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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 13 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.

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OPERATION REDSKIN

K. O. Wilson

Fire Control Officer, Region 3, U. S. Forest Service

Maps of Arizona and New Mexico are dotted with many and widely scattered Indian reservations. These range from the massive 11,000,000-acre Navajo Reservation, home of over 50,000 Navajos, to the tiny Havasupai Reservation in the depths of Havasu Canyon, a tributary to the Grand Canyon of the Colorado, which is home for less than 300 Havasupai Indians. Ruins of the dwellings of ancient tribes long since gone are common, and the entire Southwest is steeped in Indian lore and legend. Public opinion to the contrary, most of the tribes are no longer uncivilized savages. As a matter of fact, many of the younger Indians are well educated and several tribes can boast of a good sprinkling of college graduates. All very interesting, you say, and even educational, but how did this get into a fire control publication?

For several years the Forest Service in the Southwestern Region has been using Indian crews on fire suppression work. Some of these crews, whose homes are within the forest type, have been trained in fire work by the Indian Service. The Mescalero-Apache tribe in southern New Mexico and the Fort Apache and San Carlos tribes in east-central Arizona fall in this category. By contrast the Navajo and Hopi tribes of northern Arizona live well over one hundred miles from the nearest forested land, although they live in plain view of the forest-covered mountains in the distance.

But trained or untrained, these Southwestern Indians are peculiarly well adapted to fire suppression work. They are by nature outdoor people, skilled in the use of hand tools, exceptionally well disciplined, and possessing amazing endurance. In addition, the fire camp life which we normally think of as rigorous is oftentimes at a level or higher than that to which the average Indian is accustomed; and too, the very nature of suppression work is well suited to the Indians' likes. Another important factor is that they are almost fanatically home-loving individuals and very much dislike to be separated from their families for long periods. The long hours, short tenure, and relatively good pay characteristic of fire suppression work are made to order for these Indians.

During a serious fire bust in southern California in 1950, 2 organized 25-man crews of Hopis were dispatched by plane from Winslow, Ariz., to San Bernardino, Calif. (fig. 1). Their performance was so outstanding that they were called back on 3 subsequent fires in that season. During the disastrous 1951 season, 20 such crews were dispatched to California. At one time there were nearly 200 Indians from Arizona and New Mexico on fire suppression work in California. These were from 3 tribes: the previously mentioned Mescalero-Apache and Hopis and 3 crews from the Zuni tribe in west-central New Mexico.

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FIGURE 1.—*Top*, Region 3 organized Indian suppression crew boarding Air Force plane for out-of-region assignment. *Bottom*, Indian crew building line in heavy brush type in California.

The normal organized crew consists of 1 foreman, 2 strawbosses, and 22 line workers, all Indians. The size of the crews sometimes must be adjusted to fit the capacity of the planes in which they travel. It is general

practice to send a capable forest officer with each crew to handle timekeeping, feeding, transportation and liaison work.

Many of you have heard tales and read about the poverty-stricken, starving Southwestern Indians. While some of these stories paint the picture somewhat darker than is actually the case, it is true that most of these tribes are very poor by our standards. Their wants are few, and fortunately so, because job opportunities are not plentiful in this vast, thinly populated area. Short growing seasons, poor soil, and limited water make successful farming an impossibility. The income from fire work is a welcome addition to their economy. The 1951 season produced a revenue from fire work of over $100,000 for the three small tribes used most often. One group of three organized crews spent 16 days on suppression work in California and returned with checks which averaged $340 each.

Because of the many advantages in the service of these crews, the Forest Service is emphasizing their use in a trend away from pick-up labor. Ten top-flight crews are now available, and the region is currently negotiating with several other tribes and with the Indian Service in an effort to organize several more.

Indians are unconsciously safety minded. They watch each other, help each other, and warn each other of impending danger. Among the organized crews, we have yet to experience a lost-time accident though they have logged many thousands of hours of the most hazardous work—a truly outstanding record.

Through the many centuries that these people have lived in the Southwest, their everyday customs and essentials of life have found expression in colorful ceremonial dances. The fire dances, harvest dances, rain dances, and many others are as much a part of their lives as eating and sleeping. On one occasion a Hopi crew working on a particularly troublesome fire in southern California requested permission to put on a rain dance. Within 2 hours after their dance there was a veritable cloudburst. All that was left of the once troublesome fire was a mass of steaming mud. It would indeed have been difficult to convince any Indian in that group that the welcome rain was not a direct result of their ceremony. You can undoubtedly think of a number of organized fire crews that possess many of the qualities which make these Indian crews outstanding. Do you know of any that bring along their own rainstorms?

KEEP YOUR AX HANDLE TIGHT

HARVEY H. SMITH, *Wood Technologist,* and JOHN P. BURKE, *Forester*
California Forest and Range Experiment Station [1]

On a forest fire in Idaho two men were working together. As one man started to chop, his partner stepped back out of the way, but the ax, supposedly tight, slipped off the handle and struck him in the face. He spent many painful days in the hospital—and the accident could have been fatal. There is always the possibility that a loose ax head may fly off the handle as this one did, or it may slip, upset the chopper's balance or aim and cause the ax to glance.

The difficulty arises from the fact that we insert a shaft of wood, which can change in cross sectional area, into a steel eye which is virtually constant in cross section. Yet there is no better material for an ax handle than wood. It is light and strong, shock resistant, and flexible. Its low-heat conductivity makes it comfortable to hold in hot or cold weather. The solution then, is in keeping the handle tight.

Wood shrinks as it dries and swells when it becomes wet. Remember how doors sometimes stick on wet days and then swing freely again in dry weather? Ax handles swell and shrink with the same changes in the weather. Axes used for fire fighting are particularly troublesome. Many of them are necessarily kept in field cache boxes, which are usually tightly closed and placed in the sun where temperatures are extremely high and the air is dry. This shrinks the handles of axes and pulaski tools.

Scores of axes with factory-fitted handles have been inspected late in the fire season, after this drying effect had had a chance to work. Not a single ax that had been stored in cache boxes was found to be tight and safe. The axes stored in buildings, not being subjected to such high temperatures, were somewhat better. Even there, however, many handles had become loose and dangerous.

To make matters worse, many men hired for fire fighting are not skilled in the use of the ax. A highly skilled axeman senses any slight change in balance or impact which occurs when an ax handle is loose. The axeman is thus warned. The unskilled user chops on—without warning—until the accident occurs.

Several methods are used for tightening handles in axes which have been improperly hung or wedged, but most methods are at best no more than a temporary expedient. The handle can be soaked in water until it is tight, but when it dries out again it will be looser than before. Wetting causes the wood to swell, but the swelling is restrained by the eye of the ax. The forces that develop as the wood increases in moisture content will crush some of the wood fibers. These crushed fibers do not recover

[1] Maintained by the Forest Service, U.S. Department of Agriculture in cooperation with University of California, Berkeley.

when the wood dries, and the handle has actually shrunk to a size smaller than before. Repeated wetting and drying will cause further "compression set," and it will become increasingly difficult to keep the handle tight.

Adding a metal wedge to a loose fitting handle is little better than the water treatment because it also subjects the wood to stresses resulting in a compression set. A hardwood wedge does the same thing, and also acquires a compression set of its own. Neither the metal nor the hardwood has sufficient capacity to expand as the handle shrinks.

Loggers and logging companies have long been confronted with this problem, and many of them have found a satisfactory solution. For years large timber companies have bought axes and good handles separately. After the handles have been seasoned to a moisture content of 8 to 10 percent, competent men are put to work installing the handles, using a very dry softwood wedge, such as white pine. One company employing up to 2,400 woods workers follows this procedure, and old loggers have done so for years. Their ax handles stay tight.

Recently tests were run with factory-hung axes as a check, with axes fitted with softwood wedges, and with axes treated according to two other suggestions for keeping handles tight. One suggestion was to supplement the factory hardwood wedge with two flat-head No. 16 by 2-inch wood screws, firmly driven into holes properly drilled and countersunk. The other suggested method was to use an oil-base wood preservative, supposed to prevent shrinkage. After preparation, nine axes in each group were subjected to temperatures of 130° to 140° F. at low humidities, approximating field cache conditions, for 6 weeks. After this time each ax was driven securely into a log. The looseness of the handle in the eye was then determined by measuring the distance that the end of the handle had slipped. Results were:

Sample	*Number of axes*	*Number of tight axes, no slip*	*Range of slip (inches)*	*Average slip (inches)*
Factory check	9	0	0.06-0.69	0.30
Preservative oil	9	0	.16- .69	.44
Screw wedges	9	1	.00- .31	.18
Soft pine wedges	9	9	.00- .00	.00

Besides these 36 samples, 2 axes were refitted with soft pine wedges and the original factory handles, but it was necessary to cut nearly all the shoulder to get a good fit in the eye. These axes were included in the test to show the result of cutting away the shoulder. Neither remained tight, one slipping 0.03 inch, the other 0.16 inch. This limited sample indicates that a shoulder is necessary.

The superiority of softwood wedges is explained as follows: (1) Softwood exerts sufficient pressure to hold the well-fitted handle tight without crushing and damaging the hardwood fibers. (2) The softwood will adjust to shrinking and swelling of the hardwood throughout the range normally experienced under reasonable conditions of storage and use.

What is the practical meaning of this test? If you want a safe, serviceable ax, buy the head and handle separately, and hang the head yourself. Factory-fitted handles are not seasoned to "fire season dryness," and are wedged with a hardwood wedge, which is also somewhat moist. Metal wedges are often added, crushing the wood fibers. Here is how to guarantee a tight ax handle, usually for the life of the ax:

1. Get a straight, clear, well-seasoned hickory handle.

2. Inspect the eye of the ax for cracks. Remove bur edges at each end of the eye.

3. Fit the handle to the eye as closely as possible, clear through the eye, leaving ½-inch shoulder and a smooth wood surface in the eye. The shoulder should not bulge.

4. After the handle is fitted, remove it and saw a wedging slit down the center, parallel to the flat sides of the ax, to a depth that will be two-thirds the way through the eye when the handle is driven home.

5. Select a piece of sound, dry, straight-grained softwood, with annual rings parallel to the broad face of the wedge (flat-sawed lumber). It should be about ½-inch thick, as wide as the length of the eye, and not less than 6 inches long. Dress it down across the full width of the wedge so that it tapers gradually to a 1/16-inch-thick point which is then sharpened to a short, blunt edge. The wedge should have a rectangular cross section, except for slight rounding at the edges to fit the eye. It should be proportioned to exert pressure throughout its flat surfaces, the greatest pressure at the outer end of the eye.

6. Drive the handle firmly into position with 24-ounce hammer.

7. Drive the wedge into place as far as possible but avoid splitting it.

8. Saw off excess length, dress off with coarse file, and paint end.

9. Store axes in best cool, dry place available. Field caches should be ventilated and, if possible, placed in the shade. Though it is best to avoid wetting the ax handle, it will stay tight through considerable moisture change if properly fitted and wedged.

Is this procedure too much work? Ask the man who was struck by the flying ax.

New Device for Examining Lookout Coverage

The National Research Council and the Forestry Branch of the Federal Government are investigating jointly a new method for examining coverage from wooded hilltops in connection with lookout tower location. This involves the use of a collapsible 50-foot radio mast on top of which is mounted a camera using 35-millimetre film, operated and rotated from the ground by electrical control. The total weight of mast, camera, and all necessary tools and equipment is about 300 pounds. The maximum weight of any one piece is 15 pounds and the length of the longest mast section is 11 feet. About three hours is required from arrival at the site to departure, using a three-man crew.

The pictures, when enlarged nine diameters and mounted in panoramic form, show promise of considerable usefulness in determining lookout coverage. Some mechanical and optical improvements are now being made by the National Research Council. The possibility of reducing the weight and bulk of the equipment is also being studied.—From Forest Fire Protection Abstracts. Canada Dept. Resources and Devlmt. 2:5. 1951.

THE LAKE STATES BURNING INDEX METER

J. A. MITCHELL

Forester, Lake States Forest Experiment Station [1]

The Lake States Burning Index Meter, issued first in 1936, is a device for rating the relative severity of burning conditions. It was developed for the use of forest officers and others responsible for forest fire control in the Lake States. As revised in 1949, it consists of a windowed envelope with a movable slide by which the factors considered can be integrated and their combined effect on the flammability of forest fuels rated (fig. 1).

The factors on which the meter is based are: (1) *the average moisture content of light fuels in the open*—determined from its correlation with condition of vegetation, precipitation, days since rain, and relative humidity, and (2) *current wind velocity.* To use the meter, the slide is first set so that the number of days without precipitation (since the last rain of half an inch or more) shows in the opening under "condition of vegetation." The "burning index" is then read from the table in the upper opening, under the current "relative humidity," and opposite the current "wind velocity." Each day thereafter on which no precipitation is recorded at 8 a. m. the slide is advanced one day. For days on which precipitation is recorded at 8 a. m., a pencil is inserted in the hole opposite the amount of rain observed and the slide retracted as far as it will go. Thus, *the period between rains,* as well as the amount of precipitation, is taken into consideration. For example: .23 inch of rain on the tenth "day since rain" (as shown on the meter) would set the meter back to the sixth day, while the same amount of precipitation on the sixth day would set it back to the second day. This is a unique feature of the Lake States meter.

The "burning index" indicates the relative severity of burning conditions *in percent of the worst probable,* 1 representing minimum severity, and 100 maximum. As pointed out, the scale is *relative*; that is to say, for any given level of "risk" (chance of fires being started) and "hazard" (determined by the character and amount of fuel present), the probability and severity of fires vary with the burning index.

Based on experience, the burning index ratings are divided into seven classes characterized in general as follows:

Safe (0-1).—Fires will not run beyond the heat of a campfire or burning brush pile.

Very low (2-3).—Fires will start from an open flame but spread slowly and tend to go out.

Low (4-6).—Fires will start from a lighted match and spread slowly (rapidly in dead grass) until extinguished.

Moderate (7-12).—Fires will start readily from a match, burn briskly, and tend to spread rapidly as they increase in size.

High (13-24).—Fires start readily from a match or glowing embers, spread rapidly, and tend to crown in young conifers.

[1] Maintained by the U. S. Department of Agriculture, Forest Service, in cooperation with the University of Minnesota at University Farm, St. Paul 1, Minn.

LAKE STATES

BURNING INDEX METER

Relative Humidity - %								Wind Velocity m.p.h.
80 up	70 to 79	60 to 69	50 to 59	40 to 49	30 to 39	20 to 29	10 to 19	
0	1	1	2	3	5	7	10	0 - 3
1	1	2	3	4	6	9	13	4 - 6
1	1	2	4	5	8	11	17	7 - 12
1	2	3	5	7	10	14	21	13 - 18
1	3	4	6	9	13	18	26	19 - 24
2	4	6	8	11	16	23	32	25 - up

Burning Index

Condition of Vegetation

Green	Intermediate	Dead

Days Since Rain

4	3	2

Precipitation (Inches)

.50- up
.45-.49
.40-.44
.35-.39
.30-.34
.25-.29
.20-.24
.15-.19
.10-.14
.05-.09
.00-.04

Directions

Set slide to show (under "Condition of Vegetation" prevailing) the number of days without rain, since the last rain of .50" or more.

Advance slide one day for each day without rain thereafter.

For subsequent rains, insert a pencil in the hole opposite the amount of precipitation and retract slide as far as it will go.

"Burning Index" indicated opposite current "Wind Velocity" under current "Relative Humidity."

1949

FIGURE 1.—Lake States burning index meter.

Very high (25-49).—Fires will start from burning tobacco or sparks, spread rapidly, and tend to crown generally. Spot fires common.

Extreme (50-100).—Explosive conditions. Fires start readily from sparks, burn fiercely, and tend to crown and spot generally.

Standard practice calls for daily observations at 8 a. m., noon, and 5 p. m. from April 1 to October 31. In years when the fire season opens earlier or closes later the period of observation is extended accordingly. The minimum equipment required consists of a rain gauge, a sling psychrometer, relative humidity tables, an anemometer indicating wind velocity in miles per hour, a Lake States Burning Index Meter, and forms for recording observations. The observations called for are: condition of vegetation, precipitation, relative humidity, and wind velocity.

The theory on which the Lake States and most other burning index meters are based is that fuel moisture content and wind velocity are primarily responsible for the degree of flammability or severity of burning conditions prevailing. Because we are dealing with a complex aggregation of fuels which vary widely in amount, density, and exposure, the *average* moisture content of the primary fuels (together with wind velocity) is the best measure we have of the prevailing level of flammability. In the Lake States, heavy fuels are not, as a rule, an important consideration. The condition of light fuels in the open is, therefore, used as the criterion of burning conditions because this largely determines fire occurrence and behavior.

Because it is impractical to determine the *average* fuel moisture currently by direct measurement, it is arrived at indirectly from its correlation with the principal factors which determine it (i.e., condition of vegetation, precipitation, days since rain, and relative humidity).

"Condition of vegetation" is rated by the observer or district fire control officer as "dead," "green," or "intermediate" on the basis of prevailing conditions. "Green" is used when the grass and herbaceous vegetation is green and the broadleaf trees and shrubs are in full leaf. In the Lake States, this roughly coincides with summer and usually prevails from early June until mid-September. It varies, however, from year to year and from place to place; hence, is not tied to specific dates. "Dead" is used when the grass and herbaceous vegetation are dead or cured and the hardwood leaves (with minor exceptions) have fallen. This condition is typical of the spring and fall fire seasons. "Intermediate," formerly called "curing," applies to the transition period between green and dead and dead and green. This condition is usually of short duration (10-20 days) and confined to late spring when the grass is well started but the hardwood leaves are not yet fully developed and to early fall when the annual vegetation is cured or dead but the hardwood leaves have not yet fallen. It can also prevail in summer as the result of a prolonged drought and the consequent drying up of grass and herbaceous vegetation.

"Precipitation" is measured each morning at 8 a. m. Less than .005 of an inch is recorded as a trace but ignored in setting the meter. For the first setting of the meter, the amount of the "last rain" is taken as the total precipitation occurring on consecutive days and must amount to half an inch or more. Subsequent rains are considered day by day, the meter being set back according to the amount of precipitation occurring. If rain occurs between 8 a.m. and noon or between noon and 5 p.m., it should be measured and the meter set back accordingly at the time of

the noon or 5 p.m. observation, in which case amount measured is deducted from the total for the 24-hour period in setting the meter the following morning.

"Days since rain" is counted from the day on which precipitation is last recorded at 8 a.m. Following rains of half an inch or more it will always show as one day. When the meter is set back for less than half an inch of rain, the number of days showing on the meter or "meter days" depends on both the amount of precipitation and the number of days the meter has been advanced. In no case, however, is the meter set back beyond the first day for the condition of vegetation prevailing. In case of snow, "days since" is counted from the first day that enough fuel is exposed for fires to run.

The prevailing "relative humidity" and "wind velocity" are used in determining the current "burning index." Normally, the "burning index" is determined daily at 8 a.m., noon, and 5 p.m. It can, however, be determined at other times if desired, for example, when conditions are acute or there is a fire burning.

The number and location of fire-weather stations are determined by the homogeneity of conditions, the availability of a suitable exposure for the rain gauge and anemometer, the availability of an observer, and by administrative considerations. As a rule, one fire-weather station in each protection district is ample. For administrative reasons, it is desirable to make the observations at the dispatching center or protection headquarters. Where conditions at headquarters are not representative or where a suitable site for the instruments is not locally available, the fire-weather station is located at the nearest point where conditions are suitable and an observer is available.

The burning index ratings serve two major purposes. First, they indicate the severity of burning conditions prevailing currently, as a guide for administrative action—manning of lookouts, need for stand-by crews, strength and speed of attack called for, etc. Second, and equally important, they make possible a comparison of conditions prevailing from place to place and from time to time. They serve also to call attention to the build-up of acute conditions and provide a basis for determining the normal severity of conditions and for judging the progress and efficiency of fire control effort.

Prevailing burning conditions are best shown by a chart on which the maximum burning index recorded each day is indicated graphically. Such a chart shows at a glance conditions from day to day throughout the fire season; the date, duration, and severity of acute periods; and currently the build-up of acute conditions. Years, seasons, and protection units can be rated for comparison by averaging the burning index ratings for the periods or units in question. For this purpose, days are rated on the basis of their maximum burning index. This is of value in over-all protection planning, in the allotment of protection funds, and in the assignment of personnel and equipment. The number of days in each burning index class is also useful in determining the normal fire load, its seasonal distribution, and the probable cost of effective protection. Last but not least, burning index ratings make it possible to properly rate accomplishment and the efficiency of fire control effort by providing a measure of the severity of conditions prevailing.

While the Lake States Burning Index Meter rates current conditions, it is useful, in connection with weather forecasts, in determining the severity of conditions likely to prevail. For example, if the weather forecast gives the relative humidity and wind velocity expected the following day, the probable burning index can be determined by advancing the slide one day and using the predicted humidity and wind velocity. Lacking a forecast, it is common practice to assume that the humidity will be at least as low as for the current day and to advance the slide one day to get a rough idea of what to expect. In settled weather also, afternoon conditions can be approximated from the 8 a.m. observations by using half of the 8 a.m. relative humidity to determine the probable afternoon burning index.

Because the Lake States meter is based on empirical data, it is not recommended for use where conditions are materially different from those prevailing in the Lake States, for example, where heavy fuels or elevation and aspect are important considerations, or where the fire season is continuous and of long duration. In the Lake States, heavy fuels are the exception rather than the rule; elevation is not a factor, and aspect is only locally important. Normally, also, "lows" occur at frequent intervals and more than two weeks without rain is unusual. On the other hand, the fire season is intermittent and erratic, and acute conditions can occur, after a few days of drying weather, any time the ground is not snow covered. Fire periods, however, are seldom of long duration. Most fires also start and burn in the open. Only under extreme conditions will fires run in mature timber. Acute burning conditions are indicated long before this condition is reached, however.

Local rains are the chief cause of unsatisfactory meter ratings because they can result in a wide variation of conditions in a relatively small area. This, however, is no fault of the meter because meter ratings are necessarily based on conditions prevailing at the point of observation. To meet this difficulty, supplemental observations of precipitation at outlying points are advisable to avoid being misled by local conditions, particularly in summer when local rains are frequent.

The Lake States Burning Index Meter has been revised several times and doubtless will be improved in the future as knowledge and understanding of fire and weather relationships increase. Experience has demonstrated that the basis of the present meter is sound and that, when properly used, it can be depended on to indicate the relative severity of burning conditions prevailing. No meter, however, can account for all of the factors and contingencies that affect fire occurrence and behavior, or eliminate the need for experience and judgment in determining the action called for in specific cases. The best that it can do is to indicate average conditions resulting from given combinations of the factors considered.

MOUNTING THE NEW MOBILE RADIOS WITH WEATHERPROOF CASE

A. M. Gardner

Communications Technician, Coconino National Forest

A number of satisfactory methods have been developed for mounting the various makes of mobile radios externally on pickups and trucks. In publishing this one we do not intend to infer that it is superior to all others we have seen. Rather we wish to make available to those who are still seeking a solution to the mounting problem for this particular unit an answer that appears quite simple and satisfactory.

This model 1147-5-1 mobile radio was specially developed by the manufacturer in cooperation with Northwest loggers who wanted a unit that could be mounted directly on the side of a pickup in the space just ahead of the rear fender. In connection with developing other mounting arrangements the company's manual cautions that (a) the 12-inch width dimension must always be kept in a horizontal plane and (b) vertical mountings on the ends of long vertical brackets should be avoided where excessive vibration might result. The diagonal brace included by Mr. Gardner to stiffen his mounting should eliminate harmful vibration.—*Ed.*

A mounting arrangement for the new mobile radios (Model #1147-5-1) which offers many advantages has been devised and is being used in Region 3. The mount is based upon use of the weatherproof case which can be obtained for these units.

The basic mount consists of three ¼- by 2- by 42-inch pieces of mild steel drilled to bolt to the case and into a corner of a pickup or truck bed. The pieces of steel are first bolted to the case with 5/16- by 1-inch carriage bolts (fig. 1). By drilling the holes ⅜ inch the bolts will force fit most effectively. Punched gasket material is placed under the heads of the bolts on the inside of the case to insure a weathertight fit. The bolts will

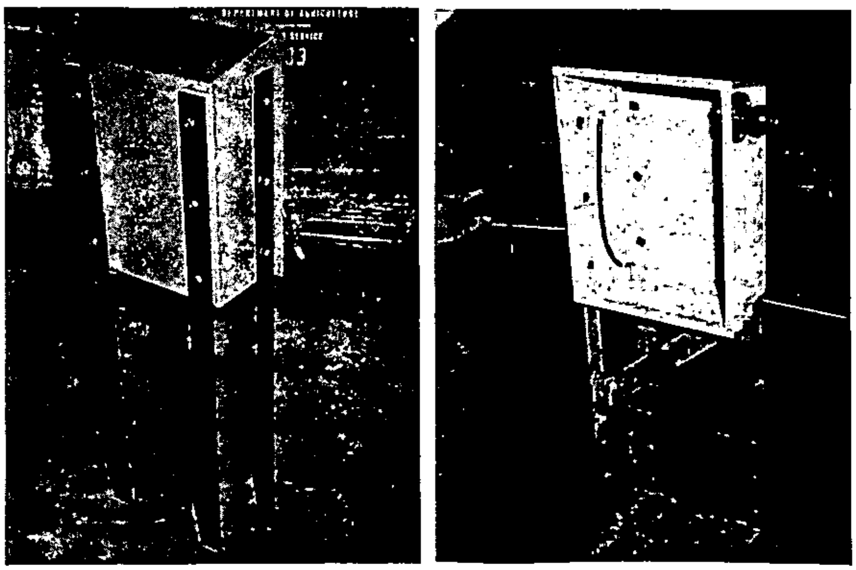

Figure 1.—*Left,* Steel supports are bolted to case. *Right,* Bracing insures rigidity.

pull up and the heads will not interfere with the fitting of the chassis into the case.

A diagonal brace of the same steel as the legs is welded between the front leg and the one diagonally across the case to the back. Bracing this back leg as near the bottom of the case as possible is essential to rigidity of the mount (fig. 1).

This mount may be bolted into the left front corner of pickup or truck bed with two of the legs on the outside, where the headboard curls in (see fig. 2), or with all legs on the inside where the headboard curls outward as in the power wagon.

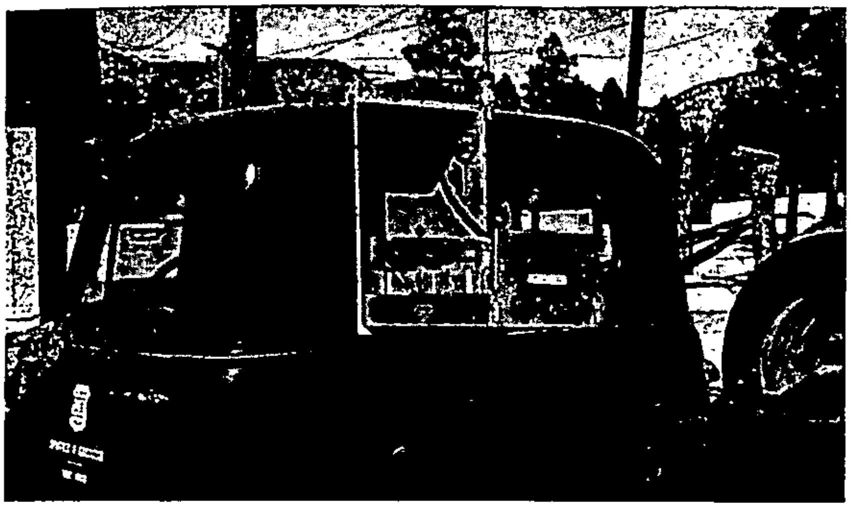

FIGURE 2.—Case mounted on pickup.

The antenna is mounted directly on the case, which comes with the necessary holes already punched.

Some of the advantages realized are:

1. Mount is adaptable to various makes and sizes of trucks.
2. Mutilation of cabs of trucks is avoided. (Some cabs do not have enough room between top and liner to accommodate roof-top antenna mounting.)
3. Radio is very accessible to technician for maintenance and repair.
4. No space is taken from the pickup or truck bed.
5. Antenna is mounted high enough and sufficiently in the clear to permit nearly optimum results in all directions.
6. Radios can be installed with ease and speed.
7. Radio is mounted approximately midway between front and back wheels for best riding conditions.
8. Short antenna cable reduces transmission losses to minimum.

Tests made with these mobile radios using this mount showed better than expected results. At extreme marginal conditions, some directivity was observed slightly to the right of front of vehicle. This could be expected from the ground-plane effect of the cab roof-hood combination lowering the angle of maximum transmission radiation in that direction.

RADIO MOUNT IN 1/4-TON JEEP

William E. Towell

Chief of Fire Control, Missouri Conservation Commission

The 4-wheel drive jeep has proved extremely valuable in many States as a fire fighting vehicle. During the past 6 years about 60 1/4-ton civilian jeeps and 20 1-ton jeep 4 x 4 trucks have replaced pickups and conventional trucks as fire fighting units in Missouri. One disadvantage of the small 1/4-ton jeep has always been limitation of space. Until recently all jeep radio installations were made in a waterproof box carried in a 3-foot bed extension at the rear of the jeep.

A new-type FM radio unit, Model FMT-R-41 V, (DF) 1 C (Front Mount) is almost tailor-made for the small jeep. The radio itself is a 12-watt set with the control panel and speaker mounted in the front of the single cabinet. It is a self-contained unit requiring only antenna and battery connections to place it in operation. This radio is available either for the 30-40 mc. band or the 152 mc. band and can be obtained for operation on one or two frequencies.

In the 1/4-ton jeep this radio is mounted between the two front seats with the control panel forward (fig. 1). The extra passenger or right-hand

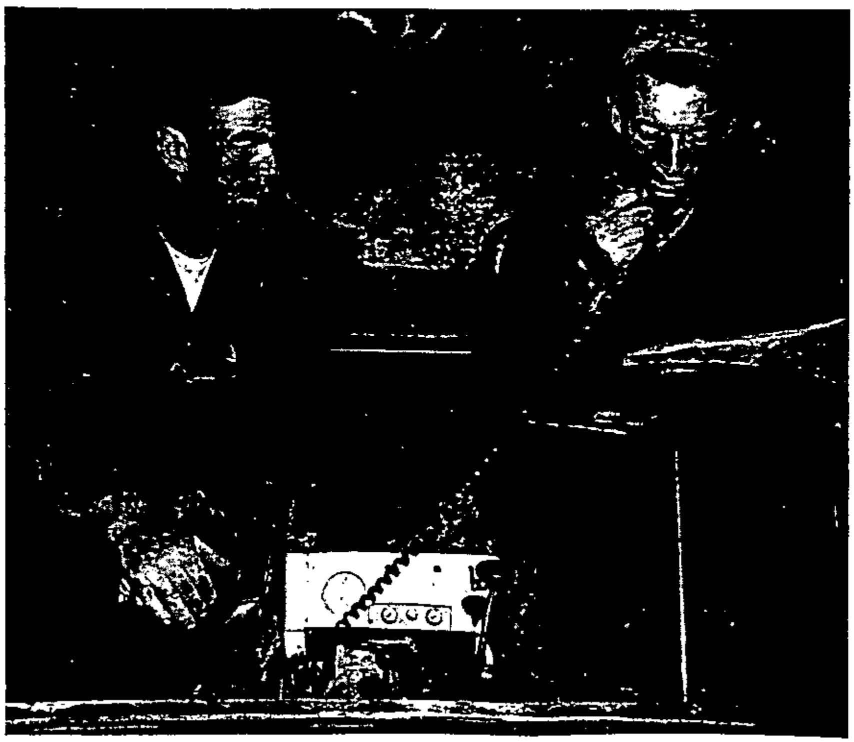

Figure 1.—FM radio mounted between front seats of a 1/4-ton jeep.

seat is moved to the right about 2 inches to make room for the radio. This is a simple operation for anyone with a portable electric drill. The radio is mounted on three small rubber shock mounts of the type normally used for refrigerator units. Controls and microphone are easily accessible to the driver or passengers in either the front or rear seats.

In transporting fire crews it is often necessary to carry three passengers in the front seats. To prevent damage to the radio and still be able to carry the extra passenger, a steel plate or guard has been mounted over the radio. The original pattern was designed and built by Merald W. Johns on the Lake Ozarks District. The supports are secured to the floor with bolts and wing nuts so that the plate is easily removed to provide access to the radio. Holes are cut in the plate for the control knobs and speaker. The entire installation requires only about 3 hours, and the protective plate can be made in any machine shop for about $5.

Published Material of Interest to Fire Control Men

*Fire Fighting—*1911 *and* 1951, by A. L. Anderson. Conserv. Volunteer. July/Aug. 1951.

Fire—Game's Friend or Foe?, by A. D. Doll. Wis. Conserv. Bul. Aug. 1951.

Fire Resistance of Longleaf Pine Seedlings, by D. Bruce. Jour. Forestry. Oct. 1951.

Fire Statistics for 1950 *Activities.* Calif. Dept. Natural Resources, Dept. Forestry. Sacramento. 1950.

Fire Tower Talk, by R. B. Miller. N. Y. State Conserv. Oct./Nov. 1951.

Forest Fire Insurance, by S. D. Richardson. Quart. Jour. Forestry. Oct. 1951.

It Could Happen Here; Think We'll Never Have Another Super-Colossal Forest Fire? Don't Be Over-Confident. Maine Had A Good Fire Record, Too, by N. Lemay. Wis. Conserv. Bul. Sept. 1951.

Miracle Fires of '51, by W. D. Hagenstein. Lumberman. Oct. 1951.

The New Approach To Slash Burning, by H. Weatherby. Brit. Columbia Lumberman. Oct. 1951.

The Use of Helicopters to Combat Forest Fires, by W. H. D. Hanchet and J. W. R. Drumond. Pulp & Paper Mag., Canada. Sept. 1951.

We Need Certified Fire Wardens, by F. J. G. Johnson. Brit. Columbia Lumberman. Oct. 1951.

Forest Fire Damage Appraisal Procedures and Tables for the Northeast, by A. W. Lindenmuth, J. J. Keetch, R. M. Nelson. U. S. Forest Serv. Southeast. Forest Expt. Sta. Paper 11. 28 pp. Sept. 1951.

Forest Fires in Missouri, 1951. Missouri Conservation Commission, Jefferson City. 1951.

Montana Smokejumpers, by M. H. Starkweather. Natl. Gard. Nov./Dec. 1951.

The Effectiveness of Forest Protection. The American Forest Products Industries. Washington. 8 pp. 1951 ed.

The 1951 *Forest Fire Record,* by L. F. Cook. National Parks Mag. Jan./Mar. 1952.

The Helicopter as a Fire-Fighting Unit, by R. L. Hall. Canada Pulp & Paper Assoc. Woodlands Sect. Index 1200. 4 pp.

Upward Climb of Man-Caused (Forest) Fires in State Halted. Calif. Cattleman. July 1951.

A Home in the Sky, by R. L. Lowndes, Jr. South. Lumberman. Dec. 1951.

Forage for Fire Protection; Grazed Firebreaks in the North Carolina Coastal Plain, by R. H. Hughes and J. L. Rea, Jr. South. Lumberman. Dec. 1951.

Holy Old Mackinaw in the Smoke, by H. V. Simpson. Amer. Forests. Nov. 1951.

LONG-ROPE PARACHUTE

Aerial Equipment Development Center
U. S. Forest Service, Missoula, Montana

The long-rope parachute, nicknamed "long-tailed chute," has been successfully used for dropping light loads in timbered country for two seasons. Although the action of the long rope, in letting loads down through thick timber, is desirable for dropping heavy loads up to 150 pounds, we have previously confined the use of this development to light loads of 50 or 60 pounds.

The long-rope parachute consists of a standard canopy with regular load lines, but it is packed in a manner which allows the load to hang on the bottom of a long rope during descent. Its principal use is in tall timber where the regular parachutes, with the load attached in the normal manner, often hang up in the tree tops. This necessitates considerable delay in retrieving both the parachute and the load, and often results in damage if the tree is felled.

The load, upon entering the tall timber, is stopped from any forward motion, and the parachute drifts on. As the package descends to the ground the long rope will be caught by limbs which cause the parachute to act as a drag or brake in letting the load down to the ground. There is very little landing shock because of friction of the rope over branches, and the braking action of the parachute as it is pulled back to the tree by the descending load. The long rope, from the parachute to the ground, greatly facilitates the removal of the parachute from the trees, and usually eliminates climbing or felling to retrieve the canopy.

When we attempted to drop heavier loads of 150 to 170 pounds, the number of "break-aways" presented a serious problem. Observation and pictures pointed to the trouble: the parachute became inflated before the load reached the end of the long rope. There was no deceleration of the package as the parachute inflated, and a terrific shock resulted when the load reached the end of the line.

We tried ⅜- and ½-inch nylon rope. They held for one or two drops, but could not be depended upon after that. Apparently the shock came too quickly to allow the natural stretch of the rope to take place. This was indicated by breakage which always occurred within 1 or 2 feet of attachment, either at the parachute or at the load. Other things, such as several sizes of rings on the load lines to slow down the opening of the parachute, various packing methods, and rubber shock absorbers made of heavy bungee cord, were tried with more or less success. Twisting the suspension lines provided an effective method of slowing down the opening, and it was very easy to do; but 20 test drops failed to show a consistent opening speed, which is necessary for accurate spotting of loads. One method, consisting of four rings used to divide the load lines and placed near the perimeter of the chute in a manner which retarded the

opening until the rings could slide down the lines, was unsuccessful for the purpose intended, but it did reduce oscillation considerably. This may be worth further experimentation, since oscillation is one of the major contributors to landing damage.

Later experiments used a simple extraction chute, which was opened by the static line in the ship, and which in turn opened the large freight chute after the load had reached the bottom of the long line (figs. 1 and 2). This method has been definitely established as the most positive arrangement for deployment of the long rope. Final tests were completed on May 14, 1951, and the job breakdown and instructions posted for use by riggers.

For those familiar with packing procedures, the following brief description will be of interest:

An 8-foot bomb parachute (or a similar chute used for extraction) in a muslin sack is tied securely into the apex lines of the standard freight chute. From all appearances this resembles a pilot chute. The standard freight parachute is packed with normal procedure, except that the one strand of 8-cord, which laces the container, is run through the attaching loop of the bomb or pilot chute. In other words, instead of passing the lacing cord through a break ring, it is passed through the loop formed by the bomb chute lines.

The bomb or pilot chute is stowed, lines first, in the muslin sack and a 1-inch cargo break ring tied into the apex with a single strand of 5-cord. This single strand should be about 4 inches long. The bomb or pilot chute is pushed into the sack far enough to allow gathering the open end (with the ring hanging out), doubling it, and looping a doubled No. 32 rubber

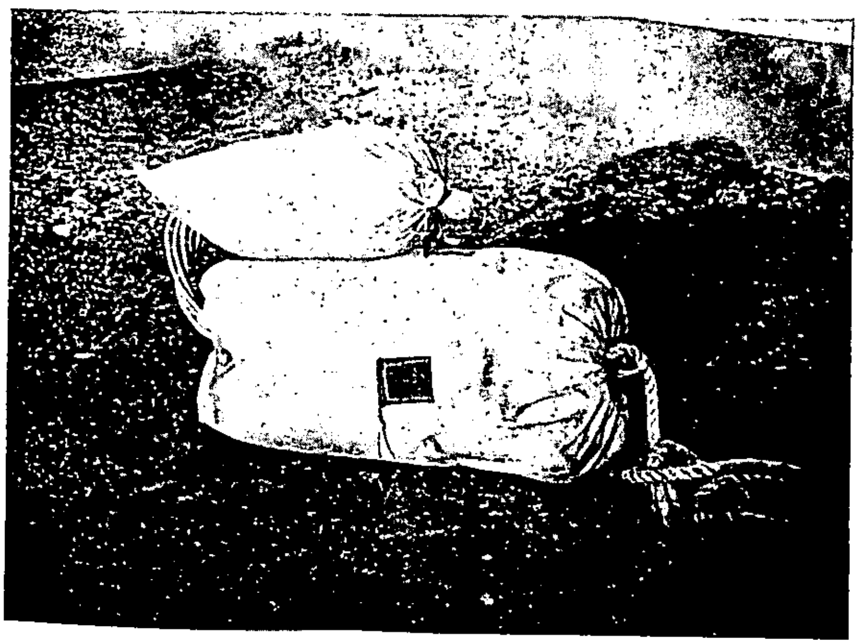

FIGURE 1.—Long-rope parachute with pilot chute.

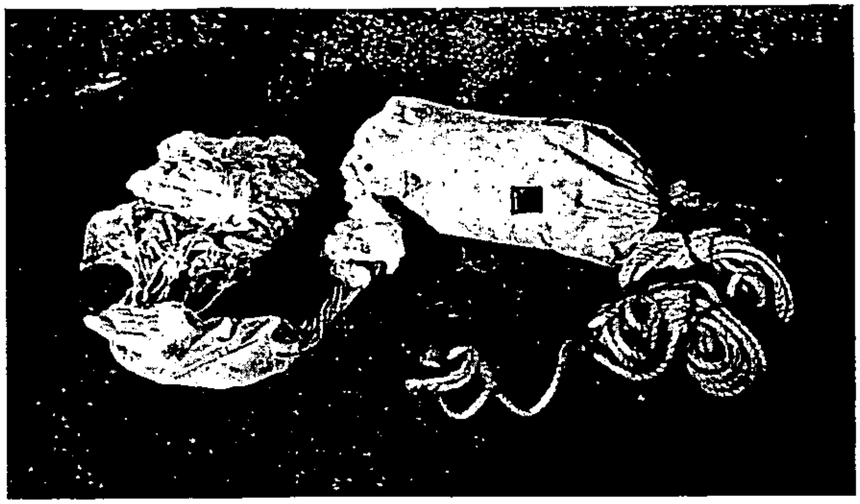

FIGURE 2.—Long-rope parachute partially deployed. Pilot chute is pulled out by static line. Main cargo chute does not open until load has reached the end of the 75-foot rope extension.

band over the folded end of the sack. The extraction and freight chutes are now packed.

Next, the 75-foot, ½-inch hemp rope is stowed in the same manner as the freight chute suspension lines. These stows should be held with heavy No. 50 rubber bands. Place the rope stows inside the bungee container, leaving about 3 feet of rope hanging out. Next, tie a single strand of 8-cord to the "V" ring of the freight chute riser with a bowline knot, and then tie the other end to the free end of the rope at the point where it emerges from the bungee container. Use a clove hitch to tie the 8-cord to the rope.

The hemp rope should be attached to the webbing of the cargo chute riser loop with a clove hitch followed by two half hitches.

When the rope is attached to the cargo bundle, care should be taken to pad or otherwise reinforce the point of attachment so the rope cannot shear itself with its own knot. If a heavy webbing loop is provided, the attaching knot should be a jam hitch with the running end wrapped twice around the base of the loop before it is extended back through the loop.

Drawings and complete instructions are available upon request.

MICHIGAN HYDRAULIC SULKY PLOW

STEVEN SUCH
Engineer, Michigan Forest Fire Experiment Station

Currently being tried in Michigan is a recent development in sulky plows using hydraulic controls. This new edition, the pilot model of this design, has undergone two seasons of field testing with good success. Performance data is still being gathered and studied. No attempt has been made to standardize on this unit as a general fire tool in the State. Past history of the plow, however, gives it better than an average chance of acceptance for forest fire control.

Being classed in the light-heavy or semi-heavy group, this unit weighs 1,400 pounds, almost all of which is acting on the plow when it is in operation. The basic design is similar to the standard heavier sulky plows in Michigan, the main differences being in the control mechanism and the size. The heavier and larger Michigan sulkies are winch-controlled and fall in the 2,000-pound class, and their bottoms have a wider spread.

Best application of the new hydraulic plow is yet to be determined, but it appears that it will find its place behind a crawler tractor of 20 or 30 horsepower, depending somewhat on assignment (fig. 1). In actual tests a four-wheel-drive power wagon handled the plow with good results. At the time of these tests the possibility of using this plow regularly with the power wagon was seriously considered. One drawback to this practice, however, was the difficulty encountered in trying to back up while in the woods. Operator experience and slight mechanical improvements have remedied this situation somewhat.

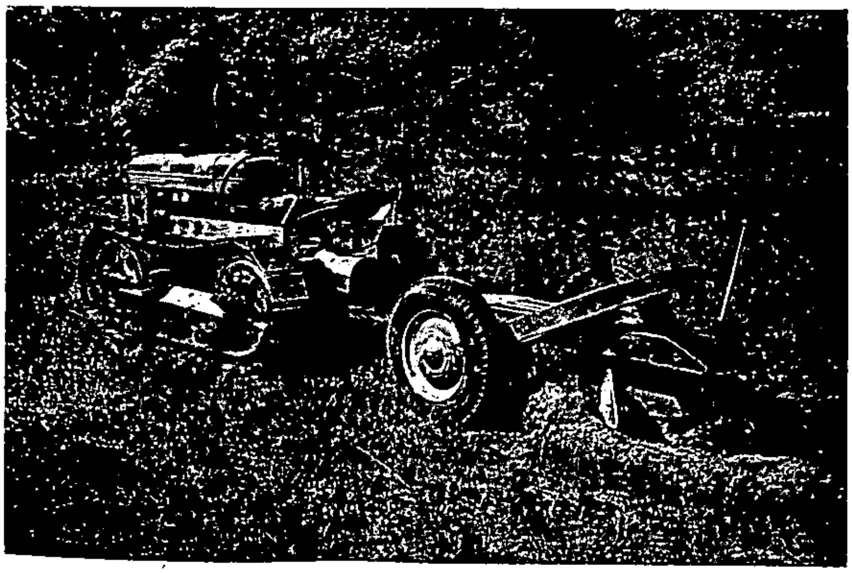

FIGURE 1.—Michigan hydraulic sulky plow in working position.

The hydraulic sulky is rugged in construction and presents a low silhouette. It is mounted on heavy-duty rubber tires and may be towed at any safe vehicle speed on the highway. The balance points are so placed as to permit one man to handle the entire plow just as easily as he would a light trailer. The reenforced U-shaped carriage insures adequate strength even for the most severe fire conditions. The beam is of 5-inch, 9-pound-section, channel iron. A 24-inch rolling coulter and 2 cut-down, 18-inch, plow bottoms make up the principal components of this machine. The bottoms are cut down to reduce the drawbar power requirements. The head casting provides for adaptors for quick attachment to either tractors or trucks. Experiments with satisfying results have been run on the use of the trailer type ball hitch for plowing. There seems to be no objection to this practice if the maximum capacity of the hitch is not exceeded, and if caution is taken to strengthen the ball assembly.

Though hand operated, the hydraulic section of this plow provides an easy and efficient control device for raising and lowering the carriage. It is in this action that the plow is unique since many factors are centered around the proper functioning of the carriage. It must be remembered that the transportation of the unit, the stability and correct action while plowing, the most advantageous distribution of weight, and the safe and efficient operation of the plow are all affected by the carriage design. With the single-acting hydraulic cylinder used in this design, the carriage is allowed to float when plowing. Normally this means that almost the entire weight of the carriage is then resting on the plow thus giving a desirable added weight for penetration on most tough plowing chances. The floating action is particularly helpful in rough and irregular ground.

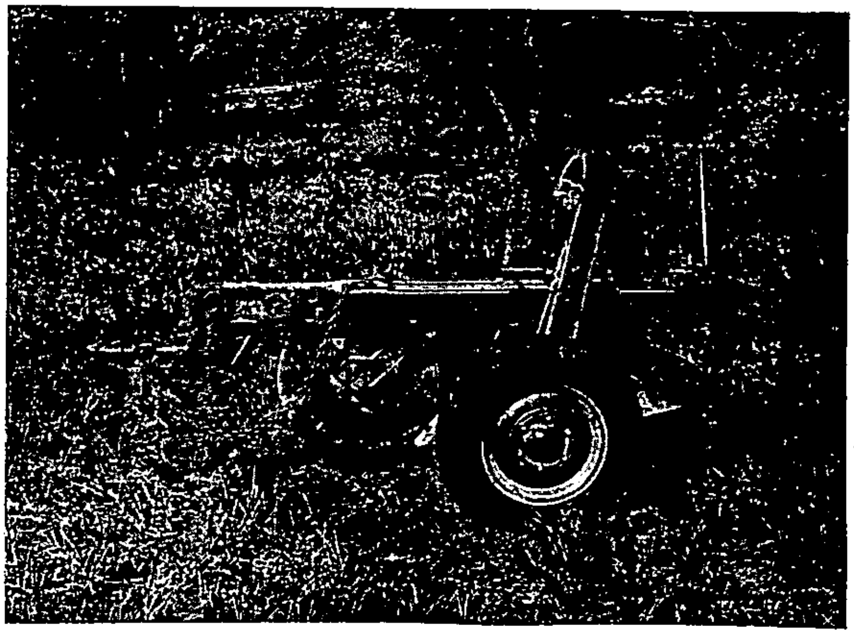

FIGURE 2.—Michigan hydraulic sulky plow in raised position.

When through plowing, or for any other reasons that may arise, the operator can raise the carriage by use of the hand pump on the rear of the plow (fig. 2). A pin is used for positive locking for highway travel to relieve the load on the hydraulic system and to insure safe travel. The hydraulic cylinder is actuated in one direction by gravity, as in plowing, and it is moved in the opposite direction, as in lifting the plow, by the hand pump.

Briefly, specifications on this unit are as follows:

Type: Double-bottom sulky on rubber tires
Weight: 1,400 pounds
Length: 80 inches
Height: 53 inches
Bottoms: 11-inch right and left steel bottoms, cut down from 18 inches
Rolling coulter: 24 inches diameter
Control: Hydraulic
Total width of line: 66 inches

Prints, specifications, and other information about this plow and other Michigan equipment may be obtained from the Department of Conservation, Lansing, Mich.; or from the Michigan Forest Fire Experiment Station, Roscommon, Mich.

New Fire Line Tool

In Ontario a hoe type of tool with a shovel steel blade of 6 inch by 6 inch dimension and having a small, light axe head forged or welded to the top of the handle socket is being tried out, and is receiving favourable comment from fire fighters as an excellent trenching tool. The small axe head, about 3 inches long with a 3-inch face, is handy for cutting roots in the trench and the hoe blade is found to be more efficient than a shovel in scraping off leaf and moss litter. The tool is intended to complement the shovels and axes now used on the fire line.—(Report on Forest Fire Research in Canada. January 1948 to July 1949, Canadian Society of Forest Engineers) From Forest Fire Protection Abstracts. Canada Dept. Resources and Devlmt. 1:19. 1950.

A NEW TYPE OF COMPASS FOR SMOKECHASERS

Gail C. Baker
Staff Assistant, Deschutes National Forest

The Deschutes National Forest was given the assignment of trying out a new compass during the 1951 fire season. A supply of these compasses sufficient to equip all the firemen on one ranger district was received on the forest in June shortly before the guard training camp. We included instruction for their use in the smokechasing course and discovered that the instruction job, which consisted basically of proper holding, boxing the needle, and sighting, was greatly simplified (fig. 1). The problems of getting the needle to settle quickly, being careful that it was swinging free, and the troublesome reversal of east and west, which characterize the standard box, were eliminated.

As part of our guard camp program each year we have a compass contest. A 10-sided, closed traverse is staked on the ground and the angles measured carefully with a staff compass. All trainees at the camp are required to run out this course in their spare time using their pocket compasses. The winner and the runner-up in this year's contest were both using the new compass, and their cumulative error was less than 2 degrees. This compares with a low error of approximately 5 degrees for the standard box compass.

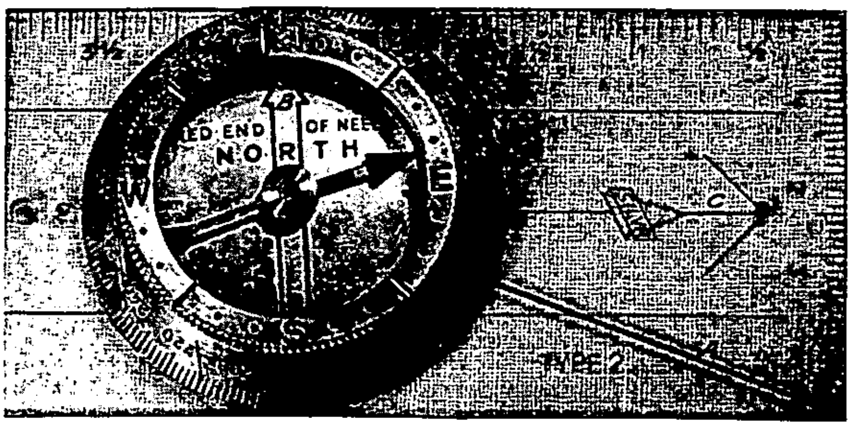

Figure 1.—Operation of the compass is simplified if the graduations on the back are disregarded. Set off the magnetic declination by scratching and then inking in line *A* (called target line). Declination in photo is set off for 20° (each mark on the compass housing is 2°). To run a compass course: (1) Set desired azimuth on target line *A*; (2) hold the compass in the usual manner with the "line of sight" arrow *C* in front of the body; (3) turn the body (and compass) until the magnetic needle is in the etched needle box *B* inside the compass housing. Your course is then line of sight *C*.

The District Ranger, his assistant, the fire control officer on the forest, and 10 firemen had the opportunity of trying out this type of compass during the past season, and they consider it far superior to the standard box type compass. It appears to have the following advantages:

1. The needle is quick-settling, thus saving considerable time in taking a reading.
2. It has no lid to spring open accidentally and allow the needle to fall off the pivot or become demagnetized. The needle is in liquid, and it swings freely in any position.
3. The cover is shatterproof.
4. It is very light in weight and can be carried in the shirt pocket without notice.
5. There is an inch scale on the plastic base which can also be used as a straight edge.
6. It can be set on any azimuth reading and will remain there until a new reading is desired.
7. The east and west is not reversed. Thus a source of confusion is eliminated for trainees.
8. The azimuth circle is numbered clockwise, the same as the trainee's protractor (not counter-clockwise as on the box type compass), thus aiding the trainee in his sense of direction rather than confusing him.
9. It is simple to understand and operate, thus saving considerable time in training.
10. It costs much less. The present price is $4, compared with about $10 for the box type.
11. It should require very little maintenance; the box compass requires frequent and expensive maintenance work.

The Procedure and Cost of Conducting Forest Protection Analysis

The Western Forestry and Conservation Association has issued a series of reports on "Various Recommended Forest Practices and Techniques." One of the reports deals with "The Procedure and Cost of Conducting Forest Protection Analysis."

This protection report covers the following points:—

(1) The determination of present standards.

(2) The determination of improvements necessary for raising standards or for maintaining existing standards at lower cost.

(3) The justification of recommendations for improvements.

It also gives an outline of the costs involved in making protection analyses.—From Forest Fire Protection Abstracts. Canada Dept. Resources and Devlmt. 2:23. 1951.

IMPROVED SMOKE CANDLE

A. B. EVERTS
Equipment Engineer, Division of Fire Control, Region 6, U. S. Forest Service

Samples of an improved smoke candle were furnished by the Washington Office to Herbert K. Harris, Region 1, and Jack S. Barrows, Northern Rocky Mountain Forest and Range Experiment Station, for testing in connection with an intensive visibility and detection study. Others were supplied the author and William G. Morris, Pacific Northwest Forest and Range Experiment Station, for testing in an attempt to develop a device capable of generating sufficient smoke to clear 150-foot trees without dispersal. The findings of the investigators are combined in this report.

According to Harris, burning time of 91 candles varied from 8 to 19 minutes, depending to some extent on the relative humidity. The average was 12.6 minutes.

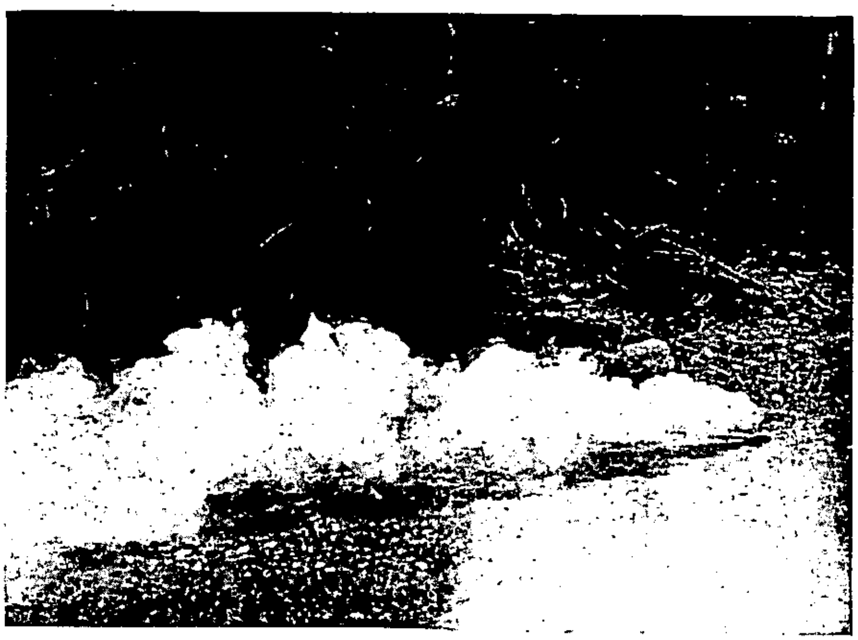

FIGURE 1.—Smoke produced by a candle. There was no noticeable wind in the deep timber, but natural draft along the roadside was sufficient to "pull" the smoke horizontally. In this case the smoke did not rise above the trees.

Out of some 130 candles used in tests the investigators reported 14 fuse failures. If a fuse burned out, considerable heat was required to ignite the chemical. Fuses were used for this purpose. When a candle is first ignited, a "plug" of hot, glowing chemical breaks loose from the end. This plug could set a fire.

Smoke color was adjudged very good by all observers.

Smoke rise was not good (fig. 1). This is probably due to lack of sufficient volume and heat. Application of additional heat resulted in little if any increase in the smoke rise because of a reduction in the volume. Best results were obtained by concentrating the smoke behind a flat rock or board with approximately 1 square foot area. This caused puffs of smoke which took longer to dissipate and consequently attained a greater elevation at times.

Volume was sufficient for most use on still days. Wind velocities of 3 or 4 miles per hour reduced the visibility distance considerably by causing the smoke to drift close to the ground until too thin for detection at maximum distances.

Visibility of the smoke was very good when it was rising and spreading normally and without wind gusts. Smoke was seen very clearly at a distance of 14 miles by Region 1 observers looking toward the sun in preliminary tests. For maximum distance the smoke must be established in open areas because of its small volume. No visibility tests were made in Region 6; smoke would not rise in timber under any conditions without too much dispersal. It was agreed that for open areas, brush fields, and young reproduction the candle is superior to any tried out before.

Two types of balloons to lift the candle above the tree tops were tried in Region 6, but the weather balloons were the only successful ones. These

FIGURE 2.—A weather balloon filled with cylinder hydrogen lifted the 1-pound candle 175 feet into the air.

can be inflated to a diameter of 5 feet or more with cylinder hydrogen in a minute's time. Hydrogen costs $2.16 per 100 cubic feet; the smallest container is the 191-cubic-foot size, weighing 135 pounds. Hydrogen is explosive, and it is believed it should not be used generally. Helium is safe, but the cost is high, $13 per 100 cubic feet.

A 1-pound smoke candle was attached to a balloon with a copper wire. Then a 175-foot length of stout cord was tied to the candle. The balloon had sufficient lift to take the candle straight up (fig. 2). No difficulty was experienced in "steering" the balloon through the trees. This method will get the smoke up where it should be visible for considerable distance.

Combination Pressure Relief and Check Valve

We have found that placing a separate pressure relief valve somewhere in a hose line is a great inconvenience. Consequently, we have taken a combination check and bleeder valve and brazed an adjustable, automatic pressure relief valve to the check valve cover plate. This gives the pump operator full control over the pressure relief valve setting and eliminates a second piece of equipment. Also, by having the relief valve in this spot, if a pressure that is higher than the relief valve setting is needed, it is instantly obtainable by the pumper operator; and he may accurately control this setting because he has the pump gauge to work by.

The automatic relief valve which is used should be one of ¾-inch capacity, adjustable between 160 and 225 pounds with a hand wheel and lock nut on the valve stem. However, any good adjustable relief valve will do the job. The pressure relief valve should be disassembled and the check valve cover plate removed during the brazing. Care should be taken to prevent excess heat from distorting the seat of the check valve or the pressure relief valve.—Alwin E. Hodson, Jr., *Chief Fire Warden, Nobscot Reservation, Framingham and Sudbury, Mass.*

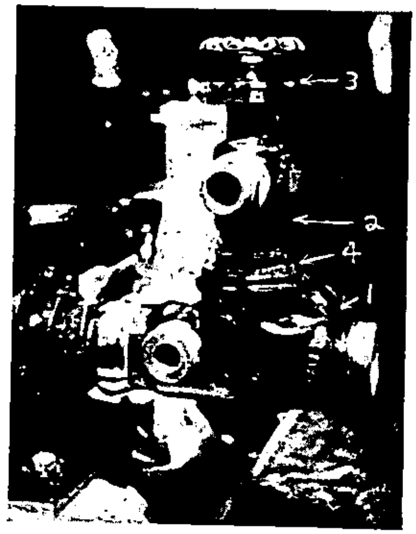

FIGURE 1.—Complete pressure relief assembly: 1, Check and bleeder valve; 2, automatic pressure relief valve; 3, relief valve lock nut with finger wings; 4, point at which automatic relief valve is brazed to the check valve cover.

THE TREE PUSHER

C. E. HEIN
General Foreman, Deschutes National Forest

The Bureau of Reclamation engineers designed a Tree Pusher mounted on a land-clearing blade to clear lodgepole pine from the Wickiup Reservoir site. At the completion of the clearing project, the Deschutes National Forest purchased a surplus Tree Pusher from the Bureau and fitted the attachment to an Isaacson land-clearing blade mounted on a D-7 tractor. A major improvement was made in the Bureau's design by welding short heavy teeth to the pusher bar; this makes possible a better grip on the trees and enables the tractor operator to better control the direction of fall (fig. 1).

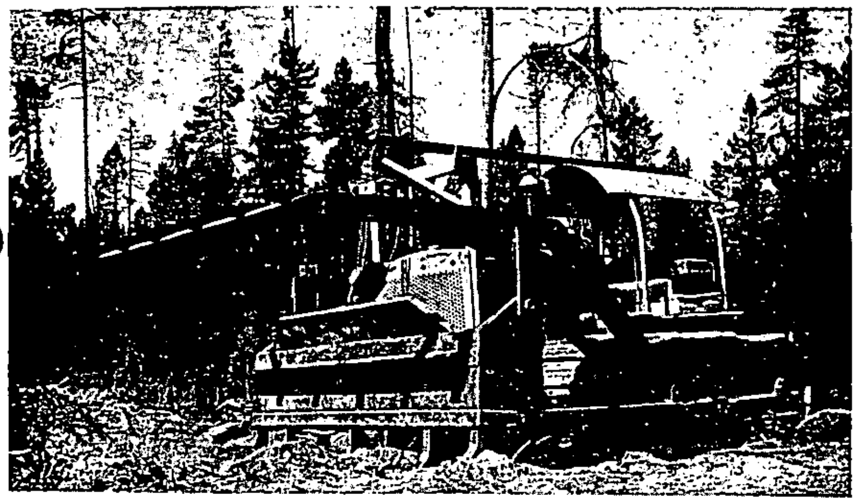

FIGURE 1.

The improved Tree Pusher has been used on road right-of-way clearing through lodgepole areas where a few trees of ponderosa pine and white fir have been in the cleared strip. Trees up to 24 inches in diameter are easily pushed and trees as large as 40 inches have been pushed in favorable locations. The added weight of the Tree Pusher is a slight handicap governing the maneuverability of the tractor. Pushing activities should be confined to relatively level ground.

In road right-of-way clearing, an average of three tractor-hours per acre was expended on clearing work. Using this accomplishment as a measuring stick, it is safe to assume that in clearing a 10-foot fire line (width of dozer blade), about one-fourth mile per hour could be cleared.

The operator is protected by a steel canopy and is instructed to push only those trees that will come with a continuous forward motion of the tractor. "Rocking trees" is prohibited as a safety measure.

A TRACTOR-DRAWN FIRE RAKE

WILLIAM E. TOWELL
Assistant State Forester, Missouri Conservation Commission

An entirely new principle in fire line construction has shown exceptional promise in initial tests in Missouri. This new fire rake is a special adaptation of the Ferguson side-delivery hay rake. Those who have seen the fire rake in operation are confident that the principle is a long-sought answer to mechanical fire line construction in the central hardwood region.

The possibilities for use of a fire rake as a fire fighting tool were first realized by District Forester Lee C. Fine, of Sullivan, Mo., and his assistant, Harold J. Reutz, of Steelville, Mo. Fine and Reutz watched a Ferguson side-delivery hay rake in a field and arranged to try one in the woods. In spite of excessive width of the hay rake and the resultant poor maneuverability in the woods, it raked a good fire line. Observation of this trial enabled the manufacturer to obtain several ideas for modification of the tool for fire fighting purposes.

The fire model is a miniature of the commercial hay rake. It is sturdier in construction and was designed so that the width would not exceed the outside wheel width of the farm tractor (fig. 1). It is connected to the tractor by the standard three-point hydraulic lift connections and is powered by a drive shaft fastened to the rear power take-off of the tractor. The speed of the rake is governed by the speed of the tractor engine. The entire rake is raised or lowered by the hydraulic lift, and an alert operator can raise it over large obstructions.

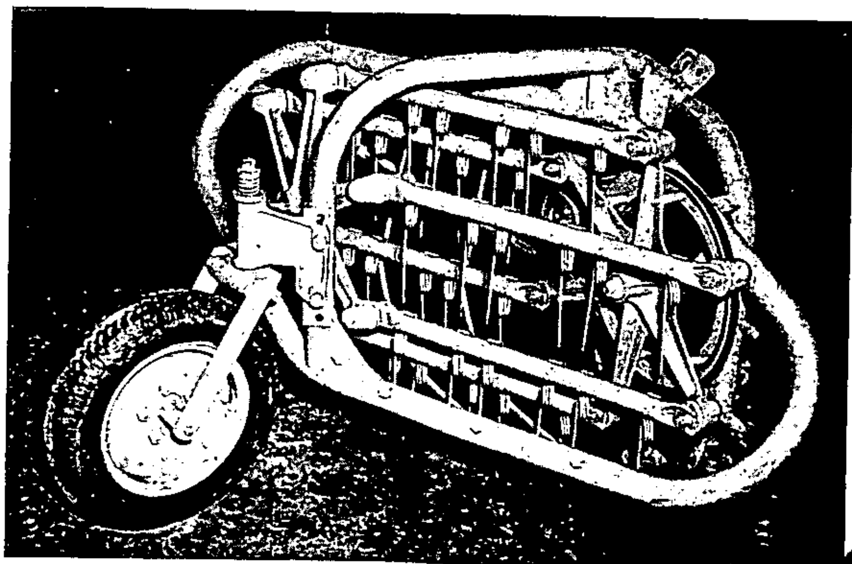

FIGURE 1.—The tractor-drawn fire rake. (Photo courtesy Mo. Conserv. Commission.)

The spring steel teeth move parallel to the ground for several inches kicking or raking debris to the left side of the direction of travel, then they go up, over, and down to raking position again. A single rear wheel, adjustable in height, allows positive contact of the teeth with the ground but prevents the weight of the rake resting on the teeth. The teeth can be quickly straightened or replaced.

In its current stage of development the fire rake makes a clean line to mineral soil about 3½ feet in width in broadleaf fuels. All leaf litter is windrowed to the left side. The tractor and rake can operate in first, second, or third gear, and it averaged about 3 miles an hour in initial tests over moderate terrain and fairly open hardwood cover. One particularly encouraging feature was the clean line made through buckbrush and blackberry vines where the teeth had a combing action. In one test against a five-man crew with broom rakes, the tractor-drawn fire rake made three times as much fire line of comparable width and quality.

Several modifications of the pilot model have already been made in the field. The teeth have been shortened about 2 inches; stripper bars between the teeth have been removed; and the rear depth wheel has been raised. Another change to be made by the engineer is in the design and composition of the teeth. Both the tractor and rake were left on the Meramec Fire Protection District for actual use during this spring's fire season. Complete records will be kept of operation on actual fires for future detailed reports.

At the present time the fire rake offers the following advantages as a mechanical tool for fire line construction:

1. The rake and farm tractor are considerably cheaper than crawler tractors and fire plows.

2. It is adaptable to any power unit with a hydraulic lift system and power take-off (crawler tractor, power wagon, or jeep).

3. The rake merely moves the surface litter, exposing mineral soil, and does not plow a furrow that might be objectionable on some privately owned lands.

4. On a farm tractor the rake can be raised by the hydraulic lift and tractor can be roaded to fires at a speed up to 30 miles an hour.

5. The rake is light in weight and can be transported with ease on any stake truck or small trailer behind a pickup or jeep.

Although this fire rake is not yet a perfected fire fighting tool, it shows great promise and is regarded as a new principle that may eventually be used throughout the country. The rake is not yet made commercially.

A HEAVY-DUTY BROOM RAKE [1]

The most efficient hand tool used for fire suppression by Federal and State Fire Protection Agencies in the Central States of Region 9 is the heavy-duty broom rake. It is especially adaptable for use in raking or constructing fire lines in leaf fuel types on steep hillsides, in ravines and very rough terrain, and in very rocky areas where mechanized equipment cannot be used to good advantage.

The many commercial makes of broom rakes on the market were developed for use on lawns and other places relatively easy to rake. None are heavy-duty rakes that can be used dependably and effectively in an accumulation of leaves and where considerable amounts of grasses, brush, branches, and other debris are encountered. With increased forest fire protection, ground fuels become heavier and require a broom rake with a stiff spring action of the tines for clean sweeping. Also, one is required that will stand up under hard use and retain its temper after carrying burning fuel in backfiring work.

Following tests and trials of several pilot models under actual conditions, the Roscommon Fire Equipment Development Center produced a broom rake that has been accepted by experienced fire fighters as ideal for woods use. It is classed as a heavy-duty rake, but is usable for lighter work on lawns, etc. It will outperform and outlast any other rake used for fire line construction. Important features in the rake are adjustability in sweeping width; carbon steel tines that withstand heat when used for backfiring; automatic tension on tines for light or heavy going; compactness for transportation, shipping, or storage—when tines are closed the rake will fit into a small tool box or can be carried in the cab of a truck; and tines all of the same length and shape for easy replacement.

The adjustable feature of the rake permits spreading the tines to 19 inches when fully extended, and a closed width of 7 inches. The adjustment also provides a variable tension on the tines for sweeping under either difficult or easy conditions. A greater tension when tines are closed makes it easier to sweep in a heavy accumulation of leaves, branches, or other debris. With tines extended for lighter fuels the tension is lessened and the sweeping area is increased.

Another important feature of the rake, and one not usually found in lawn rakes, is the shape of the lower tine holder. The duo-directional curved shape of the holder provides a desirable sweeping position for the tines. The forward concave shape causes the outer tines to be positioned ahead of the center tines and keeps leaves from slipping off and around the sides of the rake; it also forms a "basket" for carrying burning material in backfiring work. All of the tines are in contact and level with the ground when the tool is in a position for sweeping.

The carbon steel used in the tines is more desirable than surface tempered wire, in that (a) a better and more uniform tension is provided; (b) it allows a wider range of bending and will return or spring back to normal position; (c) spring tension is not lost through heating when burning leaves are carried in backfiring; and (d) tool steel is more abrasive-resistant than other forms of wire stock and will stand up better in rocky or stony areas.

[1] Condensed from a report by E. E. Aamodt, Fire Equipment Engineer, Region 9, U. S. Forest Service.

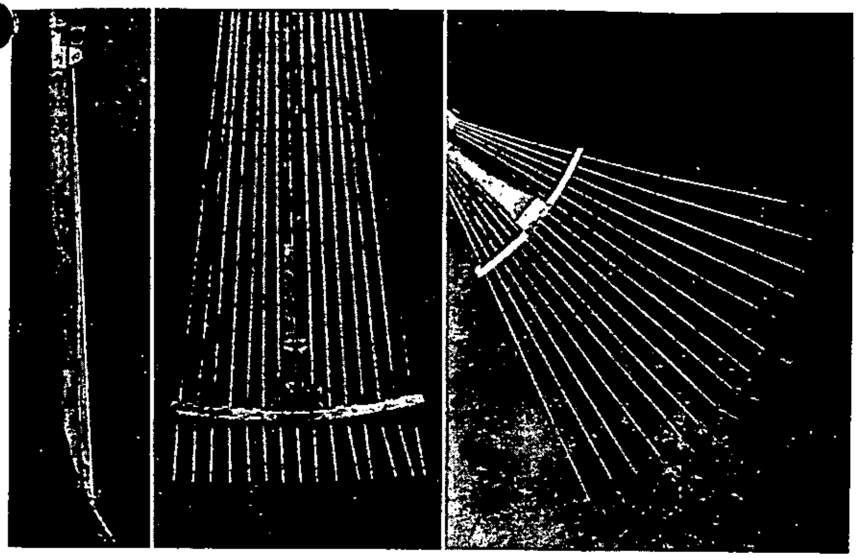

FIGURE 1.—*Left.* Side view of broom rake closed; *center,* front view of rake closed; *right,* back view of rake opened.

Figure 1 shows views of the rake. Details of its construction follow:

Handle.—Hard maple, 1 inch in diameter. Length with tines extended, [illegible]0 inches; with tines closed, 46 inches. Lower end of handle, inserted in ferrule, is straight, not tapered, to provide a better contact between metal and wood.

Sliding expansion sleeve.—A quarter-inch carriage bolt with a wing nut holds sleeve on handle and permits tine holder to slide up and down when nut is loosened.

Upper tine holder.—A bolt 3 inches long, 3/16 inch in diameter, 16-gauge cold-rolled steel, zinc plated. Upper ends of tines have completely turned eyes which loop over holder bolt and prevent tines from pulling out of place.

Lower tine holder—16-gauge, channel-shaped, cold-rolled carbon steel. Channel perforated with evenly spaced tine holes through which tines slide when rake is adjusted for width of spread.

Tines.—15, 19 inches long. Made of 11-12 gauge 1055-1065 carbon steel, zinc coated. All same length and shape; interchangeable. Lower 2 inches of each tine bent to secure best sweeping angle. Angle of bend is about 45° off horizontal; this prevents any tendency to pierce through and pick up leaves, etc., and clog the rake.

Weight.—Approximately 2 pounds, 4 ounces.

Additional information about the heavy-duty broom rake can be obtained from the Regional Forester, U. S. Forest Service, Milwaukee 3, Wis.

KNOCK-DOWN HANDLE FOR THE COUNCIL RAKE

JOSEPH BRISHABER
District Fire Warden, Indiana Department of Conservation

Fire wardens and other conservation officers of the Indiana Department of Conservation always carry a few firefighting tools in their cars or pickups during the fire season. One of the most common tools used by fire personnel is the long-handle Council rake. This tool has always been a problem for transporting both from the standpoint of safety and storage space required. During a meeting of the Fire Equipment Development

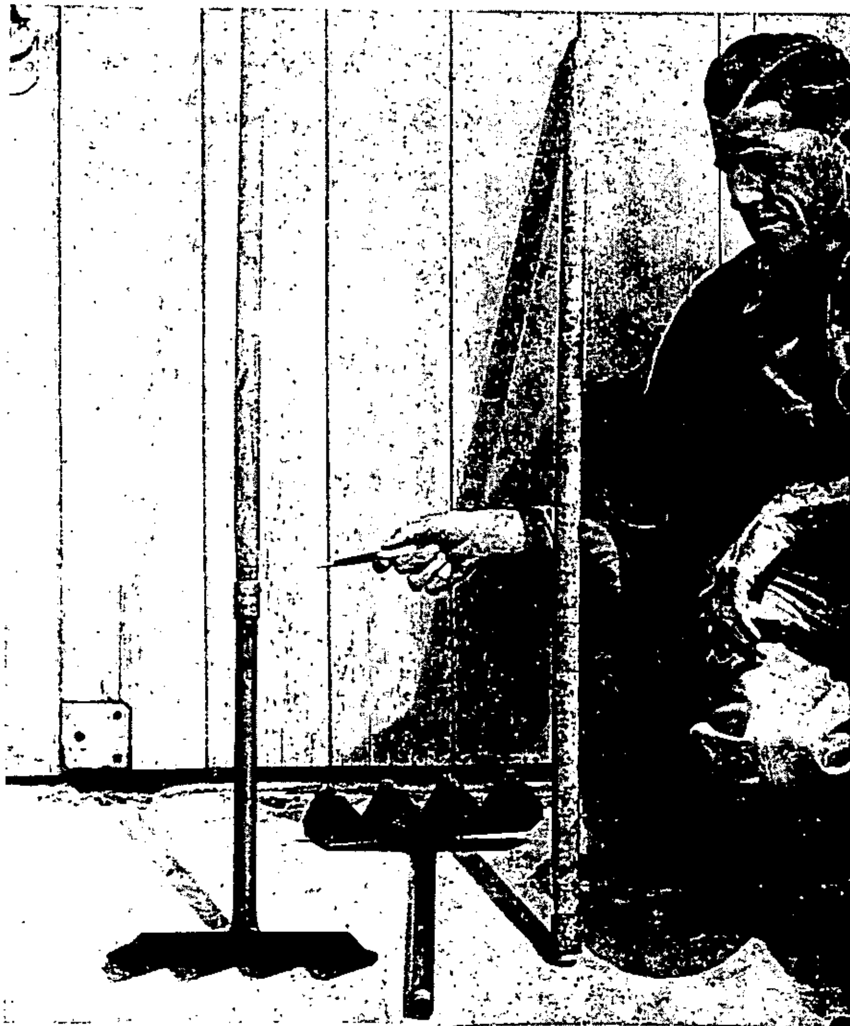

FIGURE 1.—View of Council rake showing the assembled and unassembled knock-down handle. (Photo courtesy Indiana Dept. Conservation.)

Committee, the Department accepted an assignment to find a solution to this irksome problem. A knock-down handle was developed, and the rake (fig. 1) was presented for the first time at a State District Fire Wardens' Meeting last June. The rake was later exhibited at the Region 9 Equipment Development Meeting and Demonstration at Roscommon, Mich.

The simple conversion of the handle can be made as follows: Remove the handle from the metal shank. Thread the top end of the shank with a ¾-inch die after cutting 3 inches from its length. Fit a ¾-inch threaded coupling to the beveled end of the handle by screwing the handle into the coupling as far as it will go. Drill a hole through the assembled coupling and handle; rivet both pieces together by inserting a 20-penny spike through the holes. The threaded shank of the rake can then be screwed into the opposite end of the coupling, and the tool is ready for use. This simple conversion does not seem to decrease the strength of the original handle appreciably. The conversion can be readily made in any forest shop at small cost.

Helicopter Used for Fire Suppression

The Ontario Department of Lands and Forests, in co-operation with the R.C.A.F. Air Rescue Co-ordinating Centre at Trenton, Ontario, used a helicopter in suppressing an experimental fire.

The helicopter was loaded with a light pumper (Jackmite) and a 25-gallon drum of water. The pumper was operated while the helicopter hovered over the test fire which was approximately twenty feet in diameter. It was found that:

(a) the downdraft of the helicopter rekindled the fire

(b) the discharge of the pumper could be directed but was shattered by the helicopter downdraft

(c) the 25-gallon drum, emptied in approximately three minutes, effectively doused the whole fire; only a few of the larger pieces of the wood remained smouldering.—(Report on Forest Fire Research in Canada, July, 1949 to July, 1950, Canadian Society of Forest Engineers.) From Forest Fire Protection Abstracts. Canada Dept. Resources and Devlmt. 2:12. 1951.

Plastic-Impregnated Maps

The Lower Ottawa Forest Protective Association has been experimenting with fire tower maps which had been impregnated with a plastic before use. The maps so treated may be written on without marring the surface, and are said to be practically indestructible.

These maps were treated in 1950 at a cost of about $6.00 each.—(Proceedings of the Fourth Meeting, Sub-committee on Forest Fire Research, Associate Committee on Forestry, February, 1951.) From Forest Fire Protection Abstracts. Canada Dept. Resources and Devlmt. 2:21. 1951.

CANTEEN CARRIER

WREX K. HAUTH
Forestry Aid, Mark Twain National Forest

A device for carrying 1-gallon canteens on stake trucks or pickups equipped with side racks has been developed and put in use on the Mark Twain National Forest. The carrier provides a safe and handy place for canteens, and is out of the way of other cargo or passengers being trans-

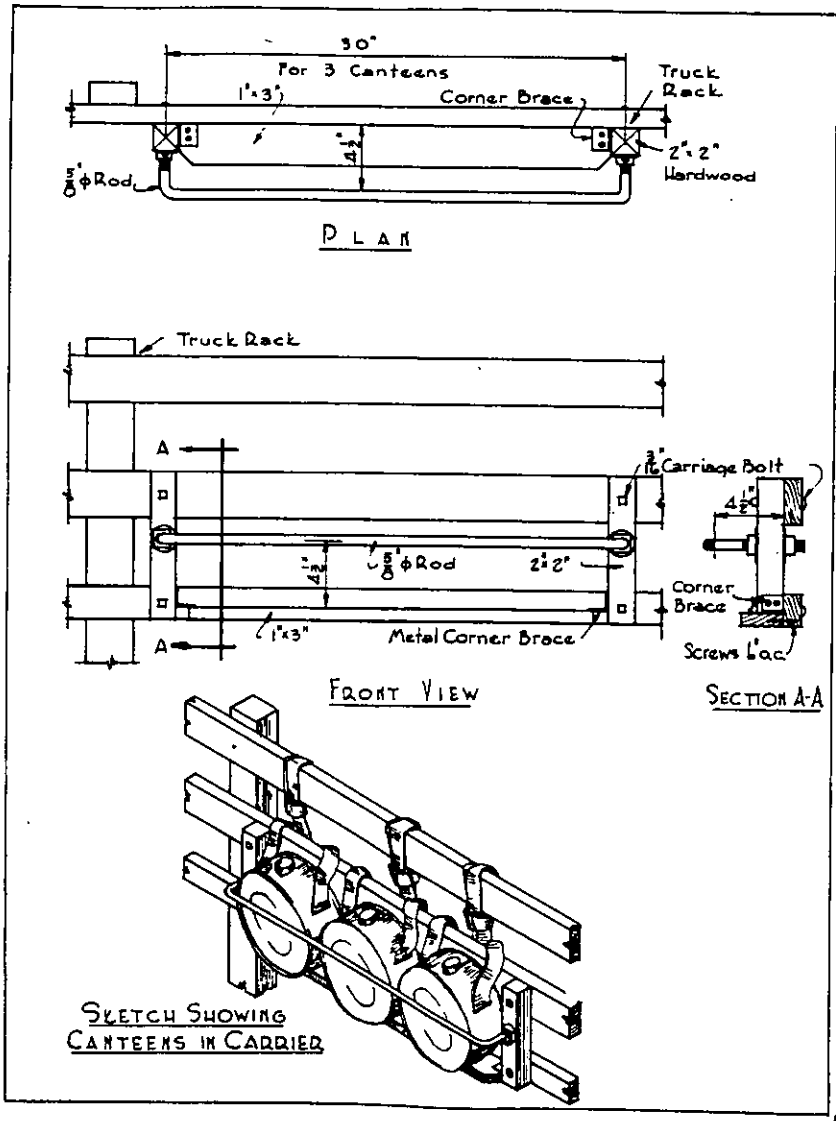

FIGURE 1.—Canteen carrier for truck rack.

ported in the vehicle. It also prevents damage to the paint job of the truck, and excessive wear on the canteens, such as that caused by swinging from the truck rack, rear-view mirror, or cab door handle.

The carrier is made of 1- by 3-inch lumber and a ⅝-inch steel rod mounted on two 2- by 2-inch pieces of wood fastened to the side rack of stake or pickup trucks (fig. 1). Assembly is as follows:

Step 1.—Bolt 2- by 2-inch hardwood uprights to rack of truck with 5/16- by 3½-inch carriage bolts, in a vertical position. Bottom ends of uprights may need to be beveled to fit flare of truck bed on pickup trucks.

Step 2.—Fasten 1- by 3-inch piece of lumber horizontally to side of truck rack and in a position between uprights so that it will support bottoms of canteens.

Step 3.—Drill one ⅝-inch hole through each upright 5 inches above top of the 1- by 3-inch horizontal piece. This will place the supporting rod mentioned in Step 4 approximately in center of canteens.

Step 4.—Bend ⅝-inch rod at right angle approximately 5½ inches from each end. This will allow about 5½ inches on each end of the rod to be inserted in the ⅝-inch holes drilled in the uprights. Place one ⅝-inch nut and flat washer on each end of the rod. Insert ends of rod through ⅝-inch holes in uprights and place another nut and washer on ends of the rod. Four inches of thread on each end of the rod will allow adjustment to fit thickness of the canteens. The length of the rod and the spacing of the uprights will depend upon the number of canteens to be carried. A 44-inch rod will accommodate three 1-gallon canteens.

Wright Hose Vulcanizer

The Forestry Branch has developed a vulcanizing device which will produce patches and splices capable of withstanding pressures exceeding 200 pounds per square inch.

One of the important features of the unit is that it produces a splice which lies flat when not under pressure so that the hose may be rolled or folded with practically no increase in bulk.

Splices may be made for approximately 75 cents each and patches for considerably less, depending on the type of patch necessary. This estimate is based on the cost of materials and labour in 1949.

Detailed information on the machine may be obtained by writing the Director, Forestry Branch, Department of Resources and Development, Ottawa.—From Forest Fire Protection Abstracts. Canada Dept. Resources and Devlmt. 1:23. 1950.

INITIAL FIRE REPORT FORM, REGION 4

FRANCIS W. WOODS
Communications Officer, Region 4, U. S. Forest Service

A few years ago it became apparent that there existed a real need to streamline our initial fire report form. Reports should—

1. Be usable Region-wide.
2. Be usable both by the lookout and the dispatcher, and permit the dispatcher to record his fire and follow-up actions on the same form.
3. Be easily understood and readily filled out with as little writing as possible.
4. Carry essential information arranged in logical order.
5. Be easily read.
6. Be designed so that when bound, either on the side or top of the sheet, all essential data will be out in the open.

The report shown in figure 1 is the result of suggestions from all of Region 4's forests and is based on one field season's use. The example below illustrates its application.

In use the lookout would fill in Line 1, preferably ahead of time. He probably would fill in a dozen or so sheets. When a fire is seen he fills in Lines 2 and 3. (In Line 2, use 24-hr. time. Example: 12:30 a.m.=0030; 8 a.m.=0800; 3:00 p.m.=1500.) On Line 4 he circles the appropriate word. On Line 5 he fills in the first three items and circles the appropriate quarter section. On Lines 6 through 11 he circles the appropriate word, fills in Line 12, and calls the dispatcher.

In the following example of a radio report, the dispatcher is located at Salmon. The lookout is Long Tom. 10-80 is Region 4 fire emergency code. The dispatcher would use a check mark wherever appropriate in filling out the form. Example:

Lookout calls: Salmon, Long Tom, Over.

Dispatcher answers: Long Tom, Salmon, Over.

Lookout says: 10-80; 2 - 220; 3 - Head of Long Gulch; 4 - Yes; 5 - 6N, 7E, 36SE; 6 - South; 7 - Grey; 8 - Grass; 9 - North; 10 - Calm; 11 - Spot; 12 - North along Long Gulch trail. Over.

Dispatcher says: 10-4.

A call takes less than 30 seconds—less writing by both the lookout and dispatcher. There is no conversational type contact. Such a system of reporting is capable of handling 30 to 40 fire reports in 15 to 25 minutes.

In the event the dispatcher missed out on a part of the report, (Line 8 for example) he would ask for a repeat thus: "10-9, Line 8." The lookout would use the one word, "grass" Over. The dispatcher would say "10-4, Salmon Out." 10-9 in this case is Region 4 code for "Please repeat from." If the situation warranted, the lookout would spell grass thus: "George, Roger, Able, Sugar, Sugar; Over."

Note: Use 24 hr. time example: 12:30 a.m. = 0030; 5:00 a.m. = 0500; 3:00 p.m. = 1500.

After Fill-in Transmit Report as Follows (Example):
LOOKOUT SAYS: Salmon – Long Tom – Over
DISPATCHER SAYS: Long Tom – Salmon – Over
LOOKOUT SAYS: 1-080; 2-220; 3-head of Long Gulch; 4-yes; 5-6N -- 7E -- 36 -- SE; 6-South; 7-Grey; 8-Grass; 9-North; 10-Calm; 11-Spot; 12-North along Long Gulch Trail. OVER.

INITIAL R-4 FIRE REPORT

FILL IN OR CIRCLE

LOOKOUT FILL IN

1	LOOKOUT: ON NF REPORT TO
2	AZIMUTH: DATE TIME
3	LOCATION: BY LANDMARKS:
4	IS SMOKE BASE SEEN?: YES NO QUESTIONABLE
5	MAP LOCATION: T. R. SEC. 1/4 SEC. NE. SE. SW. NW.
6	SLOPE FACES: N. NE. E. SE. S. SW. W. NW.
7	SMOKE COLOR: BLACK GREY WHITE BROWN BLUE REDDISH
8	BURNING IN: SINGLE TREE, GRASS, BRUSH, GREEN TIMBER, OLD BURN, 2ND GROWTH, CUT OVER
9	SMOKE DRIFTING FROM: NORTH NE EAST SE SOUTH SW WEST NW
10	WIND VELOCITY: CALM, V. LIGHT, LIGHT, GENTLE, MODERATE, FRESH, STRONG
11	SIZE IN ACRES: SPOT. 1/4. 1/2. 3/4. 1. 2. 5. 10. OVER 10.
12	BEST ROUTE TO FIRE:

NOW CALL DISPATCHER

IF YOU GO TO FIRE TAKE THIS FORM WITH YOU

DISPATCHER ACTION: READINGS FROM OTHER LOOKOUTS

13	LOOKOUT: AZIMUTH TIME SMOKE BASE SEEN – NOT SEEN
14	REMARKS:
15	LOOKOUT: AZIMUTH TIME SMOKE BASE SEEN – NOT SEEN
16	REMARKS:
17	LOOKOUT: AZIMUTH TIME SMOKE BASE SEEN – NOT SEEN
18	REMARKS:
19	FINAL LOCATION: TWP. RANGE SEC. 1/4 SEC.
20	DISPATCHED FROM: FOREMAN NO. MEN
21	DATE: TIME: TRAVEL BY: FOOT, HORSE, AUTO, PLANE, COPTER
22	TRAVEL ROUTE:
23	EXPECTED ARRIVAL TIME INITIAL ATTACK FORCE: DATE TIME
24	SPECIAL EQUIPMENT:
25	FOLLOW UP ACTION: DATE TIME SUPERVISORS FIRE NO.
26	FIRE NAME

FORM 19 R4
AGRICULTURE-OGDEN

FIGURE 1.

A TIMETABLE FOR LARGE FIRE MANAGEMENT

BYRON BEATTIE
Forest Supervisor, Sierra National Forest

Rapid initial attack, calculation of fire location by specific periods, crews on the line by daybreak, tactical plans to coincide with diurnal variations in fire weather—these are some of the time factors characterizing fire suppression operations. These and comparable tactical time factors have been repeatedly stressed in fire literature, in fire training plans, and in fire boards of review. They are, therefore, common knowledge and accepted principles of strategic, tactical, and operational fire suppression within the ranks of fire overhead personnel.

Why then does the record of large fire suppression reflect in case after case the failure to realize such well-recognized tactical timings in vital suppression actions? What are the reasons behind unattained tactical timing? And what can be done to help the men on the job—the Fire Boss and his staff—bring about tactical timing?

In considering the reasons for failure in tactical timing one usually finds the Fire Boss reporting: (1) The day shift resources didn't arrive in time; (2) the fire camp was not fully set up and we couldn't get men out in time; (3) we didn't get our plans and instructions prepared in time; (4) we spent too much time on strategy and didn't get around to activating a plan of control. We didn't realize it was so late, and finally . . . ; (5) there just wasn't time enough to do everything.

Behind the lines, where manpower and material must be mobilized and dispatched, the report usually is that orders were incomplete, or orders were received too late.

Certainly, anyone who has been involved in managing a large free-burning fire realizes that under such stress it is common to lose all concept of time and to become involved in an endless and time-consuming chain of tasks and decisions. Inevitably, the deadline for action arrives. The result? A timetable of service functions impossible of attainment, hurriedly made decisions of major import and, eventually, a poorly instructed, haphazardly equipped line force that arrives on the line much later than had been planned.

In an effort to focus attention on the preliminaries essential to attainment of tactical timing and to guide fire management in prorating their available time to all functions of management, a timetable was developed. In practice, it has been successful.

Intelligent understanding and application of the timetable must recognize the following:

1. It is a guide. Times are not absolute and may vary by individual operations. However, all fires and/or divisions operating under a single General Headquarters must adhere to the master schedule of Headquarters.
2. Adherence to schedule requires that subordinate officers be provided with and comply with a schedule of accomplishment, correlated with that of fire management.

DIVISION OR SINGLE FIRE HEADQUARTERS TIMETABLE

Hour	Fire boss	Plans chief	Service chief	Line boss
Origin 7P	1. Review of available information. 2. Review of Line Boss plan (Incl. Reconn. or study) and confirmation or adjust. 3. Compute spread and probable duration of fire. 4. Compute 2d day control force requirements. 5. Select base of operation. 6. Place 2d day orders. 7. Organization and supervision, with emphasis on plans and service functions.	1. Reconn. and/or problem study. 2. Work with Fire Boss or independently on calculation of probabilities and control force requirements for 2d day (detailed). 3. Initiate 1st night intelligence. 4. Organize and supervise plans unit.	1. Compute, order, place in operating condition service needs. 2. Study base to fire line access and travel times. 3. Organize and supervise service unit.	1. Review - analyze available information on fire. 2. Enroute to fire secure vantage point, size up. 3. Prepare initial plan of control (through 1st night) and notify dispatcher of the situation; control force required. Mobilization point (complete within 30 minutes). 4. Organize and supervise line action until relieved.
7P-9P	Joint planning and decision—2d day shift operation			
9P-11P	Supervision with emphasis on plans and service.	Detailed instructions day shift. Bring records up to date.	Preparation for morning dispatch.	
11P-3A	Off duty. Available for decision.	Off duty.	Off duty.	
3A-3½A	Review of night intelligence; minor adjustment of plans and instructions.		Final check dispatch preparedness.	
	Line overheard breakfast 3 to 3:15; crew boss and manpower 3:15 to 3:45.		Dispatch line forces.	
3½A-4A	Brief line overhead.			Change of shift.
4A-5A	Breakfast			
5A-6A	Night shift overhead interrogation/24-hr. service needs.			Line supervision.
6A-8A	Progress report and 24-hour plan of control.		Night shift service preparation.	Critical-sector supervision.
8A-10A	Field reconn. Night shift plans.	Night shift plans.		Calm-sector supervision.
10A-1P	Off Duty.			
1P-3P	Field reconn. and supervision—free lance.	Reconn. - supervision of plans unit. Detail instructions for night shift.	Service unit supervision—Field reconn.	Critical-sector supervision and general correlation of all sectors until relieved
3P-4P	Review of day intelligence reports. Minor adjustments of plans and instructions.		Final check night dispatch arrangements.	
	Line overhead supper 3:30-3:45; crew boss and manpower supper 3:45-4:15.			
4P-4½P	Brief line overhead.		Dispatch line forces.	Change of shift.
4½P-6P	Off Duty.			
6P-7P	Day overhead interrogation.		Initiate day shift service arrangements.	Line supervision.
7P-9P	Prepare plans and instructions. next day shift. Joint planning and decision 3d day shift operation.			Line supervision.
9P-3A	Off duty.			

GENERAL FIRE HEADQUARTERS TIMETABLE

DAY OF ORIGIN

Hour	Fire boss	Chief of staff	Plans chief	Service chief
Origin	1. Initiate mobilization of G.F.H. 2. Observation or study of fire problems. 3. Check calculation of fire probability and control force requirements.	On the ground assistance to Division Fire Boss. 1. Probabilities. 2. Control force requirements. 3. Organization of division forces.	Work with Fire Boss or independently on: 1. Observation or study of fire problems. 2. Check calculation of fire probability and control force requirements.	Procurement and delivery of division's anticipated needs for 2d and 3d shifts..
SUBSEQUENT 24-HR. PERIODS				
9P-11P	Staff conference—review of situation; action-plan next 24 hours.			
11P-5A	Off duty			
5A-9A	Field reconn. and consultation.	Field reconn. and consultation.	Field reconn.	Mobilization and delivery of Divisional needs. Observe mobilization plans and/or demobilization plans.
9A-Noon	Joint review of division's 24-hour plan of control; Division notification and Headquarters action plan.			
Noon-7P	Free of operational duties, available for decision.	Field liaison and counsel.	Check calculations emergency or disaster plans.	Same as a. m. plus trouble shooting.
7P-8P	Joint conference and plans.			
8P-5A	Off duty. Available if needed.			

3. Fire management must base 2d day decision, plans and action on available information. Unless the 7 p. m. day-of-origin deadline is met, tactical timing fails.

4. First-night rest must be secured as indicated to avoid a sluggish and mentally dull management team.

5. Cold-blooded organizational discipline and self-descipline is a must.

6. Items shown in the timetable are only key factors of position requirement.

As implied above, field fire management must recognize the existence of a behind-the-lines organization which may be limited to a forest fire control officer who functions as chief of staff, and a supply or procurement officer. However simple the organization, it should be established and function as General Fire Headquarters. The field operation then becomes a Division, and field management functions as a Division Fire Headquarters.

Locally, we have found that this provides the tie between the going fire and behind-the-lines recruitment, and sets the stage for expanding from the single-fire to the multiple-fire operation.

FIRE PREVENTION PROGRAM ON KIAMICHI RANGER DISTRICT

D. D. Devet
District Ranger, Ouachita National Forest

HISTORY

The Kiamichi Ranger District of the Ouachita National Forest is located in Oklahoma. It has a protection area of 257,463 acres with a net U. S. land area of 180,313 acres. Since 1939, the number of annual forest fires has varied considerably—84 occurred in 1950, and only 8 in 1945. During the same period, the percent of annual burn has varied from 3.24 in 1943 to 0.01 in 1944.

North and west of the district, there is no organized protection; local residents burn at will and State fire laws are ignored. South of the district, the Oklahoma Division of Forestry and Parks is providing protection for State and private land. Much of the timberland outside the forest is held by absentee owners who provide little or no protection for their properties.

An analysis of the causes of 562 fires on the district during the years 1939-51 indicates the following:

Cause	*Percent of total fires*
Lightning	10.3
Railroad	7.8
Lumbering	1.6
Smoker	19.8
Debris burning	4.3
Incendiary	38.8
Campfire	5.3
Miscellaneous	12.1

PATTERN OF BURNING

More than 1,500 families live adjacent to or within the Kiamichi Ranger District. The tradition of open range woods burning in the spring still prevails, and an analysis of incendiary fires revealed the following reasons for burning: (1) To improve grazing. (2) To reduce hardwood undergrowth in order to: increase visibility for hunting; make woods riding easier; remove briars; kill ticks and snakes; make locating hogs and cows easier; improve visibility in general. (3) Job fires. (4) Spite against neighbor, warden, or lookout. (5) Cattle concentration burn for roundup. (6) Turkey burn. (7) Want of excitement while intoxicated. (8) Just like to see the woods burn.

ORGANIZING THE PREVENTION PROGRAM

During the summer of 1951, it was concluded that ordinary prevention efforts were not obtaining the desired results. An intensive program was therefore developed with plans to follow it for 3 or 4 years. Most of the Kiamichi Ranger District residents realize that wild forest fires are damaging to their interests in the long run, and routine prevention efforts in

general suffice to reach them. Scattered throughout the district, however, are a few individuals who believe that an annual burning of the woods benefits their interests. The objective of the intensive prevention efforts was to reach these individuals.

Analysis of the situation and development of the prevention program involved the following steps:

1. The entire ranger district was divided into problem areas where a characteristic pattern of fires occurred each year. For instance, in one area there are usually one or two Class E multiple-set incendiary grazing fires annually. In another, debris burning is the main problem. In a different area, hunters who leave burning hollow trees and campfires are the principal cause of fires. In still another area, job fires occur frequently. Thus, the individual problem areas were defined.

2. The second step taken was to list those individuals likely to have been responsible for the fires in each problem area.

3. Finally, each individual suspect was studied closely for his habits, source of livelihood, companions, weaknesses, reasons for causing the fires, the people he respects and whose advice he follows, and his relatives. An avenue of approach was studied for each suspected group of incendiaries.

PREVENTIVE ACTION

With the analysis completed, a course of action was decided upon. Personal contact was chosen as one of the most effective prevention media. The first step is to get well acquainted with each of the suspected incendiaries to try to gain his confidence and friendship. A different approach is used for each individual based on a study of his habits, personality, and attitudes. For instance, incendiaries suspected of setting range fires to improve grazing are accompanied into the woods range. While crossing areas burned by wild forest fires, attention is called to the prolific sprouting of hardwood brush as a result of fires, and how the brush is choking out the forage. On adjacent unburned areas, the greater abundance of forage and less dense hardwood underbrush is noted. It is explained how spring fires cause a large number of sprouts to originate from each stem of hardwood burned. To provide better forage, the cattle owners are encouraged to investigate the possibilities of improved, fenced pastures. In order to meet the cattlemen on equal terms, cattle breeds, range conditions, pasture management, and local range problems are studied with the advice and assistance of the county agent.

Arrangements are made to go on coon or possum hunts with hunters suspected of leaving warming fires and smoking hollow trees. While on the hunt, the correct method of putting out warming fires and fires used to smoke game out of hollow trees is demonstrated.

Soil-tilling methods, fertilizers, and the use of ammate and other chemical means of brush and broom sedge control are discussed with debris and field burners. When burning cannot be discouraged, correct burning techniques are explained and demonstrated.

In areas where job fires are suspected, the possibility of new industries is investigated. For instance, broiler raising is studied and information on this disseminated. In order to keep the residents occupied and to demonstrate the value of the timber crop, effort is made to increase the

number of sales of timber products in these areas. Information on employment possibilities is passed on to idle residents of these communities.

Thus, through understanding, guidance, and education, personal contact work is conducted among the minority suspected of being responsible for most of the man-caused fires. Each individual presents a new problem that requires a different approach.

Another contact approach is the marshalling of public opinion against man-caused forest fires. This is done through becoming acquainted with the most influential members of each community. By showing these leaders the damage done by wild forest fires, it is possible to build up indirect pressure against the intentional setting of uncontrolled fires. Another prevention tool used is the local newspapers. Every week the two local papers covering the district publish a short column entitled Your Forest Service. This column attempts to bring a realization to all forest residents that they have a personal stake in the activities and management of the national forest in Oklahoma. The column covers various activities of the district with emphasis on fire prevention.

Facilities of the local radio station are also utilized. Each month one or two 15-minute broadcasts are made by Forest Service personnel in cooperation with the county agricultural agent. These broadcasts are released over a radio station whose beams reach a majority of district residents. Activities covered in these broadcasts are closely tied in with fire prevention. In addition to these programs, the county agent, who has a program of his own called On the Farm Front, frequently inserts fire prevention ideas in his broadcasts.

Advantage is taken of every opportunity to show movies and slides, and to give lectures to schools, veteran classes, clubs, and churches. Through this means, better relations are cultivated with teachers, veteran vocational advisers, club leaders, and ministers, all of whom help formulate public opinion. Show-me trips are also used to advantage. They are the best way to show the loss to the community caused by forest fires and the rapid growth of pine timber on unburned areas.

A thorough and prompt investigation of all man-caused fires is a must. Sometimes the investigation is made in the company of a local, well-known law enforcement officer; this may have a beneficial psychological influence. All employees of the ranger district are trained to help carry out the prevention program, and each acts as a prevention man in his own sphere of influence.

The fire statistics for the next few years will tell whether the Kiamichi fire prevention program has succeeded or failed. Although the results will be slow in showing up, the reaction from local residents indicates that some progress has already been made.

FIRES BY THE DOZEN

Ralph C. Bangsberg
Fire Control Officer, Shasta National Forest

Monday morning, July 24, 1950, was just another day at the Supervisor's Office on the Shasta National Forest. Nothing very outstanding in the way of a day so far as fire control was concerned. Forest Dispatcher Adams had informed the fire control officer of the weather forecast which involved little or no change from the day before. Fire danger in the high bracket.

The morning wore on with "business as usual." The weather man was pretty close to right. It *was* getting hot and a good breeze was coming from the south; it looked as though we were in for a warm afternoon.

The quiet was suddenly interrupted by the startling blast of the Mt. Shasta city fire siren. Someone had a fire! By phone from Dispatcher Adams it was learned that a defective steam engine on the Southern Pacific Lines had left Black Butte station some 8 miles north of Mount Shasta city and was traveling south setting what looked like dozens of fires along the right-of-way. It had just gone through the city, a distance of more than a mile, and had left at least 10 or 11 smokes. Efforts were being made to stop the engine as soon as possible.

Just how many fires there were out on the forest could not be learned at first. There was plenty for all and it was "all hands on deck." It wasn't hard to find a fire and any number of small grass fires, some too small to count, were extinguished on the run—knock down one and run to the next.

It all looked like a hopeless confused mess at first, but soon the steady pressure of a well-trained and determined fire organization began to show. From 11:40 a. m. until 1:00 p. m., an interval of 1 hour and 20 minutes, at least 16 fires were reported spread out over a distance of about 17 miles. Add to this the 11 fires within the city limits of Mt. Shasta and you have a picture of the alarming situation confronting the fire fighting organization.

Success in handling such a string of fires in dry grass and brush in the middle of a hot July day doesn't just "happen." It should be noted that the defective engine was stopped, but not before it could set five small fires close together in the bottom of the rugged Sacramento Canyon. All other fires were handled and kept to Class A or B. The five fires on the steep slopes of the canyon quickly ran together and produced the one large Class D fire.

The summary chart shows three separate tanker crews and the FCA dispatched to fires, and behind this organization there was one lookout able to see the entire string of fires, a Forest dispatcher and a Ranger District fire dispatcher. Linking this entire organization together was a complete net of mobile two-day radio. Each unit—dispatchers, lookouts, and attacking forces—was 100 percent equipped. The drama of what happened and how it happened is difficult to detail.

SUMMARY OF FIRE BUST OF JULY 24, 1950

Fire No.	Time discovered	Controlled	Elapsed time	Size class	Crews handling	First report
1	11:40	12:10	0:30	A	So. Yard	Initial dispatch
2	11:46	12:05	0:19	A	Weed	do.
3	11:47	12:16	0:29	B(3 acres)	do.	Reported en route
4	11:57	12:10	0:13	A	Castella	Initial dispatch
5	11:57	12:15	0:18	A	do.	Reported en route
6	11:57	12:30	0:33	A	do.	do.
7	12:00	12:15	0:15	A	Patrolman	Initial dispatch
8	12:08	1:00	0:52	B (.9 acre)	Weed	Reported en route
9	12:15	12:30	0:15	A	FC Assist.	do.
10	12:15	12:40	0:25	A	do.	do.
11 (5 fires)	12:30	7/25 2 a.m.	13:30	D (130 acres)	All crews	do.
12	1:00	1:50	0:50	A	So. Yard	do.
13	2:43	3:10	0:27	A	Castella	do.
14 (11 fires in city; handled by city)	...	...	...	A's	City	

Note: All times daylight saving.

The lookout reporting fires to the district dispatcher and directing crews into smokes. The district dispatcher sending crews to new fires the moment they controlled their present smoke. The crews reporting their progress and asking for new assignments. The lookout again reporting on the seriousness of old or new smokes. The forest dispatcher calling in other mobile field units from other districts, holding them here, turning them around to stand-by at other locations, directing their entry to the fire zone, etc. The district dispatcher directing and receiving reports from scout cars. All of this wove itself into a pattern that snuffed out the seemingly endless string of fires one by one until at last all fires were controlled except the large one in the canyon. As the crews were freed from the smaller fires, they were directed to the one remaining large fire, eventually converging upon it and we might add—none too soon.

Anything slower than the instant medium of radio would have delayed the attack on other fires. The result would no doubt have been nothing short of catastrophe.

Tankers, crews, tractors and men converged on the now rather savage brush fire that had come up out of the canyon and was making a bid to the dubious fame of becoming a very large and destructive brush fire. Houses, an airport, heavy traffic on U S 99, and timber all stood in its direct path. It *had* to be stopped at the one remaining barrier, the railroad tracks.

Tankers shoved into the fight, directed by observers in radio cars, and picked spot fires as fast as they came. Not one less than the four or five tankers used in this spot fire attack would have been enough. They had to be there, and able to move from spot to spot as directed by radio—and fast!

Time was of the essence as was complete coordination by those directing operations. It is safe to say that the cost of the radios used in this day's operation was insignificant compared to the money they saved in directing the attacking equipment and men.

Can you picture what might have happened if the crews had to depend upon hunting up a telephone to make their report after each fire or seeing another fire, rushing to it, only to find that two other crews had done the same, while other more serious fires burned unattended?

The city of Mt. Shasta experienced in a small way what could have happened. Our lookout on Black Butte gave the dispatcher information that there were three fires in the north end of the city. The dispatcher notified the city fire department. Immediately they sent their three trucks to these fires. In a few minutes seven or eight more fires were reported in the city limits. Frantic calls flooded their dispatch center. The situation was finally handled through the aid of messenger service, local volunteers, police cars, and others. Obviously, with many people at hand and short distances, such a difficulty can soon be overcome, but not so with widely scattered fires in isolated areas.

Paper for Covering Piled Slash

The kind of paper to use for covering piled slash, as reported in the July 1951 issue of Fire Control Notes, is referred to in the trade as "counter rolls." It is waterproofed kraft building paper, laminated 30-30-30, 9 inches in diameter, uncreped, not reinforced, class C. It is sold by the pound. A 48-inch wide roll weighs approximately 76 pounds, contains 2400 square feet, and costs about $10 per hundredweight. Its principal use is for lining the holds of ships.—DIVISION OF FIRE CONTROL, *Region 6, U. S. Forest Service.*

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.


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PREVENT
FOREST
FIRES!