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FIRE CONTROL NOTES

A PERIODICAL DEVOTED TO THE TECHNIQUE OF FOREST FIRE CONTROL

FOREST SERVICE • U. S. DEPARTMENT OF AGRICULTURE

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

Volume 14 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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ACTUARIAL FIRE PLANNING IN THE NORTHERN REGION

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Fire control planning differs from many types of planning because the immeasurable and unpredictable features greatly outnumber the stable. For this reason it becomes necessary to anticipate the results that may be expected from a combination of separate elements, many of which cannot be accurately weighed by themselves. This places the fire control planner in almost an identical position with the insurance actuary, hence the term "actuarial fire planning."

The problem is to calculate the mathematical probabilities that certain conditions will exist as a result of certain combinations of stable factors and imponderables, according to the specific time of year and locality; to interpret the results of these calculations in terms of men, machines, and other facilities needed to meet each situation; and finally, to identify these various "levels of preparedness" according to the impact of weather conditions on each major fuel type.

There are many combinations of circumstances which may result in the need for a certain number of men and machines at a given place and at a given time. If we are caught short, it makes little difference what the reason was. Any one combination of circumstances is not likely to be repeated in the same manner within the span of a reasonable planning cycle. In attempting to use individual factors which in various combinations go to make up the fire load, we complicate the problem by introducing a series of elements about which we can do little more than speculate. It is proper, of course, to continue the study of these elements with the idea of developing better forecasting results for our day-to-day action; but for the advance organization and placement of men and other facilities, we need to simplify our methods. That is the reason for actuarial planning, which analyzes and measures the results of the past and converts them into terms of future probabilities.

Basic Material

In order to develop a complete series of actuarial tables, it is first necessary to conduct an individual fire analysis, a transportation analysis, and a number of additional, separate studies regarding certain phases of fire control activity. Emphasis should be

placed on the importance of getting the best available information in all cases. There should be no hesitancy in utilizing data that has been worked up for other purposes or in other regions provided it is applicable and the best that can be obtained. On the other hand, the entire planning project need not be delayed simply to wait for the completion of a long-range research study. Use the best data that exists, but if nothing else is available within reasonable time limits or realistic financial limitations, individual judgment may have to be resorted to in certain instances. Only by this means can the plan be carried to its "payoff" conclusion. If we slow up the whole job in order to substitute measurements for estimates in a few isolated cases, we may find that the good reliable data has become obsolete before it can be put to use.

Allowing for the normal losses in pioneering a work of this kind, the Northern Region spent approximately 2½ man-years annually, plus 6 weeks per year per forest, contributed by regular personnel, for a total period of 5 years, to complete the job of analyzing basic material.

Following are brief descriptions of the important analyses and special studies that are basic to the plan.

The Analysis of Individual Fires

The Northern Region suppression plan is based on a searching analysis of approximately 27,000 fires that occurred during the 20-year period 1931 through 1950. It is planned to analyze the succeeding 5-year period at the expiration of the 1955 fire season, and to continue this procedure at half-decade intervals.

Punchcard tabulations cannot be used for this type of analysis. Each fire is regarded by itself and very often the facts of greatest importance cannot be coded on the individual fire report. Furthermore, it is almost always necessary to consider the accumulated effect of a number of separate factors together, in order to catalog a fire in one of the special categories or make the proper manpower and time adjustments.

Considerable emphasis should be placed on the importance of uniform methods in making the analyses and the requirement that fully qualified men be used for the work. Adequate coordination can be assured only by the participation of a planning specialist through most of the operation on every forest. Throughout the entire job, those making the decisions should be cautioned first against accepting recorded action, especially on the less recent fires, without judging it in the light of modern conditions; and secondly, to be realistic in recognizing the kind of errors that cannot be wholly eliminated. In this way, it is possible to get a reasonably accurate picture of what would be expected in the way of action under present-day conditions, assuming an adequate supply of men and all necessary facilities.

Detailed instructions for making the individual fire analysis have been prepared and are available for use.

The Transportation Analysis

This analysis is designed for the purpose of determining the best answers to the following problems:

1. Proper location of manpower, machines, and other equipment.
2. Need for transport equipment, including trucks, airplanes, and pack mules; also the proper balance between ground and air facilities.
3. Degree of centralization required to promote the greatest efficiency in purchasing, warehousing, and distributing.
4. Need for extensions and adjustments (including establishment of standards and priorities) in the road, trail, and landing field systems.

The transportation analysis includes a number of separate studies, the most important being:

1. The transportation zone map. A map of each forest on which is shown the present road system and the usable airports. Details of this map cover the following:
   a. Classification of roads as to speed and load capacity; i.e., will it accommodate heavy transports, long-wheelbase buses, etc. (three classifications each for speed and capacity).
   b. Location of all barriers or bottlenecks (weak bridges, steep grades, poor alinement, etc.) that prevent through traffic of special equipment. Each barrier indicated by a number that corresponds to a descriptive tabulation.
   c. Time calculations recorded at each road intersection, figured from all important distribution centers (existing and prospective).
   d. Zone delineation from one or more major supply centers, indicating the end of road transportation according to hour-control standards for heavy reinforcements.
   e. Delineation of air-delivery zones or areas that cannot be reached by truck haul within allowable time limits. Within these zones the time is shown by air transport from one or more airbases (existing and prospective).
2. The travel-rate study; broken down into two phases, road and trail. Air travel, being direct, and involving such readily measurable elements as airline distances and cruising speed of different types of airplanes, does not usually require a special analysis. This study results in a series of travel standards for each recognized type of facility.
3. The trail study. Confined mainly to the back-country areas that are in the air-delivery zones. This analysis deals with the logical rearrangement of trail systems to fit in more closely with smokejumper use in such areas. It establishes travel-time standards to be used principally for evaluating the comparative efficiency of back-pack, pack-stock and various types of mechanical trail transport in the return of smokejumper or other air-delivery equipment.

4. The study of volume in ton-miles hauled (includes breal down by air and ground transport according to supply base)
5. Expansion and adjustment of the transportation syste (affects all air facilities, roads and trails, and includes proje priorities).

Special Analyses

1. *Bulldozer Analysis.* A special study of bulldozer use, inclu ing a map delineating those areas or zones, ordinarily accessibl to dozers, and where such equipment is usually effective. Include also in a comprehensive study of all identifiable dozer fires fro which rates of progress in line construction and percent of tot perimeter that is operable by dozers can be determined for eac zone. The maps and other data are by individual forests.

2. *Tanker Analysis.* A special study of the tanker fire proble by individual forests, covering such fields as:

a. Occurrence rate and trend in man-caused fires.
b. Slash or other rapid-spread fuel areas in relation to roa accessibility.
c. Nonroad tanker use; study of areas where lighting as we as man-caused fires may be accessible to 4-wheel driv equipment.
d. Study of existing and prospective tanker bases and nee for water-source developments.

3. *Smokejumper Analysis.* This study covers the entire field smokejumping, including transportation. It is used to determi the number of jumpers required on an expectancy basis; the rel tive value of different operating bases and the degree of central zation needed to insure efficiency. It also covers the subjects pack-stock and mechanical equipment for the return of gear.

4. *Minor Power Equipment.* As other types of power equipme (i.e., chain saws, fireline trenchers, etc.) come into practical us separate studies are conducted along the lines of the bulldozer an tanker studies and for similar purposes.

The Method

The actuarial system of fire suppression planning can best l described by use of a triangle, similar to the familiar fuel-hea oxygen combination used in explaining flammability. In this cas however, we use fuel, weather, and fire-starting agencies as t three points of the triangle. Under previous planning system mobilization has been based on something like this:

Fuels rate X and weather is such that we are approaching Burning Index of Y; therefore, since it is midsummer, with t likelihood of severe lightning storms, and since the woods are fu of huckleberry pickers, we must be prepared to "give 'er t works." Just what that means in terms of men, methods an machines, as applied to that particular fuel rating at that parti ular B. I., at that time of the year and in that area, is left main to judgment. This may mean the pessimistic reflection of son

oldtimer on the tough seasons of 1929, 1931, and 1934, or it may mean the vague optimism of a newcomer who has never seen a bad fire season.

In the new system, we attempt to calculate the precise mathematical betting odds in all cases where measurements are impossible and forecasts good only on a short-range basis. In application it works thus: With an X fuel rating and a Y Burning Index, at this particular time of year and in this unit, the betting odds are 2 to 1 that we will need K men, L units of certain specified types of power equipment, F trucks, G head of pack-stock, etc., etc. The "even" or 50-50 odds may double the manpower requirement and boost the need for trucks, but not change the special equipment—or it may do otherwise. If we want to play a safe game, with the odds, say at 1 to 19 in our favor, the requirements may approach the high levels of the oldtimer's memories of 1931; and it might be utterly foolish to prepare for such an eventuality. As conditions become more critical, specific-requirement and locality calculations can be made daily and pinpointed to a finer degree.

The arrangement of the planning material is such that data on individual factors can be segregated and localized to almost any degree of refinement desired.

I should like to repeat here that the individual fire analysis from which the expectancy tables are compiled is not just a mass of statistical data. What may be regarded as the equivalent of a careful post mortem was conducted for each fire. Only the geographic location, time of year and time of day, are recorded with historic exactitude. All other facts regarding behavior and action are recast in terms of present-day conditions, transportation facilities, and methods. Certain man-caused fires were thrown out because they would not have occurred under the present situation. Many fires were adjusted downward as to manpower and length of control-line requirements, in order to compensate for the faster transportation or better techniques that are available now. In other instances, the manpower (or machine power) was boosted appreciably to comply with present-day practices—the result being less burned area and less final cost at the expense of heavier initial attack.

As is logical in a system based on expectancy tables, averages are not used except in a few instances where a quick figure is needed for purposes of comparison. In the calculation of such factors, for example, as number of suppression men required, the average figure is almost invariably much too high. This is due to the tremendously overweighted effect of one or two bad seasons against a normally light load.

To avoid the obvious dangers of a "strength-of-force" plan based on average figures, the present system employs a means of determining various "plan levels" that can be tied in with the characteristics and peculiarities of the various fire seasons. These are explained as follows:

Plan Level 1 (*the ranger district level*).—In order to provide businesslike margin of safety, the normal (or 50-50) level has be adjusted slightly upward—usually to provide coverage for 11 12 out of a 20-year total. In defense of this, it may be stated th no insurance agency that expects to remain solvent will mal contracts that give the policyholders an even break with the cor pany; this is just commonsense logic. Plan level 1 may, therefor be defined as representing the maximum requirements of a norm season, with a small safety margin added. The "normal" seas in this case is not measured by average fire dangers, duration dry weather, and total fire occurrence. It is measured in terms the impact that these and other elements have on manpowe machines, other equipment, transportation, and communicati facilities, overhead, special services, and everything else that go to make up the total fire load.

Plan level 1 is also referred to as the ranger district level, b cause it is the level at which every ranger district should attem to become self-sufficient. This does not mean that every distri ranger who has need for bulldozers, chain saws, or similar iten of power equipment at plan level 1, should have such equipme tied down for his exclusive use. It does mean that he must kno where he can get it on short notice and that he must provide t necessary contracts and other arrangements well in advance the time of need.

Plan Level 2 (*the forest level*).—Rarely if ever does it happ that all ranger districts on a given forest are hit by a combinati of circumstances that involve all three points of the triang (fuels, dry weather, and fire starts) at the same time. Thus, wh every ranger district has gone as far as possible toward becor ing self-sufficient at plan level 1, it generally results in a strengt ened forest organization that can meet a somewhat higher lev (usually 13 to 16 years out of 20). This level is attained by pr arranged plans for rapid interdistrict movement of men and fac ities, plus the use of project crews and equipment that are ce tralized at the forest level. Plan level 2 is recognized as a defini step above the normal, but it still lacks many of the earmarks of critical season. After all available facilities are exhausted, if t requirements cannot be met, the forest should seek help fro other units through a designated dispatcher. Sometimes the pro lem is relatively simple because a neighboring forest is in contr of certain facilities that are in excess of its own plan level 2 nee At other times it will require special efforts and arrangemen which may be a regional as well as a forest responsibility.

Plan Level 3 (*the group level*).—We now come to the seas that is definitely in the critical category. This does not necessari mean critical on a regional basis, we must remember to keep o sights properly alined and recognize that one tough spot in t region can place us in a situation that may require despera measures. If properly organized in advance, it may often happ that an individual forest that is barely able to meet its own le

2 obligations can pull one ranger district through a level 3 ordeal without outside help. Generally, however, when we speak of plan level 3, we think of a situation in which at least one forest is definitely beyond its depth through having more than one—perhaps several—ranger districts in a critical situation. Such situations immediately become a regional problem but should be confined at the group or zone level insofar as reasonable and practical. It is often difficult and sometimes virtually impossible to line up the volume of manpower, machines, overhead, and transport facilities within one group of forests to meet a simultaneous outbreak in, say, three forests in the northern Idaho zone or two in western Montana, but we can still do our best. A plan level 3 organization within one zone should take care of from 17 to 19 years out of 20 within the group area.

Plan Level 4 (the regional level).—This is the top level represented by the so-called bust season. Within the 20-year period covered by the analysis, the Northern Region has had three such years that affected the entire region. These were 1931, 1934, and 1940; the first two were occasioned mainly by critical burning conditions, the other by worse-than-normal burning conditions coupled with extreme concentrations of lightning fires. As with the other levels, it must be recognized that a single ranger district or even an entire forest can reach level 4 without necessarily loading the region to that level. However, it is almost certain that a level 4 on a single ranger district with a high potential, will not only greatly overload the forest but may place the entire group in a level 3 situation—even though all other districts are at normal or below. The planning of facilities and manpower for level 4 on a regional or even a zonal basis becomes immediately a regional problem and invariably requires aid from other regions or from military sources, or perhaps both. While the entire region has not experienced level 4 conditions since 1940, certain individual forests were very closely approaching that condition in 1944, 1945, and 1949.

Uses of the Plan

In conclusion, I should like to emphasize the fact that the Northern Region's actuarial fire suppression plan is neither a substitute for, nor an adjunct to the well-known "Hornby Presuppression Plan" that has been used (with increasing modifications) in this region for the past 20 years. By the very nature of its construction, the new plan cannot differentiate between certain presuppression and suppression features. Hence, it does overlap the Hornby Plan to a limited extent in the field of preparedness and initial action on the small (smokechaser) fire. It does not enter the phases of prevention or detection, but it does cover all action subsequent to the initial discovery, from the single mission of a lone smokechaser to the heaviest reinforcements required on large project fires.

Once the analyses are completed and the data properly ranged, modernization of the plan at 5-year intervals, or e oftener if desired, is not an exceptionally difficult nor time-s suming job. It is assumed, of course, that transportation m maps and records of slash and other high-hazard areas, and s similar data will be kept currently up to date with a reason degree of regularity. This, of course, would be necessary u any kind of planning system. Assuming that this is done, actual analysis of a recent 5-year period, and consolidation of data into a set of revised tables, can be accomplished in fro to 6 man-weeks per forest. New innovations in travel speeds fireline producing equipment will, of course, require additi study and analysis, but again, this would be needed under consideration.

Probably the greatest present value of this type of plan is adaptability in providing the answers to almost any kind special problem. To date, it has played a major part in such n ters as the determination of pack-stock needs, evaluation of Remount and Winter Range, decentralization of warehousi various problems concerning the smokejumpers and other ae services, the Spokane Warehouse, the new aerial developm center, and others. It has been the basis of priorities in the assi ment of tanker units and is used currently in establishing le and approving placement of handtools at the ranger-distr forest, and subregional levels. It also determines the levels for centralized fire caches at Missoula and Spokane. It is used a check in approving or disapproving revisions and adjustments the seasonal forces of the various forests and in the distribution fire training funds.

The most recent use made of the tables was to determine impact of peak loads on present and probable future radio ch nels. From the expectancy tables it was possible to graph the formation needed in a matter of hours; otherwise it would h taken weeks of study and compilation.

Another and perhaps greater use is dependent on progress developing simplified methods in fuel-map revision and our abil to teach rangers and district dispatchers to use the suppress plan guides. A few are well acquainted with this system planning, having taken a part in its early development, but ma more are unfamiliar with the data itself, as well as with the me of application to a ranger district.

The satisfactory completion of a zoning project, which wo divide the region into suppression zones and attack units, is No. 1 need if we are to get maximum use out of the vast amo of information that has been compiled. Next, and perhaps equa important, is the need for continued efforts to indoctrinate rang and their fire control assistants in the application of the actuar principle, particularly to the organization and mobilization suppression forces. These are the only real stumbling blocks t prevent the suppression plan from reaching its final goal— completion of a workable action plan on every ranger district.

EXPLORING THE POSSIBLE USE OF FIRELINE PLOWS IN THE WEST

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In the southeastern United States, fireline plows have long been used as a tool in fire suppression. The past decade has seen remarkable progress in the development of effective fireline plow units. The use of these plow units has expanded until practically all organized forest fire control agencies and many industrial timberland owners depend upon such equipment for fire control work. (More than 1,500 mechanized plow units are working in the South.)

For the past two years Region 8 of the United States Forest Service has been conducting extensive tests of fire plows to determine the capabilities of proved units, by types and size classes, under many different conditions. The results of these tests will be available to fire control agencies wherever plow units have possible use as an effective fire control tool.

In September 1952, a reconnaissance trip through several areas in the West was made to determine the possible use of fireline plows. The examination was based on a comparison of conditions existing on these areas with the various conditions encountered during test work in Region 8. Many similar conditions were found.

The first area examined was the Bessey Division of the Nebraska National Forest. This area had many characteristics common to the sand pine "scrub" of the Ocala National Forest, where the disk-type fireline plow has been the principal fire tool for more than 10 years. The forest areas on the Bessey Division consist of ponderosa, jack, Austrian, and Scotch pine and eastern redcedar plantations up to 40 years old.

Soils on the two areas are similar, a deep porous dune sand, free of rock. The sod is light, and while the Ocala "scrub" has scattered clumps of woody shrubs, the forest floor of the older Bessey Division plantations are practically free of anything other than a thin low grass. The only obstacles to plowing are the occasional short steep slopes and these can be successfully overcome.

Comparing forest and soil conditions on this Division with the testing areas in Region 8, a light disk plow pulled by a crawler tractor of about 20 drawbar horsepower should be effective in the younger plantations and the open areas, building 150 to 200 chains of plow line per hour. In older plantations where stand density will be a factor, a medium or heavy disk plow pulled by a crawler tractor of about 38 drawbar horsepower should produce between 125 and 170 chains of line per hour.

The other seven selected areas examined during this rec naissance trip were on the Harney National Forest in So Dakota, the Boise Forest and the Bureau of Land Managem lands in Idaho, the Modoc and Lassen Forests and a portion the Sacramento front country in California, and the Cocon plateau in Arizona.

Topography on these areas varies from rolling to steep a rugged, yet on all of them sufficient plowable topography exi to justify the use of fire-plow units. Many of the forest conditi and much of the terrain in the ponderosa pine type, occurring most of the areas examined, resembled conditions found on testing areas in the Ouachita Forest of western Arkansas, wh a light plow pulled by a light crawler tractor is successfully us

Dense stands of ponderosa pine reproduction, similar stands lodgepole pine, and some brush areas will be definite physical stacles in plow line production. Similar conditions of dens existed on one or more of the testing areas in South Carolina a Florida. These physical obstacles can be overcome by use of suitable size crawler tractor. Most of the juniper-sagebrush t is definitely plowable. as are considerable areas found in lodgepole pine, alpine fir, and white fir types.

Down timber (heavy logging slash, down snags, blowdown, a bug-killed timber) is one physical obstacle to plowing that v cause difficulty to the plow unit on areas otherwise suitable. areas where down timber is heavy, it will be necessary to clea way for the plow.

The plow type suggested for use on these seven areas is t Talladega mountain-type middlebuster. This plow is simple construction, has no moving parts, and is designed for use rocky soils. It makes a V-shaped furrow, moves a minimum dirt, and distributes the berm evenly. The plow point is desig to work between rocks and to free itself of most of the solid r and tree roots encountered. This type of plow unit is compact, is necessary for operation in mountain country.

This type of plow was tested in the mountains of northe Georgia and western Arkansas. During these tests a light craw tractor with a rating of 18 drawbar horsepower was successfu used to construct plow line on downhill slopes of up to 66 perce side slopes up to 45 percent, and uphill slopes up to 30 perce Line production on these tests averaged 91 chains per hour 31½ miles under simulated fire suppression conditions.

The successful use of a fireline plow in the areas examined dependent upon a well-balanced unit which is properly armor adjusted, and outfitted for the job, operated by a well-qualifi and experienced man familiar with the unit's capabilities a working with a trained and well-organized support crew. Un such conditions fireline plows could be highly effective fire s pression tools.

A COMPACT MAP CABINET FOR FIRE DISPATCHER'S USE

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This map rack was designed to hold all maps, forms, and information required by the dispatcher, in an easily accessible manner but in only a minimum amount of wall space. Overall dimensions are 33 by 31 by 7 inches. In addition to the space on the back of the doors, the rack contains four panels mounted on a movable base bolted to a frame. This frame is fastened to the inside center of the cabinet and can be pulled out so that all four panels can be consulted merely by turning the panels as pages in a book (fig. 1).

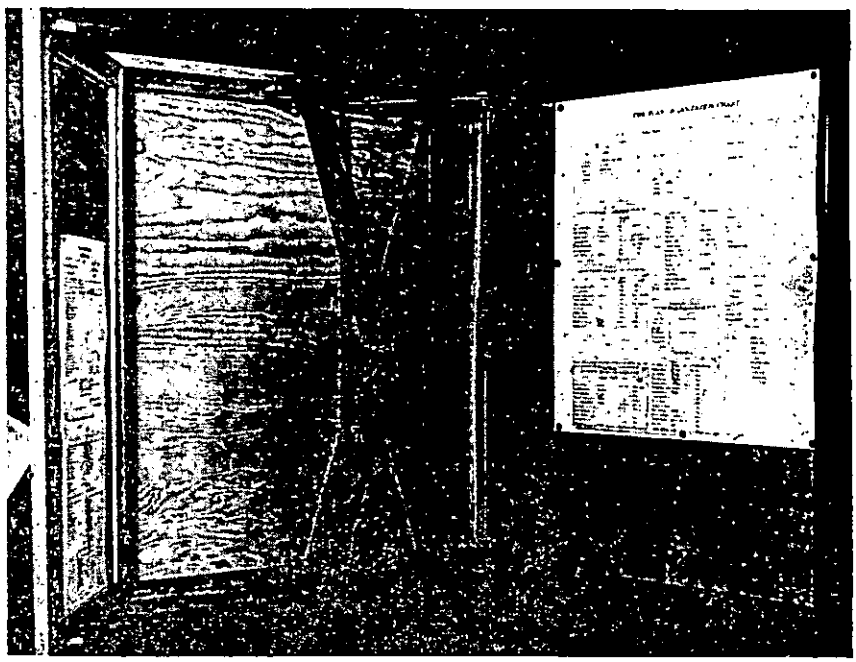

FIGURE 1.—Frame pulled out and panels ready to be turned.

The cabinet contains the following material: Travel-time maps, a lookout manning guide, firefighter wage rates, names and telephone numbers of five firefighter squads, the Cass Lake District presuppression plan, a fire danger record form 274 R-9, Forest Supervisor's presuppression plan, the current fire record form F-5 R-9, a current fire record map, a district map showing areas requiring special attention in fire protection, an organization map, a services of supply map, the Unit action plan, a manpower placement map, a fire organization chart, and an atlas of district fuel type maps.

FIRE PLOTTING RULE

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The transmission of accurate fire data from an air scout to t forest fire officer on the ground is always of paramount impc tance. In the interests of efficiency, the data must be both bri and complete. This becomes increasingly more important duri periods of high fire danger when traffic on radio channels is a to be heavy.

A simple rule to facilitate the work of the air scout is shown figure 1. The device consists of a plastic azimuth circle equipp with a graduated indicator arm of the same material. A bra rivet acts as the pivot around which the arm rotates. The azimu circle is a Forest Service issue item used in plotting fires. T. indicator arm was constructed of plastic 1/16 inch thick.

On a map, preferably timber type, the air scout picks a suitab orienting point near the map information he wishes to plot. T orienting point may be a section corner, point of a lake or strea or any other easily identifiable map feature. The center of t. azimuth circle is placed on this point. In figure 1 the orienti point is the one-quarter corner between section 13 and 18.

Readings of angles and distances to relevant data such as wat chances, spot fires, ridges, and swamps, are transmitted to t receiving party by means of radio. They are plotted by means a similar device similarly oriented on a map of the same type a scale. Figure 1 shows the location of some pertinent points on going fire.

When map data gets outside the range of the graduated ar the orienting point can be shifted to some other map feature a plotting continued from the new point.

Should other facilities be lacking, the size and shape of a fi can be reasonably shown by plotting and joining tangents to curves on the perimeter of a fire.

When photographs are used instead of maps, a holder is su gested. A simple holder, made from a square of plastic and fitt at the corners with photo holding slots held in place by plas cement, will carry a 9- by 9-inch photo. The photo fits on t reverse side of the plastic holder. The azimuth circle and indicat arm are fixed in the center by plastic cement. When the photo in place, the principal point will fall directly underneath the piv Readings are taken as before, transmitted by radio and plotted the receiving station on a similar photo. The use of photos limited to where two sets of similar prints are available.

From brief experience, the indications were that the meth could best be utilized by having the observer-scout as a passeng together with the forest officer in charge of directing the ope

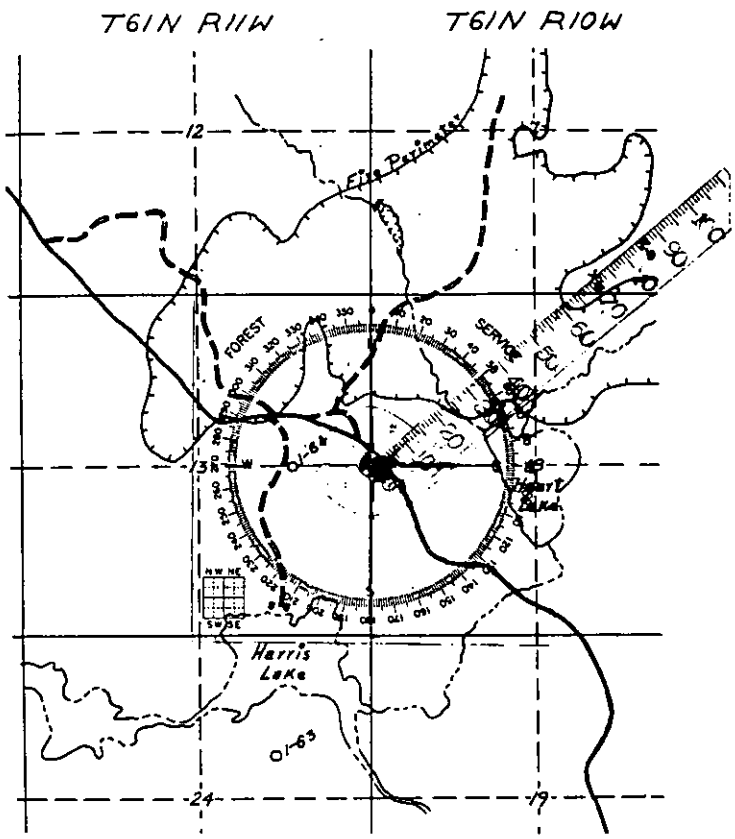

FIGURE 1.—Plastic azimuth and scale in use. Readings are to spot fire *a*, 49° distance 71; spot fire *b*, 50° distance 86; and beaver flowage, 1° distance 64.

tion from the air. This allows the scout to do his plotting in conjunction with current actions. It also allows the scout to divorce himself from other radio traffic and treat the mapping job as a separate project.

Photo interpreters with a background of air checking photographs can readily adapt themselves to mapping and plotting fire data, gaging distances, and identifying types.

This method of transmitting fire data is very simple to apply. Each orienting point in effect simulates a fire tower giving angle and distance readings to any point within the range of the indicator arm.

KENTUCKY FIRE FINDER

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The Kentucky fire finder is not exactly a new idea, but rat a new combination of several old ideas. Its construction is r tively simple; materials are easy to obtain and cost only al $5 per finder (fig. 1).

The sights and the various disks were cut out on a small b saw. A zinc linecut of a standard 8-inch Forest Service p tractor was made at the local newspaper office and used in a press to print the protractor directly on the ½-inch plywood d This provides a cheap, accurate and durable protractor.

A solid top with a small window and cross hair for observ the protractor makes it possible to eliminate errors in readi This is considered important with the inexperienced lookouts often used these days.

The finder's three small disks provide a simple yet accu method of shifting the finder to clear obstructions. This idea taken from the Minnesota finder described by Roger Williams the January 1951 issue of Fire Control Notes.

Materials needed are as follows: 1- by 3-inch seasoned yell poplar for sights *A* & *B* (fig. 1); 3/8-inch fir plywood for top c *C;* ½-inch fir plywood for disk *G;* 1/4-inch fir plywood for three small disks *H;* 3/4-inch fir plywood for bottom disk 1/8-inch hard board for washer *E;* a zinc linecut of an 8-i protractor from which impression *F* was obtained on disk seven 1/8-inch flat-headed bolts to assemble the various pa (notice that the three bolts *L* project 1/4 inch beyond their n and fit into holes *K* in disks *H*); two horsehairs for sight *A* opening *D* in disk *C*. The horsehairs were the most difficult terial to obtain.

Sights *A* and *B*, 4½ inches high, are brought to a slight po at the top center, to help "rough in" the sight on a fire. Disk *C* 16 inches in diameter. Window *D* has a radius of 3½ inches inner cut and 4 3/8 inches for outer cut; an angle of 40° fr center determines other two sides of window.

Washer *E* has a 6-inch diameter with ½-inch center hole. D *G* is 17 inches in diameter. Stock for this disk was cut 18 inc square, and the protractor *F* was printed roughly in its cent After the ink had dried the 17-inch circle was inscribed about center of the protractor.

Disks *H* are 7½ inches in diameter. Holes *K* 6 inches fr center take bolts *L* (straps could have been used in place of th disks as in the Minnesota finder, but it was felt that the di would provide a steadier base). Disk *J* is 17 inches in diameter

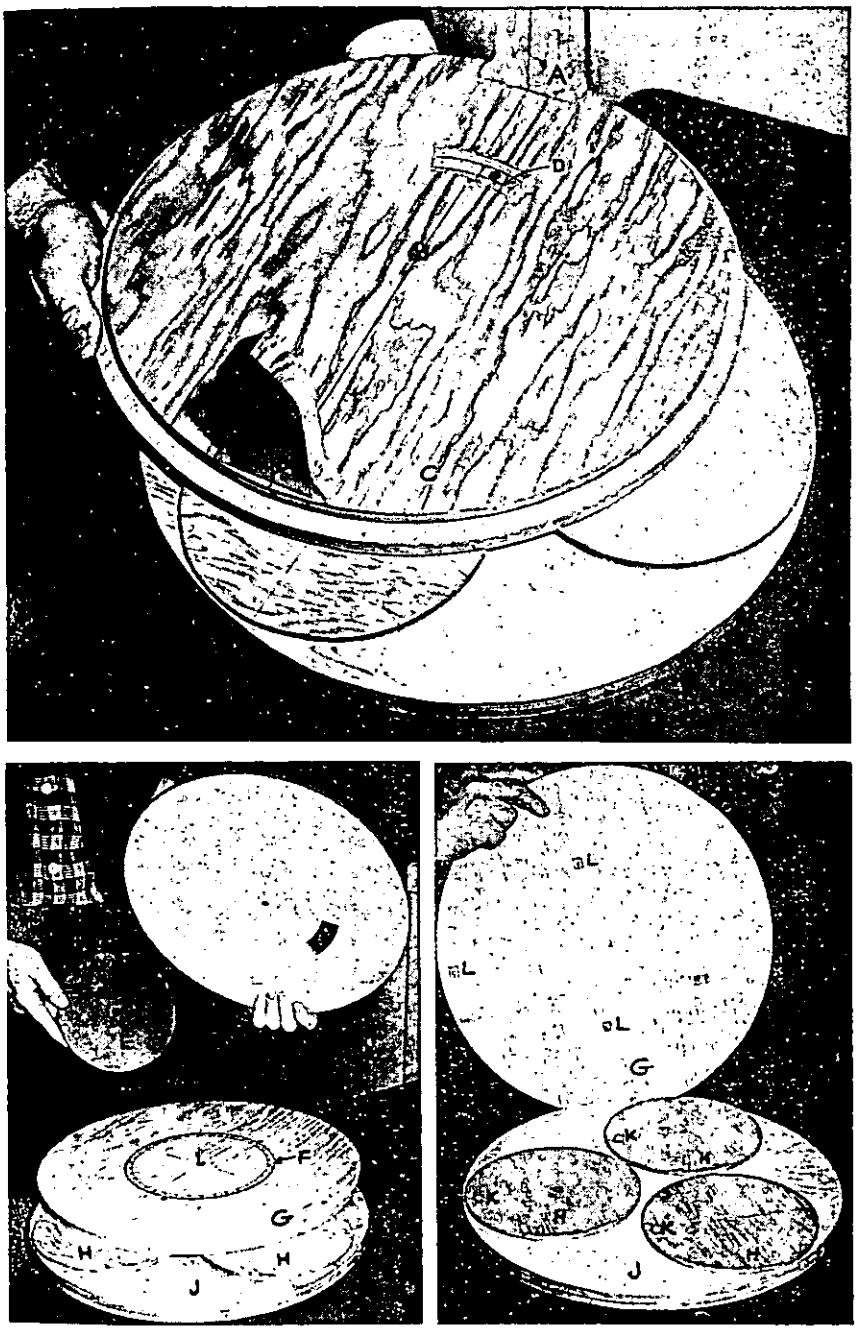

FIGURE 1.—Three views showing component parts of the Kentucky fire finder.

WASATCH FIRE TOOL CACHE BOX

FRANK STONE

Fire Dispatcher, Wasatch National Forest

We have recently designed a fire tool cache box that we beli is an improvement over the old-style caches we have used. Ot forests and regions may be interested. The box is designed fo 10-man outfit. The equipment is placed in the box as foll (fig. 1): 1st long compartment at back of box, 4 pulaskis safety sheathes; 2d long compartment in center, 8 baby shov 3d long compartment in front, 10 knapsacks with supplies an files, 1 whetstone, 4 small first-aid kits, 1 5½-foot crosscut s and 2 handles; 4th compartment at left end, 1 5-gallon waterl and 5 1-gallon canteens. Because the box partitions are remova it can be used for almost any combination of tools.

A sheet-metal covering adds to the life of the box and give protection against the weather. Two- by four-inch cleats are tached to the bottom to prevent rotting when the box rests on ground.

The box can be transported easily by pickup. This facilita both spring delivery to cooperator, per diem guard, or other lo tion, and pickup when the season is over so that the contents be checked and reconditioned at the central warehouse.

Drawings of the box can be obtained by writing to the Regio Forester, U. S. Forest Service, Ogden, Utah.

FIGURE 1.

PICKUP TOOL RACK AND RADIO BOX

VERNON LEWIS

Fire Control Assistant, Klamath National Forest

A pickup tool rack and radio box has been designed and put in use on the Salmon River District. The rack provides a safe and handy place for tools and does not interfere when pickup is used for hauling. The rack sits next to the cab and is fastened to the bed by two 1/4-inch bolts at each end. The radio transmitter and receiver boxes are mounted on sliding shelves so they are easily available for servicing. (fig. 1).

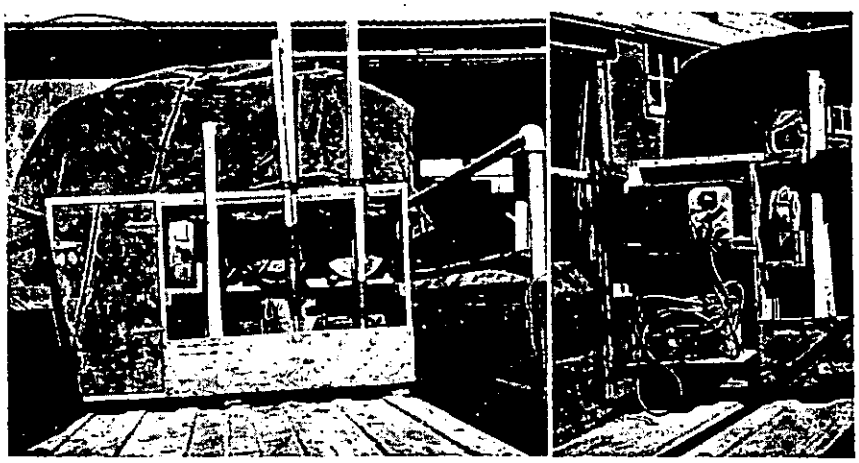

FIGURE 1.—Tool rack from rear of pickup; radio box door closed and open, showing transmitter and receiver units on sliding shelves.

A canteen rack mounted behind the tool handles consists of a 1- by 4-inch base with a 1- by 2-inch back. Canteens are held in place by a cord and light spring. The cord is fastened to the rack at one end and a screen door hook is used on the other end.

Scrap lumber was used to make these racks but 3/4-inch plyboard would be better and would simplify construction. Light aluminum was used to cover the radio box. Small blocks of 2- by 4-inch lumber, shaped or notched to hold tool heads, were nailed to the bottom. Rubber straps with spring snaps hold handles in slots.

An accessory box may be placed in front of the rack and securely locked in place by fastening 1½- by 4-inch pieces to the bottom of the box and extending them beneath the tool rack to the front of the pickup bed. Removable pins through the bottom of the rack into these pieces lock the box in place. When needed the box may be removed by pulling the lock pins and sliding box out.

STATISTICAL FIRE NARRATIVE REPORT

RICHARD F. JOHNSON

Assistant Fire Dispatcher, Angeles National Forest

Immediate analysis of fire suppression action is conceded to one of the best methods of recognizing and remedying weak spo in a fire organization. Prior to 1940 the U. S. Forest Servi Statistical Fire Report required an analysis of such items as Di covery Time, Report Time, Get-Away Time, and Travel Time, a important factors in fire suppression. Revisions of the Statistic Fire Report Form 929 in recent years have eliminated this anal sis section leaving the fire planner with an excellent set of stati tics but in many cases without the reasons as to why the acti occurred.

STATISTICAL FIRE NARRATIVE REPORT

(Complete form in pencil for each Statistical Fire-Include only information not covered in Form 929 follow forest service-action that leads to first constructive work on the fire)

NAME OF FIRE DRAW-BACK SIZE CLASS B DATE 7/10/52

DISCOVERY TIME: 25 (Min.) Hrs. If Discovery time exceeds Regional Standard of 15 minutes check reason. (1) Lookout man failure_____(2)Lookout not occupied__X__(3) Fire at night_____(4) Smoke or haze_____ (5) If in "Blind Area" state time since last detection patrol_____ (6) Patrolman away from patrol area__X__(7) Other_____

REPORT TIME TO FOREST SERVICE OFFICER: 10 (Min) Hrs. If Report Time exceeds Regional Standard of 5 or 8 minutes (whichever is applicable-Ref: Page 97, Fire Control Handbook Part I, check reason. (1) Uncertain of existence or location of fire _____.(2) Dispatcher seeking confirmation of location_____(3) No one available to receive or transmit report_____ (4) Telephone failure_____(5) Radio failure_____(6) Failure to use nearest communication facilities_____(7) Failure to report directly to responsible agency__X__(8) State the route report followed in #7 L.A. CITY FIRE DEPT. TO L.A. COUNTY FIRE DEPT. TO ANGELES DISPATCHER (9) Other_____

GET AWAY TIME: 2 (Min) Hrs. If elapsed Get-away time exceeds Regional Standard of 2 minutes check reason. (1) Seeking confirmation____(2) Gathering men_____(3) Not prepared to go_____why_____ (4) Stopping to eat_____(5) Mechanical failure_____(6)Handling this fire as one of series_____(7) Other_____

TRAVEL TIME: 30 (Min) Hrs. If elapsed Travel Time exceeds standard on Hour Control Map, check reason: (1) Got lost_____(2) Took wrong route_____ (3) Stopped to pick up men or equipment enroute_____(4)Location of fire erroneous__X__(5) Hunting for fire_____(6)Work on other fire enroute_____(7) Congested traffic conditions_____(8) Fire not chased by nearest man_____(9) Other_____

INITIAL ATTACK FORCE: Were initial attack forces adequate, considering fuels, topography, weather conditions etc? NO (yes - no) If inadequate, state why SUFFICIENT PUMPERS WERE DISPATCHED BUT HAND TOOL CREWS SHOULD HAVE BEEN MOVED IN EARLIER

FIGURE 1.

Boards of Fire Review held in Region 5 at the close of the 1951 season pointed out the need of some method of supplementing the statistics with a narrative report that would explain the reasons involved in failure to meet elapsed time and performance standards. The Statistical Fire Narrative Report (figs. 1 and 2) was designed by the Angeles National Forest and has been in use during 1952.

The report is submitted in pencil for each statistical fire that occurs. It is intended to follow Forest Service action regardless of the cooperative assistance received in the suppression action. Entries are confined to information that does not appear on the Statistical Fire Report to avoid duplication. These reports are reviewed currently by the district ranger, fire control officer, and fire dispatcher. A summary review of each district's fires is made at the end of the year to point out additional training needs and corrective measures.

INITIAL ATTACK ACTION: State briefly the size-up and action taken in initial attack.

ORIGINAL DISPATCH OF FOUR PUMPERS SENT TO GOLD CANYON IN BIG TUJUNGA DRAINAGE AND WERE TURNED AROUND AT 1430. INITIAL ATTACK DELAYED APPROX 20 MINUTES. ACTION ON FIRE AFTER LOCATION CONFIRMED WAS SATISFACTORY.

Did the first man on the fire immediately report conditions upon arrival? YES (Yes / No) If not, why.

DIRECT BY RADIO. ALSO CONFIRMED EXACT LOCATION OF FIRE.

REMARKS: State any additional pertinent information that will clarify action

NEAREST LOOKOUT ON DAY OFF DUE TO MEDIUM INDEX. PATROLMAN AWAY FROM STATION FOR THREE DAYS ON NORTHERN CALIF. FIRE. FIRE DISCOVERED BY PASSING MOTORIST FROM LITTLE TUJUNGA CYN. ROAD. REPORTED AS BEING IN GOLD CYN. WHICH IS IN BIG TUJUNGA DRAINAGE. FIRE ACTUALLY LOCATED IN GOLD CREEK OFF OF LITTLE TUJUNGA DRAINAGE.

In your opinion what corrective measure should be taken?

PROVISIONS SHOULD BE MADE TO LOOKOUT ON DUTY OR PROVIDE A RELIEF PATROLMAN FOR THIS AREA WHEN REGULAR MAN IS ABSENT FOR EXTEND PERIOD. WORK WITH OTHER AGENCIES AND COOPERATORS TO GET REPORTS ROUTED DIRECTLY TO AGENCY RESPONSIBLE.

Name Date

FIGURE 2.

A DISPATCHER'S FIRE LOG

A. VIRGIL SHOEMAKER

Central and Zone Dispatcher, Angeles National Forest

To be complete, a fire log should include an orderly arran ment of the day's events as they happen, including times, orde action, and significant statements or decisions influencing the d patcher's action. It should contain the bare facts and nothing mo The official log appears on every dispatcher's desk, along with t radio and telephone, all within easy reach.

The record may be jotted down in a very informal way, t log may be typed, or it may consist of a mechanical recording. any event, the facts are preserved in the record for the assistan and protection of the dispatcher and the agency.

The Angeles dispatcher is responsible for initial action in t Los Angeles River Drainage, for Forest-level dispatching for t balance of the Forest, and as a zone dispatcher for Federal lan in southern California. The type of action required varies wide and assistance may come from many different sources. For o particular problem, the commonly used bound log, or 3-ri binder, does not meet our needs as well as the following thr forms maintained in pencil:

First report of fire.—This letter-size form, punched for a 3-ri binder, contains spaces for all "Lookout Flashes" and "First R ports" from other sources. In the case of a "Lookout Flash," t observer classifies and identifies his report, and the dispatch makes the appropriate entries on the form. A check is used in t "Type of Flash" column when the observer is uncertain, that object may be smoke, dust, cloud, ground fog, dense haze, etc.: (for Smoke Flash) when certain of smoke, but may be incinerat railroad, or legitimate burning; F (Fire Flash) when certain th a fire is seen, flames or other visible evidence; and O (Othe for such as burning airplane in flight.

If the "First Report" originates from other than a lookout, much detail as possible is obtained on what is burning, locati of fire, what is on or enroute to fire, its size, wind, rate of sprea cover, and pertinent remarks, as well as the name of the pers calling, his location, and how to reach for further informatio Sources other than lookouts account for 90 percent of the fir reports on this Forest. Subsequent remarks and facts are enter on the back of this form, and extension sheets used when neede

Dispatch record.—Overhead, labor, and all vehicular or speci equipment sent to or requested by the fire is entered on an 8- 15-inch dispatch record sheet. On large fires, labor may be enter on one sheet, equipment on another. Items sent by the dispatch are entered in columns 4 to 10 which show (4) position on fi

(5) name-unit sent, (6) number sent, (7) source, (8) equipment used, (9) time ordered, and (10) time left station. Orders received from the fire are set up on columns 2 (day, hour, number), 3 (order by), and 4, and a check entered in column 1 when order is filled and columns 5 to 10 completed. Places for "releases," "at headquarters," and "remarks" are provided. This procedure permits the dispatcher, in one glance, to see what has been sent and what orders are pending. No need to thumb through the pages of a log and hunt for buried remarks. A carbon copy is sent to the fire at the end of the first hour or two, to assist the fire boss and records officer.

Fire order.—Whenever another office or function is involved, as in the case of a tractor and transport ordered by the fire and furnished out of a Division of Engineering equipment depot pool, a written "fire order" in drawn up and, if at all possible, actually delivered to the office involved. This eliminates the hazard of duplicate orders or new orders being interpreted as a confirmation. It also furnishes a written route of travel, and indicates the proper fire charge, time of order, and other pertinent information. The dispatcher is advised when the order goes and the "order sent" columns are completed and the information posted on the Dispatch Records. Unfilled orders are held in a "pending" bin.

Inasmuch as the Supervisor's (administrative) officers are in another city, carbon copies of all orders involving payment are sent in. This covers orders for rental buses, U-Drive trucks, organized crews, and similar items where payment is required. This establishes a fire obligation, avoids overlooking payments and similar orders contracted for during emergency conditions.

"First Report of Fire" form, "Dispatch Records," and "Fire Orders" for a particular fire are held and maintained together in 5- or 6-bin desk trays.

Substantial advances in dispatching service will come from new methods and improved working tools and we have found the above system to be of help in our particular job.

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States Forest Fire Law Enforcement Record, 1952

During the calendar year 1952 the States initiated 7,193 prosecutions for violations of their forest fire laws. This exceeded 1951 prosecutions by 954 cases. The 1952 prosecutions resulted in 6,557 convictions or 91 percent. At least 22 cases were still pending at the time of this report.

Of the 7,193 cases prosecuted 1,927 were for technical violations such as illegal brush and debris burning, failure to extinguish camp fires, collection of fire fighting costs, etc. Prosecutions for escaped fires amounted to 5,266.

Virginia again led all other States in the greatest number of prosecutions with a high of 1,145 cases of which 99 percent resulted in convictions. North Carolina was again second high with 976 prosecutions resulting in 97 percent convictions.

The States' records of convictions secured on the number of prosecutions is very good but it should be remembered that the total number of prosecutions is relatively small considering the fact that more than 100,000 man-caused fires were reported on State and private lands last year.

CARD SYSTEM FOR RANGER DISTRICT FIRE DISPATCHING

KEITH K. KNUTSON

District Ranger, Pike National Forest

On ranger districts with no organized Forest Service suppr sion crews, manpower is often hard to obtain with the speed quired for effective first attack. This is probably the situation a majority of the ranger districts, and it is certainly the case o side of the so-called "fire regions."

It was forcibly brought to my attention when I transferi from the Arroyo Seco District of the Angeles National Fore with headquarters at Pasadena, Calif., to the South Platte D trict of the Pike National Forest, with headquarters at Buff Creek, Colo. Buffalo Creek is a hamlet consisting principally of general store, a filling station, and a considerable number summer residences, and it is about 50 miles from Denver, t nearest city. I believe it is safe to say that on the Arroyo Se District I had more men in my summer fire organization th there are permanent residents on my present district.

The South Platte District embraces more than 200,000 ac and is typical of those on the eastern slope of the Rockies Colorado. It has rough topography, not too many roads, a fuel ranging from sparse to heavy, and from flashy to slow bur ing. Closely restricted grazing in the past few years has built the grass cover and the lower slopes support a cover of o brush and mountain-mahogany with some cheatgrass in plac Because of its accessibility to Denver and the very heavy tour trade in Colorado, the recreation use is extremely heavy. tourist behind every bush" is a stock expression here during Ju and August. In addition, there is a "lightning belt" centered on t district.

In spite of the potentialities, the actual fire occurrence is n high. The normal fire load for the past few years has been starts per year, with 3 of them man-caused, but it has vari widely in different seasons. Although this normally low load an advantage, it also presents a problem in giving the local pe ple, upon whom we must depend for help, enough actual fi experience so that they are properly trained and in the mood either respond quickly to a fire call or to take independent acti when necessary.

The district is staffed in summer with one ranger, one assista ranger, one lookout with an alternate (the only lookout on the Pi Forest), and one patrolman whose time is largely taken up clea ing campgrounds after tourists. For all other first-attack and fir

reinforcement forces we are dependent on local ranchers, woods workers, resort owners, miners, and miscellaneous persons.

The general principles of cooperation by local people and the preparation of district fire plans have, of course, been in successful operation on this and other forests for many years. The present discussion deals only with a workable method of putting that cooperation into effect with the least delay.

To get the speediest initial attack with this type of labor, we felt that the first requirement was a central dispatcher. The lookout is currently manned by a married couple who have been there at intervals for several years. The wife is the regular lookout, and the husband serves as alternate and also takes care of nearby trail improvement and maintenance when not on lookout duty. Since the lookout crew is the first discovery source for 75 percent of South Platte District fires, and on duty at all times, it was decided to give them this second responsibility. This has not in any way lowered their efficiency in performing their primary duty of detection, and occasionally it gives an opportunity to demonstrate to visitors, of whom there are some 5,000 or more during the summer season, what actually takes place when a fire is discovered by the lookout.

The preliminary work in setting up this kind of system is done mainly by contacting prospective wardens. They are the key individuals in the organization and without their full accord the system could not be a success. They should be men who have taken an active interest in conservation and fire control, easily reached by phone, and available a large part of the time.

At the same time cooperators are also contacted. They too must have an active interest and be willing to go to fires, but their latitude of operation on initial attack is not so great as that of the wardens. A third member of the team is a manpower coordinator. This man is used to gather manpower for reinforcements when necessary. He should be an old-timer in the area who knows the best sources and availability of manpower. His age and physical condition are not an important consideration.

After the preliminary contact work is completed, the district is divided into warden zones and cooperator units. Each zone contains one or more units. All wardens agree to go to all fires within their zones if necessary. The cooperators act as initial attack forces only within their units, unless there is a previous mutual agreement that they will go into an adjoining unit when the need arises.

A great deal of thought must be used in making these divisions. Among the points that should be kept in mind are (1) physical location of cooperator within the unit; (2) method of transportation and availability of roads and trails; (3) agreed territory in which the cooperator will operate—this may have to depend on his work and his responsibilities; and (4) topography. On the South Platte District there are 10 warden zones and 33 cooperator units, and there are 1 to 7 units per zone. The outlines of the zones

on our maps are in red, those of the units in green. This color c is used throughout the system. The cards used are made up that all information needed for dispatching in one zone or uni on one card.

Zone cards show the following information, with all ph numbers:

1. Warden.
2. Complete list of cooperators and their units.
3. Manpower coordinator.
4. Adjoining wardens.
5. Where additional manpower can be obtained.
6. Special dispatching instructions, if any, in high-hazard and high-r of-spread areas.

The following information, plus all phone numbers, is shown cooperator unit cards:

1. All cards have "For fires in this area call in the following order u dispatch is made."
2. Order in which calls are made: cooperator first, supervisor's office l In all cases the ranger is to be notified. This is also noted on all ca.
3. The nearest place where tools can be obtained.
4. Where water equipment is located, if available.
5. Where to order food.
6. If power line-building equipment is available, this is noted.

In all cases the telephone number, if any, is given. This n appear to be repetition, but it is essential to speed and accura These 4- by 6-inch cards are filed under the zone headings, wh. are in alphabetical order. The unit cards are immediately back the zone card in the order in which they appear on the zone ca On the box is shown "Instruction for Use," as follows:

1. Locate fire in proper zone and unit.
2. Pull unit card and call manpower as shown on card until dispatch made.
3. If unable to contact anyone on the dispatching card, call the sup visor's office for assistance.
4. When a call is made from the fire for additional manpower, food, to water equipment, etc., call as indicated on the unit card.

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Tanker Fitting Color Code

The tanker fitting color code was developed primarily to alleviate t difficulties experienced in hooking together fittings with various types threads, such as hose, tankers, hydrants, etc., where various agencies are operating in the suppression of fires. The California Region and the I Angeles County Fire Department use five colors that are most distinguisha during both night and day operations to identify the various threads as f lows: black, Parallel Iron Pipe; yellow, National Standard; green, Paci Coast; blue, Chemical; and aluminum, Garden Hose.

A quick-drying enamel is used to paint the identifying colors on the fittin Since the various types of threads are nearly impossible to distinguish fron visual standpoint, the color code has been most beneficial to personnel selecting the correct fitting. It is only a matter of matching colors rath than threads.

The Region has adopted the color code and had printed in color enou; plastic cards, which are 4 by 4 inches with a hole in each corner, so o could be attached to each tanker.—V. E. WHITE, *Fire Control Assista Angeles National Forest.*

TOP PACK POWER-SAW CARRIER

CHARLES A. YATES

District Ranger, Six Rivers National Forest

On the Orleans District of the Six Rivers National Forest we have devised a power-saw carrier for use in our back country work (fig. 1).

The carrier is mounted on a top pack and bolted securely. The box, 3/4-inch plywood put together with wood screws, is made to fit tightly around a power chain saw with a 30-inch blade. Guides and slots inside keep the saw from shaking around. A small tool kit box is built in above the rear handle of the saw. This kit box holds tools, grease, equipment handbook, and files. A cloth wrapped around the tools keeps them from rattling. When the door is fastened down the tools cannot come out of their compartment. The saw chain is covered with a piece of discarded 1½-inch fire hose split down one side.

The saw can be taken out of the box without untying lash ropes or unloading the animal. It can be quickly loaded or unloaded, expediting trail maintenance work.

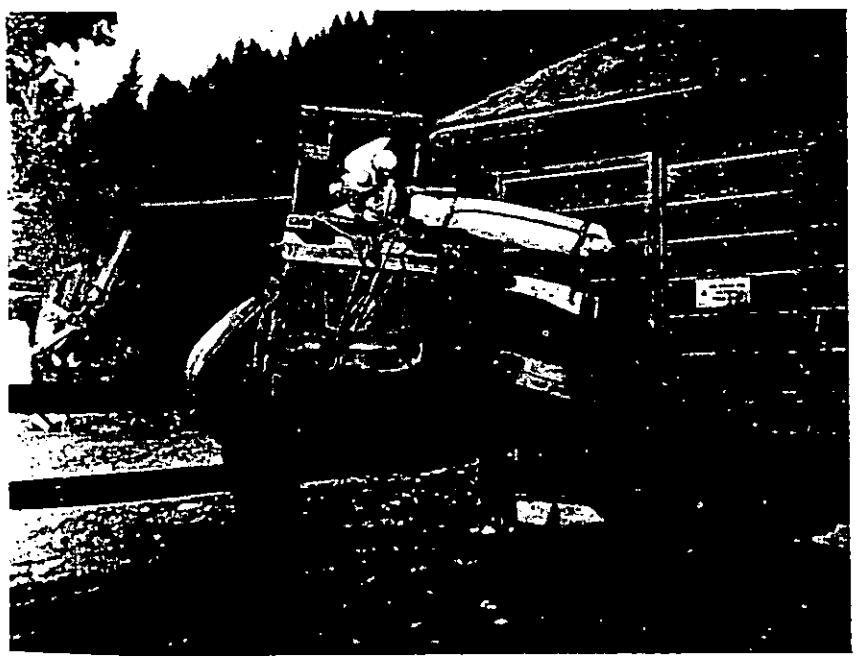

FIGURE 1.—Carrier opened, ready for power saw to be unloaded.

ELDORADO MAP CASE

E. L. CORPE

Central Dispatcher, Eldorado National Forest

A number of maps of various sizes—protection boundary, judi-
cial district, grazing allotment, improvement, etc.—are store
and intermittently used by the Fire Staff Officer of the Eldorado
The need for a case to prevent undue wear and tear, and to hav
the maps readily available for reference, had long been felt. Thi
became more acute when the Supervisor's office was moved to ne
quarters with smaller individual offices.

Bert Young, Fire Control and Grazing Officer, worked up th
original design, and after one or two refinements by other pe
sonnel, Forest Carpenter Clarence Hume constructed the first ma
case. The idea of mounting the maps on light plywood, so the
can be easily moved and displayed for small groups, was especiall
liked, and six additional cases have been built for staff officers.

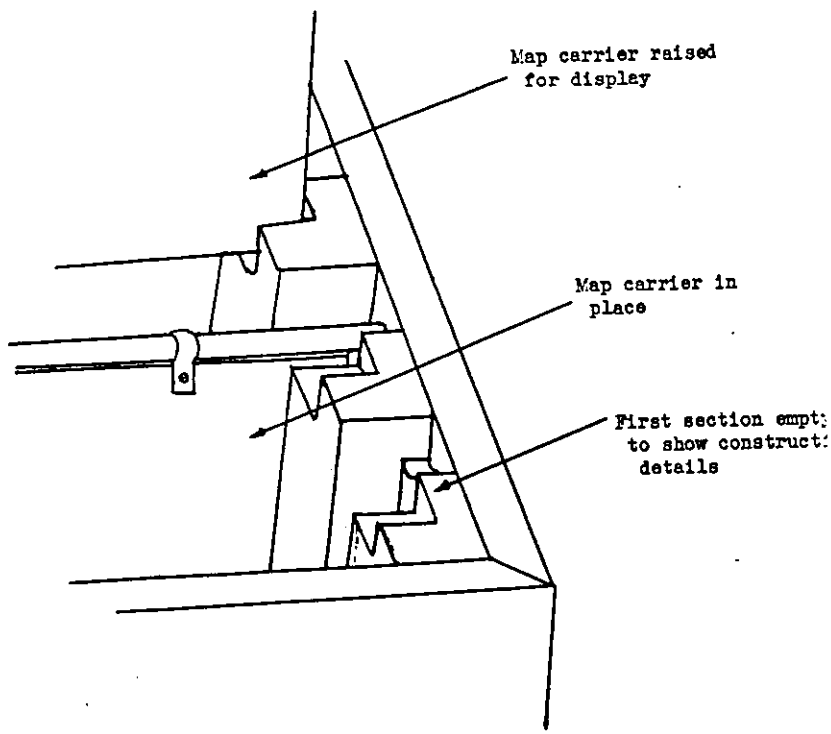

FIGURE 1.—Detail of inside corner of map case.

The case is constructed of ½-inch plywood, reenforced at joints and top and bottom. Inside dimensions are 46 by 37 by 8 inches, which gives space for seven sheets of 1/4-inch plywood, 34 by 44 inches. Maps are taped or stapled to both faces of the plywood sheets, thus providing storage of 14 full size maps, or a larger number of smaller ones.

The plywood sheets or map "carriers" are loosely fitted into grooves at the sides of the case (a tight fit will bind the sheet in the case). A 1/4-inch round dowel 45 inches in length is fastened to each sheet; the half inch projections of the dowel at each edge of the carrier serve as stops to hold each piece of plywood at the desired depth and distance apart inside the case.

FIGURE 2.—Map case with carrier sheet raised for display.

Two 44-inch pieces of 1-inch by 8-inch soft stock are routed at the top, grooved full length to receive the carriers, and secured inside the case at either end.

A tight lid to keep dust out, and a stain or varnish finish complete the construction.

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Exhaust Safety "Stinger"

The device which we call the exhaust safety "stinger" is a protective guard to prevent the operator and his helpers from being burned on the muffler or exhaust pipe on the top of a Wisconsin Model 4F-4-1 air-cooled engine. This particular engine and the pump it drives are mounted on the chassis of a 1 1/2-ton pumper.

This "stinger" is very easily and economically constructed. The framework consists of 5/16-inch rods shaped to fit over the muffler and tail pipe. They are bolted to the top part of the hood on the Wisconsin engine. The protective covering over the frame is ordinary hardware cloth secured by overlapping the ends around the rods and twisting. This is not a mechanically perfected device, but may serve as a base for improvement.—GEORGE W. VALLEY, *Fire Control Assistant, Sequoia National Forest.*

A GRAVITY SYSTEM FOR FIRE FIGHTING

ROSCOE T. FILES

Forester, Snoqualmie National Forest

This summer two visiting forest officers on a training assignment from another region saw a gravity system in operation for the first time. The use of available water by gravity is an old story to fire fighters of the Pacific Northwest, but an effective fire fighting tool in any area where water occurs in an adequate supply at an elevation of 50 or more feet above the point of use. Where it is possible to obtain a head of 100 feet or more, a gravity system will produce an effective stream. Once installed the gravity system runs continually with only an occasional check of the intake system to remove small sticks and debris.

There are several ways of installing a gravity system, the simplest being by use of a gravity sock. This is a cone-shaped piece of canvas having a 1/4-inch wire hoop approximately 10 inches in diameter sewn in the large end and a 1 1/2-inch pipe nipple, about 6 inches long, fastened to the small end of the canvas cone. Cone length may be 3 to 6 feet, the longer the more efficient.

An improvised gravity sock can easily be made by tying a piece of canvas, tin, or cloth around the end of the hose to funnel the water into the hose. Other successful versions are an old bucket, a canvas mail sack, and the end of a piece of 1 1/2-inch

hose. The gravity sock is placed in the stream where a dam can be built around the intake sock, or tied securely in place under a small falls. As soon as the water flows from the hose connection, the hose is strung out, and a new section is connected when the water starts to flow through the last connected section. When several sections of dry hose are connected and then attached to the hose line, an air lock will often occur. In this event the line will have to be opened to release the air.

Additional hose is attached by kinking the hose to stop the flow of water while a connection is made. When the pressure becomes too great for the hose to be kinked, a Siamese connection can be placed in the line to bleed off excess pressure. Additions can be made to the system until the pressure approaches the tested pressure of the hose. When the danger point is reached, a Siamese valve can be installed and an extra hose line used. Another method to reduce pressure is to run the first gravity line into a second gravity sock and connect the fire hose as explained above.

As a safety factor in nearly all gravity systems, every foot in height should be figured at one-half pound pressure to the square inch. For example, a 100-foot drop from the source of water to the nozzle will give 50 pounds nozzle pressure. This same figure may be used to determine the amount of elevation drop allowable before reaching the breaking point of the hose line.

Other suggestions of interest to users of a gravity system are the following:

By placing a 1-inch hose or 3/4-inch garden hose on the end of the 1 1/2-inch gravity system, a small amount of water can be used as an effective mopup tool.

In locations where several small streams occur on the lower part of a fire, and each stream is too small to supply a pump, the combined flow of the streams can be directed into a sump. Then, by using several short gravity systems, the sump will be capable of supplying a pump.

Where back-pack transportation is involved on a fire, linen hose is recommended for use in the gravity system because of the light weight of the hose and ease in handling.

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The Zipper Binder—A Forest Tool

The zipper 3-ring binder, first tried on the Caldor District, Eldorado Forest, seems to be the answer to a problem, and its use is spreading.

The forest guard, scaler, patrolman, foreman, or project worker no longer depends upon a pocket notebook for all of his written material. Having job instructions, job lists, safety plans, prevention plans, fire plans, training plans, instructions on closing stations, on operating radios, accident report forms, station inventories, current inspections, etc., he is faced with where to keep them, how to keep them, has he got them, is it written—the ring zipper binder takes care of them.

In the winter, the binders are brought up to date. In the spring or summer they are given out. In the fall they are collected, information (i. e. camper use, inventories, etc.) taken out. In between times they can be inspected.

They are inexpensive, dust proof, not bulky, convenient, and practical.—GEORGE I. RAMSTAD, *District Ranger, Eldorado National Forest.*

KEEP IDAHO GREEN

R. A. TRZUSKOWSKI

State Fire Prevention Director, Idaho

Our youth make a strong force in Idaho's campaign of fire prevention; and Governor Len Jordan's Keep Idaho Green committee is doing everything possible to sustain their active interest in the preservation of our State's greatest natural resource, the forests. Through the means of a statewide educational program, more than 15,000 members of youth organizations have taken up the never-ending fight to reduce the occurrence of man-caused fires. The principal contributing groups are the Boy Scouts of America, Campfire Girls, 4-H Clubs, and the Girl Scouts of America.

The Idaho State Junior Chamber of Commerce in 1946 was the stimulating factor that created the Keep Idaho Green movement, and has since maintained an active interest, offering its membership as leaders and organizers of fire prevention work. The Keep Idaho Green committee, created in 1946, is composed of public-spirited citizens representing State, Federal, and private interests. The principal objective of the educational program sponsored is a coordinated effort to reduce the occurrence of man-caused fires. The program operates on a budget of $8,000, half of which comes from donations from private sources; the other half from State and Federal funds. To coordinate the activities of the Keep Idaho Green program, a full-time director is hired by the State Forestry Department.

The vast educational program has resulted in the distribution throughout the State of more than 500,000 individual pieces of literature, including posters, stickers, postal cards, bookmarks, blotters, pamphlets, decals, and animated displays. A visual part of the program, including the showing of film strips and motion pictures, has proved most effective. The commercial theaters of Idaho contributed by showing trailers of Smokey, symbol of forest fire prevention. Idaho's radio stations sponsored fire prevention programs and spot announcements reminding the public to be careful with fire. The newspapers deserve special mention for the part they played in keeping the public informed of current news of fires and fire dangers.

On some 3,000 miles of Idaho highways, 300 road surface signs, 8 feet wide and 4 feet high, were painted (fig. 1). With these important messages in strategic locations, it is almost impossible for the traveler to go any distance in Idaho without seeing one.

In 1950, a new fire prevention character, called the "Guberif" and defined as any person who starts fires through carelessness, was introduced into the Keep Idaho Green program. The term

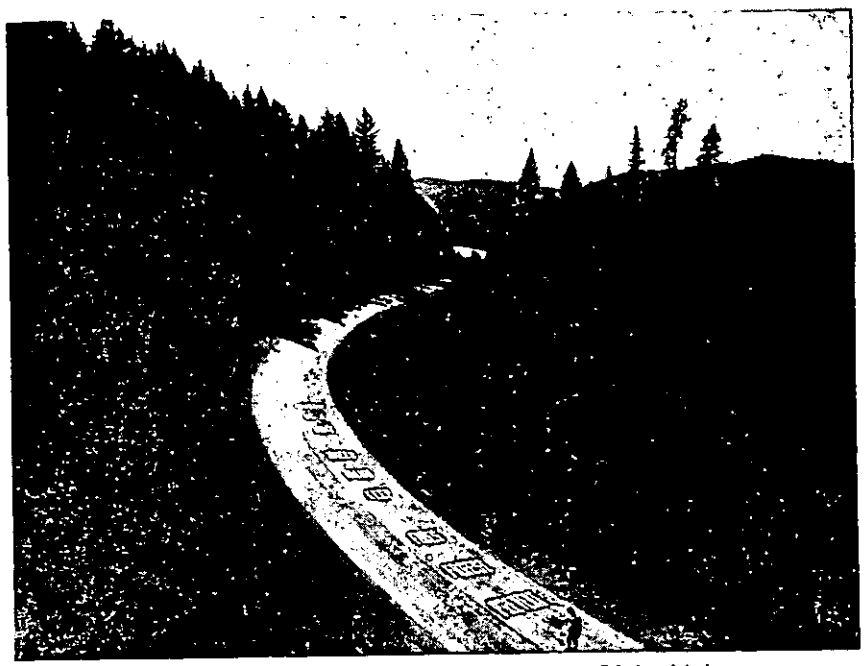

FIGURE 1.—One of 300 road surface signs on Idaho highways.

was derived from the word "firebug" spelled backward. The sight of the word has created a challenge to people being "exposed" to it for the first time. Psychologically, it has created a point of interest whereby the origin and meaning of the word are discussed, eventually leading to an active debate on fire prevention. The public-spirited citizens of Idaho are determined to stop the spread of "Guberifism." A constant effort by Idaho's youth to exterminate the Guberif will improve Idaho's fire prevention record (fig. 2).

The combination of our friend Smokey the Bear and the good-for-nothing Guberif has created a wholesome interest in our educational program. The Keep Idaho Green committee hopes to produce a series of short movies depicting the Guberif in various phases of everyday life as a media to remind the public that any person can become a Guberif through carelessness.

Idaho's fire prevention program is no different from any other. However, through continuous contact and recognition of achievement in activities, we have been successful in attaining the wholesome, active interest of many thousands of our young people. Each year more than $2,000 is awarded to youth organizations for Keep Idaho Green work. To be eligible for an award, each youth group is required to submit a report summarizing the work accomplished during that particular year. These summaries help the committee review the work being done by the various organizations. Many reports are arranged with elaborate displays and made into attractive scrapbooks.

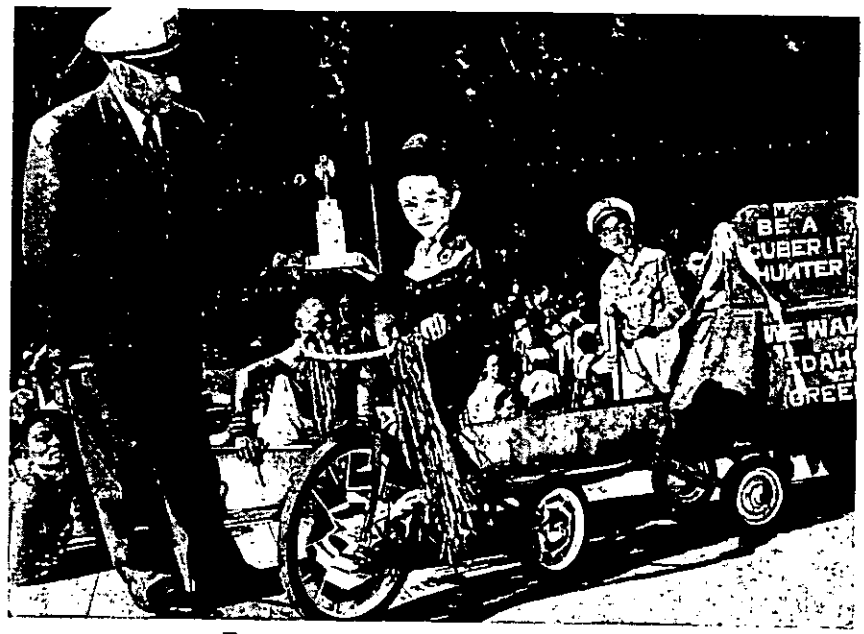

FIGURE 2.—Children's parade winner.

The never-ending battle to reduce the occurrence of forest and range fires is one that we in Idaho do not minimize. Each year, still, careless, indifferent individuals cause many fires that bring destruction to thousands of acres of Idaho's timber and grassland. This huge annual loss is needless. The responsibility for fire prevention rests on us—the people!

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Region 4's Approach To Training

We are all familiar with the old four-step method of instruction: Prepare the worker, present the lesson, try out performance, and let the trainees try out alone. Two other factors are so important in training that they have now been added: Advance preparation by the trainer and a critique or summarization. These are the six tested steps:

1. *Preparation by the trainer.*—Prepare a sound training outline, based upon definite objectives, coupled with a good job analysis in which the trainer puts all of his experience and thought; then practice until presentation will be adept and proficient.
2. *Explanation.*—Interest the trainees in the job to the extent they want to know all about it. Prepare the worker. Arouse interest and stimulate participation.
3. *Demonstration.*—Show and tell the trainees how to do the job.
4. *Application.*—Try out performance, allow the trainees to practice under close supervision.
5. *Test.*—Test to see how the trainees proceed without help.
6. *Critique or summarization.*—Review the whole procedure or job to correct weaknesses and tie the whole training program together.

If these six separate and distinct steps of instruction are adequately and expertly handled success in training is assured; they always work. Training requires such an organized approach.—*Region 4, U. S. Forest Service.*

HUMAN RELATIONS ON THE FIRELINE

FRANK F. KOWSKI, *Training Officer*, and GEORGE A. WALKER, *Chief, Fire Training Branch, National Park Service*

We have not been dragging our feet with respect to training our personnel for fire control work. For the most part the training has consisted of thorough instruction in the use of equipment and control techniques, or in the technical duties and responsibilities of fire overhead positions. But, how far have we come in improving our understanding and handling of the fire fighter as an individual? Supervisors from fire boss to straw boss, either directly or indirectly, guide and control the performance of the fire fighter, whether he is digging a fireline, operating a pump, or working in a mopup operation. Therefore, it is of the utmost importance that fireline supervisors know and understand how to work with these men most effectively.

We have all seen cases where a crew just didn't "put out" for the foreman. Probably on the opposite side of the same fire there was a crew performing work just as arduous and dangerous, yet which came into the fire camp at night with morale high and a good day's work accomplished. Sometimes people try to rationalize such situations by saying that one crew spent the day in a more difficult fuel type or that one crew was composed of a poorer caliber of workers. Granted that such conditions must be regarded as real obstacles, how much of the lack of accomplishment and low morale should be blamed on inadequate supervision and leadership on the part of the crew foreman and his straw bosses? Maybe it's time that we do some *real thinking* about how we can improve our understanding of human nature and get it to work for us instead of against us. The statements presented here are aimed at doing just that—to start us thinking again.

The subject of supervision is far too extensive to deal with in its entirety. However, there are a few guiding principles with which we might well refresh our memories. Let's start with the principle of understanding and knowing the job thoroughly. While this is of prime importance in any job, it is particularly so where any delay or hesitancy due to not knowing or understanding the job may mean the difference between successful control and the fire that got away. Nothing is more frustrating to a crew than to have a supervisor who doesn't know his job. Fortunately, the bulk of our fire control training (fire behavior, control techniques, organization) is aimed at this phase of supervision and it doesn't pose the problem that other shortcomings might.

Let's take a look at the principle of leadership. We all know the benefits of "leading" over "bossing" but all too often we hear of a fire emergency used as an excuse for extensive and uncalled-for bossing. The qualities of leadership are just as apparent in a critical fire situation as they are at any other time or place. The

ability to lead is a desirable trait in all supervisory positions, but particularly where the going is rough and there is an important suppression job to do.

What do we mean by leadership on the fireline? We usually think of an individual who understands the job to be done, who thinks clearly and acts quickly, who is willing to show the way, and who has the ability to create and hold crew interest. Most of these qualities are developed through routine training, but the ability to create and hold crew interest has been neglected. When an individual understands how and why certain things are done, he becomes more interested, and when he is interested he usually produces more and better work. Therefore, the supervisor should always explain to his crew how to do the job, the objectives, and why the particular job is important or necessary. Occasionally time doesn't permit this, but if it is customarily done, crew members will accept orders on those occasions when it can't be, confident that the supervisor knows what he is about.

Maybe we should brush up on the technique of giving instructions clearly and in a friendly fashion. Sometimes, there is a certain amount of confusion in fire suppression operations, and a supervisor scarcely helps the situation when he issues instructions that are not clear. Since most employees are reluctant to say that they do not understand, it is vital that the fireline supervisor give his orders and instructions in a readily understood language and manner. He should encourage his crew to ask questions concerning the instructions and stress the importance of their being understood.

The manner in which instructions are given is often overlooked or disregarded by some supervisors. They do not intend to arouse resentment, but their attitude or tone of voice may do just that. Friendliness in giving orders should prevail, especially if the job or task has undesirable features, and there are many of these in fire fighting. It is not too much to ask that we treat people with the same friendliness we would expect if the situation were reversed.

The current trend in fire control training gives ample emphasis to the importance of work planning, but how much is given to work delegation? It is not sufficient to know and understand the work to be done. The supervisor must also know how to organize and delegate work to the crew—and to do it wisely. Work should be assigned fairly and with consideration for those best suited to the specific job. Responsibility and authority go hand-in-hand in work delegation, and an employee must have a commensurate amount of both in order to get the job done efficiently even though final responsibility rests in the supervisor. When a supervisor has demonstrated his know-how in delegating work, he can be reasonably assured that the men will have respect and confidence in his ability to get the job done.

Frequently, bad and good work are accomplished on the fireline. The bad work is corrected and eliminated. As a rule, the good

work is recognized, but how often is it acknowledged? While it is extremely important to call attention to poor work in fire control, it is equally important to acknowledge honest effort on the part of employees. One sure method of increasing or maintaining the morale of individuals or groups is a word of appreciation for their work accomplishment. Fire fighting is hard and dirty work, often performed under difficult circumstances, and certainly a pat on the back now and then for a job well done will pay dividends.

Don't we all remember occasions when discipline on the fireline was administered on the spur of the moment when someone was tired? The average individual doesn't object to discipline if it is administered judiciously and on a fair and consistent basis. When it is necessary to take disciplinary action, it should be done immediately because delay may create additional complications—but not so quickly that all facts are not properly investigated. If it is necessary to reprimand an individual, it should be done as impersonally as possible and away from others. The supervisor can usually keep disciplinary action at a minimum if he takes the time to explain conditions and governing procedures, and why things must be done in a certain way.

Fireline safety should be mentioned here even though we emphasize the importance of safety in all of our fire training programs. We must never forget that the prime responsibility of the fireline supervisor is the safety of his men, both on and off the fireline. No opportunity should be overlooked to call attention to unsafe practices, but it is a poor policy to point out an employee as a horrible example. Supervisors must remember never to place an employee in a position where he may feel ridiculous. It is much better to correct the individual or the group in a lesson for all and avoid casting personal reflection on the offender. The men will soon be aware of the supervisor's interest in their safety, and consequently it is reasonable to assume that they will become more safety conscious themselves.

Some fire control techniques have become more or less standardized through the years, but this does not necessarily mean that they are the best. Therefore, the supervisor should be open-minded and welcome suggestions of different methods. We recall one experienced crew foreman who understood the law of gravity as well as anyone else, but he was so "pump conscious" that he overlooked the possibility of a gravity hose system until it was suggested by one of his crew members. Even if a suggestion proves to be impractical, the employee has had the satisfaction of expressing his thoughts. In addition, the supervisor has demonstrated his willingness to discuss and try out possible improvements in work methods. It is unlikely that pickup labor will come up with many innovations in fire control, but how about permanent and seasonal employees?

The morale and respect of a crew are largely determined by the supervisor's interest in its welfare. There is always a certain amount of casual interest on the part of the supervisor, but it

should be more than that—it should be sincere. If someone takes a personal interest in your well-being, it is only natural that you will try just a little harder to make your work acceptable to that person. The supervisor should maintain a close and friendly contact with his men so that he will know their wants and needs. He will improve his stature with his crew if he anticipates its needs rather than waits for a request. Willingness on the part of the supervisor to listen to complaints or grievances, both real and imaginary, and his honest effort to settle them indicates to his subordinates that he is sincerely interested in their welfare. Some of these complaints or gripes may seem trivial to the supervisor, but they are important to the individual making them. In all cases an attempt should be made to settle them as satisfactorily as possible.

How long has it been since we last programmed activities through which we could better train our supervisors? Everyone *wants* to be a good supervisor! The inclusion of human relations principles in training discussions and conferences for supervisors will go a long way in meeting this objective.

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Tire Innertubes For Line-Firing

During the 1952 fall fire season extremely hazardous burning conditions necessarily increased the use and value of line-firing in fire suppression. Discarded tire innertubes proved to be very satisfactory as line-firing torches, and the users rate them superior to the fusee torch.

Although ruggedness of terrain will determine to a degree the amount of line that can be fired, two additional factors seem important. First, innertubes vary as to type and amount of material of which they are composed. The composition very definitely determines the amount of line-firing that can be accomplished with any single tube. Second, there are techniques in handling the innertube as a torch which must be learned before maximum service will be realized. With some experience the torch handler will be able to control the burning of the innertube in such a way as to obtain the utmost service. The handler could tie a wire or stick to the tube for a handle and thereby lessen the chance of coming in contact with burning rubber.

How does an innertube work as a torch? After the innertube is cut, one end is grasped and the other is ignited at the fireline, by carbide lamp or other means. Once the innertube starts to burn freely a steady stream of burning rubber droplets will be produced. The torch handler then walks the fireline dragging the tube while the burning droplets set a continuous string of fire. It is estimated that an average of three-quarters of a mile of line can be fired in 25-30 minutes with one automobile tire innertube.

Advantages and benefits to be derived from this type of line-firing are as follows:

1. The innertubes cost nothing since most service stations are glad to get rid of them.
2. Since one man is capable of doing a job that normally would require two or more men, some manpower is released for other work.
3. Time required to burn out fireline is reduced, thereby lessening the chances of fire crossing the line and also releasing manpower for other work.
4. Line-firing at night can be accomplished practically as easily and effectively as during the day, though burning conditions are usually less suitable.
5. Unlike a fusee, an innertube after being ignited can be extinguished for additional use at another time.—ROBERT H. KING, *District Forester, Green River District, Kentucky Division of Forestry.*

LOGAN CITY-CACHE COUNTY FIRE ORGANIZATION

JOEL L. FRYKMAN

Forest Supervisor, Cache National Forest

Cache County in northeastern Utah has a countywide fire protection organization that is believed to be unique. This organization, centered around the Fire Department in the county seat at Logan, handles all city and county fires as well as grass and woodland fires on private land in the county. Logan is a city of 16,832 residents.

In 1924 the Cache County Commissioners entered into a cooperative agreement with the Logan-Cache Fire Department to suppress all uncontrolled fires on private and State lands not given protection by a Federal agency within the county, including those fires in towns and villages. The county commissioners delegated the powers of the county sheriff to the fire chief who was made responsible to the commissioners for issuance of burning permits and suppression of uncontrolled fires within his zone of responsibility.

Some of the non-Federal lands protected by the Fire Department lie inside the boundary of the Cache National Forest. The National Forest lands also lie close to the Cache Valley farmlands. By agreement between the two organizations, the first to receive a fire report located on adjacent lands will take the initial action, turning over the fire to the responsible party as quickly as possible.

All requests for burning permits on county-protected lands are cleared with the Fire Department. Examinations are made on the ground by a member of the Fire Department before permits are issued. Where these fires might also threaten National Forest land the district ranger makes an examination with the Fire Department, particularly if there is any question about issuance of the permit.

Area Protected

Within Cache County there are 752,000 acres. Of this acreage 263,622 acres are under organized protection by the Cache National Forest. The remainder, or 488,378 acres, is now being protected by the Logan-Cache Fire Department.

Outside of Logan there are 21 towns and villages to which the above organization is responsible for fire protection. In addition to Smithfield there are 5 towns with a population of from 1,000 to 1,760, 3 towns of from 500 to 1,000, and 12 towns and villages

of from 10 to 500. The valley, lying on the bed of old Lake Bonneville, is intensely farmed. The major area protected is 35 miles long and averages about 10 miles in width. There are comparatively few timber fires, as the foothills are grass or sagebrush covered with some maple and mountain-mahogany in patches. Fires in this type burn rapidly so that action must be fast. These foothills border steep mountain slopes having very high watershed values.

Equipment

The Fire Department has 5 pumper and 1 ladder trucks. The ladder and 4 of the pumper trucks are located in a modern fire station in the center of Logan. Two of the pumper trucks are owned by the county. The fifth pumper truck is located at Smithfield, a town of 2,400 residents, 11 miles north of Logan. The town of Clarkston has a small pumper truck equipped with 1,000 feet of hose. There is a county-owned pumper truck in the northern end of the county and 3 small towns each have a trailer with hose, all manned by volunteer crews.

Only the fire chief's car and one pumper unit are radio equipped. Contacts with the fire station by radio must be made through the Police Department radio. Ninety-eight percent of all fires reported are reported by telephone. The Fire Department also has an ambulance and furnishes this service countywide, there being no other ambulance in the county.

The towns having fire equipment can and do call on the Logan-Cache Fire Department to suppress fires on which they have taken first action.

Personnel and Training

The Fire Department at Logan has 23 firemen under the direction of Chief Borg. These men maintain 24-hour service. The Smithfield pumper is manned by 10 volunteer firemen. Lewiston, where the county pumper is located, has 20 volunteers. The trailer units have about 3 volunteers each but the crew may pick up others. They call the Fire Department which responds.

Cooperative fire schools are held each spring for the purpose of training men in fighting wild-land fires. Personnel from the Logan-Cache Fire Department, Cache County, Logan City, State Forester's Office, and the United States Forest Service participate as trainers. These sessions are attended by personnel from the Fire Department and their cooperator crews, city and county crews, Cache National Forest per diem fireguards and others who are interested.

Costs

The operating budget for the Fire Department in 1952 was $83,182. Of this amount the city of Logan paid $59,182 and Cache County $24,000. The county received $615 from Clarke-McNary funds in 1952.

Results

While the Fire Department suppresses uncontrolled wild-land fires in the valley and has been responsible for all property fires in the valley for 28 years, only in the past 2 years has it been responsible for wild-land fires on unprotected private and State lands inside the forest boundary. The full effectiveness of the organization in dealing with wild-land fires cannot be judged as yet, but even so, the record has been impressive. The fire prevention done through careful examination of burning-permit applications and quick action on fires has had a worthwhile effect on residents of the valley. They have become more fire conscious as a result of their participation in fire suppression work.

A thorough check of burning permits has caused the landowners to realize their own responsibilities for fire and to use greater care. The record of permits issued since 1950 has been as follows: 1950, 39; 1951, 76; 1952, 86.

During 1951 Fire Chief Borg, with the assistance of the county attorney, obtained two convictions for burning without a permit. In 1952 there were three such convictions accompanied by fines. A fourth case in 1952 for a similar offense resulted in a 60-day jail sentence for negligence in setting a fire.

Since the summer of 1951 was rather moist and the 1952 season had 61 days in September to November without measurable precipitation—a near record—the three years, including 1950, were not similar. A record of fires, kept separately by city and county origin, was as follows:

Year:	*City grass and rubbish fires (number)*	*County grass and brush fires (number)*
1950	23	19
1951	31	24
1952	17	16

While a greater number of permits was issued, the care exercised in checking those areas for which issued evidently was rewarded by fewer fires in 1952.

In 1952 the Fire Department handled its first mountain fire on private land in some rugged terrain. Prior to that year its experience in suppression of wild-land fires had been limited largely to grass and brush fires on the foothills. This was quite a change for men used to fighting fire largely in towns or near roads or in good terrain, but they came through successfully.

The cooperation between the city, county, State, and the United States Forest Service in this fire protection effort has developed a teamwork that we feel will pay large dividends in the future in reducing the number of fires, protection costs, and damages.

QUICK ATTACK PAYS OFF

W. B. WARD

Ranger, Jefferson National Forest

The fire history of the Clinch Ranger District has been the subject of much discussion locally. Invariably the argument arises between those who favor quick attack with a few men and those who want to delay initial attack to gather up a larger crew. This discussion of past fires always includes the years 1941 and 1942 in which 50.0 and 56.1 percent, respectively, of the fires were under 10 acres. In 1952 78.2 percent of the fires were under 10 acres. A check of the records revealed that in 1941-46 41.6 percent of the fires were over 10 acres while in 1947-52 only 24.6 percent were in this group.

From this it appears that progress has been made in fire fighting, so we studied the records to try to find the answer. The 12-year period 1941-52, inclusive, was used so that the two halves of the period would have comparable "bad" fire years.

Since none of the older men on the district recalled a large fire due to a long lapse of time between origin and discovery, this was ignored, and the elapsed time from discovery to first attack and average number of men in the first attack were selected for study. These two factors seemed to be the best answer to the gradual reduction in the size of fires.

In reviewing the records of individual fires it was not immediately apparent that either the size of the first attack crew or the elapsed time before attack had much to do with the ultimate size of the fire. For instance, in 1946 three men were fighting on a fire just 6 minutes after discovery but it still ran to Class D, while in 1950 one man did not arrive on a Class A fire until 1 hour and 10 minutes had elapsed. In 1942 on 19 Class C fires the average initial attack crew contained 11 men and arrived on the fire 1 hour and 18 minutes after discovery. In the same year on 5 Class D fires the initial attack crews averaged 20 men but were not at work until 2 hours and 55 minutes had elapsed! This one year seemed to prove our point, but 1943 spoiled everything. That year on 9 Class C fires the crews averaged 6 men and arrived 1 hour and 18 minutes after discovery; but 10 men attacked the only Class D fire in 59 minutes.

Obviously burning index (especially time of day) and point of origin have much to do with the final size of any fire, yet weighted averages indicate a trend to quicker attack and smaller crews as shown in the following tabulation:

	Average elapsed time, discovery to attack		*Average size of initial attack crew*	
Fire size class:	*1941-46 (minutes)*	*1947-52 (minutes)*	*1941-46 (number)*	*1947-52 (number)*
A (0.25 acre or less)	46	23	5	4
B (0.26-9.99 acres)	68	66	8	6
C (10.0-99.99 acres)	94	81	12	7
D (100.0-299.99 acres)	118	90	16	25
E (300.0 acres or more)	69	105	10	5

Before attempting to draw any conclusions there are several general points which should be mentioned. The topography of the district ranges from 1,100 to 4,100 feet above sea level and is generally sharp, giving most of the fires a hot run to the first natural break. There are only a few broad areas without some natural line locations but during the 12-year period none of the large fires occurred in such areas. Most of the Class C fires are held at the first good natural break in topography. The Class D and E fires have generally been those which started in relatively inaccessible places when the burning index was high. Although the district is small, travel is difficult and much of the protected area requires 2 to 3 hours' travel time after the crew is mobilized.

Occurrence has followed no unusual pattern. Railroad fires dropped after rights-of-way were cleared and two lines converted to diesel. Incendiarism fluctuates, both in number of fires and location, reaching a new high in the fall of 1952 with 9 fires.

Virginia has a brush burning law which prohibits burning except between 4 p. m. and midnight from March 1 to May 15. This has been in effect since 1940 and has been very effective. Fewer fires get out of control and those which do escape are easier to control when the burning index drops late in the day.

The number of fires per year has ranged from a high of 60 in 1941 through a low of 8 in 1947 and back to 46 in 1952. The average number per year for the first 6-year period was 31.7, the second 6-year period 21.0, and the 12 years 26.3. This is fairly typical of the trend for this section of the country with low occurrence during the war years and a gradual reduction throughout the period.

In the first 6 years we had the advantage of paid standby crews which influenced the number of men on first attack. During the second 6 years we relied entirely on volunteer crews but action was immeasurably speeded up by a network of FM radio in the last 3 years. Regular personnel were able to participate in initial attack in many cases when a mobile radio or scheduled check by portable radio received the report which initiated control action. The district has had a ranger and three yearlong forestry aides throughout the 12 years.

The usual tool outfit contains Council tools, ax, brushhook, hazel hoe, crosscut saw, and backpack spray pumps. No power line-building equipment has ever been used. Power pumps are available but have only been used occasionally on mopup. Water from a slip-on tanker unit was used on initial attack only one time out of 316 fires in the 12 years. This leaves the work squarely on the oldtime handtool crew. Most emphasis has been placed on proper line location and the use of water to control the backfire in initial attack.

With all the facts at hand we conclude that it is very much to our advantage every time we are able to dispatch one, three, or five men immediately and follow up with additional manpower as needed. In the last few years these first men have repeatedly said, "We got here just in time to catch it!"

THE HALFTRACK AS A FIRE FIGHTING UNIT

ARTHUR A. LUSHER

Forester, Jicarilla Indian Agency

Since World War II, halftrack units acquired as surplus property have been available for civilian uses. The halftrack is a heavy powerful machine, designed and built to withstand very rugged use conditions, and to propel itself over a wide variety of types of terrain. It can travel over improved roads at speeds of 40 to 50 miles per hour or negotiate rough areas to about the same extent as a crawler type tractor. High speeds are not recommended however, because of excessive wear to the tracks and bogey wheels. Such a halftrack was acquired by the Jicarilla Indian Agency Dulce, N. Mex., for use in protecting an area of approximately nine townships of rolling terrain of ponderosa pine timber type containing a variety of fuel types (fig. 1).

In adapting the halftrack to the fire control needs of the reservation, modifications had to be relatively inexpensive. Since the halftrack could travel fairly easily over most of the area the propelling and traction mechanism required no modification.

A Ranger Pal Junior fire plow was mounted on the rear of the halftrack by means of a solid pin hitch. The plow is placed in operating position by manually lowering it, and the hitch holds it at the desired plowing depth. The plow point is protected by a vertical rolling cutter and obstructions are avoided. It is possible to plow a fire strip 5 feet wide including fold-out.

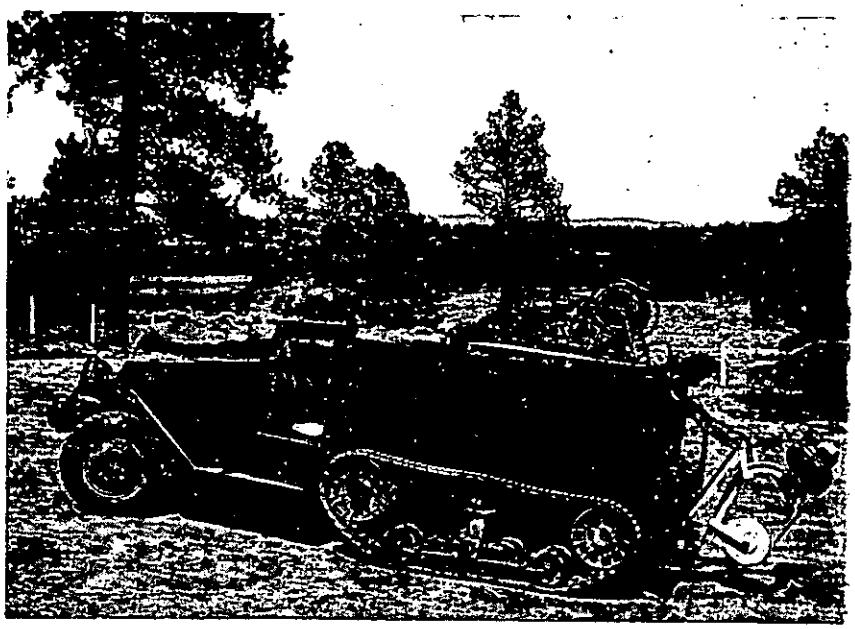

FIGURE 1.—Army halftrack converted to tanker-pumper.

Fire fighting efficiency of the unit was extended by removing the original gasoline tanks and installing a 400-gallon water tank equipped with a 101-F Bean portable pump and suitable hose and nozzle connections. Under average conditions the 400 gallons of water will last 2 hours. A 65-gallon gasoline tank was installed directly behind the driver's seat. Other modifications include installation of a high-frequency radio unit and space for rations and handtools.

The halftrack thus equipped has proved a reliable and efficient fire suppression unit. Its use has measurably reduced the travel time and manpower requirements of the protection area. The unit is versatile in that it is equally suitable for direct attack or for backfiring or burn-out methods.

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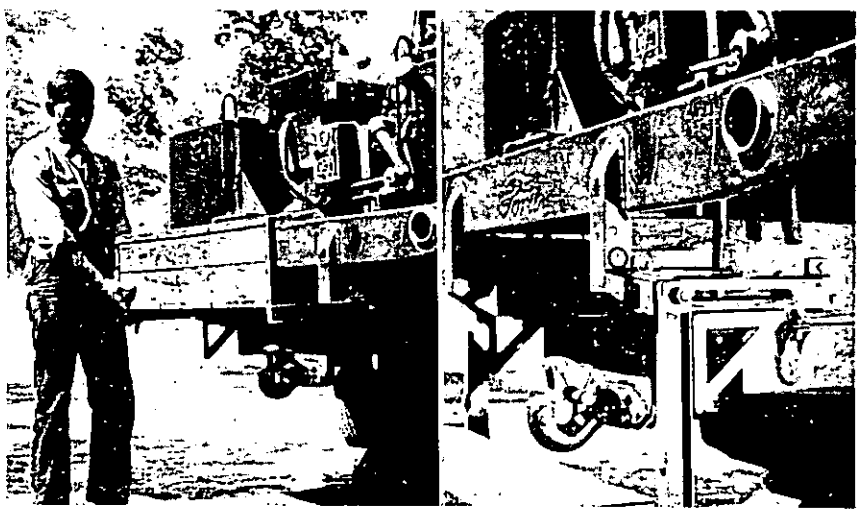
Folding Step For Slip-On Tanker

With the advent of the slip-on type of tanker the need for a folding step, which would make the unit easily accessible to the operator for operation and maintenance, was immediately apparent. The step described here is for a slip-on pumper-tanker mounted on a 1/2-ton, four-wheel-drive, flatbed truck. Since this type of truck is used on the roughest terrain, it was extremely important that the step fold away in a manner to allow complete freedom for the rear tow hook from any angle and also give maximum protection to the step in case the truck was backed into a bank or mountainside.

The step, when not in use, is held in a folded position flush against the back of the truck bed by a spring-tensioned keeper mounted on each side. The overall dimensions of the step are 37-1/4 inches by 10-3/8 inches by 1 inch. The estimated cost per unit is $30 to $40, depending on the number of steps desired.



Although the step was designed primarily for slip-on tanker use, it is believed that it can be modified and used on stake-side or suppression trucks. Additional information and construction data can be obtained by writing to Forest Supervisor, Angeles National Forest 1443 Federal Bldg., Los Angeles 12, Calif.—V. E. WHITE, *Acting Assistant Fire Control Officer, Angeles National Forest.*

MANAGING PRISON INMATES IN ORGANIZED FIRE CREWS

HURSTON S. BUCK II

Hot Shot Crew Foreman, Stanislaus National Forest

Each year the Forest Service and the California Department of Corrections draw up an operating agreement for the use of prison inmates in fire camps that will be in operation in Region 5. These men come from the four State Prisons, Folsom, San Quentin, Soledad, and Chino, and only those who have from 1 to 4 years left to serve may volunteer for camp service. None are drafted. All volunteers are given a complete checkup in the prison hospital and dentist office before being cleared for camp. Their physical condition and age are a large factor in their final selection. The past record of each man is reviewed to determine his suitability for fireline work. Upon arrival at camp and after, if the Hot Shot Crew Foreman finds a man in the group that is unable to carry out the duties of a fire fighter, he may have the man returned to the prison without hurting the inmate's record.

While in camp, inmates are restricted to areas posted with "camp limit" signs. An inmate may move around the grounds inside the limits at his own will, but to go beyond he must be accompanied either by a Department of Corrections officer or a forest officer connected with the camp. The camp is handled exclusively by 1 lieutenant and 5 officers from the prison, and at least one of these men is on duty during a 24-hour period. When crews are needed on a fire, they are counted and checked out to a forest officer. A count of the men is made while they are in camp at least every 2 hours. When out of camp it is the forest officer's duty to make the count.

The prison furnishes the food and runs the kitchen. The commissary is managed by the prison officials, and no one else is permitted to trade, give, loan, or sell any article to an inmate. Cigarettes are the articles that have to be watched most closely, because they are the same as money to an inmate; he can use them as a medium of exchange.

California Department of Corrections officers or forest officers connected with the camp are the only persons allowed to talk to an inmate whether in or out of camp. It is a violation of the law for the inmate and free persons alike if they converse.

Naturally, it is desirable to condition the inmates for fireline work insofar as strong legs and wind are concerned. These men come from prison with little recreational exercise. They are very soft, and a lot of them have never lived in the mountains. When a camp is established before the fire season starts, project work such as tree planting and blister rust is provided to help accomplish conditioning. If a camp is established after the season starts, the men are conditioned on project work between fires.

Some of the inmates have never handled a shovel or an ax, but they are willing to learn. It is necessary to start with the most

elementary instructions on handtools and fireline setup. While line of command is always important, it is a must with this type of crew. The working of the fireline from the fire boss down, and the complete fire camp setup, is explained to the men.

Hard hats, canteens, and tools are issued to the men. The writer has observed that different nationalities handle the various fire tools with varying degrees of efficiency. We do not issue brush hooks because it takes too long to properly train the men in the use of that tool. After the tools are distributed, safe carrying practices are demonstrated; emphasis is placed on safety in carrying tools while hiking to or from a fire. The men are also taught two methods of fireline construction: the "one lick" and the "bump-up." They construct practice firelines by both methods for 2 days in different cover and terrain, and they are also trained in dry and wet mopup.

When there is a call to a fire, the Department of Corrections officer in camp is notified at once. He in turn alerts the crew. We have two trucks and a pickup. The men have all been briefed in loading. Bedrolls all go in the pickup and the tools go in the truck boxes. The forestry inmate clerk has a kit already packed with the necessary forms to be used, and it is also loaded onto the pickup. The men get on the trucks and are counted by the Department of Corrections officer who is to accompany the crew. While in travel, the crew is not permitted to cross the California line because its men are wards of the State, and once out of State they are free until extradition papers can be cleared. Upon arrival at the fire the men are counted again and checked to the forest officer. These men are very willing workers on a going fire, and they are also thorough on mopup.

This unit is set up as a sector, with sector and crew bosses so that the efficiency of the trained crew will not be impaired, and the inmates will be prevented from mixing with pickup labor. In a crew of this kind there is a radio operator, clerk-timekeeper, and men trained in felling with handsaws or chain saws.

At the end of a shift the foreman counts the men and brings them back to the fire camp where they are again counted by the Department of Corrections officer and turned over to him. The officer takes the inmates into a sleeping area away from the fire camp area in general. This area is posted with camp limit signs, and the men must stay within the limits except when the officer brings them out to meals. The Department of Corrections officer is notified of the hour that the men will be needed in the morning, and it is his responsibility to have them up and fed so that they are ready to be checked out at the proper time.

The possibility of the escape of any of the inmates is of paramount importance to the Department of Corrections. This is the reason for all of the counting that is done and for the restrictions as to conversation between inmates and free personnel. If an in-

mate were permitted to run at will around the fire and fire camp, he would be in a position to make a contact for transportation and possibly an escape. The sheriff's office nearest the camp where the men are housed for the summer is given a picture of each man. The forestry foreman is also supplied with pictures of each man he takes on every fire. The Department of Corrections officer has a picture of each one too. Counted often, the men know that if they were to leave it would be but a short time before they were missed, and that it would be almost impossible for any distance to be gained. If inmates are on the fireline and one is missed and cannot be located the officer in the fire camp is notified at once. The Department of Corrections as a rule does not ask the Forest Service to chase a fugitive, but when requested full cooperation is given. If an inmate is off the line without permission, it is the same as escape and is a punishable offense.

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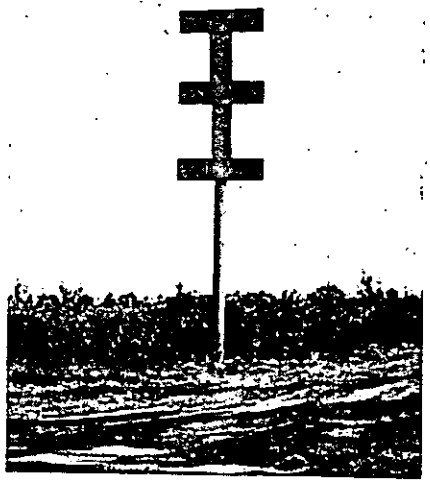
Location Marker For Lookout Reference

One of the forest fire detection problems on the Myles Standish State Forest, near Plymouth, Mass., is the prompt and accurate location of fires which are visible from only one lookout. Terrain is level to rolling without easily identified natural features. Cover is a dense growth of scrub oak and pitch pine which tends to obscure natural landmarks such as roads and ponds. Parts of this area have been cut over, and the patches of slash, in which fire travels rapidly, make accurate location for suppression crews of prime importance.



The solution to this problem is a system of markers, similar to the one illustrated, which we mounted on the top of trees and poles high enough to place them above surrounding vegetation and in locations where they are under direct visibility from the lookout. Each marker is painted a bright yellow, which seems to glow in the sun and renders the marker readily visible. Markers are located near road junctions, fishing ponds, scout camps, picnic grounds, and similar hazard areas. Exact location of each marker is recorded on the lookout map.

This system of markers provides a network of artificial landmarks within the area of responsibility of the Myles Standish Lookout that facilitates rapid and accurate determination of fire location without the aid of cross shots from other lookouts. In addition the markers provide a visible "yardstick" for estimating distance. This aid is of considerable value in training a new observer and to one not familiar with that particular area.

The usefulness of the markers was established shortly after they were put up. A fire occurred in a slash area about 500 yards from a marker. The observer was able to report the exact fire location without the aid of a cross shot. The markers have proved so useful that we plan to extend the system.—HAROLD L. BALLARD, *District Fire Warden, Massachusetts Forest Fire Service.*

INFORMATION FOR CONTRIBUTORS

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

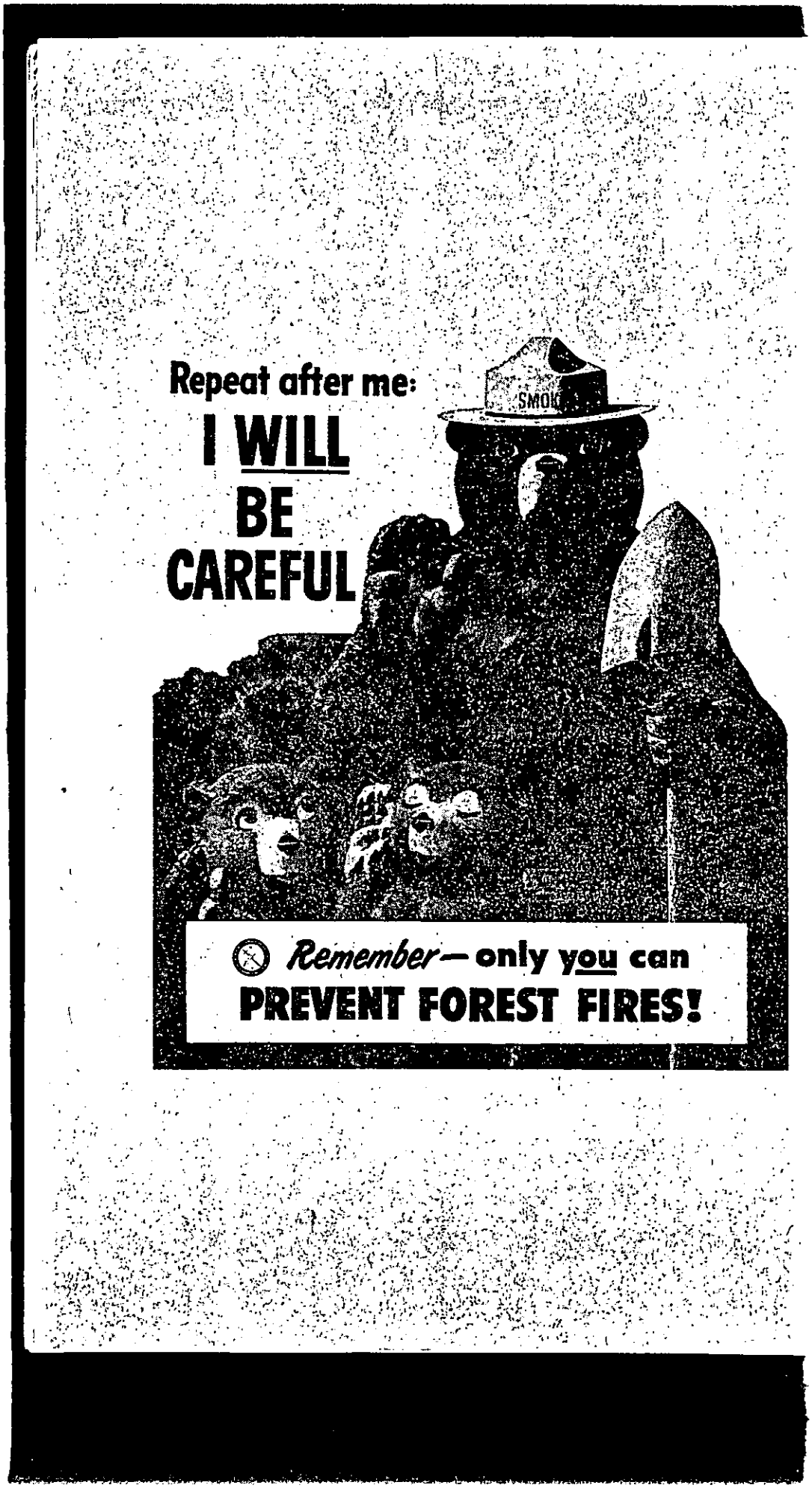
The title of the article should be typed in capitals at the top of the first page, and immediately underneath it should appear the author's name, position, and unit.

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

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

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

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


Repeat after me:
I WILL
BE
CAREFUL
SMOK
Remember— only you can
PREVENT FOREST FIRES!