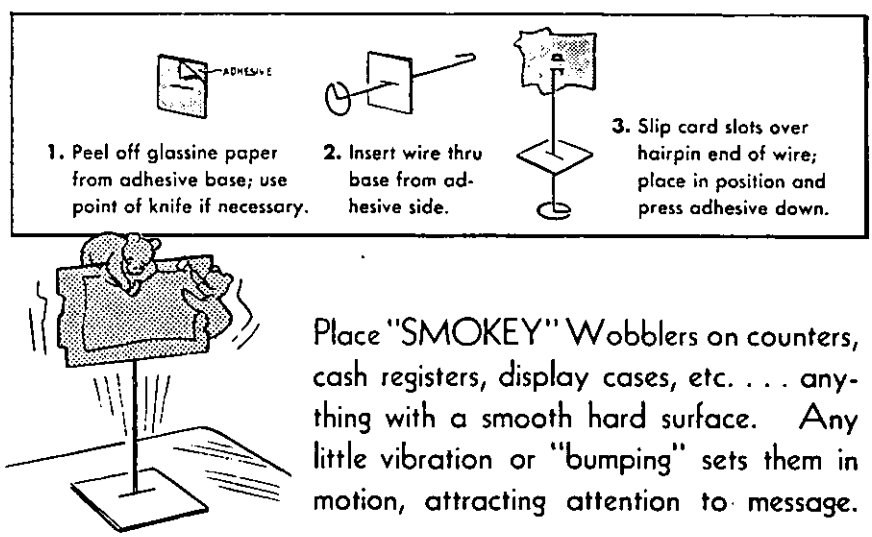

FIGURE 2.—Wobbler.

the easel and can be used at bank tellers' windows and on cash registers in sporting goods stores, and other stores and market places.

5. *Radio platters and TV spots.* The radio platters and the TV spot films (1-minute, 20-second, and 10-second animated cartoons of Smokey) are available through Smokey's Headquarters, U. S. Forest Service, Washington, D. C., or the State Forester's office. The Advertising Council, Inc., 25 W. 45th Street, New York City, arranges for support of radio and TV stations. Two television kits featuring the Smokey—Little Boy series will be sent out directly to television stations by The Advertising Council. Forestry personnel will be informed of these mailings so that they can personally contact the TV stations to stimulate the use of these TV spots.

6. *Newspaper ads.* The Advertising Council makes mailings of ads to newspapers, magazines, and house organs, but here again, personal contact of the local editors by agency representatives will get the job done. The Advertising Council is like an agent working for forest fire prevention; however, our people are on-the-ground performers who by personal contacts can use the ounce-of-prevention work that may save that pound-of-suppression work.

7. *Bus cards, three-sheet posters, and post office truck posters* are distributed by The Advertising Council, Inc., or by Smokey's Headquarters. A limited supply is available to foresters for display purposes. The bus or car card is used in trollies and buses. A supply is available for forestry agencies' use. The three-sheet poster has been popular for use at fairs and exhibits and on floats. When mounted on a cardboard, these make excellent displays. The post office truck poster is also ideal for display purposes.

8. *CFFP Material Kit.* This kit is used for distribution to large concerns, schools, conservation organizations, civic organizations, editors of magazines and newspapers, managers of radio and TV stations, and managers of timber associations and companies who are interested in forest fire prevention. They all have a vital stake in preventing man-caused fires.

9. *Smokey Bear Story of the Forest.* This booklet has been distributed to more than 4 million children. It is used as regular text in many schools. Schools and libraries will be glad to get this booklet, and rangers, district foresters, and fire wardens should all carry a supply.

10. *Other booklets.* Forest and Flame in the Bible and You and Forest Fires are also very popular and can be used in churches as well as schools. 4H, FFA, and other youth groups are making use of these publications.

11. *Junior Forest Ranger Kits.* These kits are distributed on request. However, the demand for them is now so great that we have asked radio and TV announcers not to mention that they are available. We have also discouraged magazine and newspaper ed-

itors from using stories about this phase of the Smokey Bear program. Nearly a million kits have been mailed since 1952. The youngsters are anxious to help Smokey and the field is wide open, but our present efforts in this respect must be limited.

12. *Special posters.* These posters hit at specific fire prevention problems. The debris or brush-burning poster is one example. The colorful 1957 range poster (fig. 3) aimed at the prevention of grass fires is another. We also have developed Red Cross posters, Girl Scout posters, Boy Scout posters and many other types of special posters. They are made for wide use and, although special in design, can be used in many areas. We wish to encourage more use of special posters, and we hope every forester will carefully review the new ones to see whether they meet some need in their area.

FIGURE 3.—Range poster.

13. *Commercial educational items.* Under the Smokey Bear Law of May 1952 (Public Law 359, 82nd Congress), the Secretary of Agriculture is authorized to enter into agreements with manufacturers for the use of the Smokey Bear symbol for educational items that will further forest fire prevention. The article must be in good taste and of high standards. Under this law, some 30 items have been licensed.

Some of the best sellers at present are Smokey Bear dolls, comic books, Golden Books, Smokey ash trays, tee shirts, blankets, scarves, and Smokey snuffers. These items are inexpensive and very popular, and many conservation groups are using them

for promotional material. Lumber companies are giving out snuffers to interest people in forest fire prevention, and women's conservation groups are buying the Smokey Bear comic books at $6.00 per hundred for schools and libraries.

Other commercial educational items that are planned for 1957 are a Smokey badge, a new Smokey Bear doll, and a Smokey newspaper comic strip. The Fairmont Foods Company's product, Smokey's Maple Crunch ice cream, is very popular, and Fairmont Company is carrying on a nationwide program to find a name for Smokey's friend, a little fawn. This program is getting good coverage and creating interest in forest fire prevention.

The Smokey Bear program is now international; the Canadian Forestry Association has entered into a cooperative agreement to sponsor Smokey in Canada. Other countries have expressed an interest in similar agreements. The whole world is looking to us to make a success of the cooperative forest fire prevention program. Forest fire statistics will tell the story. Smokey has done a good job up to now, but a better job is needed. With more attention to the use of CFFP material, a better job can be done.

☆ ☆ ☆

Protect Tool Handles From Powder-Post Beetle Damage

For the past 4 years we have been successfully treating the handles of tools held in fire caches or storage against damage by powder-post beetles. Our treating vat is made of 2 pieces of 6-inch eaves trough soldered in the form a "T." One 6-foot and one 18-inch piece are used and the 3 ends are capped with regular end caps. The vat is so shaped in order to accommodate tools that are already handled. We use a commercially prepared solution that contains 4.37 percent pentachlorophenol by volume. The handles are soaked from 3 to 5 minutes in the solution and then stood on end for a few minutes. They are then ready for storage.

Our vat permits economical use of the solution and is adequate for district needs. If a larger vat were needed, it could be made from a split hot-water tank. Caution should be used in handling the pentachlorophenol solution because it is irritating to the skin and eyes.—JOHN D. WHITMORE, *Jefferson National Forest.*

AIR TANKERS—A NEW TOOL FOR FOREST FIRE FIGHTING[1]

JOSEPH B. ELY, *Fire Control Officer, Mendocino National Forest;* ARTHUR W. JENSEN, *Forester, Division of Forest Fire Research, California Forest and Range Experiment Station;* LEONARD R. CHATTEN, *State Forest Ranger, California State Division of Forestry; and* HENRY W. JORI, *Pilot, Region 5, U. S. Forest Service.*

Tactical air support for ground fire fighters is a step nearer to reality. Seven agricultural-type airplanes converted for bulk water drop became part of the fire-fighting force in California in August 1956. These planes fought 25 fires from Oregon to the Mexican border by cascading 100- to 150-gallon loads of liquid through a dump valve in the bottom of their belly tanks. The planes, flown by northern California agricultural pilots, made more than 1,350 trips and dropped a total of 83,120 gallons of water and 65,990 gallons of a fire retardant, sodium calcium borate mixture (table 1).

TABLE 1.—*Use of air tankers by U. S. Forest Service and California Division of Forestry,* 1956[1]

Date and place of use[2]	Name of fire	Water	Retardant	Total drops	Effect on fire[3]		
					Help	No help	Adverse
		Gals.	*Gals.*	*No.*			
8/12 Shasta Co.	Beegum #1	4,000	200	42	x		
8/20 Shasta-Trinity	Horr's Corner	910		8	x		
8/20 Lassen	Mill Creek	4,400		36	x		
8/20 Mendocino	Potato Hill	3,600		30	x		
8/20 Shasta-Trinity	Papoose Hill	600		5	x		
8/20 Shasta-Trinity	Cinder Cone		200	2	x		
8/22 Shasta-Trinity	Lava Cave	2,000	200	15	x		
8/25 Shasta-Trinity	Bohemotash	1,200	200	12	x		
8/26 Shasta Co.	Beegum #2	1,200	400	14			x
8/27 Klamath	Serpentine	2,520		21		x	
8/28 Mendocino Co.	Aero Stud	3,360		28	x		
8/28 Mendocino Co.	E. C. Anderson	240		2	x		
8/28 Mendocino Co.	Fomo Corp.	360		3	x		
8/29 Siskiyou Co.	Widow Springs	840		7		x	
9/9 Angeles	Dunsmore	4,560	80	39	x		
9/10 Cleveland	Pine Mt.	7,245	6,200	125	x		
9/11 Cleveland	Cornwell	13,225	6,100	176	x		
9/12 Riverside Co.	De Luz	460	200	6		x	
9/17 Lassen	Lodgepole	1,680		14	x		
9/21 Mendocino Co.	Public Domain	1,440		12	x		
9/22 San Bernardino	McKinley	24,480	25,400	458	x		
9/25 Riverside Co.	Potrero		700	7		x	
9/30 Shasta-Trinity	Steep Hollow	4,800	700	47	x		
11/23 San Bernardino	East Highland		2,410	26	x		
11/24 Cleveland	Inaja		23,000	252	x		
Total	25 fires	83,120	65,990	1,387	20	4	1

[1]Tabulation of reports from field officers of U.S.F.S. and C.D.F.
[2]Name of national forest for U.S.F.S. fires; county for C.D.F. fires.
[3]Definitions: "Help"—a deciding factor in assuring control of a definite help to ground forces. "No Help"—fire would have been controlled at same size without air drop. "Adverse"—put out backfire and made control more difficult.

[1]Presented at Air-attack Conference, Redding, Calif., April 10-12, 1957.

The air tankers made newspaper headlines during 1956, but their development was the culmination of an idea that began many years ago—as far back as 1921. Ever since then, fire fighters have tried to develop practical methods for dropping liquids on fires from aircraft. They tried dropping water in bombs or paper bags and uncontained from such planes as the B-29, DC-7, Ford Tri-motor, and TBM. None of these methods became practical. Some didn't work because planes weren't readily available. Some failed because too little of the water reached the ground.

Many of the problems were overcome, however, when modification of aircraft was turned over to agricultural aircraft operators who are highly skilled in low-level flying. In 1955, at the request of the Forest Service, the Willows Flying Service developed a practical, effective, economical method of attacking fires from the air.[2]

SCOPE OF 1956 OPERATIONS

To establish limitations of this new fire tool, the air tankers were used in as many fire situations as possible during 1956. They made drops under all sorts of conditions ranging from hot, rolling brush fires to small lightning fires in timber.

This was recognized as a trial-and-error operation in which air tankers might be ineffective or only slightly helpful. Yet air attack was a deciding factor in assuring control of 15 of the 25 fires on which tankers were used. Of the remaining 10 fires, air tankers were a definite help to ground forces on 5; they did not change the control picture on 4; and they caused the loss of line on 1 fire because the drop extinguished a backfire. Even on the 5 fires where the tankers didn't help, they emphasized some of the problems in their use and thus provided information helpful in later operations.

Air tankers attacked fires from less than 1 acre in size to more than 40,000 acres. On the larger fires, serious operational problems were encountered. These included supply and loading of aircraft to keep pace with demands, coordination with ground forces, and air traffic control.

To supplement the field reports of air tanker performance on fires and to calibrate the planes, a series of test drops were made at the Willows Airport in October 1956 (fig. 1). We wanted to learn the best combination of plane height, altitude, speed, gate size, and wind for dropping borate slurries. We also wanted to test and evaluate air-to-air and ground-to-air radio control. After the tests, air tanker pilots and representatives of the using agencies pooled their knowledge to draw up the rough operational guidelines presented here.

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[2] ELY, JOSEPH B., AND JENSEN, ARTHUR W. AIR DELIVERY OF WATER HELPS CONTROL BRUSH AND GRASS FIRES. Calif. Forest and Range Expt. Sta. Forest Res. Note 99, 12 pp., illus. 1955.

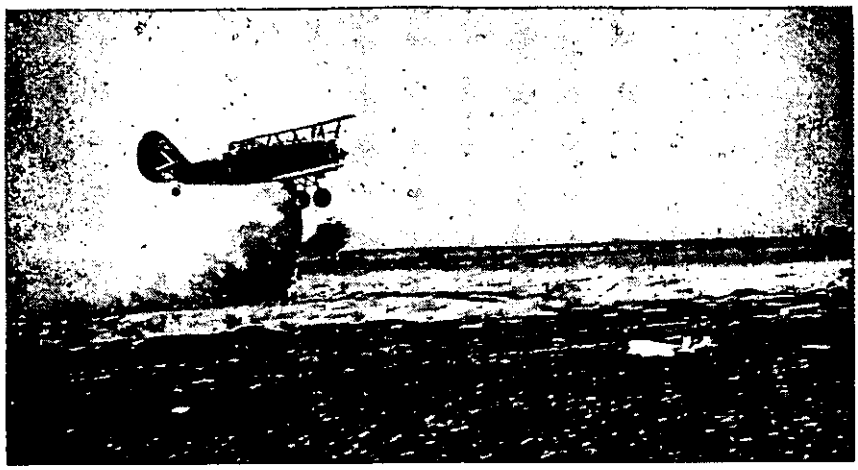

FIGURE 1.—Stearman air tanker making drop at 15 feet during October 1956 tests at Willows.

WHAT AIR TANKERS CAN DO

The 1956 experience left no doubt that water or a water and sodium calcium borate mixture dropped free-fall from aircraft can have a significant effect on grass, brush, and timber fires. Borate, because of its retardant qualities, does a better all around job than water.[3]

But air tankers with water alone can knock down fires in light fuels such as grass and young chamise. Here are some of the jobs air tankers can do:

1. Hold a small fire until initial attack forces arrive.
2. Cool down hot spots so that men can enter the area and work safely.
3. Knock down spot fires.
4. Build a fire-retardant line with borate in advance of a fire or where men cannot work (fig. 2).
5. Reduce the probability of crowning.
6. Strengthen existing firelines.
7. Directly support ground forces who are actively engaged in line construction.
8. Fireproof local areas where spot fires are probable, such as exposed slopes in steep canyons.

WHAT AIR TANKERS CANNOT DO

In some situations air tankers proved little or no help. They cannot:

1. Knock down hot rolling brush or timber fires.
2. Safely make drops in high winds (over 30 m. p. h.).

[3] MILLER, HARRY R., AND WILSON, CARL C. A CHEMICAL FIRE RETARDANT—RESULTS OF FIELD TRIALS USING SODIUM CALCIUM BORATE ON FOREST FIRES IN 1956. Calif. Forest and Range Expt. Sta. Tech. Paper 15, 19 pp., illus. 1957.

3. Make drops in the bottoms of steep canyons or other inaccessible places.
4. Cool down hot fires in heavy fuels under timber stands.
5. Work at night.

FIGURE 2.—Air tanker drops 100 gallons of sodium calcium borate on Inaja Fire, Cleveland National Forest, November 1956.

OPERATIONAL GUIDELINES

Four to six Stearman air tankers make an effective, manageable air tanker squad. If possible, they should be led by an experienced fireman in a reconnaissance plane.

Effective length, width, and concentration of the drop pattern vary with plane, height, speed, altitude, gate size, and wind direction and velocity. To obtain the greatest concentration of liquid on the ground, the airplane should fly level and as low and as slowly as conditions will permit and as nearly into the wind as possible. The more rapidly the liquid is released the greater the concentration will be. Increasing the drop height, air speed, or dropping in a cross wind will give greater area coverage, but will reduce concentration. Drops from more than 100 feet above the vegetation will usually be wasted. With a cross wind of more than 10 m. p. h., there is little chance of hitting any part of the target. Experienced air-attack pilots can achieve higher concentration by dive bombing or banking releases.

AIRCRAFT AND EQUIPMENT

Air tankers must be in top mechanical condition and have a reserve of horsepower. Minimum tank capacity for drop liquids should be about 50 gallons. The tank should be accurately calibrated and properly vented. One square inch of vent for each 5 square inches of gate area allows unrestricted gate flow. The gate should have a minimum opening of 175 square inches for plane speeds up to 110 m. p. h. and tanks up to 200 gallons. The gate size should be larger for higher dropping speeds. A free-swinging (hinges at leading edge), quick-release door seems to be most satisfactory (fig. 3). The pilot should be able to close the gate while in flight.

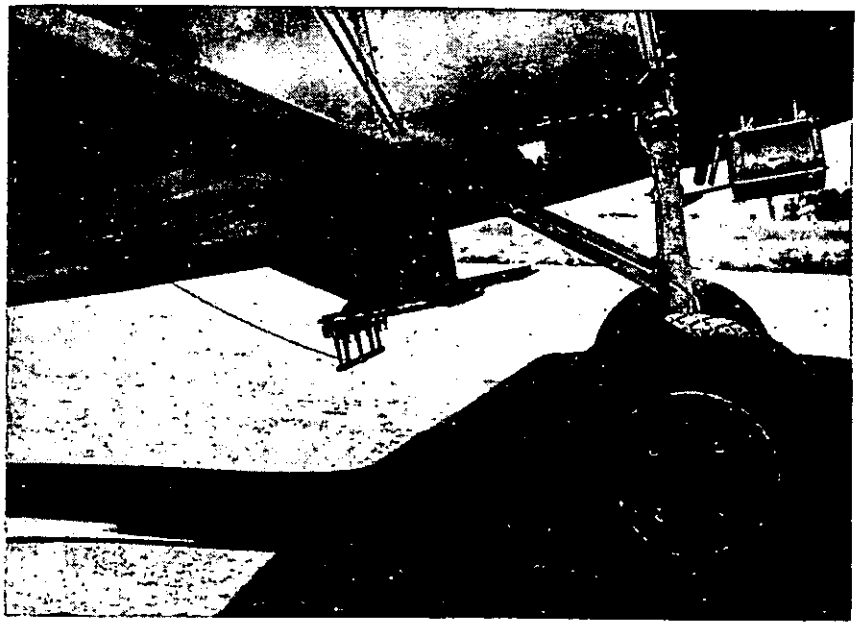

FIGURE 3.—Typical release gate (175 sq. in.) in belly of Stearman air tanker. Note release cable.

PILOTS

Until pilot qualifications are more firmly established, the following specifications are to be used:

1. At least 1,000 hours of flying time including either 500 hours of agricultural flying or 200 hours of spraying, cargo dropping, seeding, baiting, fish planting, or similar low-level mountain flying experience.
2. A performance test will be made with a series of water drops in various maneuvers. At least 5 drops should be made before a pilot is allowed on a fire.
3. A 1-day pilot training program will be conducted each spring or early summer to familiarize new pilots with operational procedures and fire-fighting tactics.

GUIDELINES FOR PILOTS

The ultimate aim is to fly as low and as slowly as is safe. Generally, this means 80 miles per hour at about 50 feet above the fuels. Here are other simple rules for air-attack pilots:

Check air hazard map.—Check the local air hazard map for the drop area. It will show the locations of power lines, telephone lines, and other safety hazards.

Make a dry run.—On new targets make a dry run at a slightly higher altitude than intended for the drop. This is specially valuable where downdraft or restricted visibility is anticipated.

Watch visibility.—Avoid continuous straight flight in poor visibility. When forward visibility at the airport or over target area is less than 1 mile, air tanker operations should stop.

Use visual signals.—A system of air-to-air and ground-to-air visual signals should be prearranged for use when radio communications fail.

AIRPORTS

For smoothest operation the airport used should have a minimum of air business—preferably with little or no commercial traffic. The whole air tanker operation can be jeopardized if proper facilities are not provided at the airport. Such things as the right kind and amount of gas and oil, high-rate delivery pumps for gas and water, adequate borate mixing equipment, a large supply of water, and even proper threads on hose and pipe fittings are important. When chemical retardants are used, mixing demands can be high. Each hour more than 2,800 gallons of retardant will have to be mixed to supply a 7-plane squadron operating on a schedule of about 10 minutes round trip from the fire. This means 47 gallons of mix must be available every minute.

COORDINATION WITH THE GROUND ORGANIZATION

Like any other specialized tool, such as bulldozers, plows, or tankers, air tankers must be closely coordinated with other fireline action. Effectiveness depends almost entirely on timing and accuracy. Direct air-to-ground communication is a MUST!

Rarely will the air drop alone be sufficient to put out the fire. It must be teamed with adequate ground forces. Thus, except in holding action, the ground forces should be in place before drops are made. Occasionally it may be necessary for the man on the ground to guide the tankers to low visibility targets, as in smoked-in areas. One important point to remember is that free-fall drops of water or sodium calcium borate are not harmful to personnel. The target area need not be evacuated.

Air drops must be accurate. Since single drops made at 50 feet elevation and 80 m. p. h. have a limited pattern (fig. 4), there is little room for error. This factor has to be considered for any given fire situation in deciding deployment of the available aircraft. Sometimes air tankers should be "stacked up," waiting for the right time to attack as a team. At other times they should attack individually.

CONCLUSIONS

The air tanker, as fire-tested in 1956, has won its place in the fire organization in California. But many questions still need to be answered:

How much water and chemicals penetrate various cover types and cover densities?

What are the relative merits of various sizes and type of planes?

How can we best distribute or concentrate planes for initial attack?

How can we make the best tactical use of many planes on large fires?

Even after these problems are solved, tactical support by air tankers cannot replace all the ground fire fighters. Instead, this specialized attack makes men on the fireline more important and more effective. Control lines and thorough mopup are still necessary: Gains made by fast air attack can be lost if firemen on the ground can't recognize critical changes in fire behavior and take full advantage of a knocked down fire.

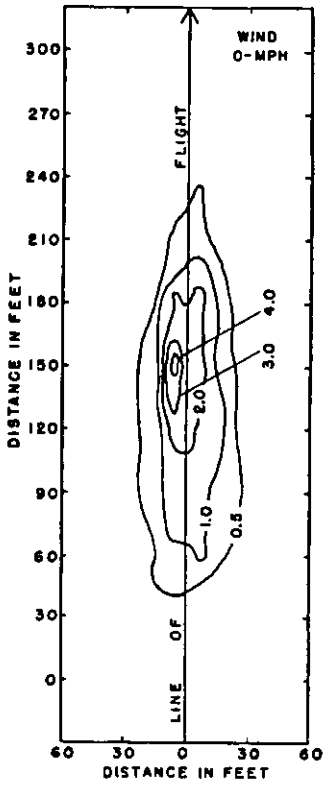

FIGURE 4.—Typical pattern for 100-gallon borate drop from Stearman air tanker with large gate (175 sq. in.) and flying 50 feet above the ground at 80 miles per hour. Contour lines show borate concentration in gallons per 100 sq. ft.

TEMPLATE AIDS INSPECTION AND MAINTENANCE OF 3½-POUND DOUBLE-BIT AXES AND PULASKI TOOLS

L. DON WILLIAMSON

Spokane Warehouse, Northern Region, U. S. Forest Service

During various inspections made of axes and pulaski tools in our Spokane fire cache, and at other field headquarters, it was found that visual inspection only was resorted to, with much discussion as to whether or not a tool was satisfactory and should be discarded or resharpened. The accuracy of the decision varied between individuals, upon the amount of time each person allotted to each tool, and many other factors. Many instances have been found where worn out and unsafe tools have been maintained and used, and where tools still possessing satisfactory life have been set aside for condemnation.

No one was using a physical or material guide that would be of satisfactory accuracy to form the basis for determining action. A listing of the specifications, a rule, and their application seemed to be the nearest system and this was time consuming and seldom used.

Most axes and pulaski tools are of bimetallic construction. According to their specifications, the bit steel is overlaid and welded to the body. This steel extends only 1/2 inch to 5/8 inch back from the cutting edge of the tool, and when this has been expended, the tool should be discarded.

To take advantage of this fact, a template was constructed at the Spokane Warehouse (figs. 1 and 2). It is made of 1-inch lumber, and is most useful assembled on a base at a 45-degree angle. As yet we have not provided for the measurement of the hoe shank, but this can easily be added. One board or template is used for both tools. The cost is approximately $15.

"A" and "B" on each template are rests to hold the tool in proper position. The pulaski tool must be properly handled so that the handle fills the eye at point of support "A." The wood in the ax eye must not protrude through to keep the ax head from resting on the supports in an even position. The wooden template is hollowed out to fit the shape of each tool head. The template and stand are painted white with black lines and lettering. Red denotes unsafe area, and black safe or good steel area. When a tool

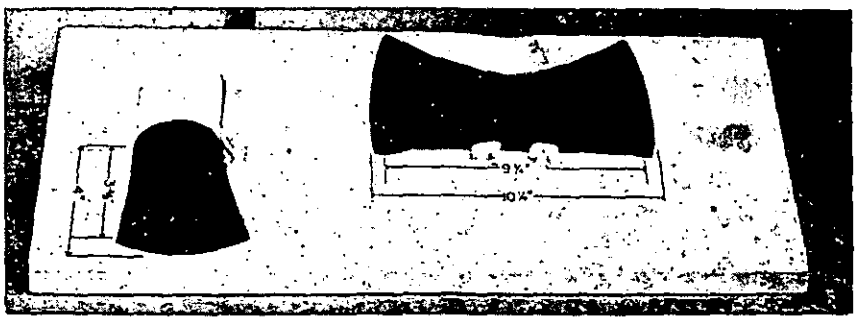

FIGURE 1.—Template; black edge denotes safe sharpening area.

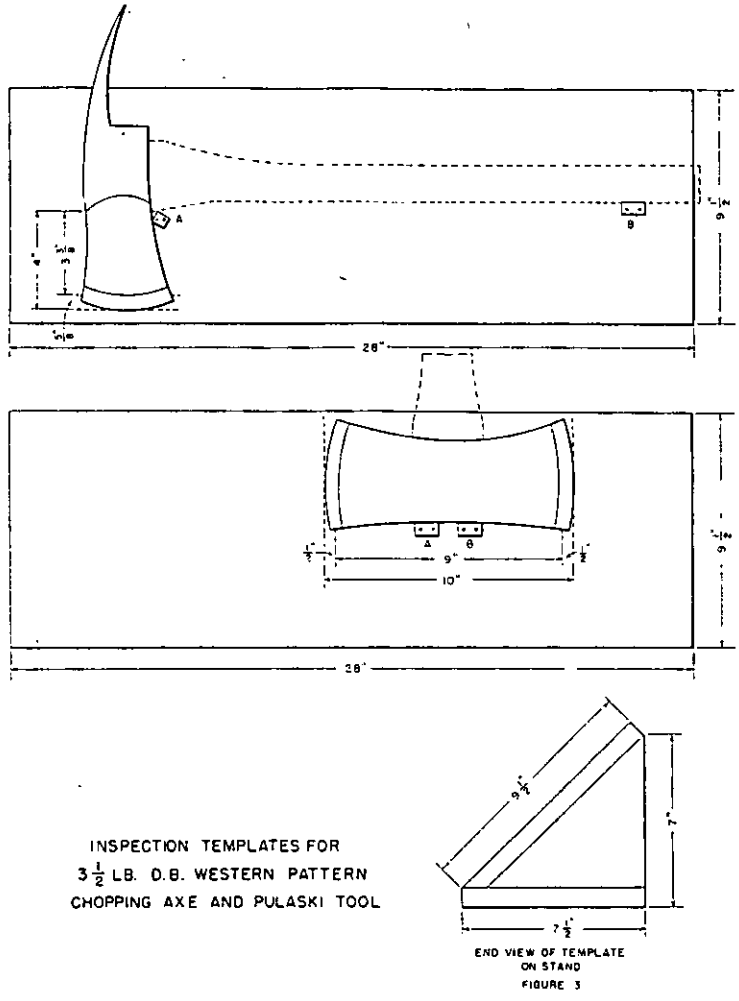

FIGURE 2.—Template measurements.

is in position, if red shows it denotes unsafe or unsatisfactory conditions which should be given careful consideration.

The use of this template at the Spokane Warehouse has taken the guesswork out of the tool sharpener's operation. He still must use his expert opinion to varying degrees, but he has a definite base to work from. Inspectors and supervisors also have a common base (visual aid) to work from in discussing work standards with employees, and it is of invaluable aid in training new and emergency employees. Besides indicating whether or not a tool is worn out or unsafe and ready for the scrap pile, the template is used as a guide in reshaping and sharpening. Our most skilled workmen accept it as a very useful working aid. Tool maintenance and inspection has been speeded up about 10 percent through the use of this template.

PRESCRIBED BURNING TECHNIQUES IN LOBLOLLY AND LONGLEAF PINE ON THE FRANCIS MARION NATIONAL FOREST

JOHN T. HILLS
Forester, Francis Marion National Forest

The results obtained by the use of prescribed fire are determined largely by the recognition of existing conditions and by the skillful application of fire. Much has been learned through the extensive use of fire under a combination of various conditions and methods of application. If consideration is given to all factors influencing a fire, the results of a prescribed burn always come closer to what is wanted than would otherwise be the case. Some of these factors are season of year, amount of fuel, fuel moisture (upper and lower layer), temperature, wind direction and velocity, and days since one-half inch or more of rain.

Several cardinal points should be considered just before and during the use of fire:

1. Get the latest weather report.
2. Remember that a constant wind strong enough to direct the fire is necessary for control.
3. Begin burning on the downwind part of the area to be burned.
4. Fire is best kept under control by fire itself—offensive action often eliminates defensive ones.

Through trial and error several techniques in applying fire under a given set of conditions have proved successful on the Francis Marion.

Checkerboard or spot firing.—The checkerboard technique is best suited for use in stands 20 years and older, medium rough (2-3 years), wind 3-5 miles per hour, temperature around 60° F. After establishing a safe line of fire on the downwind side of the area to be burned, the method consists of setting a series of spot fires in checkerboard design parallel to the baseline. The distance between the spots and their size can be varied according to the factors at hand. The advantages to be gained by using this method follow: (1) It is safe (as far as the use of fire goes). The fires compete for space and fuel, and before any damage can be done both have been consumed. (2) A clean and complete burn is assured. (3) A minimum amount of fireline construction is necessary. (4) The number of men to be used is not limited. (5) Large areas can be burned quickly—before weather conditions change.

Strip burning.—The method of burning in strips is very adaptable, and can be used in all age classes large enough to be burned. It consists of setting a series of solid lines of fire parallel to the baseline. This technique can be used effectively to kill undesirable hardwood (summer or winter fire), reduce heavy rough (as soon after rain as rough will burn), and control brown

spot, where flames should reach needles 3 feet or more from the ground. The advantages are that the intensity of the fire can be controlled by varying the distance between lines of fire in proportion to amount of fuel and the size and density of undesirable hardwoods to be killed. The advantages mentioned under the checkerboard technique are also obtained.

Flanking fire.—When the head of a wildfire is stopped, two flanking fires remain for a time. Fire fighters having experience in fire suppression in the Coastal Plain region probably have observed that such fires are very effective in killing undesirable hardwoods and removing heavy rough with little or no damage to the pine. This flanking type can also be used on an area to be prescribe burned by building the fire in the shape of a right triangle, the base of which is downwind. It is similar to a backing fire but burns much faster and cleaner.

Before selecting one of these plans of action, the land manager should consider the advantages of each method in relation to the results expected.

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Illuminated Poster

Designed by C. A. Rickard, Flathead National Forest, Kalispell, Mont.

LINEN HOSE SURVIVES THE FIRE

Arcadia Equipment Development Center, U. S. Forest Service

On September 21, 1956, 1,500 feet of new linen hose was laid by a helicopter on the McKinley fire, San Bernardino National Forest. It was charged and put into service as part of an extended hose lay along a ridgetop fireline (fig. 1). The remainder of the lay was CJRL.

FIGURE 1.—Fireline along ridgetop. McKinley fire, 1956.

At noon on the following day, the fire flared up out of a brushy canyon and spotted over the line onto the slope on the other side. The tanker crews were forced to abandon the hose and several thousand feet of it, including the linen, was subjected to the full heat of the fire. Burning embers fell on many sections of both cotton jacket and linen.

We were curious to know how the new linen hose survived this practical heat test. Since all of the linen hose had the date 1956 stamped on it, it was easily identified. We were able to account for all 1,500 feet. None of it was destroyed; none was burned through although it was badly scorched in numerous spots.

Damage to the CJRL, however, varied from small burned holes to holes 3 to 6 inches long. There were many lengths that had evidently burned like a fuse. All that was left of them were short pieces and a black residue along the ground (fig. 2).

FIGURE 2.—Part of the remains of CJRL hose used on the McKinley fire.

We brought the worst scorched of the linen hose into the Arcadia Equipment Development Center, and on October 17 it was pressure tested. It burst at 450 p. s. i., but surprisingly the burst did not occur at any of the scorched spots (fig. 3). This would indicate that the fire had not necessarily weakened the hose. In fact this hose compared favorably with hose not used on the fire which burst at 440 to 450 p. s. i. Previous tests in the

FIGURE 3.—Linen hose that survived the McKinley fire and was later pressure tested. Note that it did not burst at scorch spots.

laboratory have shown that linen hose when charged is extremely fire resistant, a very important factor in maintaining pressures on long hose lays.

USE OF POWER SAWS IN FIRELINE CONSTRUCTION

EDWARD E. BAILEY
Associate State Forest Ranger, California State Division of Forestry

Within the past few years lightweight power saws of various types designed for brush removal have been developed and placed on the market. Lacking a standard of performance or sufficient operating data to properly support field purchase requests, a test program was conducted to compare and evaluate representative groups of gas and electric saws. These machines were tested for use primarily in fireline construction on terrain not negotiable by bulldozer, and the results were compared with those of hand crew line construction.

Three circle type saws, three bow type saws convertible to a bar type, and two electric saws with a 1500-watt generator were secured (fig. 1). The test was expected to show if the generator when not being used with the saws could serve as a standby unit for a fire camp or supply additional light for night fireline power saw operations.

Two sites in Humboldt County on California's north coast were chosen as test areas. Species cut by the saws were blueblossom (*Ceanothus thyrsiflorus*), tanoak (*Lithocarpus densiflorus*), Pacific madrone (*Arbutus menziesii*), redwood sprouts

FIGURE 1.—Test crew personnel and saw types tested. (California Division of Forestry photo.)

(*Sequoia sempervirens*), *blackberry* (*Rubus vitifolius*), Willow (*Salix* spp.), and poison-oak (*Toxicodendron diversilobum*). Elevations were from 950 to 1,450 feet. Slopes ran from 0 to 105 percent.

To arrive at a statistically significant figure, 1,575 plots would be required with 10 saws. On 7 slope classes 1,540 plots in 3 densities (light, medium, and heavy) were cut with 8 saws (fig. 2).

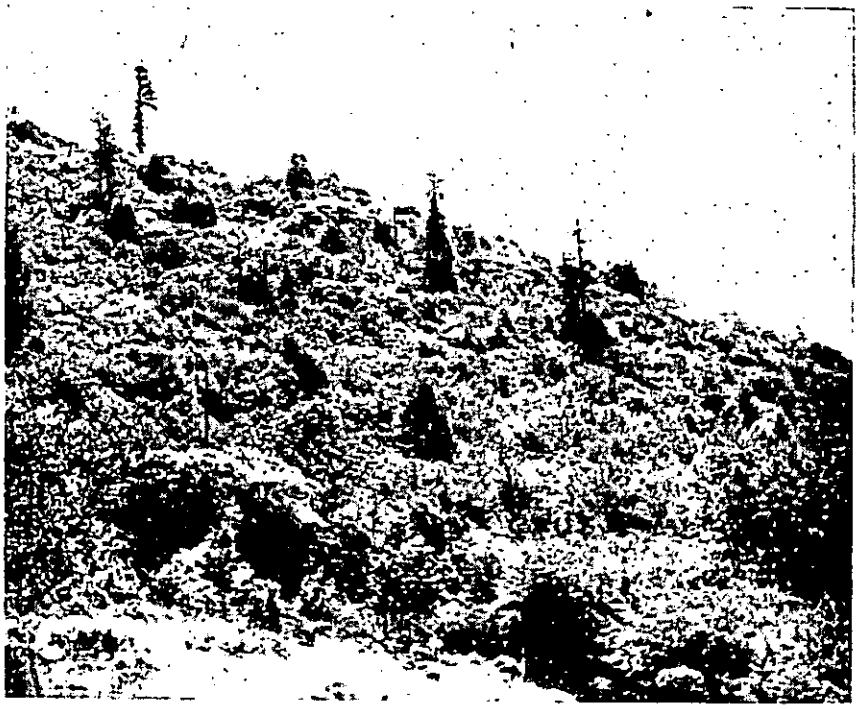

FIGURE 2.—General view of brush types on test areas. (California Division of Forestry photo.)

The personnel was divided into 4 crews composed of operator, tallyman, and observer. Each operator was assigned a test site, and all saws were rotated to that operator in the particular site. The man assigned as operator remained at that job for the 10-day period to eliminate as much as possible the human element. The tallyman measured the diameter of all stems cut and recorded them by basal area on the proper form. The observer measured out the plots and kept the record of time for each plot with a stopwatch. Each saw operator had 2-4 California Department of Corrections Honor Camp Inmates assigned as brush swampers and helpers. A saw filer and mechanic were assigned to the test also.

For each slope in his assigned site, the operator ran strips of 15 plots up and 15 plots down with each saw. The plots contained 50 square feet and were 5 by 10 feet or 10 by 5 feet depending on

the saw being used. On the third day all plots were changed to 10 by 5 feet since a 10-foot-wide line made for easier and safer operation (fig. 3).

In evaluating the saws for hand crew line construction, lines were cleared to mineral soil in these tests. On the saw operation alone the line was not cleared to mineral soil.

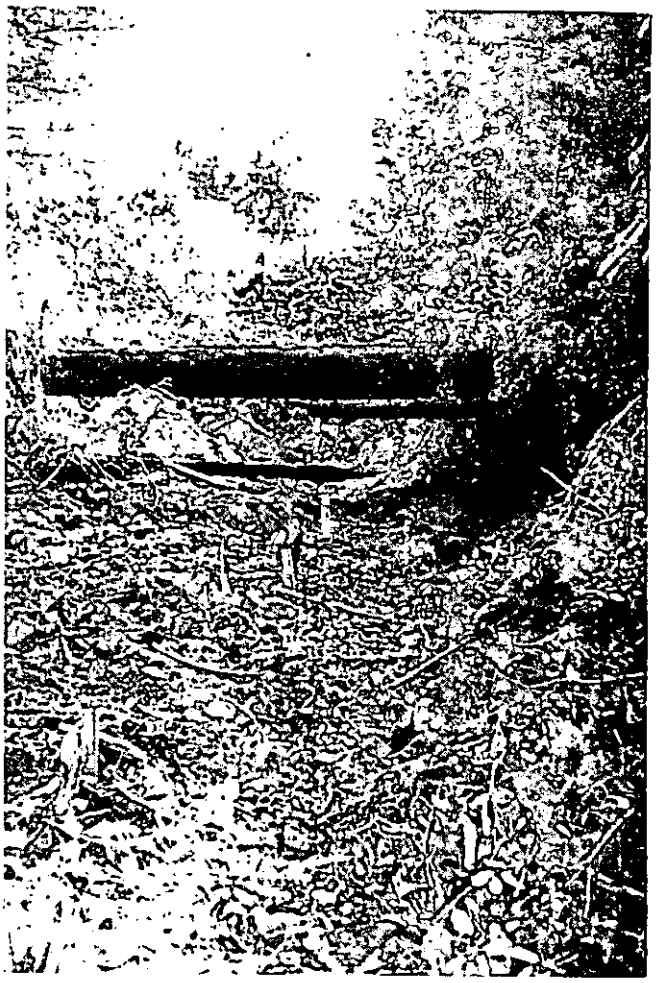

FIGURE 3.—10-foot fireline, showing typical brush and debris, rock, and slope encountered on test sites. (California Department of Forestry photo.)

From the statistical data it appears that the circular type saw will produce the most work in average brush areas. However, from observance the bow type saw would be the most adaptable in heavy stands of diameters 4 inches or larger.

Although there were no accidents, the test personnel was of the opinion that the circular saw was a potential hazard to ad-

jacent workmen. Operating techniques were controlled accordingly. Nevertheless, the overall performance of this type of saw still showed its superiority. This could have a bearing on ultimate tool selection or the possible need for restricting the use of these saws to experienced personnel only. Consequently a "power head" to which both types of saw could be adapted would meet the largest variety of conditions with which we are faced.

Contrary to what was originally expected from electric saws, their light weight and size actually proved a disadvantage and forced the operator to expend more energy in pushing the saw through the stems and in kneeling to reach the stems to be cut. The generator was not easy to handle on steep slopes or rocky ground; it required two men in constant attendance to keep the generator moved up and the cords untangled from cut stumps.

For data control purposes, line widths were originally determined to be 5 feet. After operating 2 days (406 plots), it became necessary to widen the lines to 10 feet for more space to swing the circular type saw and to provide safer working conditions for the swampers on all types of saws. Data were still collected on a square-foot basis and showed no material difference in area cleared. But for safe operation the data are sufficient to be considered in determining ultimate line widths in actual fireline operation.

Some work was done to evaluate the usefulness of the power saws at night in brush and to determine if additional light was required. This test project did not show that night operations were materially slower than day work. Observation revealed that the crews worked with added ease when 150-watt floodlights were mounted on the generator with the electric saws. It was concluded that the standard Forester headlight should be supplemented by additional light source.

The data disclosed that there was little difference in the production rate of uphill vs. downhill work. This was due to the added difficulty in cutting stumps low enough when going downhill, offsetting any natural slope advantage.

From observations made during the test and from analysis of the collected data, probably the best crew size for power saws, excepting the electric saws, would be 6 men, i. e., 1 operator, 2 swampers, and 3 men clearing the line to mineral soil. The production rate of such a crew with a power saw in brush under average conditions could be compared favorably to that of a hand crew of 10 to 12 men.

One method of weight control used by the manufacturer is the size of the fuel tank supplied and designed for his specific unit. Of the saws tested, fuel capacities varied from 1 pint to 1 quart. This factor should be considered very important in adapting power saws to fireline construction, since during the test, operating time varied from 1/2 to 1 hour per tank of fuel. It is therefore imperative that a supply of properly prepared fuel be readily available.

ADMINISTRATIVE PICKUP FIRE FIGHTING UNIT

State of Washington, Division of Forestry, Fire Control

Washington's Division of Forestry uses half-ton pickups for its district wardens and assistants. The usual practice is to load the box of these pickups with cement blocks, rocks, or old iron to give weight and make the pickup ride better. Fire Control decided that since some inert ballast was going to be carried around regardless, the weight might as well be useful for fire suppression and thus increase the striking force on fire throughout the State.

This decision resulted in a 67-gallon pumping unit that costs approximately $200. The unit is comprised of a small rectangular tank 18 inches square and 4 feet long which sits just aft of the pickup utility box where the warden carries his gear (fig. 1). Its entire weight, plus a tank full of water, is approximately 732 pounds. Half the pickup bed is still free for other hauling.

The tank is plumbed to the fan-belt drive pump under the hood by flexible, high-pressure hose. Female couplings are used on both ends of the hose to expedite easy removal of the unit. The discharge is plumbed from the pump back to a bypass on the tank through a similar hose. With this arrangement the discharge hose is connected to the bypass on the tank, and it is not necessary to lift the hood to connect a discharge hose or engage the clutch.

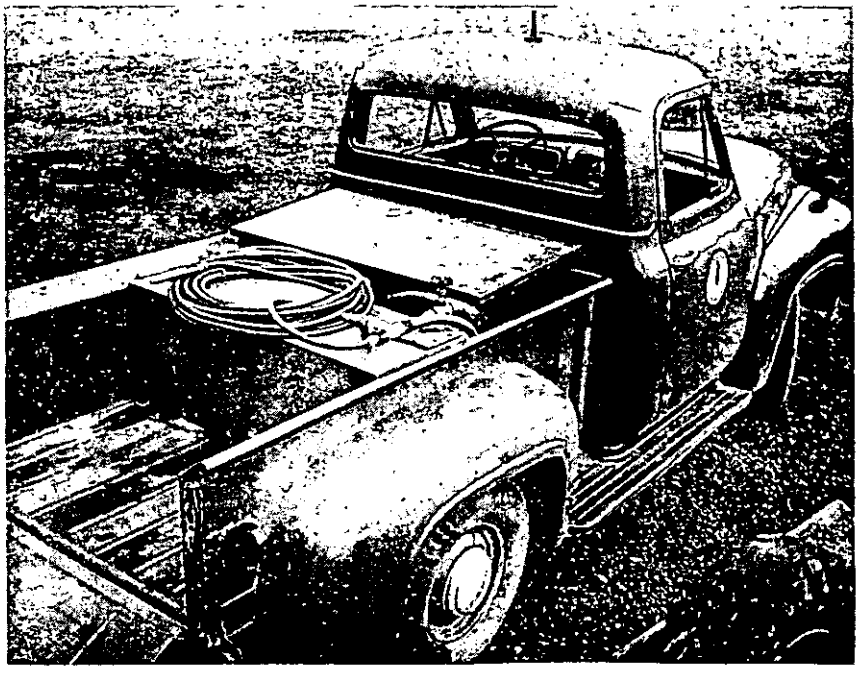

FIGURE 1.—Half-ton administrative pickup equipped with a 67-gallon slip-on unit mounted back of utility box.

The pumping unit is a gearless-neoprene or carbon-impeller type that is capable of pumping from 5 to 19 gallons per minute, depending on the r. p. m. Its initial cost is reasonable, and any needed repairs are quite inexpensive. Power is taken from a double pulley on the generator through a split V-belt pulley clutch (fig. 2). With this type of clutch the sides of the pulley are spread apart, and when the pump is not in use, the belt runs on an idler in the center of the pulley. This idler has sealed lubrication. When the clutch is closed, the sides of the pulley are brought together, thus picking up the V-belt and the power to drive the pump.

The clutch is controlled from the dashboard through a flexible control wire. A pressure gage is also mounted on the dash. The operator can start his pump before getting out of the cab, because the bypass device works as long as the nozzle is closed. The bypass is set to operate at 100 pounds pressure on the gage when the engine is a little more than idling, and the pump delivers about 8 gallons per minute at this speed. One man can handle this machine efficiently. The unit does not have a live reel, but one is planned that will carry approximately 200 feet of single-braid, neoprene, one-half inch, ID water hose.

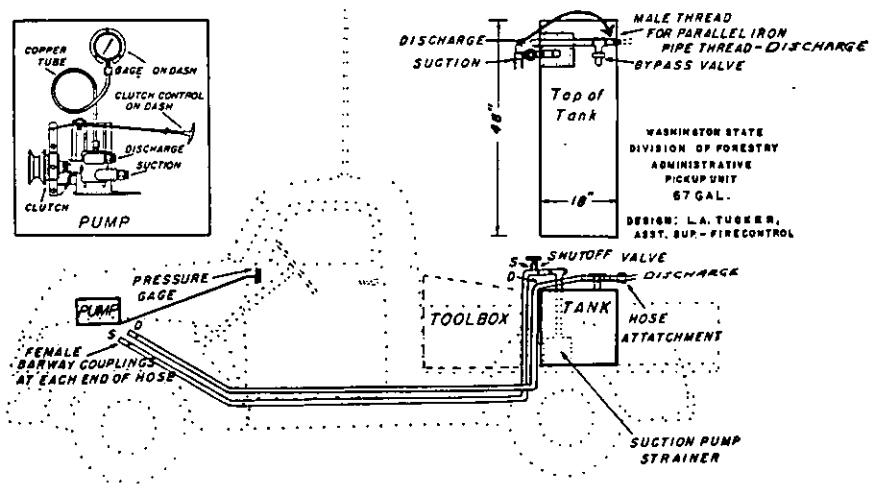

FIGURE 2.—Schematic location of 67-gallon slip-on unit, pump, pressure gages, plumbing, and shutoff and bypass valves on ½-ton administrative pickup.

Fire control did not design the slip-on unit to take the place of a major pumper, and it is stressed in training that this unit must not tie up potential overhead that should be leading others in the control of a fire. However, since all of our pickups are equipped with mobile radios, they are often the first piece of equipment to arrive on many of the small fires. They are able to take care of these fires in the incipient stage without the dispatching of other equipment.

AIRPLANES AND FIRE CONTROL IN THE SOUTHWEST

FRANKLIN O. CARROLL
Assistant Fire Staff Officer, Coconino National Forest

Because airplanes have been used only sporadically in forest fire control for many years in the Southwestern Region, great opportunities remain for perfecting and intensifying their use. The Coconino National Forest in Arizona used airplanes extensively for the first time during 1956. Prior to that time, it had used planes occasionally to scout blind spots and to drop messages, maps, and supplies to remote fires and fire camps. A steady drying trend in the past few years and an increasing number of large fires caused us to take a new look at the airplane as a tool in prevention, detection, and suppression work in our region. The following resume is based on our first year's experience.

Prevention.—Psychology plays a very important part in forest fire prevention. For example, forest users generally feel that a low-flying patrol airplane offers a very tangible warning. In order to gain the greatest benefits from this method of fire prevention, it is necessary to advise the forest-using public by radio and newspaper that such a method will be used. The use of airborne loudspeaker systems has also proved fairly effective. While the broadcasting range of this device is limited, it is adequate for short fire prevention warnings.

Detection.—We do not believe that fire detection from airplanes will ever completely replace stationary lookout systems. We do believe, however, that the use of airplanes is necessary to supplement fixed detection. Observation from planes has proved very effective on the Coconino during periods of heavy smoke and haze, after lightning storms, and during periods of heavy forest use. Northern Arizona is particularly subject to hazy atmospheric conditions during certain of the summer months when smoke from forest fires and dust blanket the country.

Normal detection flights cover areas that are blind to lookouts. These flights are also effective for the investigation of areas reported by the fixed detectors as suspect. The most effective aerial observation is made in the early morning or late evening when the sun's rays are more or less parallel to the earth's surface. The flight pattern should keep the area to be observed between the airplane and the sun as much as possible. As many persons know, a smoke may be more readily seen when the observer is looking into the light. Once pinpointed, the fire is then accurately reported to the central dispatching agency. Aerial observers on the Coconino were selected who had sufficient experience to enable them to size up each fire situation and order adequate suppression action.

Suppression.—The Coconino National Forest has had an average of 385 fires per year for the past 5 years. Record highs have exceeded 700 fires. In 1956, it had 502 forest fires, 86 of which were man-caused. Man-caused fires have averaged 85 per year, a significant number in view of the fact that forest use is estimated to have tripled in the past 5 years. Our objective has been to hold the burned-over area to 880 acres. In 1956, 1,100 acres were burned. Since only one fire burned more than 300 acres, we believe that early aerial detection and fast suppression action have reduced the average size or area burned in each fire.

The total number of fires first discovered from the air was greater than those first discovered by any of the lookouts except one. Observers in planes, using two-way radios, guided fire crews to difficult-to-find and remote fires. By "talking" the fire crews in to fires, the aerial observers saved a great deal of time and expense as well as acreage burned.

A constant source of accurate information from an aerial observer has helped many a fire boss make effective decisions in the strategic handling of large fires. During a 2-day, 99 lightning-fire "bust" in late June 1956, our observer utilized his lofty position to dispatch and guide crews and equipment to individual fires and to determine which fires required immediate attention or could be safely handled later. This alone saved many acres.

Finally, parachute supply operations have proved their worth time and again in fire control. We use planes for dropping purposes whenever conditions, terrain, and time warrant. Aerial supply methods have been extremely effective. Without doubt, the airplane is taking its rightful place as a common tool of forest fire control in the Southwest.

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Dunk That Chunk

Ray West, Supervisor, Anaconda Forest Protection Service, figures that no matter how muddy water gets, it's still wet. West's idea goes still further in that he makes just a little bit of water go a long way in the mopup procedure of fighting and beating forest fires.

In West's country, just over the Continental Divide from Anaconda and the Big Hole country of Montana, water is at a higher than usual premium on most of the fires. West has made several used 2- to 5-gallon paint pails a part of the regular equipment on each fire truck in his organization. The pail, used as a dunking utensil, takes up where the hose and pump leave off.

Dunking takes all of the fight out of the usual burning debris near the fireline. Later when it's possible to get inside the line to work on stumps, rotten logs, and other accumulations, a man with a "dunking pardner" can discourage any ideas a hot spot might have about making something big of itself.—ROBERT JORDAN, *CFM Forester, Montana.*

CAP DESIGNED TO COVER ACCESS HOLE IN ROOF OF TOWER CAB

H. H. GARTH
Chief, Division of Forest Protection, Virginia Division of Forestry

Rusty lookout tower cabs and cab roofs are unsightly and present a maintenance problem. To remedy this situation, the Virginia Division of Forestry undertook a cab painting project. The first attempt proved to be dangerous and time-consuming. Climbing, rope ladders, window scaffolds, long-handled brushes, and paint rollers were used in that attempt.

It was decided that a hole in the center of the roof, large enough to permit a man to crawl through, might be helpful. By experimenting with an exhibit tower trailer, the Division developed a method of cutting the hole, reinforcing the tower roof, and fabricating a cap.

To cut the hole, a saber saw was first tried with a small d. c. generator serving as a source of power. This method required several hours of hand sawing. To expedite the hole-cutting job, an acetylene torch was used. Where towers were accessible to ve-

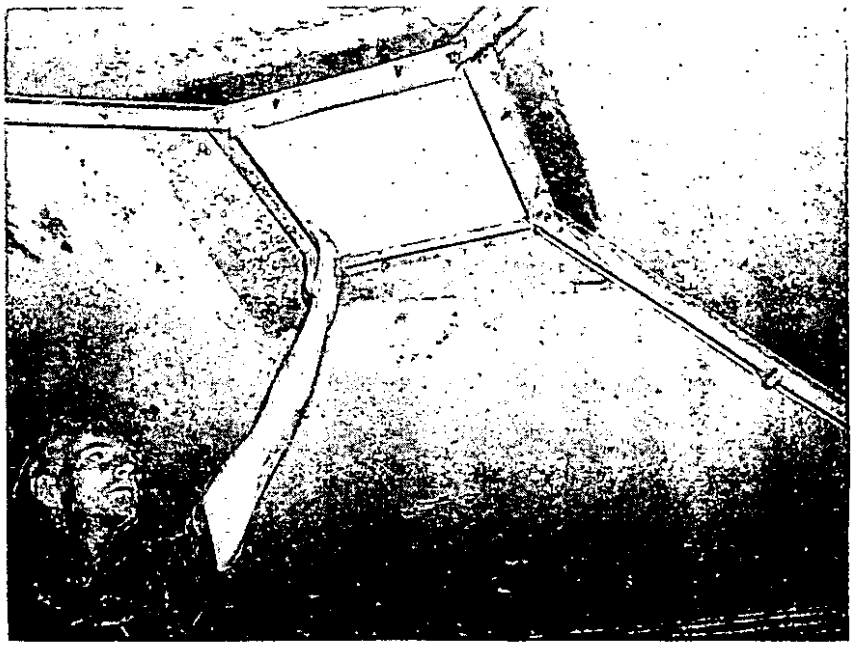


FIGURE 1.—Cab roof reinforced by bolting 1-inch angle iron to edges of 18-inch hole.

hicle travel, the gas tanks and other equipment were easily brought in to the site. Most of Virginia's towers are between 80 and 100 feet high, and there is no problem in obtaining hose long enough to do the job.

Although the hole was made with an acetylene torch in a matter of minutes, the torch has one big drawback. The heat generated destroys the galvanized coating on the cab. The Divis-

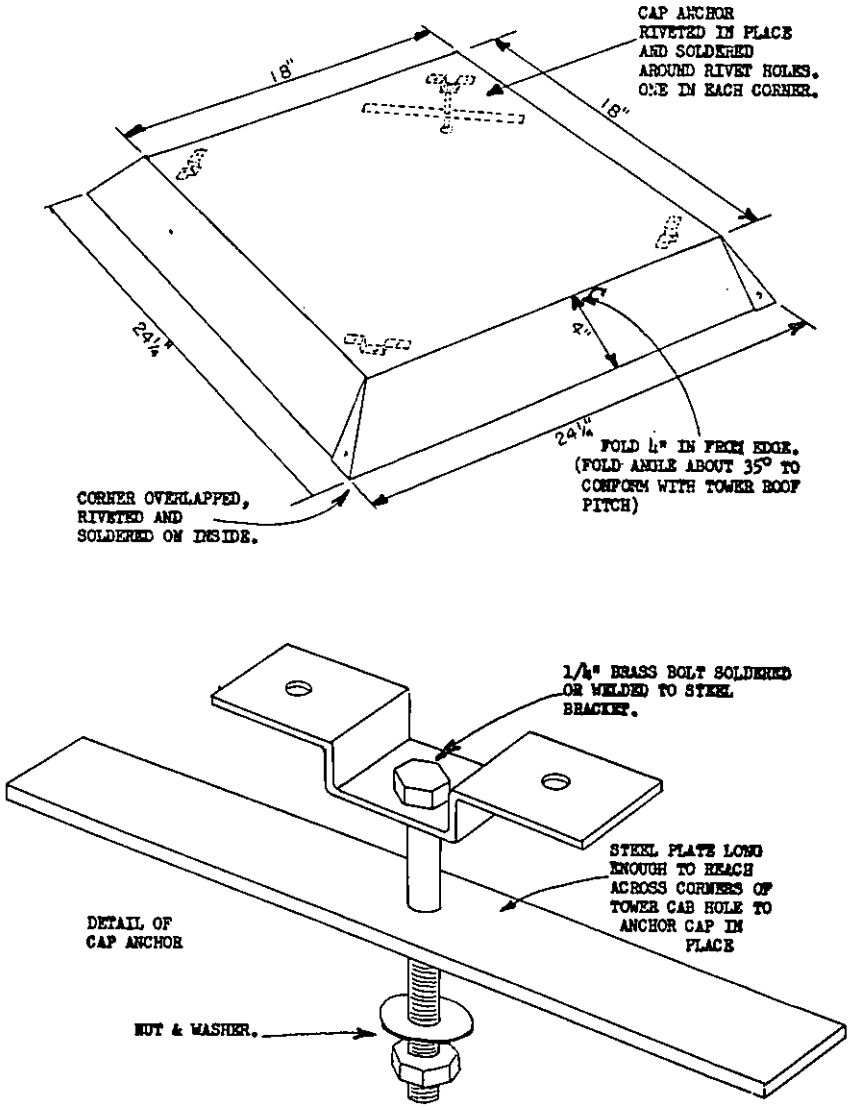


FIGURE 2.—Schematic drawing of cap to cover access hole in roof of 7- by 7-foot tower cab.

ion is still undecided as to which is best—the fast cutting torch or the slower cutting saber saw that protects the galvanizing.

The hole, 18 inches square, is reinforced with 1-inch angle iron bolted around inside edges (fig. 1).

The prefab cap is made of 26-gage galvanized metal cut to a 26- by 26-inch square. Cuts are made on a 45° angle from each corner to a depth of approximately 5½ inches. The corners are lapped and riveted and the joints soldered on the inside. Quarter-inch brass bolts are welded to small prebent pieces of steel (fig. 2). The steel, with bolt attached, is then riveted to the cap and the rivet holes soldered on the inside. This method is preferred to either soldering or welding the bolt heads directly to the cap; welding has a tendency to warp the metal and destroy the galvanized coating, and soldering does not appear to be strong enough. Small pieces of steel are bored (5/16-inch holes) to serve as anchors. The cap is then ready for mounting.

To fit the prefabricated cap in place, a rope is tossed out through the hole and permitted to fall past a window. The cap is then tied to the rope and hauled up onto the roof. The cap is squared over the hole, the anchors run up on the bolts, and the nuts tightened behind them. The cap will not go through the hole in the tower roof, and if the hole is enlarged there will be less cap overlap to keep out the weather. Gaskets, made of old linen hose, are fitted around the edge of the cap to prevent wind and water leakage.

Prior to bolting the cap in place, the cab roof is wire brushed and painted with aluminum paint. A metal tray and fleece-covered roller are used to do the painting. This same unit is used to paint the outside of the cab simply by reaching through the open windows.

THE GORDON BADE WATER RAKE

R. E. REINHARDT
Forester, Division of Timber Management
Washington Office, U. S. Forest Service

Experienced fire control men who have used the water rake believe it is a practicable and worthwhile water-saving device. It is recommended for use where water is scarce and in deep duff where water penetration is slow. One water rake is recommended for each tanker unit in areas where council tools are standard fire fighting equipment.—Ed.

The economical and effective use of water for fire mopup has been a problem. Often pumpers are employed in mopup long distances from sources of water. It is usually necessary to stretch the pumper water supply when putting out fire in duff and debris with nozzle and high pressure. More often than not inexperienced nozzle operators aimlessly squirt water at smoking debris only to have the fire come alive later and escape.

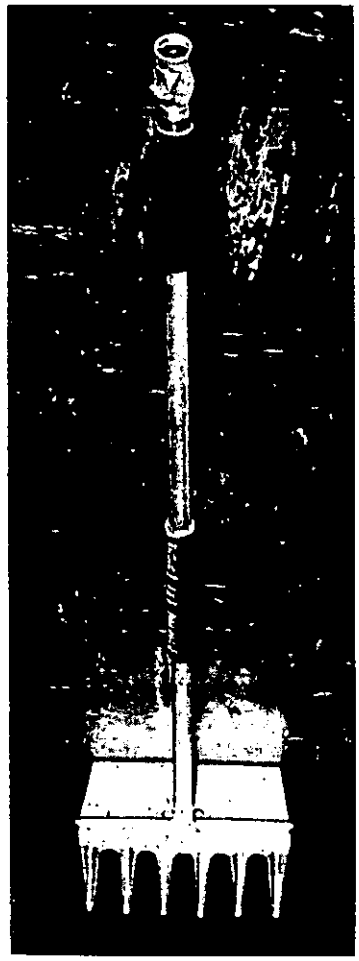


FIGURE 1.—The Bade water rake for mopup.

The mixing of a little water with duff and debris is one of the most effective and economical ways of extinguishing fires in this material. The usual practice is to have one man mix the smoldering duff and debris while another applies water to it until the fire is out. Although effective, this method requires two or more men.

Various devices have been tried to eliminate this dual use of manpower. Among these is a nozzle temporarily fastened with rope to the handle of a Kortick blade that deflects the stream on the ground while the operator rakes and stirs the smoldering debris. This is an effective method but awkward and laborious. The nozzle is generally insecure, and it is difficult to coordinate nozzle control with the raking action. The water under high pressure occasionally backfires and splashes the operator with water and debris.

Gordon M. Bade, Timber and Fire Staffman on the Kaibab National Forest in Arizona, fabricated a device almost 20 years ago which is slowly gaining acceptance as knowledge of its effectiveness spreads by word of mouth from one forest to another (figs. 1 and 2). The end of a hollow handle is attached to a hose. Water flows through the handle to a lateral distributor pipe with

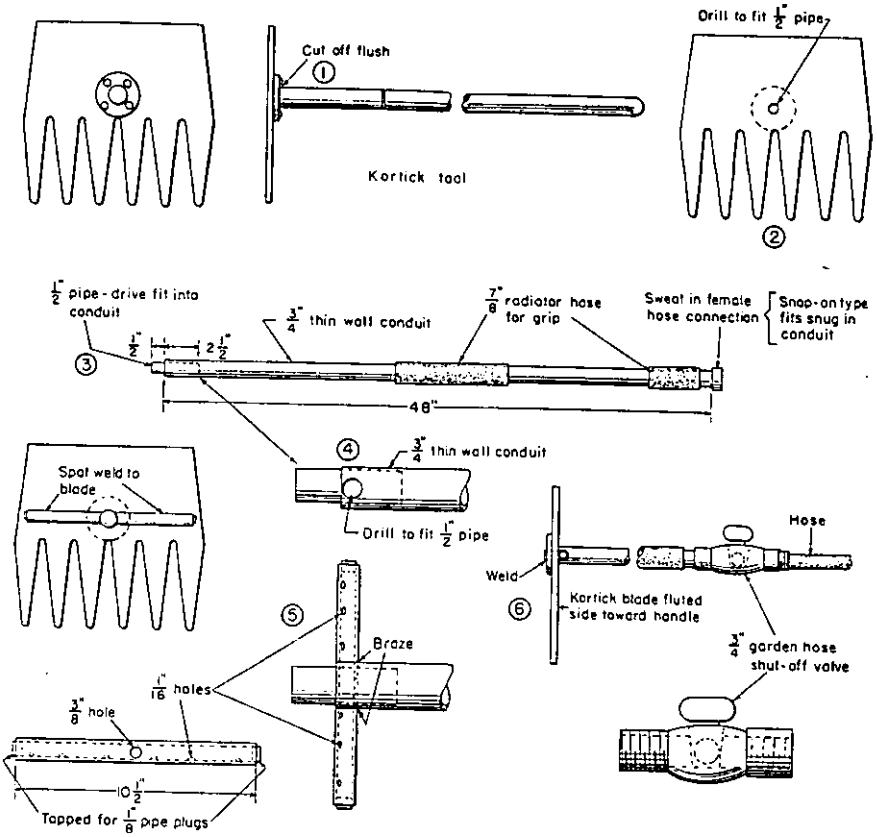


FIGURE 2.—Diagrammatic drawing of the Bade water rake.

small holes in it lined up with the concave teeth of a Kortick tool. The volume is controlled by a thumb value at the end of the handle. This tool is effective with low pressures and will use less water if the pump pressure is cut. An adaptation of this device to be used with a standard backpack pump might be feasible.

Component parts of the Bade water rake and instructions for assembling them follow:

Parts

1. 1 Kortick tool.
2. 4 feet of ¾-inch galvanized thin wall conduit.
3. 10½ inches of ¼-inch galvanized pipe.
4. 2 ⅛-inch pipe plugs.
5. 3 inches of ½-inch galvanized pipe.
6. 1 standard female brass garden-hose adaptor. (The snap-on types, available at hardware stores, fit snugly in the thin wall pipe and make sweating-on with solder an easy matter.)

7. 1 garden-hose shutoff valve. (A better device would be a thumb-control pressure valve.)
8. 18 inches of 7/8-inch radiator hose for handle guards. (Metal pipe is cold when held for prolonged periods.)

Assemblage

1. Saw the shank off a Kortick tool as close as possible to the blade.
2. Drill a hole through the blade at the center of the shank flange to fit the ½-inch pipe.
3. Drive the short piece of ½-inch pipe into one end of the thin walled conduit, leaving about ½-inch protruding.
4. Drill a hole through the thin walled conduit and ½-inch pipe to admit the ¼-inch pipe. Edge of the hole to be flush with end of thin wall.
5. Drill a 3/8-inch hole through one side at the center of the ¼-inch pipe.
6. Drill 1/16-inch holes through the wall of the ¼-inch pipe at points which center the rake teeth. The best way to do this is to run the ¼-inch pipe through the hole in the thin wall handle, center it with the 3/8-inch hole headed up the handle. Then assemble the blade and handle to determine the angle of the 1/16-inch holes to assure delivery of water down the fluted teeth. Cut down rivet heads if they interfere with delivery of water down teeth. Disassemble and drill holes in the wall of the ¼-inch pipe.
7. Tap both ends of the ¼-inch pipe for 1/8-inch pipe plugs and insert them. These will provide for cleaning the pipe if the pipe or holes become plugged.
8. Assemble pipe in proper position and braze small pipe to conduit. Attach to blade and braze or weld shut and to the blade the end of the ½-inch pipe that protrudes through the blade.
9. Spot weld ¼-inch pipe to blade to keep it in place.
10. Slip about a foot of 7/8-inch radiator hose, for a hand grip, onto the handle a little below the middle of it. Slip another 6-inch piece on at the end. The hose will fit tight and can be rammed down into place with a piece of 1-inch pipe slipped over the conduit.
11. Sweat on the female hose connection at the end of handle. (Run the 6-inch piece of hose down the handle while soldering the female hose connection to keep from burning the rubber, then return it to the top.)
12. Attach shutoff valve.

This tool has proved particularly handy for raking coals off logs and simultaneously extinguishing them. One of Bade's more rugged guards has suggested this device might be handy for the Saturday night bath.

PRESCRIBED BURNING IN SHORTLEAF-LOBLOLLY PINE ON ROLLING UPLANDS IN EAST TEXAS

E. R. FERGUSON
East Texas Research Center, Southern Forest Experiment Station

Large test burns on rolling uplands in east Texas have proved quite variable and only moderately effective in controlling undesirable hardwood understory. This is in contrast to encouraging results achieved with prescribed fires on small plots in the same general type.[1] Runoff and surface soil movement on two diverse soils were little affected by these single fires.

THE STUDY

Twelve fairly uniform units were established on the Neches District of the Davy Crockett National Forest. The units, averaging about 190 acres each, were in a shortleaf-loblolly pine sawlog stand with a medium to heavy brush-hardwood understory.

The units were paired according to similarity of topography, overstory, and understory. This provided 6 pairs of units, 2 of which were randomly assigned to each of 3 seasons of burn. One unit of each pair was randomly selected for burning and the other was left unburned as a check.

Ten sampling points were systematically located within each unit, and at each point one 1/10-acre plot and one 1/250-acre plot were established. Stems on these plots were inventoried before and after the prescribed fires.

Burns were made in November 1952, March 1953, and April 1953. Burning on all units followed the same pattern. Lines were plowed and fire was set along the leeward boundaries, following which the flanks and finally the windward boundaries were fired. As time permitted, supplemental lines of fire were started through the interior of the units.

On selected units, burned and unburned, hydrological test areas were located on the prevailing soils, Boswell fine sandy loam and Lakeland fine sand. These were 4- by 20-foot runoff plots with metal borders, located on gentle (5 to 8 percent) and moderate (11 to 16 percent) slopes. They provided weekly records of surface runoff and a cumulative record of soil loss.

RESULTS

The prescribed burns were only moderately successful in controlling the undesirable hardwoods (fig. 1). The number of stems ½ to 2 inches in diameter was reduced 1/3 to 1/2, but these re-

[1] FERGUSON, E. R. STEM KILL AND SPROUTING FOLLOWING PRESCRIBED FIRES IN A PINE-HARDWOOD STAND IN TEXAS. Jour. Forestry 55: 1957. (In press.)

ductions were largely offset by an increase in sprouts and root suckers. The result has been a moderate, but probably temporary, reduction in understory volume.

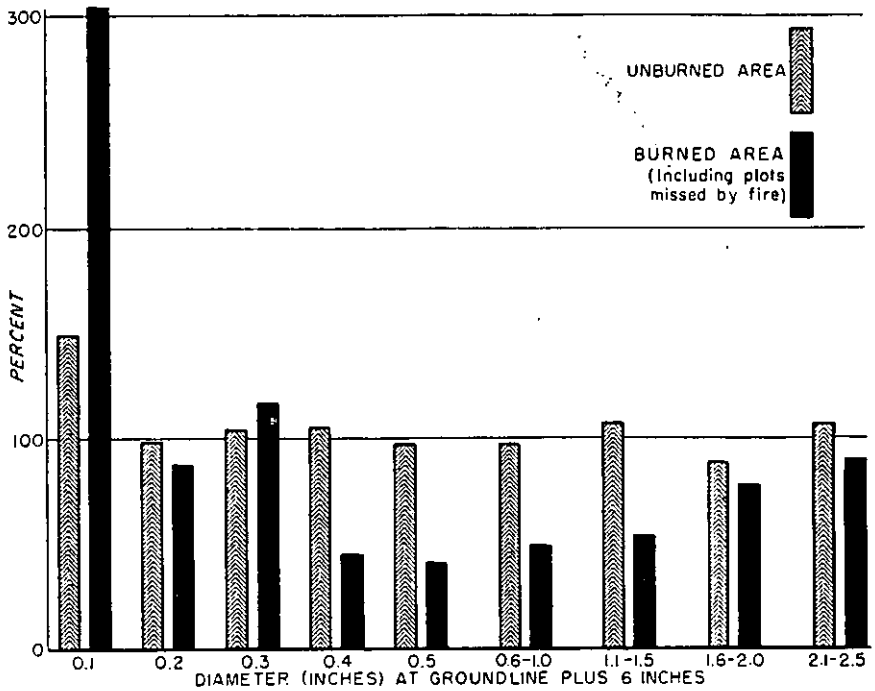


FIGURE 1.—Hardwood stems after treatment, shown as percent of number on plot before treatment.

There were no differences in effectiveness between burns made in the three seasons tested.

Failure to achieve greater reduction in small hardwoods was in part due to the light and variable nature of the prescribed burns. Only about 80 percent of the area within the burning units was actually burned, and less than half of that was covered by a medium or severe fire. On limited areas with severe burns, there was some loss of sawtimber pines. Such divergent results reflect the widely varied burning conditions that occur on extensive areas of rough terrain. To approach the effectiveness demonstrated on small plots, prescribed burning will require much closer control with resultant higher labor costs and equipment expense.

The single fires of the study had little effect on surface water runoff and soil movement from the hydrologic test plots. On the Lakeland fine sand, the prescribed burns had too little effect on infiltration rate to be reflected in runoff. On the Boswell fine sandy loam, burning appeared to increase runoff slightly. There was little difference in runoff on slopes ranging from 5 to 13 percent.

Soil loss was light on all plots (table 1) and safely below the maximum erosion rate permissable on watershed lands.

TABLE 1.—*Soil loss per acre /18 months*

Treatment	Lakeland fine sand		Boswell very fine sandy loam	
	Slope	Soil Loss	Slope	Soil Loss
	Percent	*Tons*	*Percent*	*Tons*
Burned	8	0.14	5	0.73
Burned	12	.11	11	.28
Unburned	8	.15	6	.17
Unburned	15	.16	13	.13

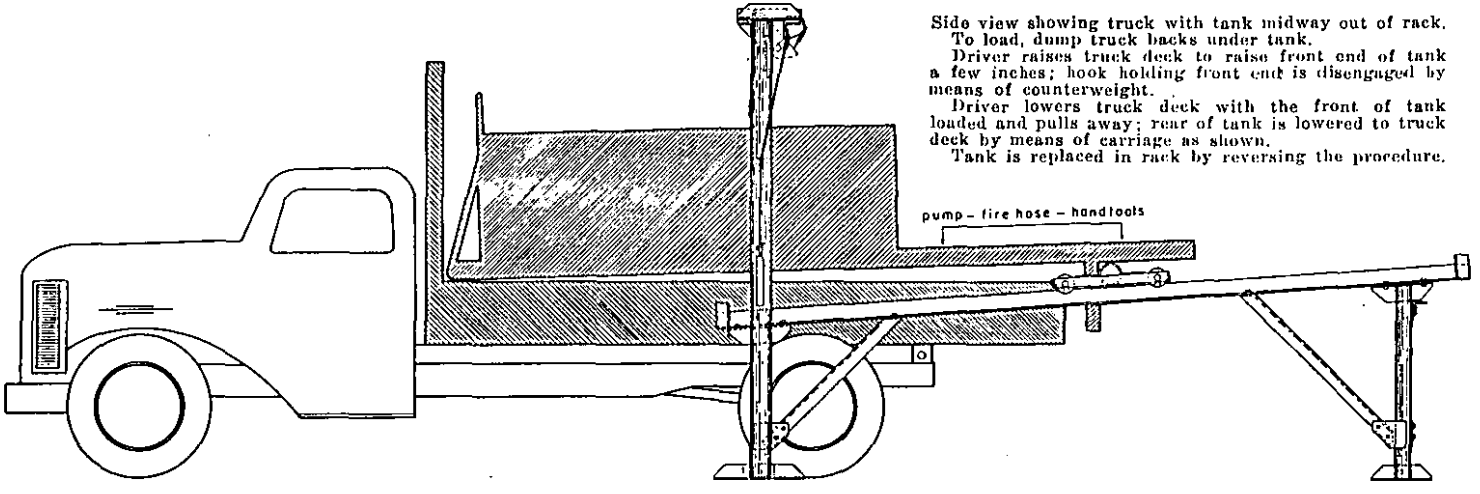
The possibility that more severe or repeated fires could have more serious effects should not be overlooked. The test plots still had 1/8 to 1/4 inch of litter after the fires. With complete exposure of the mineral soil, both runoff and erosion undoubtedly would have been much greater.

☆ ☆ ☆

Fire-Danger Board

Designed by R. T. Files, Glacier Ranger District, Glacier, Wash. (For specifications, write to author.)

Self-Loading Tanker Unit (Patented)



Side view showing truck with tank midway out of rack.
To load, dump truck backs under tank.
Driver raises truck deck to raise front end of tank a few inches; hook holding front end is disengaged by means of counterweight.
Driver lowers truck deck with the front of tank loaded and pulls away; rear of tank is lowered to truck deck by means of carriage as shown.
Tank is replaced in rack by reversing the procedure.

Here is a device by which any open-end dump truck can smoothly and automatically pick up a load of more than 5 tons in less than 1 minute without the driver leaving the truck. He can also unload in a like manner.

The truck is not tied up with the tanker unit until fire occurs. When the fire is over, the unit is replaced in the rack and the truck can resume its normal duties. The rack holding the unit is bolted together. It can be quickly taken down by two men, moved, and set up in another area as the hazard dictates. During high-hazard periods, the truck may remain parked under the unit, relieved of the strain of heavy load yet ready for instant action.

Provisions were made to chain this unit to the truck when loaded. Chaining is unnecessary, however, when strips of rubber from a used tire are attached to the bottom. The friction holds the unit even on rough roads and in hilly country.

When a truck capable of carrying more than 5 tons is tied up with a tank, the various uses of a very expensive piece of equipment become restricted. We believe that in capacity, getaway time, and ultimate function, the self-loading unit is equal to the regular tanker, yet the self-loader has a greater economical advantage.—WM. EDEN, *Assistant Fire Marshal, Marathon Corporation of Canada Limited.*

RURAL PUBLIC RELATIONS[1]

The People Side of the Large-Scale Forestry Operation

GLENN R. DURRELL
Head of Department of Forestry, Oklahoma Agricultural and Mechanical College, Stillwater, Oklahoma.

As a basis for understanding some of the public relations problems that harass the forester or manager of a large forest property, let us take a look at the situation from the standpoint of the rural citizen who lives as a neighbor to the operation.

This citizen is a member of the community. His thinking is a part of public opinion. He makes up the juries that try our cases in court. He elects the people that make and enforce our laws. His needs for public services influence our tax rates. He may be part of our labor supply and one of the consumers of our product. He uses our land for recreation, for forage, for fuel, sometimes for protection from erosion or flood damage. He is a free man. He respects himself and his family. He likes to deal with the boss rather than with hirelings. He has the same wants, the same basic human urges, drives, compulsions, that the rest of us do. He is fearful of the unknown, he is inclined to resent and distrust bigness. Numerically, he out-votes us. Generally he or his ancestors were here before we were and had established use rights long before we attempted management of our forests.

He is as law-abiding as we are—that is, law-abiding according to his own code, which may or may not resemble in all respects the laws on the statute books. The code he follows, however, fits his own needs and is generally accepted, and enforced, by him and his neighbors.

We can ignore his needs and feelings, stand on our rights under the law—and remain unwanted aliens in his country, or we can attempt to understand him, respect his situation and perhaps —certainly slowly—gain his good will and acceptance into his community.

As foresters we like to feel—and often boast—that well-managed forests make major contributions to the welfare of the individual and the community. We are often surprised and are usually disappointed to find that relations between large ownerships, public or private, and their rural neighbors may deteriorate rather than improve as forest management is intensified. This deterioration may be expressed in many ways. The most common, of course, is the setting of fires. Others are timber theft, destruction of fences and other improvements, lack of support in law enforcement, election of county and state officials opposed to what we consider progress, inequitable tax assessments, violation of understandings and so on. Why should this be when managed forests mean more jobs, more income, community stability, etc.?

[1]Reprinted by permission from the December 1955 issue of *Southern Lumberman.*

STAGES OF FOREST DEVELOPMENT

We are taught in our study of forest history that the stages of forest development are the same in all countries. The nomadic man gathered his living where he found it. The domestication of animals and the beginning of agriculture put pressure on the forest for space for pasture and crops. Then the development of the crafts led to local exploitation for special products. Machinery and transportation extended the scope and area of exploitation. Then tree culture and finally management develops. Most of us overlook a principal point to be gained in the study of history; we assume that we are at the beginning of intensive management—and, as far as some of the forest lands are concerned, we are. The important point, I think, is that man has always used the forest to meet his current needs—and that these needs, these several stages of forest development, can exist side by side, as far as our neighbors are concerned, on a relatively small forest property. One of our neighbors needs the berry crop, or mast for game and hogs; another more pasture or more land for crops; a third wants special products from the forest for his particular craft; still another wants work to eke out his livelihood, and he wants to stay at home, not move to town or to the next county.

Another point that should be stressed in our study of forest history, and a study of our own behavior should point out the same thing, is the strong foundation in our thinking of rights developing through use. Some of this system of establishing rights through use has found its way into law—squatters' rights, public thoroughfares, acquisition of water rights through beneficial use, for example. To bring this closer to home, think for a minute of the use rights that you possess and would raise a fuss about if they were threatened; your desk, other office furniture, the company car assigned to you, tools and equipment, your space in the parking lot.

A related idea, that one individual or corporation should have no more of basic resources than he can use is firmly fixed in the public's thinking and many examples of this also can be found in our laws. Our public land disposal policies, some escheat laws, limitations on the amount of land to be irrigated by individuals on Bureau of Reclamation projects, the perennial attempts to pass graduated land tax laws are examples. Perhaps our graduated income tax laws, although theoretically based on ability to pay, are also a reflection of this same idea.

A human trait common to most of us, even those of us who consider ourselves civilized and law abiding citizens, is the habit of using land, space, resources, that do not belong to us if the rightful owner does not appear to be using the property for the moment, or if other non-owners are using the property. What happens to an abandoned farm, for example? What goes on in the vacant lot in your town? It is a depository for unwanted trash and a source of soil if you need it. It is a playground for the neighborhood. What happens to junk and garbage if your town does not have an adequate collection system?

WHY RESENTMENT

With these gleanings from history and human nature—that human needs in an area can vary greatly, that we instinctively fear bigness and try to limit it, and that we are inclined to use that which isn't being used—let us review our activities in the light of the individual neighbors involved to see if we can find answers to the question of why, if good forestry practices are so beneficial, they may stir up resentment rather than support.

We started out with acquisition, the building up of holdings. In this process (except in the creation of the forest reserves by withdrawal from public domain) we dealt with the citizens as an equal. We became acquainted with him and his family. Because travel was usually on horseback or on foot—distances were relatively great—we took our meals with the family and spent the night in his house. We accepted his hospitality. We brought him news from the outside world. We discussed our work and our plans with him. Our money for his timber improved his lot. We were taking off his hands something that he couldn't use and that we thought we could at a price both parties considered fair. He didn't care much who owned the vast wooded areas around him—one non-resident owner was as acceptable as another—and perhaps the new owner would do something with the land. We often told him to help himself to fuel wood, to graze the forest, even to leave his buildings or occupy a favored spot on our lands—all we were interested in was the mature timber of certain species and we might not cut that for twenty years. In fact, we often bought the land only because we couldn't acquire the stumpage without it.

These concessions, freely made, and usually not formalized by written agreements, were transferred to new owners as rights when land changed hands. Others decided that if it was all right for one man to use company land it must be all right for them to use it too. As these use rights passed to new owners or to the next generation in a family they became more firmly established in the minds of the owner. Any limitations, either terminal or provisional, that might have been included in the discussion at the time the original concession was made became inoperative because they were not exercised and hence ceased to exist.

TREADING ON TOES

When we started logging it was a progressive operation. As we pushed our railroads and spurs back into the timber the local resident came into contact with another group of our employees. This group had a job to do and they were rated on their ability to get the logs out of the woods at the lowest possible cost. Some of them in their zeal to do a good job, as rated by the cost standard, trod on the toes of the local citizen. The concentration of people in the logging camps sometimes depleted the local game and fish supply which the citizen regarded as his own. Right-of-way problems for the spurs arose. Logging roads created erosion problems. Log hauling on local roads through all kinds of weather tore them up and made them almost impassable to the or-

dinary farm wagon. Some felt that they had to sell their timber while the logging was going on in the area because they might not have another chance, and because this situation existed many felt that they had lost part of their bargaining power and hadn't got as much for the timber as it was worth. They began to feel the bigness of the outfit and to resent somewhat the fact that money was being made out of cheap stumpage. As the logging front passed on some of the neighbors followed the job, often leaving too few people in the settlements to support schools, churches, roads, and the crossroads store. The woods were left full of tops, and slash which constituted a fire threat to grass, rail fences, and buildings. This had to be burned for protection, and following the logging and fire, brush and reproduction came in threatening the grass crop. This led to further burning in a losing battle.

When we decided that there might be a future in holding our cut-over lands for future crops of trees, these fires could no longer be tolerated. Fire laws were passed which, in effect, made criminals out of people who felt that they were only protecting their firmly established rights. We employed wardens and rangers, built towers and telephone lines. Some of our lines were built under contract. The contractor, in order to make the maximum profit also at times made enemies for us by promising phones for right-of-way, by cutting trees that the citizens valued, by swinging the line over roads and trails to avoid clearing, by placing the lines too close to buildings. His job was to get the line in as cheaply as possible—not to win friends and influence people. Restrictions on the use of the lines also made enemies. Generally efforts were made to get emergency calls through but there was much difference of opinion over what constituted an emergency.

As state protection agencies developed, the fire job was transferred to their hands and another contract between company and citizen was broken. Gradual abandonment of telephone lines in favor of radio also has left some individuals and communities without contact with the outside world.

With the decision to practice forestry, residual stands became more important and valuable both as a seed source and as a base for the next cut. Trespass men were needed to protect this resource, a resource that as far as the local resident could see was not being used. Some of our trespass men too lost much of their effectiveness and their standing in the community by their own violation of other laws.

AREAS OF CONFLICT OPENED

As our forest management work was intensified, more areas of possible conflict were opened. Newly planted areas had to be protected from excessive grazing. Both the planting and the necessary fencing eliminated grazing land to which the local citizen felt that he had an established right through long use. Timber stand improvement work meant, to the local citizen, a reduction of hog and deer feed in the woods, fewer den trees, fewer bee trees.

Increased costs of the forestry program dictated more intensive use of the land. Idle acres became an expensive luxury. We began to look at the adverse uses (many of them freely granted during the acquisition program) to see if they could be eliminated or made to pay their way. Since no record had been made of early promises and many of the men who had made them had passed out of the picture, difficulties in adjusting these uses on an equitable basis were bound to arise. The grapevine carried the news from one area to another. A fence removed in one area became company support for a general stock law by the time the news had made the rounds.

The development of the forestry program also brought a change in the company representatives who deal with the local people. The foresters have entered the picture—young, enthusiastic, anxious to make a showing—and for the most part, foreign to the local people and their ways of life. They understand little of company background and history and less of past dealings with the neighbors. Practically all of them have immediate military backgrounds with emphasis on unquestioned following of orders rather than on finesse in dealing with people.

The citizen sees more of this young man as he passes up and down the road—not as a neighbor but as a threat to his security. The forester is a busy man. He doesn't have time to stop and visit, to take a meal or spend the night. His contact with the citizen is apt to be brief and businesslike. His activities arouse suspicion and since he seldom takes the time to explain why he is doing the things he is, and what he expects to do next, the citizen must speculate and put the news on the grapevine to be distorted as it is repeated.

Now, what can we do about it? How can we extend the advantages of good forest practices to the rural citizen as well as to our urban neighbors? We must remember first of all that there is a basic difference between many of our rural people and those who have adapted their lives to the ways of town where wants are satisfied by earning money with which to purchase material things and the pleasures that represent a comfortable living. The rural citizen often has an entirely different set of values. One of the most important of these is freedom: freedom to go where he pleases, when he pleases, space in which to live; freedom to make his own decisions; freedom from bosses and time clocks and mill whistles. Money is important, of course, but to many it is a secondary consideration. We must remember that they may not want to be woods workers or forest farmers; that they like their way of life; that they don't want things changed. Particularly, they do not want to lose use rights that have been theirs for generations.

MARKING OF BOUNDARIES

How do we go about establishing actual as well as legal title to our property? It is generally agreed that the marking of boundaries is a helpful first step. There is a right way as well as a wrong way to go about this simple job. If the avowed purpose is to establish lines that will save time and money on future operations,

timber cruising, logging operations, protection, etc., if it is the intent to keep our workers off the lands of others it will be acceptable. If, on the other hand, the job is approached from the standpoint of, "This is our land. Keep off", resentment is sure to follow. The line marking crew is also in position to hear firsthand of adverse uses, of boundary disputes, of rights granted by former employees, etc. These should be recorded and reported as a basis for further action. A next step toward acquiring actual ownership might well be the formal recognizing of uses of our lands by others by written documents. This can be done from the standpoint of protecting the user in his right by making it a matter of record so that future employees will recognize it. At the same time it establishes the fact of ownership and the right to grant or reject such uses. Such agreements can have a terminal date requiring renewal or relinquishment. When once placed in writing the use ceases to be inheritable property.

It might be a good idea to take an inventory of uses or needs that exert pressure on the forest property—uses and needs of rural neighbors and communities. Fitting in as many of these needs and uses as can be tolerated without undue cost or adverse effect (or establishment of questionable precedent) on the forest would be a good investment in public relations. The job must be done on a businesslike basis, not with a paternalistic attitude, if it is to be effective. In general our experiences in buying cooperation with concessions has not been too rewarding.

RECREATIONAL USE

It would be well to recognize that the public at large will never surrender recreational use of forest lands regardless of ownership. Watershed influences are probably in this same category. We will have to recognize these public uses and make room for them in our planning. If we do not, we can expect, eventually, the exercise of the right of eminent domain, or legislation that will protect these rights for the people. In the main these uses will not conflict with the management use of the forest except for the added fire risk. Studied effort on our part might provide for these uses on an acceptable basis. At the same time it is questionable whether the development of recreational areas for public use on private property is the answer. The damage to tree growth in areas of concentrated human use is great and the upkeep of such areas in an acceptable condition is a constant job and a heavy expense.

A next step in acquiring rights in our own land is evidence of more intensive use of that land. A twenty-year cutting cycle for example, may be reasonable on a large property but to the neighboring landowner twenty years with no activity on the area is a long, long time. It has the appearance of abandonment to him and consequently he feels free to use the area. A chance at a woods job every twenty years has no attraction in planning a way of life. Shorter cutting cycles where feasible, planting, timber-stand and improvement work, marketing of special products, prompt salvage work, seed collection, renewal of boundaries, all indicate

use of the area and in addition offer opportunities for frequent employment as well as demonstrations of good forestry practices. Incidentally, our handling of part-time work possibilities merits careful consideration and planning. The worker is entitled to know the probable duration and extent of his employment. He has to live. If only part-time work is available, that time should be so arranged that it interferes as little as possible with his principal occupation. If, for example, he is normally a farmer and we work him through the planting season and he misses a crop then we have probably contributed another family to the local relief load during periods when we have no work for him.

Now, the problem of the young forester: How can he appear businesslike without giving the impression of officiousness? How can he take time to explain forest objectives and policy without creating an impression of idleness? How does he learn of the promises and concessions granted by his predecessors and superiors without incurring official wrath or being regarded as nosy? How does he go about learning the attitude of the rural neighbor toward the outfit he represents is important to the organization and how can he be made to realize that his actions definitely influence that attitude?

With a few exceptions, the attitude and approach of the employee reflects quite accurately company policy and attitude of superiors; with almost no exception the reaction of the public to any organization is based on impressions made by the employees with whom they come in contact. The foreman, the timber and wood buyer, the trespass man, the pay clerk, and to an increasing extent the forester are the windows through which the rural neighbor sees the company. While policy must come from top down, one employee, in his dealings with the public, can, by being officious, overbearing, grasping, unfair in his dealings, completely negate that policy. If this be true then special concessions, donations to rural community projects, publicity campaigns, barbecues, and public relations experts, while sometimes useful are not in themselves the solution to the problem. Respect and neighborly support cannot be purchased. It can only be earned.

ATTITUDE MUST BE RIGHT

Perhaps then, the following steps are in order: First, the company attitude must be right. Good public relations must be desired. The company must want the cooperation and support of the rural neighbor. This fact should be stressed as part of company policy in employing the new forester and others who will contact the public. As a corollary, company policy should be reviewed from the standpoint of public relations. Especially should new programs, new woods activities, be analyzed from this standpoint. In the job planning stage setting up the program of explaining the new activity to the public should be just as important a step as any other part of the plan.

Second, the forester must know company objectives and policy and some of the reasons behind them. If he must perform his work on the basis of orders alone he is working in a vacuum. He will make mistakes in interpretation and application. His activ-

ities will be misconstrued. It must also be recognized that it takes time to do a good public relations job and that perhaps a few hours spent in getting a message across to the public is more productive in the long run than the same amount of time spent supervising the crew.

Third, the forester must be given the tools with which to do the job. The most important of these tools is the freedom to do a fair and honest job in his dealings with his neighbors. This includes an adequate knowledge of wage scales, stumpage rates, methods of payment, contact requirements, etc., that enable him to be accurate and prompt in his dealings. It also includes explicit instructions as to honesty and fairness in his business transactions. Underestimating, underscaling, unreasonable docking should not be tolerated. He should not be allowed to capitalize unfairly on the neighbor's lack of technical forestry knowledge. At the same time he should understand that there is nothing to be gained by overscaling, overestimating, overpaying and similar practices; that such practices buy contempt rather than support.

Fourth, the forester's public relations activities should be subject to review and inspection, just as is his job performance on other activities. Foresters are human. They place effort on the activities on which there is the greatest pressure. They like to be able to measure accomplishments. Unfortunately the results of a good public relations program are hard to measure and they come about slowly. If emphasis is not placed on the program it is apt to be slighted.

It goes without saying that careful selection of the employee in the first place is an essential. It is difficult in a brief employment interview to form a complete picture of a man's ability to deal with others. Some clues may be found, however, in his college activities, his work experience, and his background.

Changes in public attitude toward large ownerships cannot be expected overnight. Such changes can come about, however, through conscientiously applied programs based on the principles of old-fashioned neighborliness and fair business dealings. More foresters in the woods with closer contact with the people and with authority to handle more and more of the decision on a local basis, as they develop the judgment and capacity to make such decisions, is part of the solution.

As the forester assumes the management of the area entrusted to him, becomes the representative of the company to the people, and makes a place in community life, then part of the fear and distrust of bigness and "foreign" ownership is lifted. When management is intensified and the forester's area of supervision is reduced in size from a small empire to an area of the size that rural people can comprehend (and the forester can manage intensively) this effect will be more pronounced. It is probably too much to expect that the rural neighbor will ever speak with pride of the company as "our company", but it is within the realm of possibility that he will someday think of the forester as a neighbor and of the forest and the resources it represents as an important part of his community.


SMOKEY SAYS:
Be careful - BECAUSE
EVEN LITTLE FIRES
KILL LITTLE TREES!
SMOKEY
Remember — Only you can
PREVENT FOREST FIRES!

INFORMATION FOR CONTRIBUTORS

It is requested that all contributions be submitted in duplicate, typed double space, and with no paragraphs breaking over to the next page.

The title of the article should be typed in capitals at the top of the first page, and immediately underneath it should appear the author's name, position, and unit.

Any introductory or explanatory information should not be included in the body of the article, but should be stated in the letter of transmittal.

Illustrations, whether drawings or photographs, should have clear detail and tell a story. Only glossy prints are acceptable. Legends for illustrations should be typed in the manuscript immediately following the paragraph in which the illustration is first mentioned, the legend being separated from the text by lines both above and below. Illustrations should be labeled "figures" and numbered consecutively. All diagrams should be drawn with the type page proportions in mind, and lettered so as to permit reduction. In mailing, illustrations should be placed between cardboards held together with rubber bands. *Paper clips should never be used.*

When Forest Service photographs are submitted, the negative number should be indicated with the legend to aid in later identification of the illustrations. When pictures do not carry Forest Service numbers, the source of the picture should be given, so that the negative may be located if it is desired.

India ink line drawings will reproduce properly, but no prints (black-line prints or blueprints) will give clear reproduction. Please therefore submit well-drawn tracings instead of prints.