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FIRE CONTROL NOTES

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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 15 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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Forest Service, Washington, D. C.

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HOW TO GET THE MOST FROM YOUR BINOCULARS

ROBERT J. REICHERT and ELSA REICHERT[1]

Written at the request of the U. S. Forest Service for use in its training program, and for distribution to its forest fire lookouts and forest fire reconnaissance personnel to help them achieve maximum efficiency of binoculars in fire detection.—Ed.

When scanning the landscape from your lookout tower, you can usually identify a smoke sooner, and see the details clearer, if you examine them through your binocular—assuming, of course, that the instrument is in good condition, and that you use it correctly. Both are up to you.

Method of adjustment.—For clear and comfortable vision you must adjust your binocular carefully to your eyes. Undoubtedly the glass is the individual focusing type, standard for lookout work, with both eyepieces adjustable. Once you learn their correct position *for your eyes,* you will not have to repeat the following operation.

Select a suitable location; it will probably not be the lookout tower. Focus on a sign, such as a license plate, at least 100 yards away, with print too small to be read with the unaided eye. Do this out of doors, or through an open window, as most window glass is optically imperfect. Proceed by turning both eyepieces as far out as they will go, but without forcing them. Then look through the binocular, with your right eye closed, and turn the left eyepiece slowly until you read the print clearly. To adjust the right side, close your left eye and turn the right eyepiece. Then bend the hinge adjustment until your eyes look through the centers of the ocular lenses.

The binocular is now correctly focused for your eyes for *all distances,* from the farthest star to as close as 40 to 50 feet. Note carefully the marking where each eyepiece is set, so that, if it is moved, you can put it back in correct position without looking through the binocular. If you have exclusive use of the glass, you might fasten each eyepiece with scotch tape, so the glass will always be precision adjusted to your eyes—ready for instant use.

If your binocular is the center focusing-wheel type, adjust for your left eye by turning the center wheel; then for your right eye by turning the adjustable right eyepiece (fig. 1). With this type of focusing mechanism there is practically no way to maintain a permanent precision adjustment. It is also less well sealed against moisture and dust.

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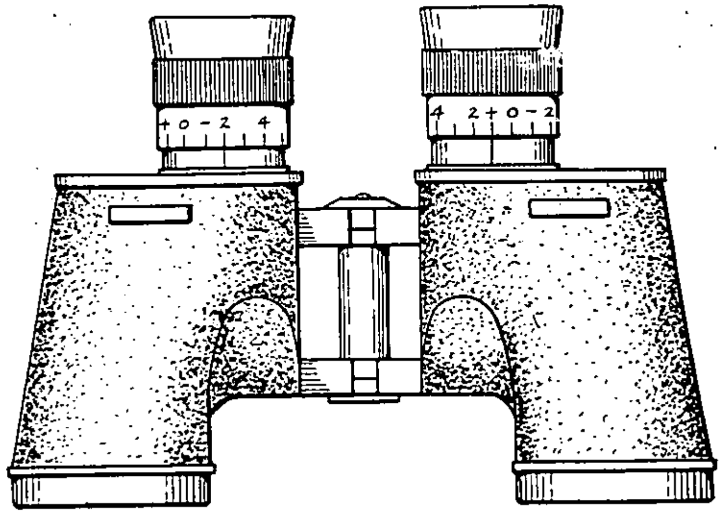
[1]Robert J. Reichert and Elsa Reichert have been operating as the Mirakel Repair Co., 14 West First St., Mount Vernon, N. Y., since it was established in 1923. They were binocular importers for about 15 years, and have visited most of the foreign binocular factories. Before the war they manufactured binoculars of their own design. Besides making the mechanical parts, they have computed the optical system and manufactured the lenses. The production of this binocular was ended by the war.

Figures 2 and 6, and several paragraphs of the text, have appeared in other articles by the same authors printed in Audubon Magazine, published by the National Audubon Society, New York City.



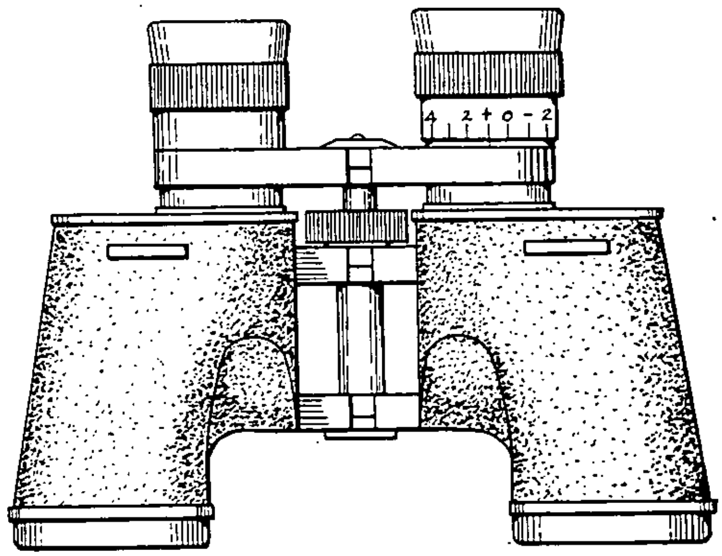


FIGURE 1.—The upper binocular, with individual eyepiece focusing, has calibrations on both the left and right eyepieces. After focusing, note and remember the numerical positions relative to the vertical line on each ocular tube. Keep your binoculars set on these readings to keep in focus for your eyes. The lower binocular, with its center focusing wheel for both eyepieces, has calibrations on the right eyepiece only.

Clarity and cleanness.—The clarity of each side you have already tested, to some extent, while focusing on distant print to adjust the binocular to your eyes. If the instrument has been used previously, you should also inspect the optics for cleanness, to make sure you get the maximum clarity. A binocular has at least

8 surfaces on each side, and if dirt or moisture has settled on any of them vision is more or less obscured. Hold the binocular about 10 inches from your eyes, in reverse position, with the ocular (eye) lenses away from you and pointed towards the sky (fig. 2). Look *into* the binocular, not *through* it. You will plainly see any dirt or "fog" on the optical surfaces. If this is appreciable the binocular should be serviced.

Alinement.—After verifying the clarity of each side, when looked through separately, you should check the alinement of one side to the other. The view you see through the right side should be exactly the same as the view you see through the left. If they differ even slightly, you cannot see clearly when you look through the glass with both eyes.

This test, as a rule, cannot be made properly from a fire tower. The set-up, though simple, requires an open window with a view of a straight, horizontal line at least 100 feet away, and a table, or other level surface, in front of the window. Place the binocular on the table, and point it toward the horizontal line, with the eyepieces close to the near edge of the table, so that you can look through the binocular at the line. If the line is too high to be visible through the binocular, tilt the objectives (the lenses farthest from your eyes) upward. Use any convenient device that will raise both objectives equally.

A good way is to put the instrument on a book with the binding toward you, and place a ruler between the pages and parallel to the binding (fig. 3). The book cover must be stiff enough so it will not sag under the weight of the binocular; and the instrument should, of course, be correctly set for your eyes. You can now make the test, for which you should use *one eye only.*

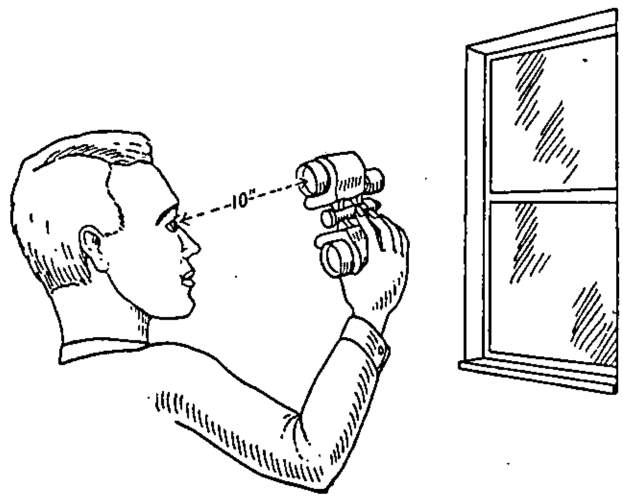


FIGURE 2.—To see dust specks or dirt that indicates your binocular needs cleaning, hold it about 10 inches away from your eyes with the ocular lenses away from you and toward the sky. Look into the binocular not through it.

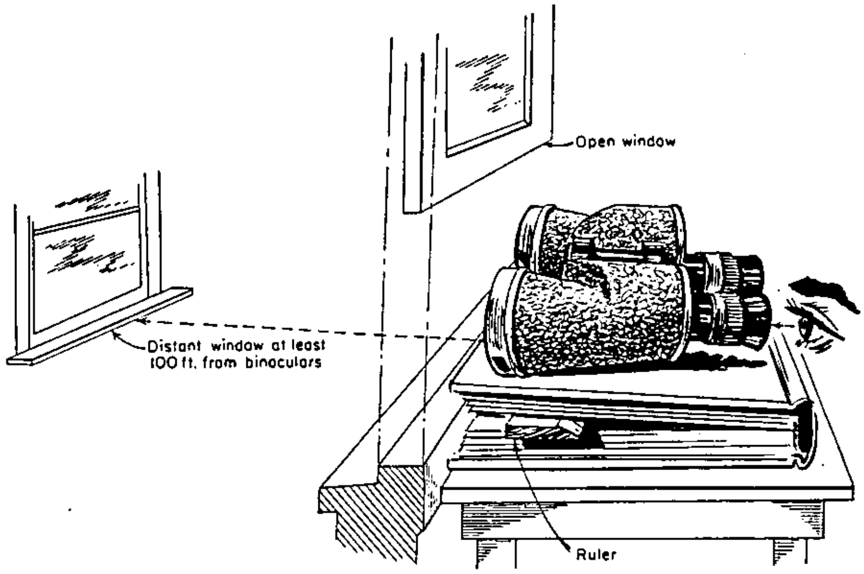


FIGURE 3.—Set-up for checking alinement.

Look through the left side of the binocular, and raise or lower the objectives by moving the ruler forward or back until you see the horizontal line at the bottom of the field. Be sure the ruler is always parallel to the binding, so that the two objectives are raised exactly the same amount. If this method does not raise the objectives sufficiently, raise the outer edge of the book by putting under it another ruler or very thin book—use anything that will raise both objectives equally.

Now, without moving the binocular, look through the right side. If the line is in the same position (fig. 4, *A*), the alinement is correct. If it appears higher (fig. 4, *B*), the binocular is out of alinement. If it is not visible, the line is lower than on the left side. To determine how much lower, repeat the test, starting with the right side instead of the left.

When you try to use a binocular that is out of alinement, and your eyes attempt to fuse the two different views, you do not get

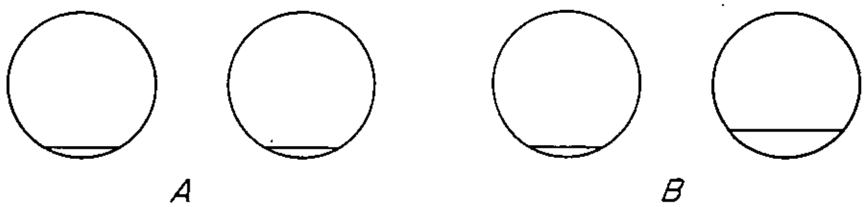


FIGURE 4.—A, When the horizontal line seen through the right side of the binocular is the same height as the line seen through the left side, the binocular is in correct alinement. *B*, When the horizontal line seen through one side of the binocular is higher than the line seen through the other side, the binocular is out of alinement.

one clear, steady image. Continuous use will sooner or later cause eyestrain. If, by any chance, you do see clearly and without effort, you will know that one of your eyes has ceased functioning. You have a "master eye." Both may function under normal conditions, but taxed in this way the weaker eye "quits," and you see only through the stronger. You might as well use a *mono*cular, for you are not getting *bin*ocular vision.

Perhaps you have heard a lookout object to using his binocular because it seems to "pull" his eyes and he "can see better without it." Possibly it is not correctly set for his eyes; more likely it is out of alinement. He is right not to use his binocular in that condition; but he is needlessly depriving himself of a valuable aid in fire detection. He should have the instrument re-alined.

Strange as it seems, you may check a binocular and find the alinement good, and another lookout find it poor—yet you may both be right. The alinement is correct only for *your* hinge position, not for eyes closer together or farther apart. This happens when the two optical axes are not parallel to the mechanical axis (the hinge). Undoubtedly the alining was done "by eye"—checked by a method as crude as that described above. In a properly equipped shop a precision testing instrument known as a collimator is used, to ensure the accuracy essential for clear and restful vision.

Coating.—Does a binocular that is clean, in alinement, and correctly adjusted to your eyes, under all conditions give you the clearest vision obtainable with that model? Not necessarily; not if the instrument is prewar and has not been modernized. When light passes from air into glass—or from glass into air—about 5 percent is reflected back from the glass surfaces. This occurs 10 times on each side of a binocular; and only about 50 percent of the light that enters the objective lens reaches your eye (fig. 5). These numerous reflections reduce the clarity of vision under certain lighting conditions.

On dark, overcast days, or at dawn or dusk, not enough light reaches your eye from the object you are observing, and it appears dim and indistinct. On very bright days, when you view objects against a brilliant sky, or in the general direction of the sun, the 10 bright reflections from the glass surfaces cause a glare—an "internal haze"—that may almost entirely obscure vision.

Before the war this high percentage of reflection was unavoidable, and often rendered a lookout's binocular of little help in fire detection and identification. During the war a new process was perfected, called coating. A film of magnesium fluoride is applied to the glass surfaces by electrical means in a high vacuum, to a thickness of only 5 millionths of an inch. This coating reduces the reflection from a glass surface from about 5 to about ½ percent. When all the light-reflecting surfaces in a binocular are so treated, the light transmission is increased 50 percent; and glare is so greatly reduced as to be negligible.

When coating became available for civilian use, experiments with coated and uncoated glasses were made by fire tower lookouts

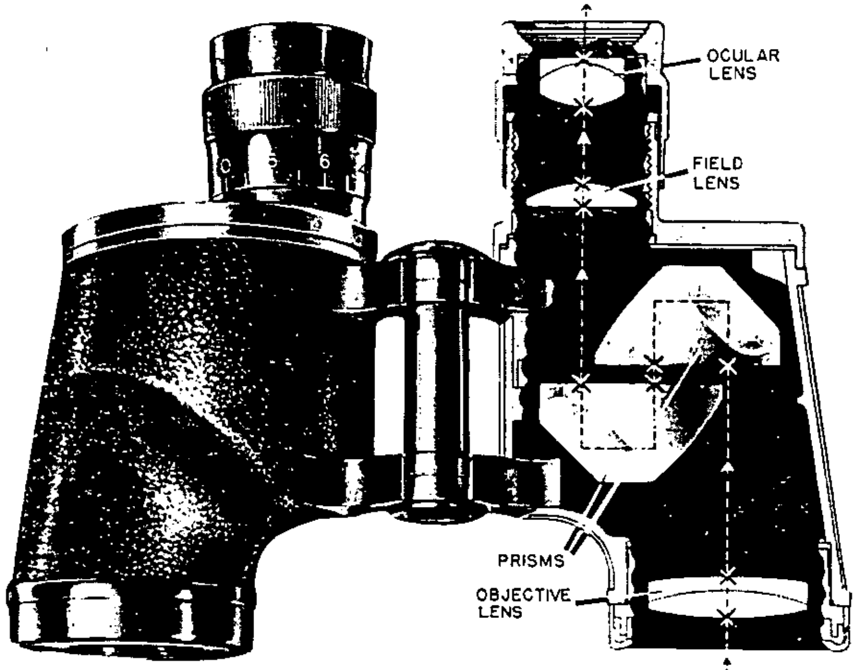


FIGURE 5.—6x30 prism binocular. Each side has an achromatic (doublet) ocular and objective lens, a simple field lens, and two prisms. The "X's" mark the 10 optical surfaces where undesirable reflections occur. It is these surfaces that are coated to reduce reflection.

and plane patrols in various parts of the country. The following briefly summarizes their opinions:

"In poor light, such as late afternoon, the coated binoculars are definitely better. Objects appear much clearer with them."

"In hazy weather, a smoke appears clearer, more distinguishable with the coated binoculars."

"When looking in the direction of the sun, the coated glasses make less glare than the uncoated ones."

It is apparent why U. S. Forest Service binocular specifications require coating of all air-glass surfaces; and why many forestry agencies are having their prewar binoculars coated.

How can you tell whether a binocular is coated? Unfortunately there is no way *you* can tell how many glass surfaces in a binocular are coated. You can be sure only of the objective lenses. Look at one of the objectives under an electric light, preferably fluorescent, and note the two images of the light. If both are white, the lens is uncoated, and you can be reasonably certain the other optical elements are also uncoated. If both images are bluish-purple, both surfaces of the lens are coated; if one is white and one purple, only the inner surface is coated. As the ocular lenses are difficult to check, and you cannot examine the field lenses and prisms, you have no way of telling whether or not any of the other glass surfaces are coated.[2] Therefore, when having an old glass processed, make sure that the work is done in a shop you can rely on to coat *all* the air-glass surfaces; and also to re-aline the instrument, after processing, to the required precision.

Eyeglasses and goggles.—The usefulness of a binocular depends to some extent on the *visible* field of view; how much of the landscape you can see at a given distance without moving your head. If you wear eyeglasses or goggles when you look through a binocular the field is appreciably reduced, because the ocular lenses are too far from your eyes. This is easily rectified by using shallow (flat) eyecaps, instead of the usual deep caps, to bring the ocular lenses approximately the correct distance from your eyes (fig. 6).

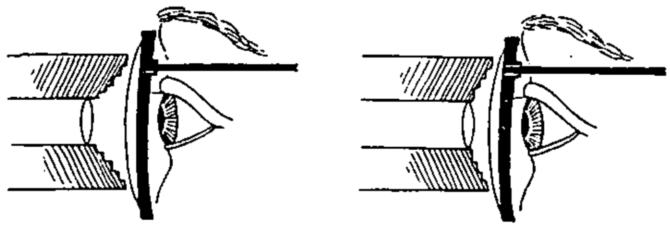


FIGURE 6.—Normal binocular eyecap used with eyeglasses (left) holds eye too far from the ocular lens for maximum field of view. Shallow cap (right) brings the user's eye to proper distance from lens, and full field of view can be seen.

The subject of goggles raises an interesting issue. Numerous attempts have been made to find some means of "penetrating" haze and fog, and of differentiating between these and wood smoke, without as yet any very conclusive results. Most lookouts find that in hazy weather a coated binocular makes a smoke appear clearer than an uncoated one. Many lookouts consider colored goggles helpful; but opinions differ as to the most useful color. Incidentally, goggles, in filtering the light, also reduce its volume. Therefore, binoculars used with goggles should be coated, in order to transmit as much useful light as possible, and make the smoke more clearly distinguishable.

Ways of damaging a binocular—all easily avoidable.—Don't drop or bump it. A binocular is a sensitively adjusted precision instrument. The displacement of any optical or mechanical part as little as 1/100 of an inch will put it out of alinement.

Don't keep it out of the case when not in use. And never leave it lying in the sun, especially with lenses toward the sun. Both ocular and objective lenses are doublets—two lenses cemented together—and the sun's heat may melt the cement and cause the lenses to separate.

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[2]It is common practice to advertise new binoculars as "coated" when any —even only two—of the glass surfaces are coated. You may expect the following percentages: American, 100; first quality German, 70-100; lower priced German, and most French and Japanese, 20-80. Very few foreign binoculars are 100-percent coated.

Don't let the hinge and ocular adjustments collect dirt. When grit works into the moving parts it wears the metal down, causing play or wobble. Metal thus worn off cannot be replaced, and proper tightening of the parts is impossible. Packing with heavy grease is obviously only a temporary repair.

Don't scratch the outside surfaces of the ocular and objective lenses when cleaning them. First blow off any loose dirt and grit; then breathe a film of moisture on the surfaces and wipe with a perfectly clean handkerchief, or fresh cleaning tissue.

Don't under any circumstances attempt to clean any of the inside surfaces, or take the instrument apart for any reason whatever. You are sure to put it out of alinement, and will probably damage some part.

Checking and servicing.—At the beginning of the season, check your binocular thoroughly, for smooth operation of the mechanical parts, for cleanness of the optics, and—above all—for alinement. If the instrument is not functioning perfectly, have it serviced immediately, of course in a shop equipped and qualified to work to the required precision.

During the season, if the binocular is dropped or badly jarred, check it for alinement, and have it repaired if needed.

At the end of the season, be sure to check the instrument thoroughly. Winter is a good time to have it put into first-class condition, ready for the next fire season.

Usefulness of binoculars.—Competent forest fire reporting often depends on the use of binoculars. Naturally, where visibility is limited, because of topographical obstructions or atmospheric haze, a glass is of less value than where the range of visibility is greater. In most parts of the country a binocular, in good condition and correctly used, is an important aid in speeding the discovery and accurate location of forest fires, and is a great help to the lookout in achieving a good record in fire detection.

[Readers can obtain without charge a comprehensive 12-page booklet on binoculars by writing the authors and mentioning this article in Fire Control Notes.]

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USE OF IRRIGATION PIPE IN FOREST FIRE SUPPRESSION

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A smoldering ground fire is a continuous hazard and causes extensive damage to soil and cover. In the past when ground fires occurred in areas where the water table was not high enough for successful jetting of wells, or when an open water supply was not close, the usual method of control was to trench the perimeter of the fire and maintain a patrol until it burned itself out. This method was accepted because the line loss and the labor involved in laying, picking up, cleaning, drying, and reeling several thousand feet of heavy hose made that method impractical.

Lightweight aluminum irrigation pipe looked like the answer to many of the problems. The first issue consisted of 100 pieces of 3-inch pipe in 16-foot lengths, together with necessary fittings and adapters, all of which was carried on a 4-wheel trailer. There was an opportunity to try this pipe in October 1952. Immediately after a long period of dry weather, fires, even in high ground, started to burn and had to be pumped out. Four fires were selected on different types of terrain and cover to demonstrate the outstanding advantages of aluminum pipe.

The first fire occurred in a spruce and tamarack swamp in the afternoon. It was quite easily brought under control but immediately started to burn in the duff. A decision was made to pump it out but the nearest water supply was 3,600 feet away. Sixteen hundred feet of irrigation pipe was laid and to this was attached 2,000 feet of 2-1/2 inch rubber-lined hose. The pipe was put down by 3 men just as fast as a power wagon could roll along in creeper gear pulling the trailer; pipe joints were just slipped together and required no locking. When a road had to be crossed, two sections of pipe were stuck together and pushed through a culvert. It took more than twice as long to unroll and couple an equal length of hose. Using a 500-gallon per minute centrifugal pump, 8 hours of pumping were required to completely drown out this fire which was approximately 3 acres in size.

After the fire was out, there was an excellent opportunity to compare the amount of work needed to pick up the pipe with that for the hose. The 1,600 feet of pipe was disconnected and loaded on the trailer by 4 men in just 30 minutes. It took 2 hours and 20 minutes to load the 2,000 feet of 2-1/2 inch hose on a stake-rack truck, using 5 men. The hose was just doubled back and forth and piled on the truck. It was then hauled to headquarters where it was uncoupled, dried, cleaned, and rolled. This operation kept 4 men busy for an entire 8-hour day.

The next fire occurred in hardwood hills. It was about 4 acres in size and was burning in buried logs and duff. The nearest water supply was 2,200 feet from the fire, but an additional 2,000 feet of irrigation pipe had been received so that it was not necessary to use hose. This water supply was a stream so small that it had to be dammed up overnight to get sufficient water. Twenty-two hundred feet of pipe was laid out in about 45 minutes. An adapter with three 1-1/2-inch outlets was used at the end of the pipeline, permitting the use of 3 short pieces of 1-1/2-inch hose (fig. 1). As fast as it was necessary to work farther into the fire, the adapter was pulled off, additional pipe added, and the adapter replaced. The line loss was negligible. With 100-pound pressure at the pump, an estimated 85 pounds was delivered at the nozzles.

Before this fire was completely out, a call was received on a 1-acre muck fire. The remaining 1,400 feet of irrigation pipe was loaded on the trailer and dispatched to the new fire. By 6:00 p. m. the pipe had been laid and pumping was started the following morning. This fire was pumped out in 3 hours. The pipe was picked up, loaded on the trailer, and returned to headquarters by noon. In the afternoon, the trailer was unloaded and returned to the location of the second fire where the 2,200 feet of pipe was picked up and delivered back to headquarters by that night. Had these 2 pumping jobs been handled with 2-1/2-inch hose, it would have required 5 times as many man-hours to lay the lines and pick them up. In addition, it would have required at least another 50 man-hours to clean, roll, and store the hose after it was returned to headquarters.

In each of the above three cases, the terrain was level enough so that it could be negotiated with a power wagon or pickup, and the pipe loaded and unloaded directly from the trailer.

The fourth fire occurred in a very inaccessible area along the edge of the sand dunes near Lake Michigan on the north side of Hamlin Lake. The fire ran over several almost perpendicular knobs and then went into the duff. It was a continuous menace to two valuable cottages that could only be reached by boat from

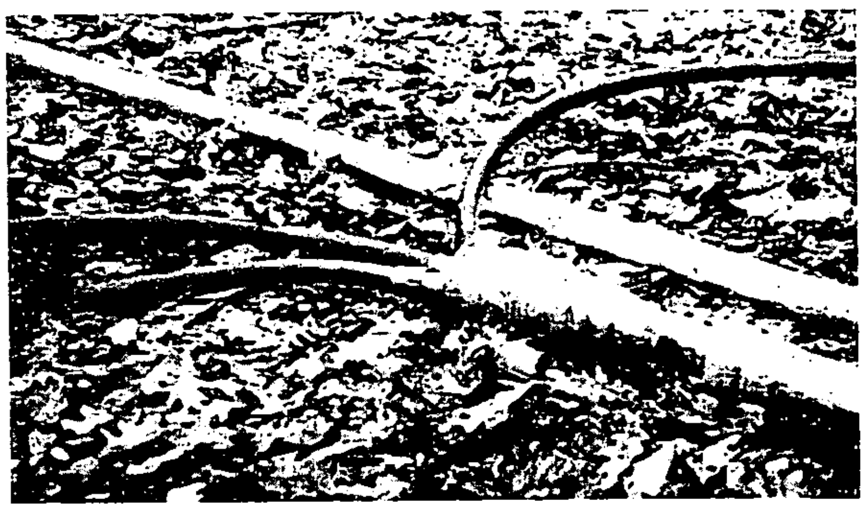

FIGURE 1.—Adapter for reducing 3-inch pipe to 1½ inch hose.

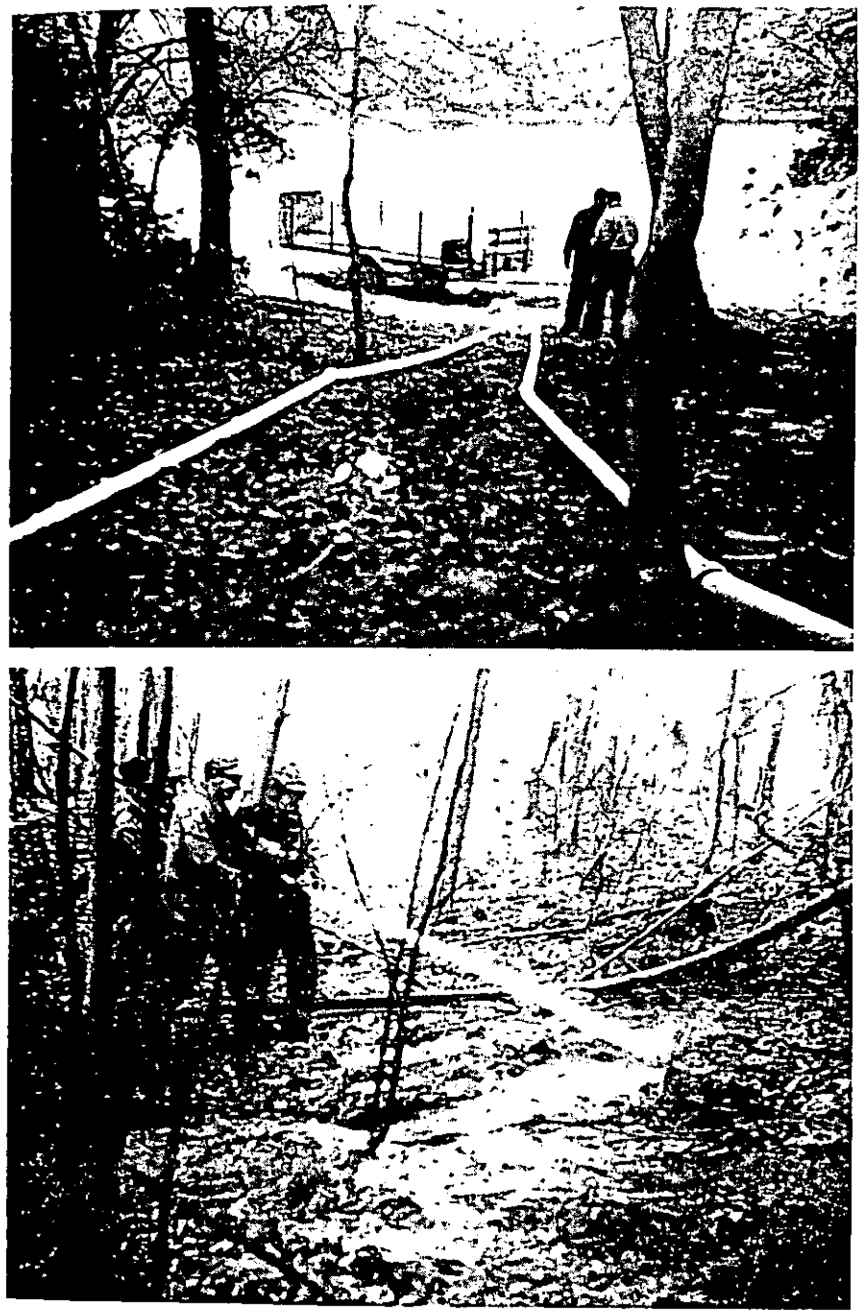

FIGURE 2.—*Top*, Two lines of irrigation pipe running from a pumper. Note pipe trailer at edge of lake. *Bottom*, Stream from 2½-inch hose with ¾-inch aperture nozzle.

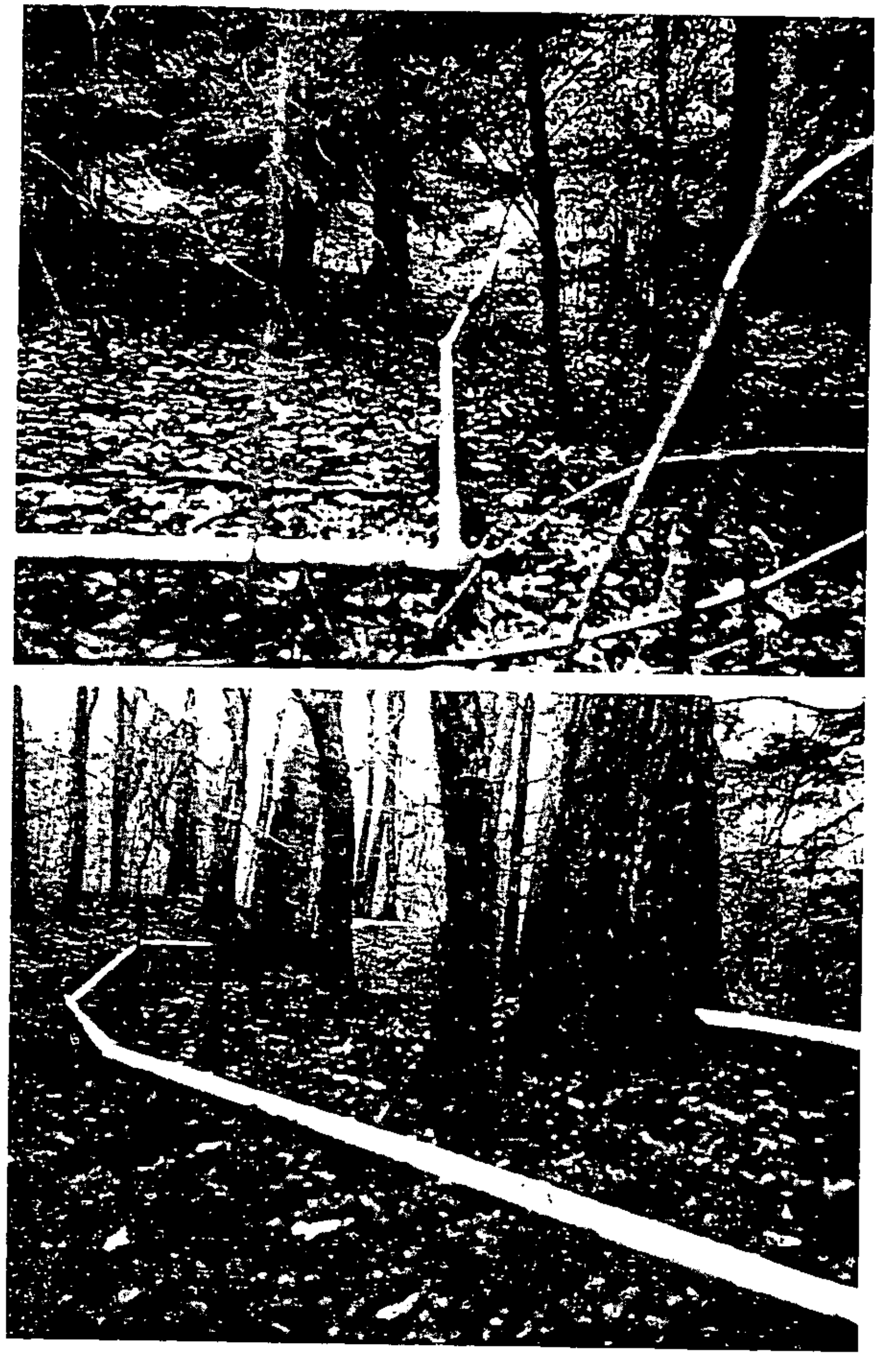

FIGURE 3.—*Top*, Using an elbow in making a 90-degree turn. *Bottom*, Change in direction permitted by flexibility in pipe joints.

across Hamlin Lake. The total area of the burn was approximately 7 acres, and there were many large patches of burning duff, as well as buried logs and stumps.

A pumper was hauled in about 1/2 mile by crawler tractor, and the pipe trailer by power wagon. Two lines of pipe were laid from the pump (fig. 2). Three 1-1/2-inch hoses were taken off one line with the use of the adapter. One length of 2-1/2-inch hose, equipped with one 3/4-inch aperture nozzle, was used on the other line. In laying out the line, all the pipe had to be carried from the trailer by hand. It was found that by tying the pipe in bundles of 5 or 6 lengths with light cord 2 men could easily carry them even over the roughest terrain.

Because of the extremely rough terrain and the large, widely scattered burning spots, it was necessary to repeatedly tear down and re-lay the lines, which varied from 200 to 1,000 feet in length. Often elbows were used to reach fingers in the fire at right angles to the main line (fig. 3). It would have been impossible to obtain enough labor to have handled comparable hose lines in the heavy cover and rough terrain encountered on this fire. It was found that the pipe would swing up, down or sideways several degrees at each joint without leaking, thereby making it possible to make a considerable turn in a distance of 4 or 5 lengths. Occasionally a piece of stump had to be placed under a joint for support where the joint passed over a very high cradle knoll. Usually sections could be just stuck together and the line would nearly conform to any surface.

This fire was pumped out in 11 hours and all line was picked up and moved out in less than an hour after the pump was shut down, using only 6 men to carry and load the pipe. It would have been virtually impossible to have pumped out this fire in 8 additional hours, using 10 more men, had hose been used.

In the past, it has always been difficult to obtain sufficient labor to pick up hose. Drafted labor simply balked on picking up heavy, wet, dirty hose, or tried to slip away when the work started. During the period covered by this report, several thousand feet of pipe was laid and picked up but not once did anyone complain or try to sneak away. In fact, the men seemed anxious to stay and help with the job. The pipe, even when laid through burned areas, is much cleaner and easier to handle than hose.

In summary, the advantages of irrigation pipe over hose are as follows:

1. It is much faster to lay and pick up.
2. It requires much less labor to handle.
3. It is cleaner and easier to handle.
4. It requires less maintenance (cleaning, drying and storing after use).
5. It can be used over longer distances because of less line loss and better pressure.
6. It does not deteriorate in storage.
7. With reasonable care it will outlast hose several times.
8. Its use makes possible the pumping out of fires rather than letting them smolder and burn out under patrol.

ACCIDENT CHECK LIST FOR FOREST FIRE FIGHTERS

(From information submitted by California Region, U. S. Forest Service.)

A. Protecting men on fireline:

1. Fire bosses must always have in mind a clear-cut plan of action to be followed in case a fire "goes bad."
2. Size up the possible risks and have a plan in mind of what to do with crew in case of emergency.
3. The boss must get his men together, give them their instructions, tell them nothing that will unnecessarily excite them, and above all keep them together.
4. If any break away to follow their own ideas, get them in hand, but don't risk the lives of the rest of the crew.
5. Have men keep hand tools with them, because they may be of great value in protecting the men.
6. Even though it may be hot, the burned-over area is safe if it has crowned out, and the burned-over area is often best even if the surface alone has burned.
7. Remember that men can travel downhill faster than they can travel uphill and that a fire ordinarily travels uphill faster than down. (*WARNING:* Fires can run rapidly downhill, especially at night when wind typically blows downslope.)
8. Do not travel ahead of a fire in the same direction that it is spreading fastest unless you know there is some safe place ahead that positively can be reached by the crew.
9. When it is not possible to get within the burn, it is better to "side step" or flank the fire and get men to one side of the advancing front by traveling parallel or obliquely to the front, than to try to outrun the fire.
10. In getting away from a fire, pick the most open ground possible and avoid dense brush where travel is slow and where men may become separated and thus go astray.
11. Suffocation is a greater risk than heat, so instruct men to keep damp cloths over their noses and to stoop low and breathe the air next to earth.
12. If there is no possibility of getting away from the front of a fire, get the men to water if possible.
13. Do these things to avoid the necessity for "last resort" emergency action:
    a. Keep your head.
    b. Keep alert to what the fire is doing—lookouts.
    c. Keep alert to what the fire can do—fire behavior know-how.
    d. Keep up-to-minute plan of get-away action in mind—burned over area? Side stepping?
    e. Cut or hack an escape route when fighting fires in dense brush.
    f. Act decisively and promptly when escape action is needed.
    g. Be prepared for emergencies.

B. Tree felling:
   1. Shout a warning as a tree is about to topple over.
   2. Fell trees into other trees only after due warning as to the number of trees or snags that may be knocked down.
   3. Carefully bring "lodged" trees to earth.
   4. Keep track of the location of other nearby workers.
   5. Be on guard against "kick-back" of a tree when severed from the stump.
   6. Wear hard hats for protection against widowmakers.

C. Watch the action of burned or burning snags. (Remember that a snag burned off at the ground or higher up usually makes little or no noise until it strikes the ground.)
   1. Watch the effect of wind action on snags or green trees that have burned around the base and spot the dangerous ones.
   2. Spot badly weakened snag tops.
   3. Size up the consequences of a falling snag (flying limbs or chunks of wood or falling of other snags).
   4. Realize that the danger of falling snags is not at the beginning of a fire, but rather after the fire has burned for some time, weakening the timber.

D. Rolling logs on steep slopes—watch:
   1. Those burning off.
   2. Those started by the natural falling of trees and snags.
   3. Those resulting from action of men.

E. Rolling rocks on steep slopes—watch:
   1. Those started by burning out of their supporting material.
   2. Those started by falling snags and trees.
   3. Those started by the walking of men or animals.
   4. Those started by tractor line building.

F. Safe handling of edged tools—remember:
   1. Axes glance or hang on overhead limbs.
   2. Saws can cause accidents by men falling on them or men being hit by a carelessly carried saw.

G. Drive carefully when going to a fire, and don't overload trucks or boats in excitement of fire fighting. Put tools in toolboxes, not loose on floor.

H. Watch tractors on steep slopes. Maximum safe side slope for a D-7 is 45 percent.

I. Guard against dangers of falling over a cliff, or on steep ground.

J. Avoid infections resulting from:
   1. Blistered feet.
   2. Carelessly dressed or undressed minor wounds.
   3. Burns or scalds.
   4. Insect stings or snake bites.

K. Prevent illness from:
   1. Lack of sanitation.
   2. Too free use of water.
   3. Tainted food.

FORCE ACCOUNT VERSUS COOPERATOR CREWS

LEWIS G. WHIPPLE

Assistant Chief, Fire Control, Region 8, U. S. Forest Service

Twenty-five years ago there was little opportunity for choice between Force Account and Cooperator Crews on the national forests in the States which now make up Region 8. Improvement crews were few and far between while poor roads, slow vehicles, and uncertain communications limited the area they could effectively cover. Numerous warden crews were the mainstay of the suppression organization, oftentimes taking independent action and turning out on short notice at any hour of the day or night. Many members of such crews were living on what came to be known as subsistence farms and welcomed (sometimes encouraged) a small cash income from fire fighting.

The advent of the Civilian Conservation Corps quickly changed the picture. One or more 200-man camps on each district provided finances, manpower under trained leadership, abundant transportation, and the resources with which to improve communication. Cooperator crews, while still experienced and capable, were needed only during peak periods of occurrence or periods of high fire danger. As the years passed, they very largely dropped out of the picture.

The termination of the CCC program, coupled with World War II, caused another major change in the region's fire organization. The camps were gone, force account operations were at low ebb, and major reliance again had to be placed on cooperator crews. However, on Coastal Plain forests, experience had already shown that manpower alone was not the solution to the increased volume of flammable rough and young reproduction resulting from years of effective fire protection. The answer was found in highly mobile plow units and a planned program of prescribed burning for rough reduction and silvicultural purposes. The use of plow units was later extended to Piedmont forests. It is now characteristic of fire suppression on Coastal Plain and Piedmont units that hand tools merely supplement fire-plow line construction.

On the mountain forests of the southern Appalachians and Arkansas, major dependence must still be placed on line construction with hand tools. Plow units are being used to an increasing extent, but ordinarily must be supplemented by raked line. Many districts, because of difficult topography, low fire incidence, or a combination of these factors, do not have plows. It is on these mountain districts that both force account and cooperator crews are still used, and where there is room for decision as to how their use should be coordinated.

During the years which elapsed since the early thirties, there have been major changes in transportation, communication, and work programs. There are roads now where no roads existed, dirt roads have been graveled, and gravel roads have been blacktopped. Trucks have more power and better gear ratios. Radio has replaced or supplemented telephone lines. The road crew has burner lit 10 piles and called out when he had finished. Time for lighting 10 piles was recorded in minutes and tenths. Fires that went out after they appeared to be established were not rekindled. A tally was made of piles that did not burn, and all other piles were inspected to see whether they had burned clean.

Table 1 summarizes the results of the experiment. It is apparent that the roofed piles were ignited much more rapidly than the unroofed. The surprising thing was that the little 2- by 2-foot roofs proved almost as beneficial as those that covered 4 times the area. Probably the explanation lay in the relative accessibility of the different classes of piles. Walking time between piles was noticeably less in the 2- by 2-foot pile area than in the other 2 areas because of the gentle slope, short distance between piles, and proximity of all piles to a road.

TABLE 1.—*Time required to ignite roofed and unroofed slash piles, Coeur d'Alene National Forest, November 1953*

Burner	Time required to ignite 10 piles that had—		
	No roof	2- by 2-foot roof	4- by 4-foot roof
	Minutes	*Minutes*	*Minutes*
No. 1	13.2	8.6	5.8
	13.6	11.5	[1] [2] 9.0
No. 2	[1] 14.5	10.7	6.8
	12.8	4.5	6.1
No. 3	10.5	7.3	[1] 10.0
Average	12.92	8.52	7.54

[1]Exceptionally long walking time.
[2]Ran out of propane; two piles lighted by burner No. 2.

The first attempt at ignition was much more successful for roofed piles than for unroofed. Twelve unroofed piles out of 50 failed to burn after the first ignition effort, against 2 piles with 2- by 2-foot roofs and 1 with a 4- by 4-foot roof. The last-mentioned pile failed to burn only because the man lighting it got in too big a hurry; it burned well when the torch was reapplied, without any change in the pile itself. The burners complained that many of the unroofed piles were poorly made, but the same complaint might have been made about a number of roofed piles that were ignited without difficulty. In fact, one burner reported lighting a 4- by 4-foot roofed pile that he would have passed by as unburnable had it not been roofed. It appeared that the so-called "poor" unroofed piles were most often simply those that lacked a natural roof of closely packed, needle-bearing branches.

All piles that were ignited satisfactorily burned clean. The time required for them to burn out was not measured. Differences in burning time appeared to vary more in proportion to the amount of fine material in the piles than in relation to the presence or absence of roofs.

A statistical test showed odds of 99 to 1 that roofing would always prove similarly advantageous in comparable situations. The test showed no difference in effect between 2- by 2-foot and 4- by 4-foot roofs. The cost analysis and subsequent discussion are based on the larger sized roof in order to be ultraconservative in estimating savings and to avoid the possibility that the apparent effect of the small roofs was due largely to accessibility.

In the experiment a given number of slash piles with 4- by 4-foot roofs were burned in 58 percent of the time required for burning the same number of unroofed piles. Put another way, this means that about 70 percent more roofed than unroofed piles can be burned in a given length of time. For practical purposes the actual time per pile determined in the experiment means nothing. The burners were ready at their first piles when the order to start was given, and they quite obviously worked at top speed. The percentage figures can, however, be applied to an average day's accomplishment in burning unroofed piles to get a rough idea of possible savings due to roofing.

The slash-burning crew had worked on the same logging chance on the preceding day, under almost identical weather conditions, burning unroofed piles only. Accomplishment for the day was 235 piles, more or less. A conservative estimate of the cost of keeping such a crew on the job in 1953 is $50 a day; this includes wages, transportation, propane, and incidentals. The cost per pile was, therefore, 21.3 cents. A 70-percent increase would bring the number of piles per day to 400, at an average burning cost of 12.5 cents. The straight. cash-on-the-barrelhead advantage of using 4- by 4-foot roofs would be 8.8 cents a pile. from which the cost of paper must be deducted.

It is apparent that the saving per pile varies inversely as the number of piles that can be burned in a day. Thus, if the crew in question could burn an average of only 100 unroofed piles a day, the cost per pile would be 50 cents; the cost of burning 170 roofed piles, about 30 cents each; and the saving per pile. 20 cents. By the same line of reasoning, if the crew could burn 500 unroofed piles a day, roofing would reduce burning costs by only 4 cents a pile.

If the savings are greater than the cost of paper, an overall cash advantage is realized from roofing slash piles, and vice versa. The current cost of 48-inch Kraft 30-30-30 Vulcan waterproof paper f. o. b. Spokane, Wash., is 0.45 cents a square foot, or 7.2 cents for a 4- by 4-foot roof, leaving a cash saving of 1.6 cents a pile. But the paper used in the experiment was Kraft 30-30-30 Leatherback which cost 19.2 cents per 4- by 4-foot roof, so a net loss of 10.4 cents a pile was incurred. Figure 1 shows the saving per pile, prior to deducting the cost of paper, effected by roofing in relation to number of unroofed piles that can be burned per man-day. While production would vary a little according to crew size, the figure affords a rough guide to the margin available for purchasing paper and also for putting it in the piles if this involves extra cost.

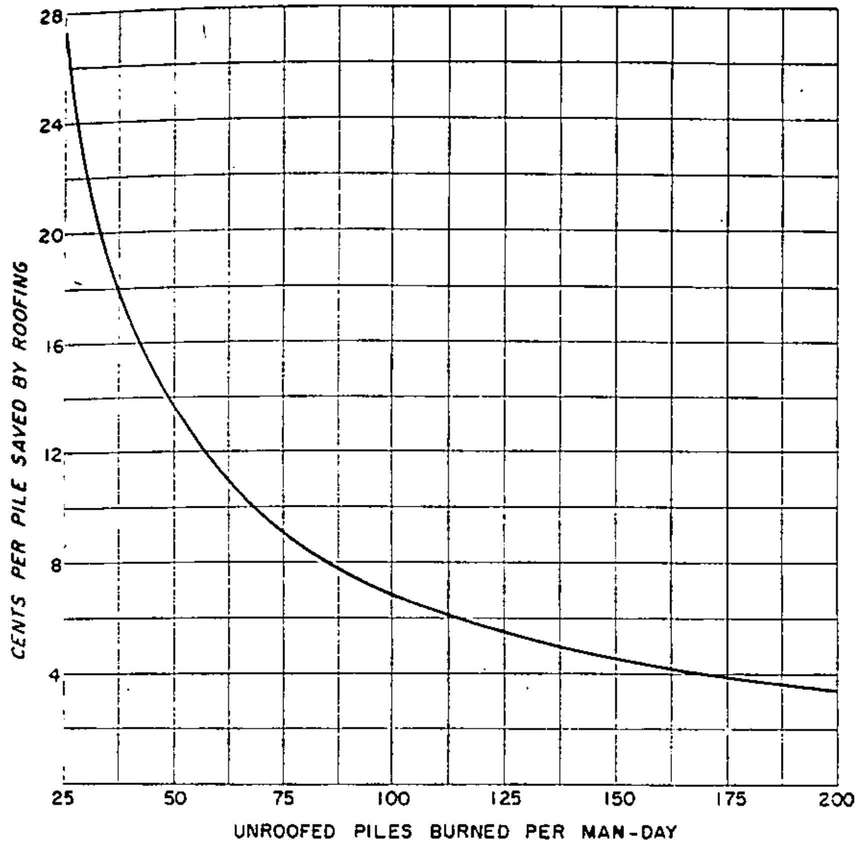

FIGURE 1.—Savings per pile roofed in relation to number of unroofed piles that can be burned per man-day.

Cash savings are not the only reason why roofing slash piles is good business. An even better reason is the certainty that roofed slash can be burned expeditiously when there is no longer any danger that slash fires will spread. No dollar value can be placed on this factor; seasons and situations vary too much. But many thousands, yes probably millions of dollars have been spent over the years in checking slash fires and in extinguishing those that got away because they were started in too dry weather or hung over into a dry period. As a consequence of diverting money to fire fighting, the overall slash-disposal program has suffered. The diversion of manpower to fire fighting has set back other activities. This waste of money and manpower, this handicap to constructive work, would be greatly reduced if the burning of piled slash could always be accomplished rapidly after the fire threat is definitely over.

This experiment dealt with hand-piled slash most of which had the needles attached, the easiest kind of slash to burn. Roofing should have a greater advantage if the needles have been lost, as in the case of old slash and hemlock and spruce slash of any age. The same principles should apply to machine-piled slash. Rather delicate timing is required to burn 'dozer piles, and the danger of hangover fires is great because of the large amount of heavy material. Further study is planned to get definite information on the value of roofing 'dozer piles and hand-piled slash that has lost its needles.

There is nothing magical about the 4- by 4-foot roof. A somewhat smaller or differently shaped one may be just as effective. In this experiment the apparent advantage of the 2- by 2-foot roofs was heavily discounted for two reasons: (1) The piles were more accessible than those in the other two classifications and (2) the piles were exceptionally well-constructed and contained plenty of fine material. A disadvantage of the small roofs is that they cannot be seen after the pile has been completed. Time may be lost in searching for the dry spot in the pile. Where larger roofs were used, an edge or corner of the paper could usually be found without much looking. It seems reasonable to believe that a substantial part of the pile should be kept dry if a complete burn is to result after the unroofed part is saturated. Savings will be increased, however, to the extent that smaller roofs can be used without a corresponding reduction in efficiency.

The experiment described in this article was too small to provide a completely dependable dollars-and-cents estimate of how roofing slash piles affects slash-burning costs. Certain generalizations appear to be well-supported, however:

1. About 70 percent more roofed than unroofed piles can be burned in a given period of time.

2. Under the right conditions an appreciable cash saving can be effected, or a loss can be sustained.

3. The factors that govern the amount of saving or loss are the cost of paper and the ease of burning unroofed piles.

4. The financial advantage of roofing should be greatest if the slash has lost its needles.

5. Probably the greatest benefit derived from roofing slash piles is the ability to burn efficiently when the danger of wildfire is past. The cash value of this ability is great, over the years, but cannot be estimated accurately.

6. It appears that money almost certainly will be lost unless roofs are put on as part of the piling job.

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Sheep Fight Fire

The California Log of September 28 reports the following interesting entry in a diary of R. P. Biglow, R-5 retiree who was in the Forest Service from 1902 to 1936; "August 9, 1902—Left Burton Meadows at 7 a.m. Found where someone had set a fire on Company land and Jeff and Frank Lewis had fought it and had it under control. They had driven their sheep around the fire and made a good, wide trail. They had to clear it out in only a few places with shovels. It was about 20 acres in area. A new one on me and a new use for sheep."

HAZARD REDUCTION BY SNAG BURNING

WYNNE M. MAULE

Timber Management Assistant, Modoc National Forest

An economical and yet highly successful method of felling snags has been developed on the Modoc National Forest during the past 7 years, resulting in efficient hazard reduction. Its originator was Clarence McCulley, assistant on the Goose Lake District of this forest, and there has been little change in it.

The equipment needed per man is 1 hard hat, 1 Alemite spring-spray gun, 1 1-gallon canteen, 1 double-bit ax, and an adequate supply of large wooden matches. In addition, a supply of diesel oil and gasoline is needed. For the 3- to 5-man crews used on the Modoc, a mixture of the diesel oil and gasoline is made in a 5-gallon safety can. Since most of the burning is done in freezing or near-freezing weather, there is little danger from too rapid volitilization of the mixture and resultant explosion. The mixture, usually 1 gallon of gasoline to 4 of diesel oil, must be varied to suit the work-day temperature. The advantage of this mixture over that of straight diesel oil is a gain in time in igniting the material to be burned.

The lands involved in the Modoc's winter program of hazard reduction were cutover lands upon which there had been no previous work of that nature. The type was East Side Sierra Ponderosa Pine, site IV, and the number of snags per acre varied from 1.0 to 2.9 with the average about 1.6.

The crew covered the area by strips, the men being approximately 5 chains apart. The majority of the snags showed considerable rot, and the sapwood had decayed in all. First, a hole was chopped into the base of the tree as close to the ground line as possible, away from or in between large roots, until the dry inner part of the tree was reached. Quite frequently the inner part was solid pitch and further chopping was necessary to acquire enough pitch chips to provide sufficient kindling to ignite the entire base. In many cases, however, the inner core was honeycombed, which insured a successful burn. When the hole had been made and the chips loosely piled in, just enough of the diesel oil-gasoline mixture was sprayed onto the chips to provide for proper ignition (fig. 1). One gallon of mixture was sufficient to ignite approximately 50 snags. After the fire had made a start, pieces of bark were piled in such a manner as to form a chimney and concentrate the heat of the fire against the snag (fig. 2).

Results to date have been highly successful. Spot checks of the burning have indicated that as high as 90 percent of the snags ignited have fallen. In no cases have results shown less than 70 percent fall. In the spring a power-saw crew can fell the remaining snags with a minimum of expense involved. In addition to the successful percent of fall, many of the snags burn up completely, thus reducing considerably the heavy fuel concentration on the ground. Estimates of the snags that burn completely have ranged as high as 50 percent, with 25 percent probably a more realistic estimate. In nearly all cases the stump burns completely.

FIGURE 1.—Hole is located close to ground line and away from large roots, and the diesel oil-gasoline mixture is applied to chips piled in hole.

Snag felling is a hazardous operation no matter what the method, and safety instructions to the crews must be an integral part of the job. Hard hats are mandatory because the danger of falling limbs and bark is always present. Bark in particular presents a danger in that it is often pulled from the snag in order to place it around the fire, and in being pulled large sections of it are loosened higher up on the tree. Proper use of the ax should be reviewed especially with regard to proper stance, since the ax glances easily when a pitchy snag is encountered.

Because the porportions of the diesel oil-gasoline mixture are made compatible with the work-day temperature, little additional risk is created over that of a straight diesel oil. It is desirable, however, that one man do all of the mixing to insure proper proportions each time. If quantities larger than 5 gallons are mixed and stored, storage should be in a barrel in the open. Cloth on canvas covers should be removed from the 1-gallon canteens before

FIGURE 2.—Pieces of bark are arranged to provide for retention of heat against snag.

use, because they will become saturated with the fuel mixture, which in time will rub off onto the men's clothing. The Modoc canteens have been painted and labeled to insure that they will be used only for the fuel mixture.

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Smokey Bear travels far.—Included in a box sent to a missionary in the Belgian Congo by one of the Circles of the First Presbyterian Church of Tallahassee were a few Smokey Bear blotters and bookmarks. In her letter of thanks, Mrs. Reinhold said, "I wish you could have seen the expression on the children's faces when I gave them blotters for this term of school. They couldn't believe they were blotters at first because they had a picture on them. They were intensely interested in the bear that wore a hat and wondered if all the animals in America wore hats."—*Region 8 News Sheet, March 1954.*

FIRE EFFECTS STUDIED IN EAST TEXAS

EDWIN R. FERGUSON and GEORGE K. STEPHENSON

Southern Forest Experiment Station

In managed stands of longleaf and slash pine, foresters now prescribe deliberate woods burning—but under rigorous controls—to remedy certain unhealthy or dangerous conditions. Such prescribed burns have cured longleaf seedlings suffering from brown-spot needle disease, have reduced hazardous fuel accumulations, and have consumed litter or brush that keeps pine seed from germinating or rooting. In the level, sandy soils of of the lower Coastal Plain, such benefits from prescribed burning have not been offset by serious site deterioration or watershed damage.

However, things are different in the rolling, hilly shortleaf-loblolly belt in east Texas. Here brown spot and fuel accumulation are no problem, but thickets of young hardwood challenge the establishment of second-growth pine.

Many foresters believe that prescribed burning (fig. 1) is the most economical method of knocking down these thickets and at the same time creating a favorable seedbed for pine. Whether fire is cheaper and more effective than poisoning, frilling, girdling, or other techniques must be individually investigated for each stand;

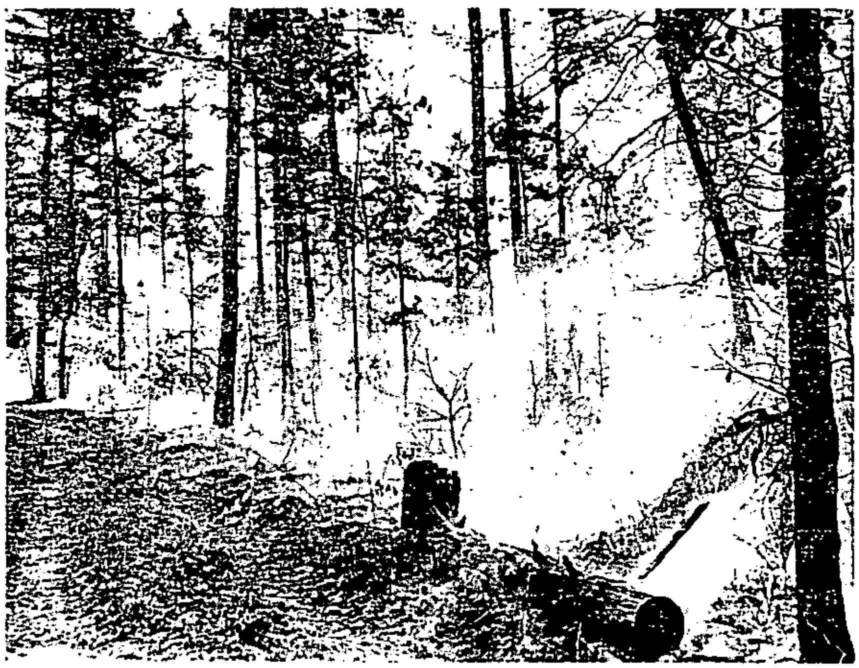

FIGURE 1.—An experimental prescribed burn in the rolling shortleaf-loblolly pine type of east Texas.

the most important factors seem to be size and number of hardwoods and size and number of small pines.

But there is doubt about the wisdom of using fire in hilly country even where it might be cheaper and more effective than alternative methods of killing undesirable hardwoods. That doubt is fathered by concern that burning might cause increased floods, soil erosion, siltation, and decreased supply of ground water. Until it is ascertained that prescribed fires do only negligible damage to the soil and watersheds of rolling uplands, Texas foresters cannot conscientiously burn for hardwood control and seedbed preparation.

In cooperation with the Texas National Forests and Stephen F. Austin College, the East Texas Research Center of the Southern Forest Experiment Station is trying to measure the effect of prescribed fires on the soil and its capacity to absorb and store rainwater. This involves setting up catchment apparatus to measure water runoff and soil movement (fig. 2), and instruments for measuring electrically the amount of moisture retained by the soil. Still another gadget is being used to estimate the maximum rate at which the soil can absorb rainfall to recharge underground moisture.

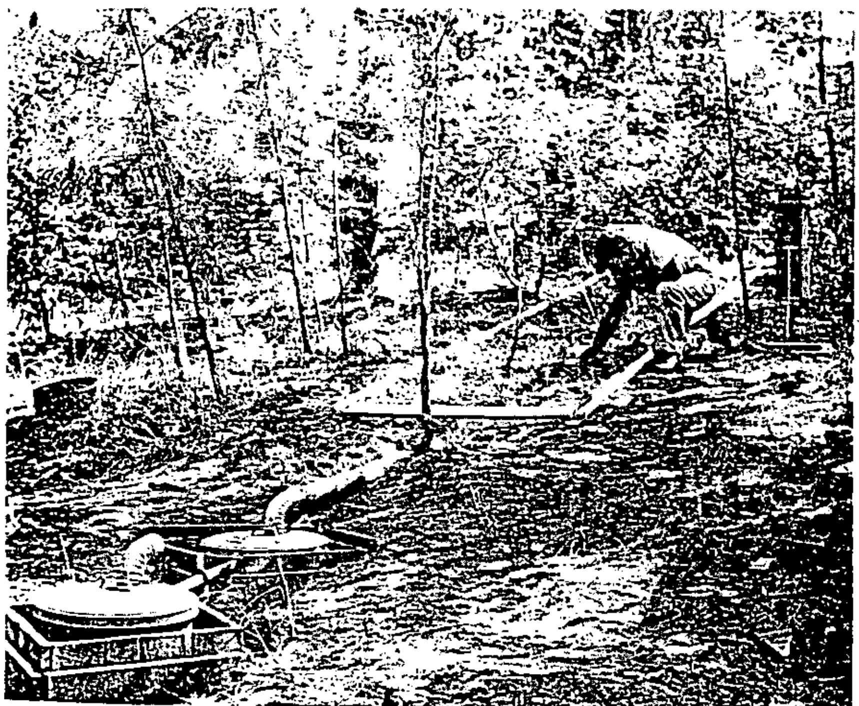

FIGURE 2.—Rainfall, surface water runoff, and soil movement are being measured in this scene. Paired installations on burned and unburned sites observed for several years will allow foresters to estimate differences caused by fire.

Investigating the effect of prescribed fire on upland soil and watershed characteristics is the major item in the East Texas Research Center's program of fire studies, because Texas lies in the dry western limits of southern pine growth, where water is usually a critical factor. However, other phases of the fire problem are also being studied.

Several bumper pine seed crops have occurred since 1945, but practically no seedlings have survived the dry summers. There are indications that preseedfall burns would allow a greater number of seedlings to become established and withstand drouth by lessening competition—not only from hardwoods but also from grass and other plants.

There are also indications that repeated prescribed burns at intervals of several years can be used to prevent hardwoods from reaching a size where they are immune to ordinary fires. There is much interest in the maximum size of hardwood which will be consistently killed back by prescribed fires. Similarly, there is much interest in measuring the damage done to pine of various sizes by such fires, so that appraisals can be made to determine whether individual stands would suffer more than they would gain from the use of fire.

Also, some criterion is needed for evaluating the risks involved in leaving merchantable pines that have been damaged to various degrees by prescribed or wildfires. Such a criterion would allow more intelligent salvage cutting and seed-tree selection. Lastly, there is the matter of selecting the most suitable time and technique for prescribed fires—different objectives may require different seasons, weather, or methods.

Experience is being built up about all these things. If it is ascertained that prescribed fire in the hill forests of east Texas results in negligible damage to watershed or soil, foresters will have the know-how to use this new tool to best advantage where stand conditions are such that fire is cheaper and more effective than alternative measures.

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Luminescent Hair

Fire Control Aid Francis D. Newcombe and I experimented with paint on the horsehairs of the fire finder, using luminescent Royal Dutch Nite Glow. We gave the hairs three light coats, leaving a large droplet at each. A flashlight beamed directly on the cross hairs causes them to glow clearly in a darkened room. During a recent night fire, the luminous hairs gave a perfect reading. We hope this will be helpful to others.—MARY E. GORMLEY, *Strawberry Peak Lookout, San Bernadino National Forest.*

AN ALL-WEATHER SHOP FOR RECONDITIONING FIRE HOSE

W. J. EMERSON

Superintendent, Superior National Forest

The problem of cleaning, testing, drying, and repairing linen fire hose is a difficult one for many fire control agencies, because much of the work must be done outdoors where unfavorable weather often makes the job a prolonged and expensive one. To this must be added the critical problem of how to quickly recondition hose during bad fire seasons so that it is clean, sound, and dry for each fire.

These problems faced the Superior National Forest, where lots of linen hose is used on most fires, and where weather favorable to hose reconditioning work is very limited. Also, the Forest was usually caught at the end of the fall fire season with a great deal of hose that had to be washed, tested, repaired, and thoroughly dried somehow during the severe winter of northern Minnesota so that it would be ready for early spring, peak-season fires. The answer was a complete indoor shop where all of the operations essential to hose reconditioning could be performed. Such a shop was recently completed at the Ely Service Center. Other nearby northern national forests having the same problem as the Superior use the Ely shop when necessary.

The shop is a 20- by 70-foot portable CCC barracks-type building (fig. 1). It has a concrete floor pitched 1 foot in 70 for the purpose of draining surplus and waste water. Heat is blown into the room from an adjoining shop by means of a wall fan. If the hose is quite dirty when it is brought to the shop, it is laid on the floor and prewashed by flushing the dirt off and down the drain by water pressure from a test pumper and a length of nozzled hose. The hose is then soaked in a stock tank full of water to loosen caked-on dirt or dirt imbedded in the fabric. If time allows, the hose is soaked for several hours. However, this step is sometimes eliminated if the hose is comparatively free of soot, char, mud, sand, and vegetative material.

After soaking, each length of hose is pulled through a special washer that is mounted on one end of the soaking tank. This washer is a wooden box 18 by 18 inches by 3 feet long with a transparent plastic top for observing the washing action. Inside the wash box is mounted a cast bronze hose-washing ring.[1] This "doughnut" is operated by water pressure from the test pumper by means of a short hose connected to a 1½-inch female coupling on the ring. A very thin ribbon of water under pressure is shot from the inner circumference of the ring as the hose passes through its center. This sharp stream of water washes off dirt and other foreign matter. To aid this washing action, two ordinary scrubbing brushes are mounted next to the washing ring, with bristle ends

[1]This washing ring was purchased from the Supply Officer, Region 6, U. S. Forest Service, Portland, Oreg. It is described in Fire Control Notes, January 1949.

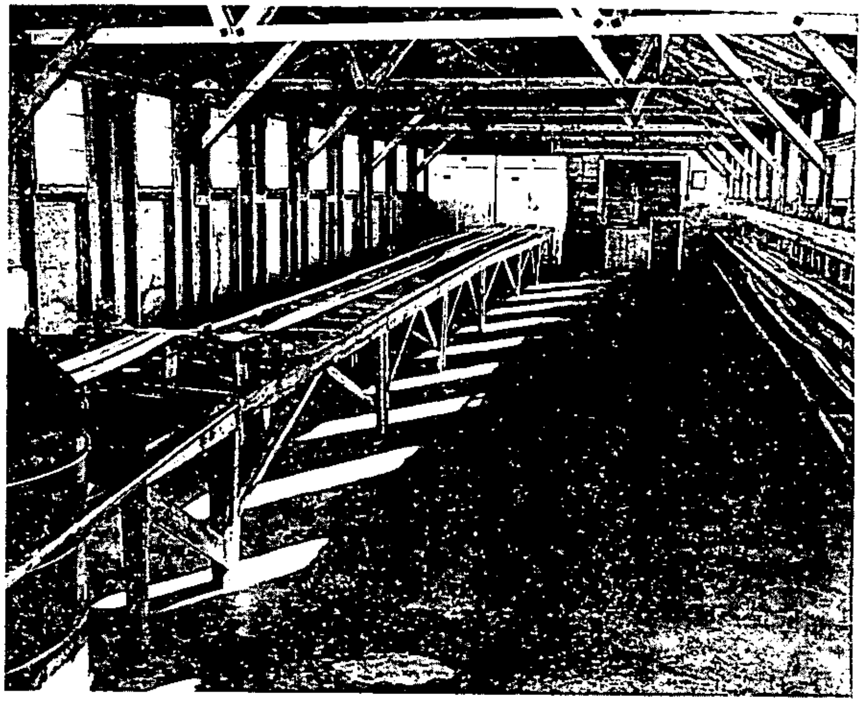

FIGURE 1.—Interior of hose reconditioning shop. Electric hose-dryer cabinets are in the background, with hose-repair equipment to the immediate right. Hose-testing assembly is at lower left in photo.

almost touching. The hose passes between the brushes as it leaves the washer, and dirt loosened by the washing ring is scrubbed off. One of the brushes is hinged so that hose couplings can readily pass through the scrubber.

During the washing process, one man usually pulls the hose through by hand so that it is convenient to stop at unusually dirty spots; a second man pulls the hose back as many times as necessary to get it clean. However, a portable hose reel could be mounted nearby the washer for the purpose of pulling the hose. This would be an especially desirable arrangement where space is limited, or where washed hose is not to be assigned to the testing rack the same day.

After washing, the hose must be tested under pressure to determine its condition, and locate breaks, pinholes, weak spots, and faulty couplings. Water pressure of about 150 pounds is provided by an ordinary portable pumper (Pacific Marine "Y") mounted on a circular, wooden test tank 4 feet in diameter and 2½ feet deep. However, a small electric-powered pump with pressure gage could be used. And if a suitable test tank is not available, the stock tank used for soaking hose might well be employed.

The test water is returned to the test tank during the operation and thus is used over and over again. This feature is particularly important from the standpoint of cost where test water is being metered from a public water source. Minor loss of test water occurs because of breaks and pinholes in the hose, so occasional additions of water must be made during lengthy test periods.

When ready for testing, the hose is laid out on top of the test rack, which is a series of lightweight tables put end to end to form a rack about 50 feet long, 32 inches high, and approximately 4 feet wide. The rack is open on top with strips built in at intervals to support the hose. This affords a chance to see breaks and pinholes on the under side of the hose. One end of the rack is against the testing apparatus, and this allows for 100-foot lengths of hose to be stretched out with a return bend to the tank. By means of a stationary 2-inch pipe coupled to the test pumper, a rigid series of siamese valves provide test control and make it possible to test as many as six lengths of hose at one time.

During the water-pressure test, the operator examines the hose carefully and marks with colored chalk all breaks, weak spots, and areas of excessive pinholes. Then the hose is taken from the test rack, rolled into loose coils, and placed on open grillwork trays in an electric dryer. This shop has 2 dryers, each of which has a capacity of 1,000 feet (10 100-foot lengths) of 1½-inch unlined linen hose, or 500 feet of rubber-lined hose in 50-foot lengths. The air in the dryer is heated by an electrical unit but is only moderately warm, the drying action being accomplished mainly by air circulation. Moist air from the dryer is expelled through the top of the unit and from the building by means of an electric fan built into each unit. Depending on the amount of moisture in the hose when it is placed in the dryer, and prevailing humidity and atmospheric conditions, it takes from 6 to 20 hours to properly dry linen fire hose for storage. Rubber-lined hose requires a longer drying time than unlined hose, and it must be completely drained of water by gravity before being placed in the dryer.

When dry, the hose is sorted. That in need of repair is kept in the shop and stretched out on long racks. Only the part of each hose length in need of repair is pulled to the repair machines, the rest of the hose length being left out of the way on the wall racks.

Hose repair consists of three different operations, any or all of which may be necessary on any particular piece of hose:

1. *Vulcanizing*—patching holes or breaks.
2. *Cutting and splicing*—removal of defective sections of hose. Splicing is also used to combine two good partial lengths of hose.
3. *Recoupling* to remove short defective sections or bad breaks near the hose ends; or to replace faulty couplings.

The patching and splicing is done on a vulcanizing press (fig. 2, *a*), which was built at a cost of $200 following plans developed by the Ontario Department of Lands and Forests. It consists of a thermostatically controlled steam-electric vulcanizing plate and a series of mechanical leverage devices for applying pressure to the patch or splice being subjected to heat. The material used for patching and splicing comes in a roll 12 inches wide and costs $1.40 a pound. This single-thickness material has replaced the old series of three layers of different materials and seems to be holding up satisfactorily. A commercial bonding agent is used. The length of time required to vulcanize a patch on linen hose is 30 minutes, while a splice takes 1 hour on the press, 30 minutes on each side. We have not had much success in patching or splicing rubber-lined linen hose, but since we are gradually replacing it with the lighter unlined hose this is not a serious limitation. As the old rubber-lined hose becomes unserviceable, it is condemned or assigned to certain restricted uses.

Another device used in repair is the hand-operated crimper (fig. 2, *b*). This machine puts a crimp on one of the cut ends of the hose so that the cut end will fit inside the other length for the splice.

The equipment required for recoupling hose consists of an expander tool (fig. 2, *c*), expansion rings, gaskets, and couplings. Since couplings suitable for reuse can be salvaged from condemned hose, purchase of this item is seldom necessary. Detailed instructions on the technique of recoupling hose can be found in some of the fire-equipment catalogs.

Before the reconditioned hose is rolled on a hand-operated winder for storage, all splices are retested on the test rack by water pressure to make sure they are sound and watertight. Patches are not retested. Ordinarily about 3,000 feet of unlined linen hose in 100-foot lengths is run through the shop at a time. During the

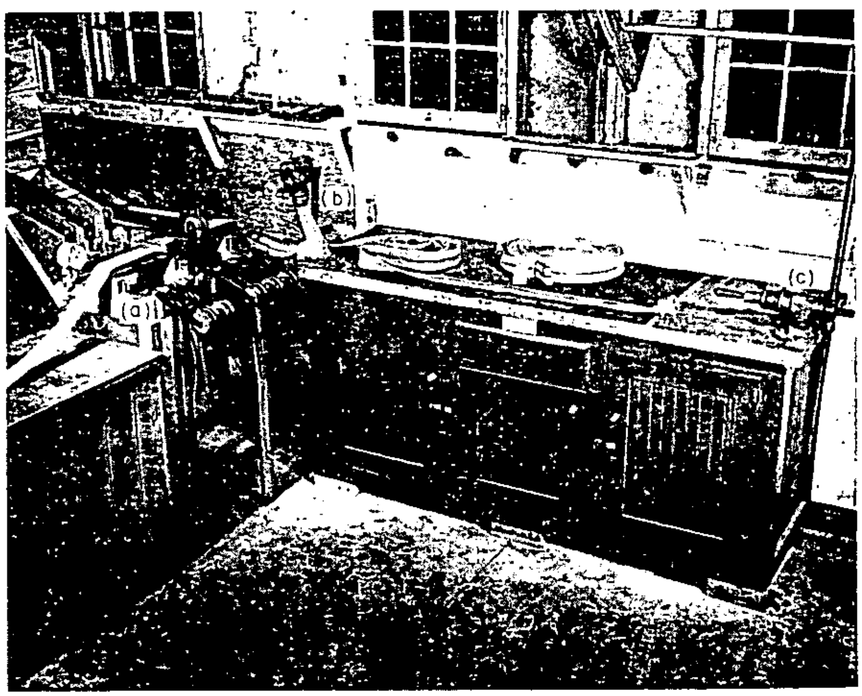

FIGURE 2.—Hose-repair equipment: *a*, Vulcanizing press; *b*, hose crimper; *c*, expander tool for recoupling.

fire season when demands for volume and speed are heavy, three men are needed to operate the shop efficiently. However, during the winter the shop is operated fairly efficiently by one experienced man who fits the various operations in with other fire-equipment repair and custodial duties. In addition to reconditioning all hose left over from the past fire season, he takes in from outlying points batches of hose that have not been used or tested for several years. Testing of this hose usually reveals the presence of several lengths of rotten or otherwise faulty hose in each batch; it is, of course, discarded and replaced with new or reconditioned hose.

A reserve hose cache at the Ely Service Center allows immediate exchange of good hose for dirty, used hose after each fire on the 10 ranger districts of the Superior. This eliminates the chance of a ranger not being ready for the next fire. The Superior's seaplanes, which are operated out of the Ely Service Center, are a great help in making rapid exchanges of good hose for used hose in remote locations.

Cost of the equipment in this all-weather hose reconditioning shop was about $1,400, but much of it was acquired several years ago at considerably less than present cost. It is estimated that such a shop could be equipped now for about $2,200, exclusive of cost of moving and re-erecting CCC barracks and adding concrete floor and drains. With new 1½-inch linen hose costing from 40 to 50 cents a foot delivered, an organization using a lot of hose but without adequate repair facilities, would probably spend as much money on new hose in 3 years as the total cost of a shop like this one, including CCC building and floor.

Costs of reconditioning hose in the Ely shop vary considerably, depending on condition of hose and size of crew needed to meet time requirements. During the fire season, 2 or 3 members of the fire standby crew are trained for hose reconditioning work, and they take care of most of it while they are at the fire control center. During the past winter a considerable quantity of hose was tested and repaired at a cost of less than 4 cents a foot; average cost of reconditioning is considered to be about 5 cents a foot, including cost of utilities prorated to the project. Because the Ely shop is newly established and our experience with it limited, and also because we have some old-type equipment, we plan to study methods and equipment used in other hose repair centers with a view to cutting down the cost of reconditioning our fire hose.

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Television Camera for Fire Detection

The hottest thing about a forest fire right now seems to be the latest experiment in Louisiana on spotting the pesky blazes by television. State Forester James E. Mixon, who witnessed the first test recently with the Louisiana Forestry Commission board, reports "very promising results."

The outdoor television apparatus was assembled by Bill Maser and Carl LeBlanc of a Baton Rouge television distribution firm and Al Vendt of the Louisiana Forestry Commission. They've tagged their brainchild with the name of "detecto-vision."

The system works with an industrial-type television camera in a plexiglas dome mounted on top of a forest fire tower. The camera is rotated continuously by means of a ratiomotor geared to less than half a revolution per minute. In other words the camera eye scans the tree tops exactly as a towerman does but in a more deliberate manner. It also sees more because it is equipped with a telephoto lens and can pick up a cow munching grass 4 miles away.

Azimuth markings are located on the dome so the camera picks up the degree readings as it scans the landscape. Because the camera's infinity lens cannot pick the degree readings up unblurred, there is a special bifocal lens included in the equipment to read the close-up numbers on the dome.

Instead of a cable, microwave transmitted the images to a television set 50 miles away at the Alexander State Forest near Alexandria. Forest fires were spotted as far as 20 miles from the camera tower.

If "detecto-vision" becomes an accepted practice throughout a parish or the State, technicians explained, there would be about three to five cameras operating to a parish. A television set for each camera in a parish would be located in a central control station where one operator would watch all sets for fires. By reading the azimuth bearing on a fire off two sets, he could immediately get a cross-out between the two and locate the exact position of the fire, much the same as is done now by towermen.

State Forester Mixon sees possibilities for the system even in the very near future "because it could well be used to give some towermen, who now are on call 24 hours a day, some rest from tower duties." He also reported that tests have been made to spot arsonists in the woods and says "many woods burners would be awfully uneasy right now if they knew how well we can focus a clear picture on a man miles away."—ED. KERR, *Louisiana Forestry Commission.*

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The Jeep Toolbox

Prior to the development of our jeep toolbox, all Forestry Division jeeps were equipped with bed extension. This was not satisfactory. A toolbox was needed to carry all of the desired fire tools where they would be protected from the weather, out of the way, and easily accessible. The toolbox also needed to be strong enough to take the pounding of rough roads and trails to which a fire jeep is subjected. Another point was to attach the box in such a manner that it would not damage the jeep and yet be in no danger of coming off in the normal operation.

With the above points in mind, the Meramec Fire Protection District built a box out of ¾-inch exterior plywood, clear one face, and the top was covered with 28-gage metal. The top was equipped with hinges and latches. The interior of the box was divided into compartments to carry 1 back-pack pump, 6 broom rakes, 1 one-man saw, 1 double-bit ax, and a canteen. Space was also provided for the jeep's tools, a first-aid kit, and flashlight.

To attach this box to the jeep, 2 pieces of 2- by ½-inch flat steel 58 inches long were bent and welded to form 2 shelf supports that were attached with bolts to the draw-bar assembly. This arrangement placed the weight of the box and tools on the heavier metal parts of the draw-bar assembly. A piece of angle iron was welded across the two shelf supports to make them more rigid and to protect the lower edge of the toolbox. The box was then bolted to the two shelf supports.

All of the Commission's jeeps are now outfitted with these toolboxes. They have been in use for nearly 2 years and have been satisfactory in every way, particularly so where the jeep is equipped with a panama pump and tank. Plans for this box can be obtained from the State Forester, Missouri Conservation Commission, Jefferson City, Mo.—LEE C. FINE, *District Forester, Missouri Conservation Commission.*

Some Pistol Flares are Dangerous

A small pistol, used primarily for athletic events, is being advertised as a device for projecting flares for signaling purposes. It is recommended as ideal for hunters, fishermen, or hikers who might be lost or injured in the mountains.

Recently this pistol with a supply of blank cartridges and flares was submitted to the Arcadia Equipment Development Center to test its potentialities as a fire hazard (fig. 1). The pistol can be used to eject gas, signal, chemical, or detonating cartridges, but it will not take ball ammunition. For signaling purposes, small flares made especially for this gun are placed in the muzzle and projected by the explosive force of blank cartridges. These flares travel approximately 100 feet vertically or up to 200 feet horizontally. A small but intensely hot flame is produced and burns 3 to 5 seconds. Even when shot vertically, some flares continue to burn after hitting the ground.

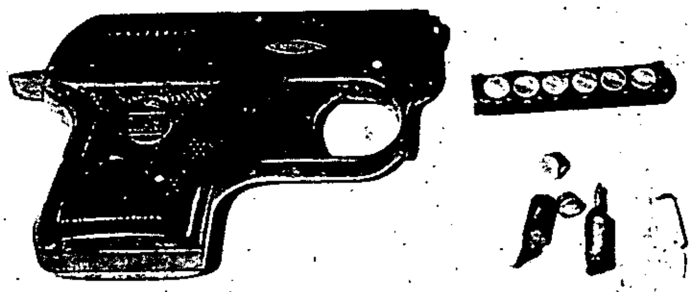

FIGURE 1.

At least 10 fieldmen, besides Equipment Development men, observed the use of these flares and readily agreed that the flares should be prohibited in forest areas.

The pistol was also submitted to the Chief of Police in Arcadia, Calif., for his appraisal. He considers it as a weapon, the use of which is restricted by law. In other words, the pistol should not be used promiscuously by the public, although it could be carried legally by hunters and fishermen. But since it resembles a toy and is priced under $10, it might easily get into the hands of irresponsible people and even children.

The general consensus of those who have tested the pistol is that its use in forest areas should be prohibited; from the standpoint of law-enforcement agencies, the use of this pistol should be restricted under existing laws on firearms.—ARCADIA EQUIPMENT DEVELOPMENT CENTER, *U. S. Forest Service.*

INSTRUCTIONS FOR USING FOREST FIRE DANGER METER TYPE 8 [1]

JOHN J. KEETCH

Forester, Region 7, U. S. Forest Service

INTRODUCTION

The following instructions apply to meter 8-W (woods-type station), and to meter 8-O (open-type station), issued by the Southeastern Forest Experiment Station. These meters replace type 5-W and 5-O, in U. S. Forest Service Region 7 territory, effective January 1954. The shift in fire danger meters has been approved by the Regional Forester for use on national forests, and by the State Foresters at their June 1953 meeting in Philadelphia.

The changes incorporated in meter 8 were suggested by experienced fire control officers throughout the region who wanted a more consistent meter, particularly with respect to the fire danger build-up during drought periods. Also, a meter was wanted that did not overrate periods of subnormal fire danger when days are relatively cool and intermittent light showers occur. Briefly, meter 8 retains the same basic factors as meter 5, but differs in three respects: (1) A "Build-up Index" disk replaces the disks on the type 5 meters representing season of the year, last rain in inches, and days since rain; (2) condition of vegetation has 5 settings instead of the former 3; and (3) the burning index scale, which is identical with the type 5 meters from 1 to 100, has been extended to 200. The extension was made so that stations in a district network having readings above 100 could be more accurately averaged when computing the district burning index.

During periods of "normal" fire danger, meter 8 will give approximately the same burning index as the type 5 meters. During easy fire weather, the daily burning index will be lower. When extended droughts occur, or shorter periods of hot, dry weather, the burning index will usually be higher—up to 150 percent of meter 5.

Because of these changes in the fire danger factors, the instructions discussed here and the revised form for recording daily fire danger (Form 14-R-7, Rev. Jan. 1954) must be used with meter 8. There has been no change in the standards for selecting danger station sites, or for installing and maintaining the fire danger equipment. These standards, and the procedures to be followed in taking the measurements of wind velocity, fuel moisture, and rain, are described in USDA Handbook 1 and Southeastern Station Technical Note 71.

[1] Also published as Southeastern Forest Experiment Station Paper No. 33, January 1954.

Instructions for Operating Meter Type 8-w

1. Turn the Condition of Lesser Vegetation disk (fig. 1), until the arrow on the central tab of the meter is exactly opposite condition 1, 2, 3, 4, or 5. Do not estimate a setting between the five positions.

2. Turn the Build-up Index disk until the computed build-up index is opposite the arrow at the outer edge of the Condition of Lesser Vegetation disk. Estimate position for amounts not shown between 25 and 100. Do not set at a higher reading than 100.

3. Turn the Fuel Moisture disk until the exact percent of fuel moisture as measured is opposite the arrow at the outer edge of the Build-up Index disk. If less than 1 percent, set at 1. If more than 30 percent, set at 30.

4. Turn the Wind Velocity disk until the measured velocity is exactly opposite the arrow at the outer edge of the Fuel Moisture disk.

5. Read the number representing the Burning Index in the segment opposite the arrow at the outer edge of the Wind Velocity disk. *Do not* estimate fractional parts of segments.

Relation of Meter 8 to Meter 5-B Scale:

Danger Class (Meter 5-B)	*Burning Index (Meter 8)*
1	1-2
2	3-11
3	12-35
4	40-95
5	100-200

Instructions for Recording Fire Danger Factors and Preparing Fire Danger Daily Record

The procedures discussed are illustrated in the sample Fire Danger Daily Record (fig. 2), which is based on a report from a typical woods-type station, using meter 8-W. The report for open-type stations, using meter 8-O, is prepared in the same way.

Fuel Moisture Percent (Columns 3, 11, and 14): Fuel moisture measurements should be recorded to the nearest one-tenth percent up to 20 percent; to nearest one-half percent above 20 percent. Example: nine and three-tenths percent should be recorded 9.3. If snow covers the ground in the woods at observation time (regardless of whether or not there is snow on the sticks), do not read the sticks. The letter S (for snow) should be recorded in the fuel moisture columns until the snow becomes patchy on the south slopes in the woods. Then resume reading the sticks.

Wind Velocity Miles Per Hour (columns 4, 12, and 15): Wind velocity measurements should be recorded to the nearest one-half mile, according to the wind correction table posted in the weighing shelter. Example: three and one-half miles per hour should be recorded 3.5. If anemometer cups do not turn during a 4-minute period at observation time, enter 0 (zero) in the wind velocity column. There is no need to read the wind when snow blankets the ground in the woods, because the burning index is automatically zero. A dash should therefore be recorded in the wind velocity

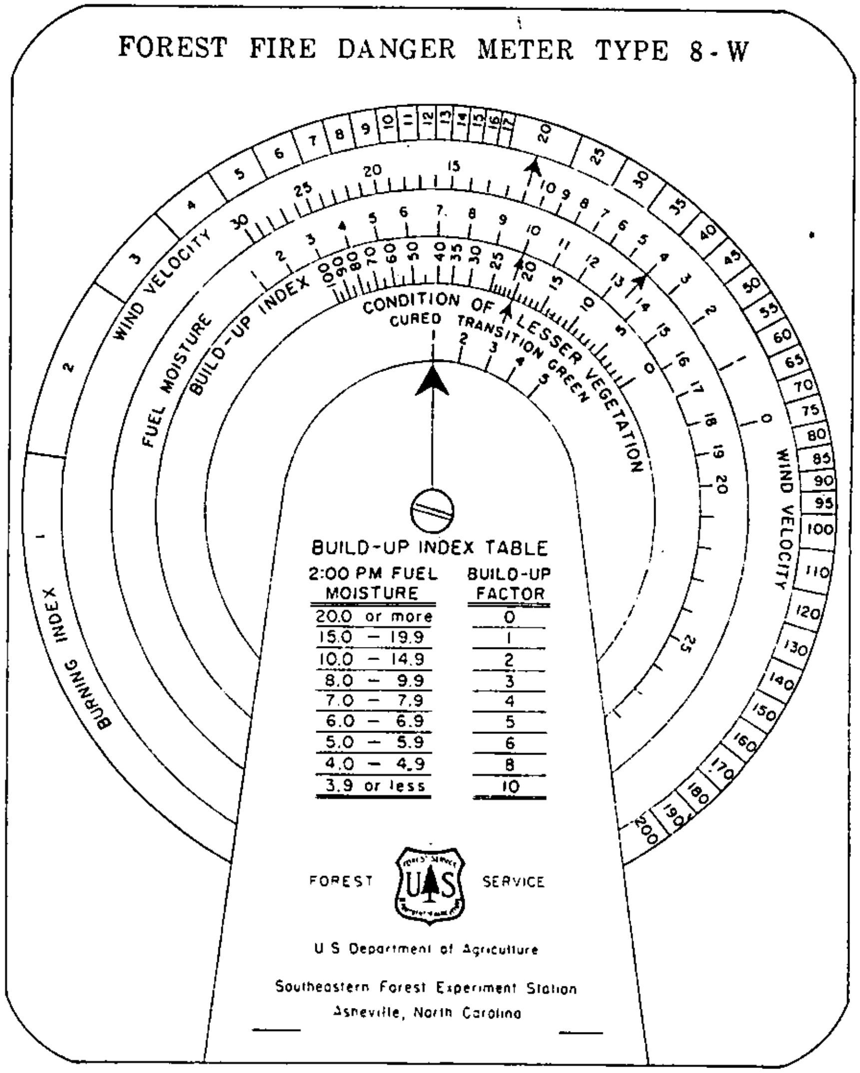

FIGURE 1.

column whenever the letter S (for snow) is recorded in the adjacent fuel moisture column.

24-Hour Rainfall (columns 6, 7, and 8): The amount of rain that has collected in your rain gage (since 2 p. m. yesterday) should be recorded in column 6, and the amount reported from a cooperating observer (if there is one) in column 7. Compute the average rainfall by adding the amounts in columns 6 and 7, divide by 2, and enter the average in column 8. When there is rain at your station, but no report is received from the cooperating station, enter a dash in column 7, and repeat your entry in column 8. When no rain occurs, zero should be recorded in column 8. [Note

Form 14-R-7 (Rev. Jan. 1954) FIRE DANGER DAILY RECORD April - 1952 (month)

Sample (State or Forest) Sample (District) Sample (woods-type) (Station) John Doe (Observer)

Day of the Month	Condition of the Lesser Vegetation	9 A.M. EST: Fuel Moisture Percent	9 A.M. EST: Wind Velocity Miles per Hour	9 A.M. EST: Burning Index	24 Hour Rainfall 2 P.M. to 2 P.M. (Hundredths): Amount of Rain Danger Station	24 Hour Rainfall: Amount of Rain Coop. Station	24 Hour Rainfall: Average Amount of Rainfall	2 P.M. EST: Build-up Index March 31 = 36	2 P.M. EST: Build-up Factor	2 P.M. EST: Fuel Moisture Percent	2 P.M. EST: Wind Velocity Miles per Hour	2 P.M. EST: Burning Index	5 P.M. EST: Fuel Moisture Percent	5 P.M. EST: Wind Velocity Miles per Hour	5 P.M. EST: Burning Index	Highest Burning Index for the Day
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1	1	50+	2.0	1	9	10	10	29	3	9.3	3.0	25	9.0	3.5	30	30
2	1	50+	3.0	1	13	25	19	15	5	6.0	5.0	35	5.3	4.5	35	35
3	1	11.0	2.5	10			0	23	8	4.0	6.0	65	3.6	4.5	60	65
4	1	8.8	0	11			0	29	6	5.0	3.0	50	5.0	5.0	60	60
5	1	50+	0	1	85	45	65	2	2	11.8	7.0	8	10.2	5.5	9	9
6	1	11.7	6.0	7			0	5	3	8.0	8.0	20	8.2	6.5	20	20
7	1	10.0	2.5	7			0	13	8	4.0	4.0	40	4.0	2.0	30	40
8	1	12.2	0	4	T	T	0	18	5	6.0	2.0	25	5.6	3.0	35	35
9	1	13.0	1.5	6			0	26	8	4.8	4.0	55	4.3	3.0	50	55
10	1	14.2	0	4			0	34	8	4.1	3.5	65	4.5	3.0	60	65
11	1	10.0	3.0	25			0	44	10	3.5	3.5	80	3.8	2.5	70	80
12	1	9.7	1.5	25			0	50	6	5.0	2.5	65	4.9	2.0	60	65
13	1	16.2	2.0	9	10	10	10	40	0	50+	3.0	1	50+	2.0	1	9
14	1	50+	0	1	40	48	44	0	0	22.0	2.0	1	20.0	4.0	1	1
15	2	17.5	3.5	2			0	2	2	11.0	4.0	5	10.9	5.5	6	6
16	2	16.0	0	1	0	T	0	8	6	5.3	3.5	20	4.5	3.0	20	20
17	2	10.2	3.5	7			0	18	10	3.5	4.0	40	3.0	2.5	35	40
18	2	9.1	1.5	10			0	28	10	3.4	3.0	50	3.1	1.5	40	50
19	2	8.2	0	11			0	38	10	3.1	3.5	65	3.0	2.0	55	65
20	2	6.8	0	20			0	48	10	2.7	4.0	80	3.1	3.0	70	80
21	2	6.9	0	20			0	58	10	3.2	3.0	75	3.5	1.5	60	75
22	2	8.5	0	20			0	68	10	2.8	5.0	100	2.7	5.5	100	100
23	2	7.4	0	25			0	78	10	3.5	6.5	110	4.0	4.5	90	110
24	2	50+	0	1	152	150	151	0	0	50+	3.0	1	50+	0	1	1
25	3	50+	0	1	78	80	79	0	0	50+	0	1	50+	0	1	1
26	3	50+	0	1	14	11	12	0	0	50+	0	1	50+	0	1	1
27	3	50+	0	1	30	65	48	0	0	50+	2.0	1	50+	4.0	1	1
28	3	50+	0	1	30	40	35	0	0	45.0	3.5	1	29.0	2.0	1	1
29	3	15.2	2.0	1			0	3	3	8.1	4.0	6	7.9	2.5	5	6
30	3	13.0	2.5	2			0	11	8	4.3	3.5	20	3.9	3.0	20	20
31																

FIGURE 2.

that the rainfall amounts in columns 6, 7, and 8 should be recorded in *whole units* (without the decimal point). For example, one hundredth of an inch (.01″) should be recorded as 1; 50 hundredths of an inch (.50″) as 50; and 1 inch and 25 hundredths (1.25″) as 125. If rainfall is less than one hundredth (.01″), enter "T" for trace.]

Condition of the Lesser Vegetation (column 2): Record numeral 1, 2, 3, 4, or 5 as advised by your district forester or ranger. Do not attempt to make a classification change without the approval of the district officer in charge. The figure to use must be based on the estimated condition of the *lesser vegetation*, such as grasses, weeds, ferns, and shrubs in *natural areas*, regardless of whether your station is the open or woods type. It is emphasized that the amount or size of tree foliage, whether the hardwood trees are in full leaf or leafless, is *not used* as a criterion in estimating the condition of the lesser vegetation.

The following guidelines will be helpful in selecting the proper condition to record in column 2:

Use number 1 when the lesser vegetation is 90 percent or more cured. This is the normal winter condition that will usually prevail throughout most of the Northeast during the 5½-month period from November 1 to April 15.

Use number 5 when the lesser vegetation is 90 percent or more green. This is the normal summer condition that will usually prevail throughout most of the Northeast during the 4½-month period from May 15 to September 30.

Use number 2, 3, or 4 when the lesser vegetation is in the transition stage, neither fully cured nor green. In normal seasons these transition stages will usually prevail for periods of approximately 10 days each, from April 15 to May 15 and from October 1 to 31. However, there is no assurance that any month in the year will be "normal," so watch out for the effects of unusual weather conditions.

In the *spring*, condition 2 may occur in late March in some years if a series of unseasonably warm days revives the lesser vegetation. Or the season may advance rapidly so that conditions 2, 3, and 4 apply only for short periods of less than a week each. A late spring freeze may set the conditions back from 4 to 3 or from 3 to 2.

In the *summer*, the thing to watch for in the normal green season is the effect of drought periods that will start curing of the lesser vegetation. Strict rules will not apply in every instance, but the Build-up Index may help in judging the condition. Vegetation condition 4 should be checked when Build-up Index reaches 40, condition 3 should be checked at 75, and condition 2 at 100. The lesser vegetation will very rarely proceed to condition 1 in the summer season. If adequate rains revive the lesser vegetation, the condition should be shifted back to 5 when warranted.

In the *fall*, with normal distribution of rainfall, the vegetation condition will usually remain in condition 5 until the first killing frost. If 50 percent of the vegetation is immediately killed, the shift would be made to condition 3, bypassing condition 4. A succession of hard freezes might produce condition 2 in a few days.[2]

Build-up Factor (column 10): The Build-up Factor is based on the 2 p. m. fuel moisture reading (column 11). Refer to the table on the central tab of the danger meter for the proper Build-up Factor, according to the measured fuel moisture. For example:

[2]The decision to change screens that shade the sticks at open-type danger stations should not be confused with the condition of the lesser vegetation. The screens are shifted in relation to the amount of tree foliage, as described on pages 8 and 10, Technical Note 71, issued by the Southeastern Station.

if 2 p. m. fuel moisture is 6.2, enter 5 in column 10; if 2 p. m. fuel moisture is 28.5, enter 0 (zero) in column 10.

Build-up Index (column 9): This is the setting used on the danger meter in place of days since rain (type 5 meters). You will note that the Build-up Index disk is calibrated from 0 to 100. Therefore, do not enter in column 9 any values less than 0, nor more than 100. The Build-up Index is computed from data recorded in column 8 (rainfall) and column 10 (Build-up Factor). The procedure is simple: Subtract the rain from the previous day's Build-up Index first, then add the Build-up Factor to obtain the new Build-up Index. In the absence of rain, simply add the Build-up Factor in column 10 to the previous day's Build-up Index. For example: Build-up Index yesterday was 20, rain 10 hundredths last night, and Build-up Factor today is 5. Today's Build-up Index would be computed as follows: 20 less 10 equals 10, plus 5 equals 15.

The Build-up Index in column 9 is the meter setting used to derive both the 2 p. m. and 5 p. m. burning index of that day. The 9 a. m. burning index, or a recording at any other morning hour, should be based on the Build-up Index of the previous day. For continuity of record, it is desirable when starting a new month to enter the status of the Build-up Index on the last day of the preceding month at the top of column 9.

Part-time Stations: Danger stations that operate only during the fire season, usually for a 2-month period in spring and fall, will have to estimate a Build-up Index in order to get started. If a yearlong key station is operating on the district, use the Build-up Index reported from the key station as a starting point, and thereafter proceed on your own measurements. If there is no key station operating, an estimate of the Build-up Index should be made on a basis of elapsed time since rain. Count back the days to the last rain of 50 or more (1/2 inch or more) and multiply the number of days by 3. For example: 6 days times 3 equals 18—the estimated Build-up Index on your opening day.

Build-up Index as a Guide to Woods Closures

The fuel moisture sticks indicate the moisture condition of the surface layer of litter. The Build-up Index reflects the cumulative build-up of flammable conditions in the litter below the surface layer. Hence, fires that occur when the Build-up Index is high and when lower fuels are drying out, are likely to be deeper burning fires that will be harder to control and will require more mopup and patrol. Since the Build-up Index will be computed daily at each danger station, the trend toward a potentially dangerous fire situation can be recognized in advance from these daily reports.

There is no single critical point on the Build-up Index scale, but values above 30 should be viewed as a warning signal that a build-up above normal is developing. To illustrate, on an annual basis, from records for the 3-year period 1950-52, less than 10 percent of the days on the Monongahela National Forest were above 30. On the other end of the scale, a Build-up Index of 80 is definitely in the danger zone. New England forests are usually closed well in advance of the 80 point. For example, the 6 closures effected in Rhode Island, 1950-52, averaged a Build-up Index of 52. Consequently, a Build-up Index range of 30 to 60 is recommended at present as a guide to the State Foresters in requesting woods closures from their governors. Closures in the lower section of this range (30 to 40) will probably be needed only when unusually high winds have prevailed, or are predicted, or when an exceptional risk is expected, such as the opening of hunting season.

In areas where a full closure calling for a governor's proclamation does not seem warranted, or in units where closure laws are not in effect, the Build-up Index should be a useful guide in stepping up prevention efforts to alert the public as the build-up progresses.

In application, the Build-up Index should be computed by districts or closure zones, as was done with the cumulative danger index, by computing an arithmetic average of the daily Build-up Index reports from the danger stations representing the unit. The Build-up Index is simpler and more accurate than the cumulative danger index; hence, the special computations involving the use of normals and adjustments for precipitation may be discontinued.

There will perhaps be some question as to how widely the type 8 meter can be applied outside of Region 7. According to the Division of Fire Research at the Southeastern Forest Experiment Station, Asheville, N. C., preliminary tests made by them indicate that type 8 meter can be used with satisfactory results for the mountainous areas of Region 8. Whether it will apply equally well elsewhere remains to be determined.

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Direct-Reading Anemometer for Recording Wind Gusts

The dispatcher at Ely on the Superior National Forest needed a device for measuring the velocity and frequency of wind gusts. Such knowledge is valuable for fire control operations; it is also a critical factor in our seaplane operations, particularly in takeoffs and landings on difficult chances. Many a takeoff or landing has resulted in a near accident because severe, unexpected gusts hit the plane anywhere from 10 to 100 feet above the ground. With wilderness fire suppression depending on many successful landings and takeoffs on critically small, narrow or rocky lakes, a better knowledge of the presence of gusts, and of their frequency and velocity was very important. Also, transportation by canoe across large lakes, an essential method in this wilderness lake country, is decidedly unsafe when strong wind gusts prevail.

The regular anemometer used for measuring wind velocity did not provide the information needed for these purposes. It also failed to provide wind velocity as a direct reading when a pilot or fire suppression crew called the dispatcher on the radio and asked for it. We found the answer to this problem in a Galegage Anemometer, a direct-reading instrument that shows us the wind velocity at any moment, and by movement of a needle on a dial, records the frequency and velocity of wind gusts.

The Galegage consists of a regular set of three anemometer cups and transmitter mounted 100 feet above the ground on a 200-foot mast that is close enough to our seaplane base to give an accurate picture of gust conditions for that area. This system is connected to a small cabinet receiver containing the gage. The cabinet is kept on the dispatcher's desk for ready reference as he talks to the airplanes and fire control forces by radio.

Further information about the Galegage can be had by writing to U. S. Forest Service, 623 North Second Street, Milwaukee 3, Wis.—WILLIAM J. EMERSON, *Superintendent, Ely Service Center, Superior National Forest.*

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.


Vacation Time...or anytime
PROMISE TO BE CAREFUL
SMOKEY
..careful with Matches
..careful with Smokes
..careful with Campfires
..careful with Any Fire!
Remember—Only you can
PREVENT FOREST FIRES!