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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 21 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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LIGHTNING PROBABILITY FORECAST

HOWARD E. GRAHAM
Meteorologist, Division of Fire Control, Region 6
U. S. Forest Service

INTRODUCTION

A probability concept was used for forecasts of lightning occurrence during the 1959 fire season for western and central Oregon national forests. This article deals with an evaluation of these forecasts, some of the problems of weather prediction and the basic need for a statement in each forecast of the likelihood for certain weather events to occur. It is pointed out that probability statements in forecasts are meaningful.

Weather forecasts are traditionally written as categorical statements. This is done in spite of the fact that whether or not uncertainty is expressed, uncertainty as to outcome exists with every weather forecast. Increased precision in forecasting is expected to come with advances in the meteorological science. However, our increased ability to observe and analyze the atmosphere is not always accompanied by a corresponding improvement in the skill with which we are able to predict future weather. Because of the importance of weather to fire control activities, it is important that efforts be made to advance the usefulness of weather forecasts within the existing state of weather forecasting accuracy. For this purpose, we will examine the nature and quality of probability estimates of future weather.

FORECAST UNCERTAINTY

Every forecast is accompanied by an error distribution. This error distribution exists for the categorical forecast, for the forecast where the error distribution is merely implied and in a probability forecast where the error distribution is clearly stated.[1] The error distribution exists for several reasons. Some of these reasons are—

1. The atmospheric sampling procedures are crude and provide only a qualitative measure of the small-scale factors which make up the real atmosphere.
2. The atmospheric processes are very complex. The complexity is so great that the mathematics of the prediction problem currently exceed our technical ability for exact solution.
3. There are unknown external influences such as variable solar activity.

FORECAST USEFULNESS

In order that weather forecasts may be fully utilized in operational decisions, it is necessary first that the degree of forecast

[1]Malone, Thomas F. *Applied Meteorology.* Meteorological Res. Rev. 3 (16). July 1957.

uncertainty be known.[2] A second, and probably equally important aspect, involves developing a systematic means for applying the degree of forecast error distribution in making the operational decision.

The categorical forecast essentially leaves the operational decision up to the weather forecaster. The probability forecast leaves the operational decision to the user. The latter is the more economically sound procedure, providing the user has accounted for both the forecast uncertainty and the operational risks. The manner in which weather forecasts are applied to a fire control decision must be determined by the forecast that is possible to make.

PROBABILITY FORECASTS

Evaluation.—There are guides to accuracy of probability statements. First, the forecast probabilities should agree reasonably well with the observed relative frequencies. This is called forecast "reliability."[3] For example; when forecast probabilities of 75 percent are made for occurrence of some weather event, this event should be observed about three out of every four times that the forecast was made. A second desirable characteristic of probability forecasts would be for a large percentage to be near certainty (yes or no).[4] This is called "resolution."

Reliability.—There have been several tests which show the feasibility of probability estimates by weather forecasters. Williams[5] pointed out that forecasters at Salt Lake City could indicate fairly well on an average whether or not their forecasts would verify. Weather forecasters at San Francisco[6] have issued probability forecasts of rain for public use. During the first winter's experience, these forecasters were overconfident on the higher probabilities. During the following winter, with more experience, the forecasts closely approached perfect reliability. There was likewise a tendency, during the second year, to increase the near "yes" and near "no" predictions. Fire-weather forecasters at Chicago[7] demonstrated that forecasters there could evaluate the chance of occurrence of tested weather elements.

[2]Thompson, J. C. *The Nature of Weather Forecasting Decisions.* U. S. Weather Bureau, Office of Meteorological Research. Unpublished.

[3]Sanders, Fredrick. *The Evaluation of Subjective Probability Forecasts.* Mass. Inst. Technol. Dept. Meteorology Sci. Rpt. 5. June 1958.

[4]Brier, Glen W. *Verification of Forecasts Expressed in Terms of Probability.* U. S. Monthly Weather Rev. 78. Jan. 1950.

[5]Williams, Phillip W. *The Use of Confidence Factors in Forecasting.* Amer. Meteorological Soc. Bul. 32 (8). Oct. 1951.

[6]Root, Halbert E. *An Evaluation of Probability Forecasts for the San Francisco Bay Area.* Unpublished. July 1958.

[7]Schroeder, Mark J. *Verification of 'Probability' Fire-Weather Forecasts.* U. S. Monthly Weather Rev. 82 (9). Sept. 1954.

FIRE-WEATHER LIGHTNING PROBABILITY FORECASTS

Procedure.—During the 1959 fire season, fire-weather forecasters at Portland, Oreg., issued routine probability forecasts of lightning occurrence for selected national-forest areas in Oregon. The forecast probability of lightning was the forecaster's estimate of the chance for the forecast to verify. These estimates were based on individual forecaster's judgment with little or no reliance on statistically based procedures.

Interpretation of graphs.—The results are illustrated in figures 1 and 2. In these figures the forecast probability is plotted against the observed percent of occurrence; for example, the Mt. Hood graph shows ten forecasts made for 20 percent probability with an observed occurrence of 20 percent because two lightning-storm days occurred out of these ten forecasts. The condition where the forecast probability equals the observed relative frequency (perfect reliability) is indicated by the dashed diagonal lines. Forecaster overconfidence is shown when points fall to the right of the diagonal line, and underconfidence by the points to the left. The significance of points is dependent on the number of cases; for example, in the Willamette graph, there is some significance in the fourteen forecasts of 40 percent probability but practically none in the location of the one forecast of 70 percent probability. The majority of forecasts plotted in the figures as 10 percent probability were actually stated in the forecasts as 10 percent or less. In every figure, this would mean that the data plotted as 10 percent should lie some place to the left and nearer to the line of perfect reliability.

Forecasts.—The forecasts for most of the national-forest areas show that the forecasters were usually able to estimate the chance of lightning occurrence. There was, however, a wide scattering of results. The Umpqua National Forest forecasts generally expressed overconfidence of lightning. The forecasts for the Fremont National Forest (fig. 2) indicated the best reliability. Forecasts for the Siskiyou National Forest had very limited reliability. The average of all forecasts somewhat closely approximates perfect reliability. Overconfidence is shown for the 40 and 70 percent forecast probabilities. The 17 cases indicated as 90 percent probability were actually categorical forecasts where it is not known whether the forecaster overlooked the probability statement or was fairly certain. A categorical forecast of lightning implies from 80 to 100 percent probability. A larger percentage of forecasts near unity (yes) would have been a desirable characteristic. How did they score numerically? Based on a possible score (resolution) of zero for perfect forecasting and a maximum value of 2 for the worst possible forecasting,[5] the sample scores ranged from

[5] See footnote 4.

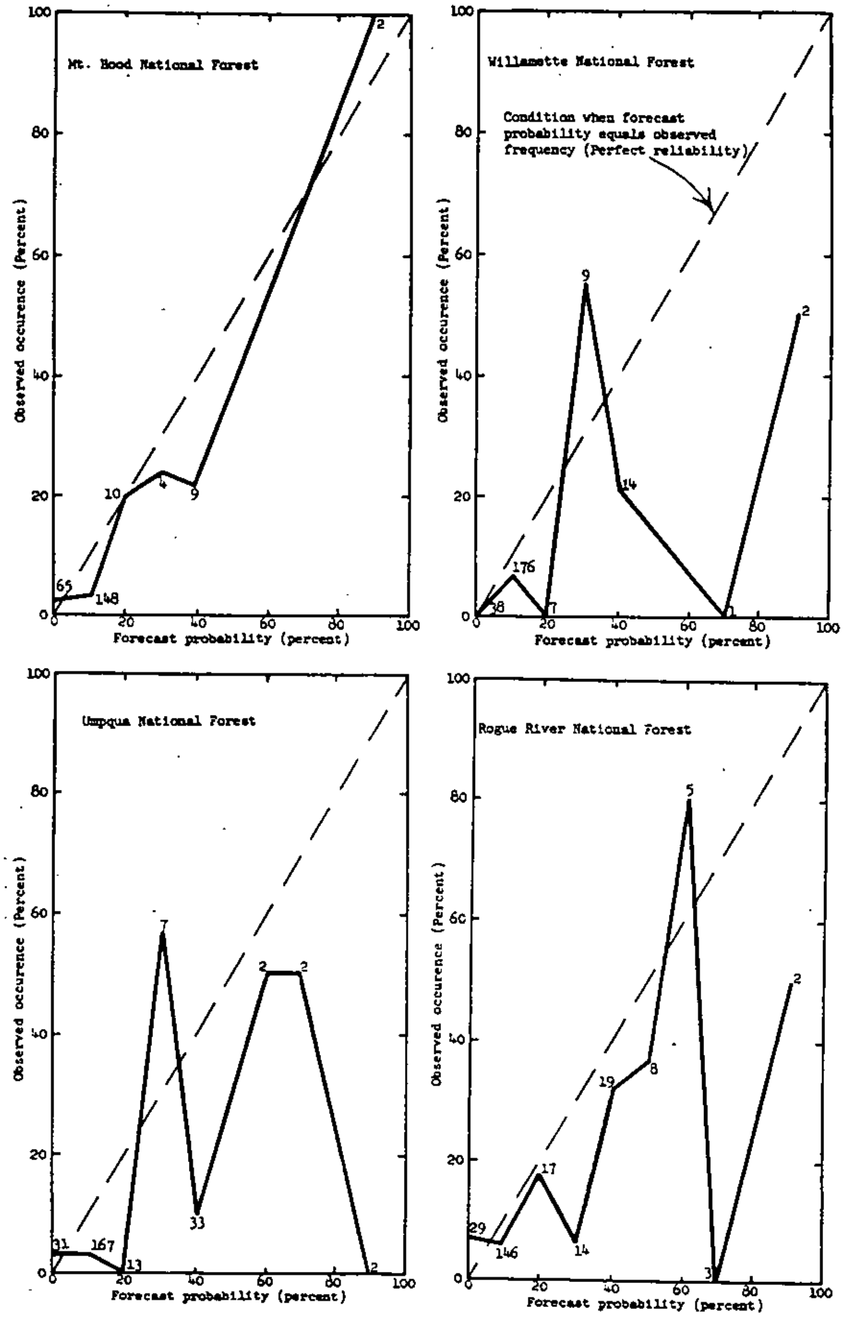

FIGURE 1.—Lightning probability forecasts July 11-September 30, 1959, for Mt. Hood, Willamette, Umpqua, and Rogue River National Forests. Numbers by points show all a.m. and p.m. forecasts.

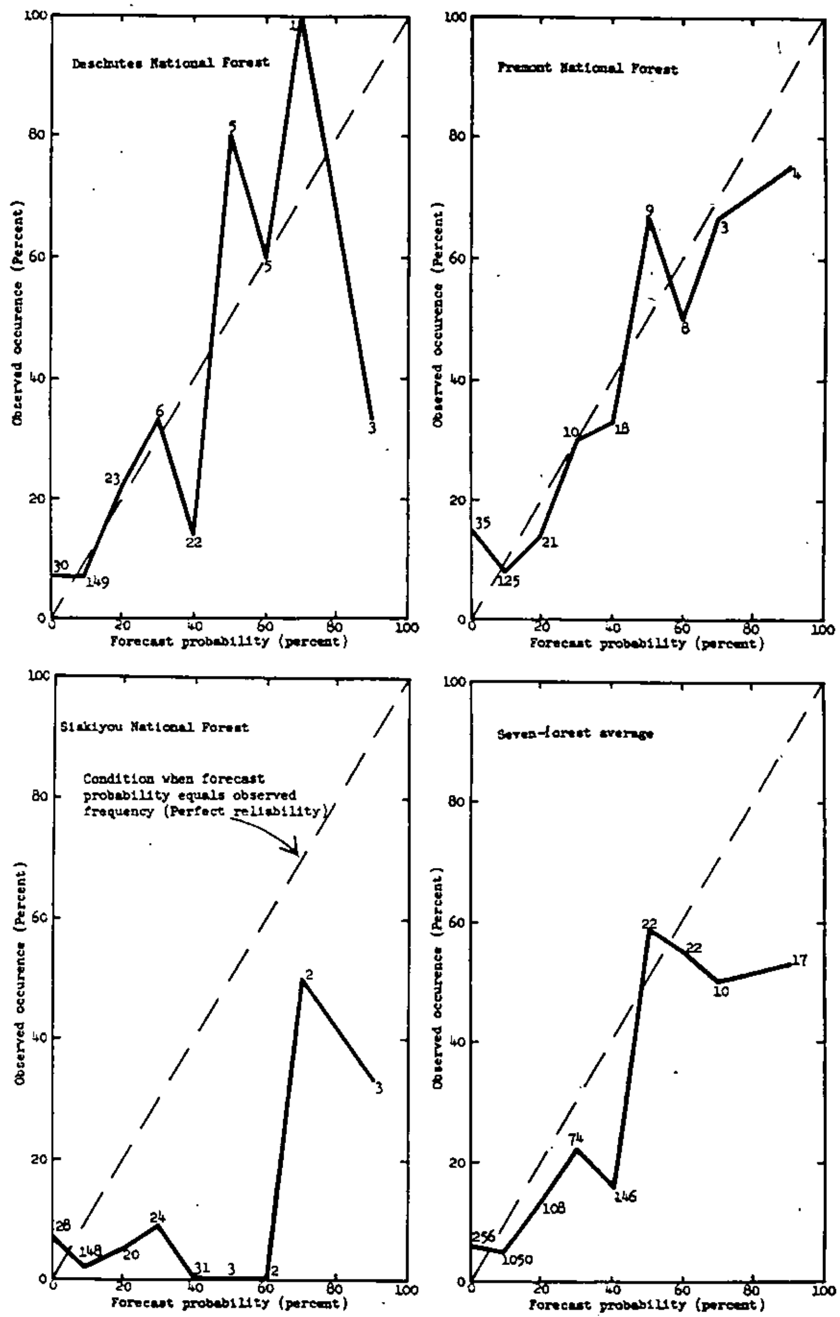

FIGURE 2.—Lightning probability forecasts July 11-September 30, 1959, for Deschutes, Fremont, and Siskiyou National Forests, and the seven-forest average. Numbers by points show all a.m. and p.m. forecasts.

0.12 to 0.28. Scores for sample national forests for the 81 forecasts during 1959, stated in terms of probability are as follows:

	Forecasts for tomorrow made at—	
	0825 P.S.T.	1505 P.S.T.
Willamette National Forest	0.17	0.14
Siskiyou National Forest	.12	.15
Deschutes National Forest	.21	.21
Fremont National Forest	.26	.28
Total	.76	.78

CONCLUSIONS

The inherent uncertainties in weather prediction may be given quantitative expression by the weather forecaster's use of the probability concept. A quantitative estimate of forecast uncertainty leaves the operational decision where it should be—with the user. From an appraisal of the forecast probability and the operational risk, there is then a logical basis for carrying out an operation.

The principal points of interest regarding probability factors with weather forecasts are these:

1. The increase in value over the use of traditional categorical forecasts depends directly on both the degree with which probabilities are concentrated toward the extreme (yes or no occurrence) and on the reliability or accuracy.

2. Experienced forecasters can prepare useful subjectively based probability forecasts.

3. The average of all forecasts issued by the Portland Fire-Weather Center shows that probability values were assigned that, on the average, agree fairly well with observed occurrence. This is in concurrence with other studies.

4. Forecasts for individual national forests were quite variable. Some were relatively reliable and some unreliable. Numerical scores show that forecasters have skill in recognizing departures from normal conditions.

5. Other studies have shown that forecaster's skill, in assigning quantitative probability estimates, can improve with experience. Foresters using probability forecasts should, therefore, expect improvement as the forecaster gains experience.

6. Assigning probability estimates of lightning occurrence has been improved in some instances by statistically developed forecasting procedures.[9] The poor results for the Siskiyou National Forest point up the definite need for research along this line.

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[9]Price, Saul. *Thunderstorm Today? Try a Probability Forecast.* Weatherwise II, 2(3). June 1949.

Cramer, Owen P. *Preliminary Report: An Objective Method for Forecasting Thunderstorms for the Willamette National Forest.* U. S. Weather Bureau, Portland, Oreg. Unpublished. Jan. 1949.

A UNIFIED FIRE DANGER RATING SYSTEM BY 1963

A. A. BROWN
Director, Division of Forest Fire Research, U. S. Forest Service[1]

All of you know of the project we have undertaken to unify fire danger ratings. It is a joint effort of the Divisions of Forest Fire Research, Forest Fire Control, and Cooperative Forest Fire Control in our Washington and field offices. I think you know too that John Keetch has been assigned the task of heading up this effort.

As State foresters you have a substantial stake in this project. Your fire control expenditures are now more than twice those incurred in the protection of Federal lands. On State and private lands east of the Mississippi, you have 250 fires per million acres compared with 70 fires per million on Federal lands. In the West the ratio is 63 fires on State and private lands compared with 29 on Federal lands. You now have 45 percent of the 3,000 fire danger stations that are maintained in the United States. The Forest Service has another 45 percent. Other Federal agencies and private organizations have the remaining 10 percent. Throughout the United States, a total of eight fire danger rating systems is in current use.

At this point we may ask ourselves why the use of fire danger rating systems has persisted and grown, and why we need to do something to unify them. The concept of rating fire danger was first developed by Harry Gisborne in the early 1930's. It was looked on at first as impractical and too ambitious. Yet even that rather crude rating system immediately became so useful to fire control managers that the idea caught on rapidly, and our forest experiment stations began adapting the system or developing one for local use. Throughout the ensuing 25 years, research in fire danger rating has continued to be a part of the program at most of our experiment stations. It has paid good returns, but overall progress in improving our systems had slowed down in the past 10 years.

In fire danger rating, we deal with two things—fire and environment. The response of fire to moisture, temperature, and wind is the same everywhere. But fuels, weather, and topography, which make up fire's environment, vary locally. Since in every national-forest region a regional system must of necessity reflect a variety of environments, a highly localized application is suggested as is a fixed accuracy up to some jurisdictional boundary. This is only where confusion begins. The regional systems vary

[1]From a paper presented at State Foresters Association Meeting Oct. 8-10, 1959, at Stowe, Vt.

too in the relative weights they give to wind, moisture, and temperature; in how they are expressed numerically; in how they are used; and in how they are interpreted.

As State foresters you are perhaps a little more fortunate than some Federal foresters, since in most instances you can use a single regional system statewide. But if you are not satisfied with it you find it awkward to change. The Bureau of Land Management finds itself in the predicament of deciding which of eight danger rating systems will best serve their purpose in the widely scattered lands for which they are responsible. The Park Service has the same problem. In Research, we have concluded that further work on refining and adapting regional systems is too time consuming and not likely to be productive. We hope to develop a basic system that will treat universal relationships in a uniform way and yet be flexible enough to take local environment into account.

In starting the job last year, John Keetch visited each Forest Service regional office and experiment station to study the status of fire danger ratings and their uses. The purpose was to make a comparative analysis of the basis on which each danger rating system had been developed, and to find the reasons for the weights that were used. At the regional offices, a study was made of how fire danger ratings are used by the fire agencies in each region, and of how well the users felt the ratings were serving their intended purpose. In making this study, Keetch talked to a great many State foresters or their representatives in California, Oregon, Washington, and the Northeastern States. In the Lake States and the States in Region 7, State foresters supplied memos to Regional Foresters on what they felt was needed. In other Forest Service regions, the Division of Cooperative Fire Control supplied similar information.

Following these studies, Keetch made a careful analysis of each of the fire danger rating systems, and he has made several numerical comparisons of his findings. Progress reports from this study were distributed to all Forest Service regions and experiment stations with circular letters on March 16 and August 28 this year. Agreement is reached on giving weight to wind speed and to some measure of flammability, but there is no agreement on what "flammability" means nor on how to determine the best measure of moisture content of fuels. This last point is perhaps the most critical one that must be settled before we can reconcile the many other points of difference.

Keetch has found a basis for classifying the rate of drying of dead fuels, which is a good unifying concept. He uses the term "timelag constant" in identifying forest fuels with similar drying characteristics. If we can clearly distinguish whether fuel dries out enough to burn in 2 hours, 2 days, 2 weeks, or 2 months, we can then clarify many of the things that cause confusion. It makes little difference whether a quick drying fuel consists of curled oak leaves in the East or ponderosa pine needles in the West; if the rate at which they dry out or take up moisture is the same, the conditions under which they ignite will also be similar.

It is quite probable we will end with a rating system that uses at least two indexes—one that shows the effect of today's weather, and one that shows the cumulative effects that increase or decrease the severity of burns. In addition, drought indexes that show periodic buildup of abnormal conditions will be needed in many areas.

The program was reviewed in August with a committee of field advisers. It was decided that the research needed to provide a complete numerical basis for a national system of danger ratings would delay the project immeasurably. Consequently, only the most important research on fuel moisture will be carried out at the new fire laboratory now available to us. For other relationships we shall depend primarily on bringing together the most reliable information we have as the base for a trial system to be ready for testing in 1961. The test will be started in regions where revision of existing ratings has been deferred, and in other places where there is special interest in helping to develop a national system. A 2-year period of testing is contemplated, with the objective of a complete system by 1963.

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Marking Controlled Lightning Fires

Often after a lightning storm some of the resulting fires that have been controlled but not extinguished will continue to smoke for days. Because all fires from a single storm do not occur simultaneously and yet may occur within a small area, confusion results for the aerial patrol and the dispatcher and crew boss in deciding whether the smoke they see is from a controlled fire or a new one.

We now mark controlled fires with strips of orange crepe paper about 6 inches wide and 7½ feet long. The crew boss places the paper in the form of an X across brush or on the ground close to the fire's perimeter. If possible, it is placed so that it will be visible from the air. Crepe paper is preferred to cloth because it will weather and fade within 2 or 3 weeks after it is used. The fading prevents possible confusion between old fires and fires that follow new storms. Then, too, the paper is cheaper than cloth.—WILLARD J. VOGEL, *Forester, Yakima Indian Agency, Bureau of Indian Affairs.*

OBJECTIVES IN FIRE CONTROL PLANNING

LLOYD R. OLSON
Forester, Division of Fire Control, Washington Office, U. S. Forest Service

Objectives are the basis for standards of performance for fire control. From them must be set up comparable standards of protection between planning units for each timber resource, forest type, value class, hazard, and risk. Fire control based on well-developed plans and uniformly applied objectives thus provides a case for adequate financing in each protection unit. Equally important, a sound approach is provided for presenting the needs of fire control to budget authorities.

Some changes in fire control objectives have occurred through the years. One reason is the tremendous increase in forest values; another is that refinements in the technique of setting objectives have helped clarify the fire control problem.

A long-term objective of fire control is to hold losses from fire to a level determined by resource managers to be tolerable for each resource and yet permit successful management. This is accomplished by limiting the size of individual fires and the average annual total burned area to the maximum that can be tolerated for each resource in the management unit. Expressed in another way, the total cost of fire control plus the total loss from fires that do occur will be the lowest possible for each resource requiring protection.

Values are a major control in setting objectives. Where no values exist, there is no loss when fires burn. The higher the values, the greater are the justifiable costs of protection. Many values in the forest can be destroyed by fire. Some, such as timber, forage, and improvements can be appraised on a dollar and cents basis. There is no such measure for many other forms of use such as recreation; and soil and water mean life itself. A price tag on these values could not be supported, and the value concept as justification for the planned fire control program could be seriously questioned. Where value classes are established there may be a question as to whether, for example, a class 5 value for timber is comparable to class 5 for soil and water, or for recreation resources. They may or may not be the same, but the method does provide a measure for comparing the protection job needed between planning units.

On the national forests, values are steadily increasing as the uses of the forests increase and population growth requires more forest products. These increasing values justify proportionately increasing expenditures for fire control. What would have been an allowable loss for a forest resource 40 or even 20 years ago would not be now. And 20 years hence objectives may need to be much higher than they are now. There may be some areas where the objective should be complete exclusion of fire.

The national fire planning objective of the U. S. Forest Service for the next 5 years is to hold average annual burned area to one hundredth of one percent for value class 6, i.e., the highest value class used in national fire planning, and to 32 hundredths of one percent for the average of the lowest values. Some extremely valuable areas will require higher protection standards; other substantial areas can be burned annually without seriously impairing forest values. Some forest values may not be realized because of the excessive cost of fire control and potential damage to higher value resources in the area. Examples would be closure to recreation use during critical fire weather in some of the highly flammable watersheds in southern California, or in areas of unburned slash in the Pacific Northwest.

The maximum size individual fire that can be tolerated will be quite small on many areas. National objectives are to control all fires on lands in value class 6 at 10 acres or less. Other areas where the maximum size fire objective is significant would include recreation areas, municipal watersheds, higher erodible soils, and areas where timber reproduction becomes a problem following fire. On many areas the size of individual fires may be relatively unimportant so long as the average annual allowable burn is not exceeded. Regional resource and fire control managers will determine maximum size fire objectives for lands in value classes below class 6 within each fire protection unit and based on local conditions and resource requirements.

National fire planning instructions provide for control of maximum allowable annual burn by use of many fire control techniques. However, primary control is achieved on the basis of percentage of hour control coverage by value classes. Coverage ranges from 95 percent or more for the highest value class (class 6) to 40 percent or less for the lowest value class. If analysis on a planning unit shows too much loss is occurring in any value class, planners should consider increasing (a) fire prevention effort, (b) the percentage of area covered within hour control time limits, and (c) strength of initial attack.

Where maximum size fire objectives are critical, particular attention will be needed to provide for adequate, readily available, and properly equipped reinforcements for the initial attack crews. Hazard reduction, firebreaks, and other advance preparation to stop spread of fires may be needed to attain objectives.

Fire planning should provide for the manpower, equipment, and facilities to attain fire control objectives during average worst fire weather. It must also provide for expansion to meet the absolute worst should it occur. Needless expense must be avoided during favorable fire weather. Fire planning is not concerned with fire control financing currently available, but rather in devising the most economical fire control system that will meet objectives. A well-prepared plan can be adjusted to make the best use of financing that is provided. Likewise a well-developed plan is indispensable to those who must determine the amount of financing that should be provided for fire control.

SMOKEY BEAR SIGN MOUNTING

EMIL J. KULHANEK
St. Regis District Ranger, Coeur d'Alene National Forest

An easily constructed mounting for the large Scotchlite Smokey Bear sign was designed by Russel Mainwaring, Foreman, for use on the St. Regis District (fig. 1). The chief advantage of this design is the ease in which the sign can be put up and taken down. The sign is hung by two strap iron hangers and anchored with two ⅜-inch carriage bolts.

Material list:	*Number*
Lumber:	
2 by 4 by 75 inches	2
2 by 4 by 60 inches	1
2 by 4 by 48 inches	3
Posts, 8-inch diameter by 11 feet	2
Iron straps, ¼ by 1 by 12 inches	2
Carriage bolts:	
¼ by 2½ inches	6
⅜ by 4½ inches	2
Lag bolts, ⅜ by 4 inches	4

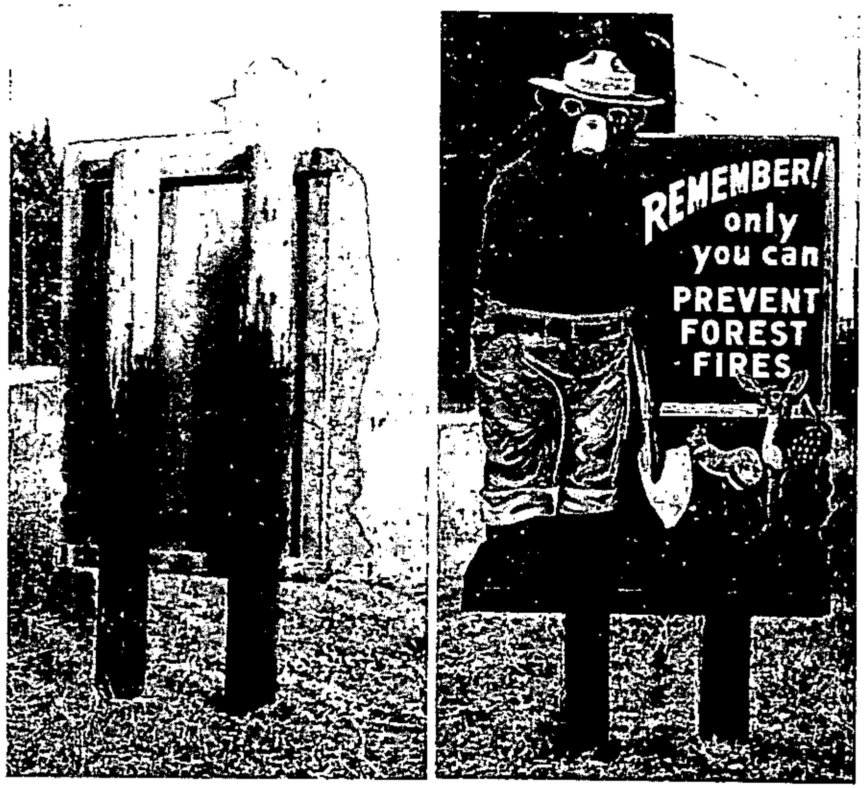

FIGURE 1.—Smokey Bear sign in place.

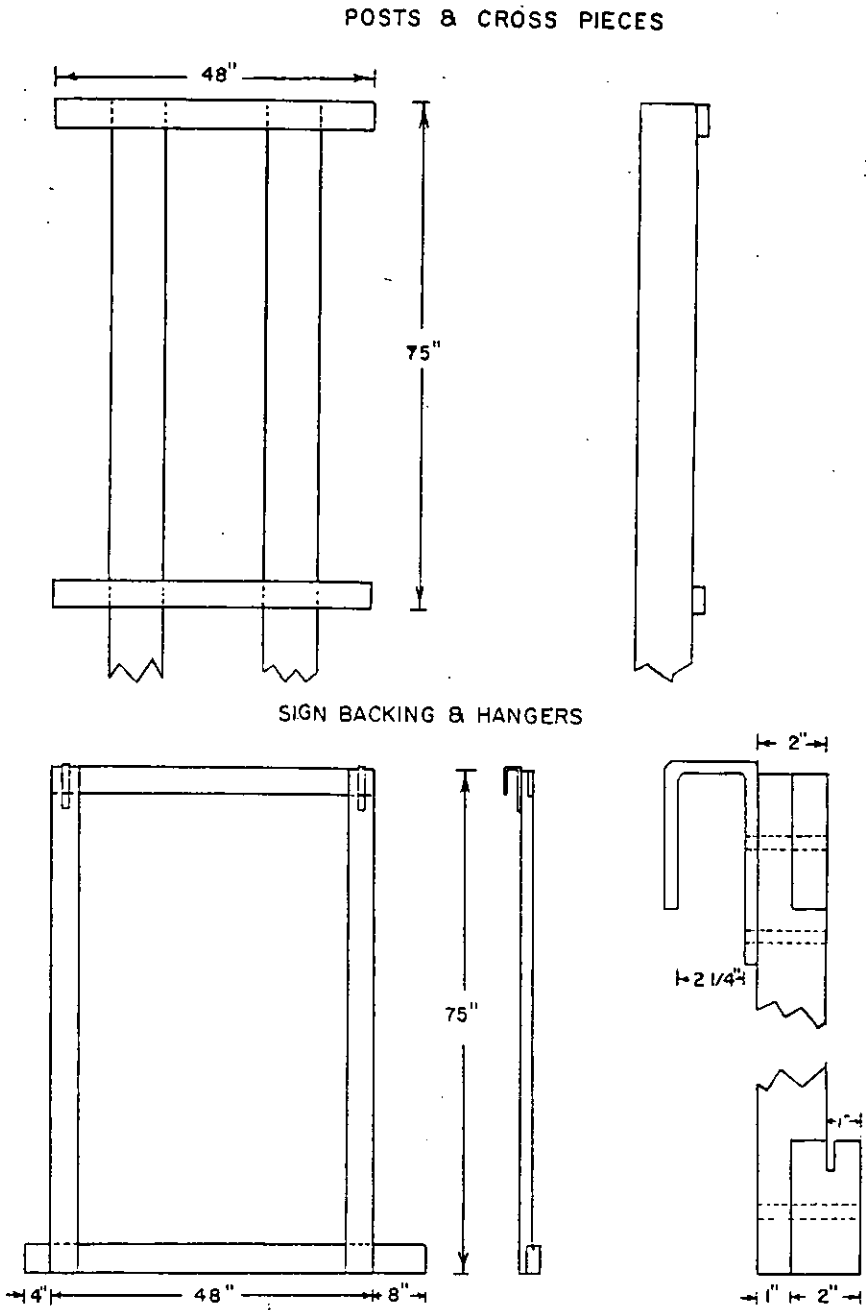

FIGURE 2.—Construction details.

Construction details.—Saw longitudinal groove in the 2- by 4- by 60-inch piece slightly wider than the thickness of the sign. Construct sign backing using lap joint construction. The bottom piece should extrude approximately 1 inch so that the back of the groove is flush with the rest of the sign backing (fig. 2). The joints can be fastened with either nails or screws but centers should be clear for boring bolt holes. Place sign face down on sawhorses and position backing on sign. Drill the two upper corner holes and bolt. Drill the side holes and bolt, being careful in positioning the holes not to go through the lettering on the face of the sign. Form the hanging brackets from ¼- by 1- by 12-inch strap iron and bolt to the sign. The corner hole may be used for the upper hole for fastening the bracket. Touch up the bolt heads with paint to match the sign.

The posts and crosspieces should be assembled at the sign site. The 11-foot post allows for approximately 3 feet in the ground and 2 feet clearance between the sign and the ground. Actual length of the posts will have to be determined by the location. The posts should be set approximately 2 feet apart. The crosspieces are leveled and bolted to the posts with the 4-inch lag bolts. Hang the sign, then drill through the bottom of the hanger and lower crosspiece. The sign is then bolted with two ⅜- by 4½-inch carriage bolts.

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Radio-Equipped Fire Tractors

In the spring of 1959, we acquired a surplus mobile radio and mounted it on one of our fire tractors. Mounting space for this old-type radio was a problem because its transmitter and receiver were in separate containers. We finally bolted it to the running board and held it in place with steel straps that were placed on the inside to prevent snagging. It was also necessary to adjust the tractor's voltage regulator to provide more generator output, since sets of this vintage cause a high battery drain.

To override the tractor's noise, a transistor-type speaker is used. Transmissions over this type of speaker are clearly understood a quarter mile away, and reception by the tractor operator is equally good. He usually works with the set at half volume.

Although no rubber padding or spring mounts were used, we have not had trouble with vibration loosening tubes or snapping soldered connections. Even though the set is not sealed against dust, no malfunctions have occurred and only an occasional cleaning with an airhose has been necessary.

The radio-equipped tractor has enabled us to attain better coordination in our fire control efforts, because the fire boss and the tractor operator are in direct communication. A guide to accompany the tractor and foot messengers are rarely needed. This practically eliminates delays and misunderstandings. Impending dangerous conditions and any change in plans are known by the tractor operator almost as soon as they are known to the fire boss or scout, and the tractor operator in turn is able to keep the fire boss fully informed of progress being made, breakdowns, and supply needs.

When we replace the present set, a dashboard-mount type will probably be attached to the side of the seat. However, the size of most sets available today is such that it should present no mounting problems.—WILLARD J. VOGEL, *Forester, Yakima Indian Agency, Bureau of Indian Affairs.*

THERMISTERS FOR MEASURING TEMPERATURE OF FOREST FUELS

BOB STEELE
School of Forestry, Montana State University

The glass probe thermister may be successfully used to measure the surface temperature of forest fuels that are exposed to direct sunlight or that are exposed in partial shade. Such temperature measurements are of value in determining the flammability of twigs, limbs, and chunks, especially in logging slash.

The surface temperature of these pieces of fuel could not be measured with an ordinary bulb type thermometer because too great a percentage of the thermometer bulb is exposed to the air and too little of it actually touches the wood surfaces that are being sampled. A device was needed to measure temperatures at a tiny spot along the surface of the fuel and still not be measur-

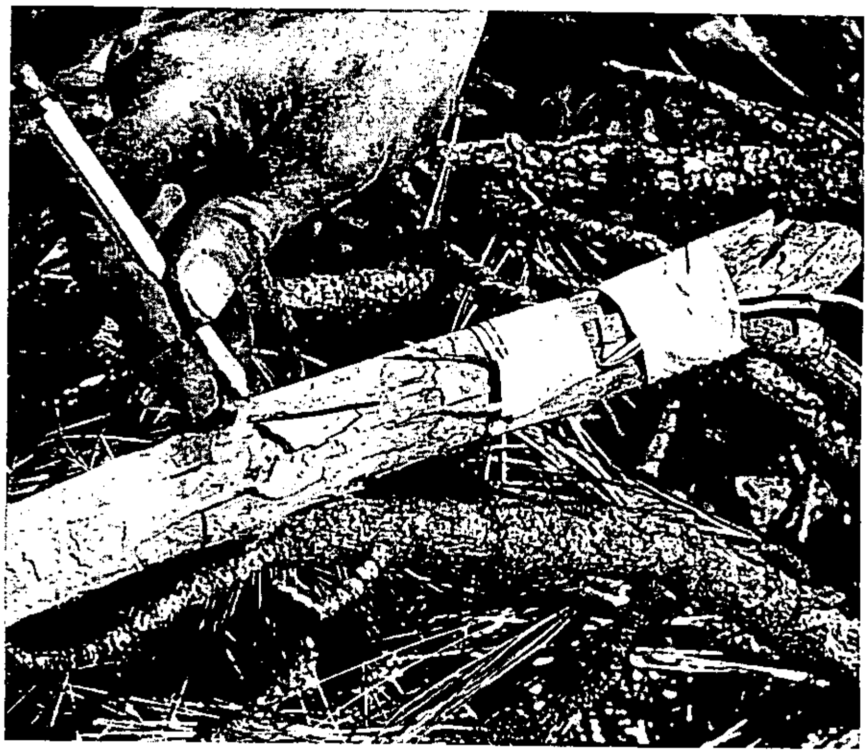

FIGURE 1.—Thermister in place; wires at right lead to ohmmeter. Pencil points to sensitive tip.

ing air temperatures that exist above and around the individual fuel pieces. This device also had to be independent of solar radiation falling on it.

The glass probe thermister consists of a glass rod 0.07 inch in diameter, 2½ inches long, terminating in a glass bead tip 0.10 inch in diameter. This bead tip contains a mixture of oxides of manganese, nickel, cobalt, and copper molded into a ceramiclike substance and encased at the end of the probe. This tip serves as an electrical resistance unit which changes its resistance with changes in temperature. The material in the tip has a high negative temperature coefficient, which means that the higher the temperature, the lower the resistance. Through the length of the thermister are fine wires molded in the glass to which are attached the leads of an ohmmeter (fig. 1). This meter gives a direct reading of electrical resistance in the circuit.

To measure the temperature of a forest fuel, the sensitive tip is placed against the surface of the material and the whole thermister secured in place (fig. 1). As resistance changes with temperature, a corresponding current change can be noted on the

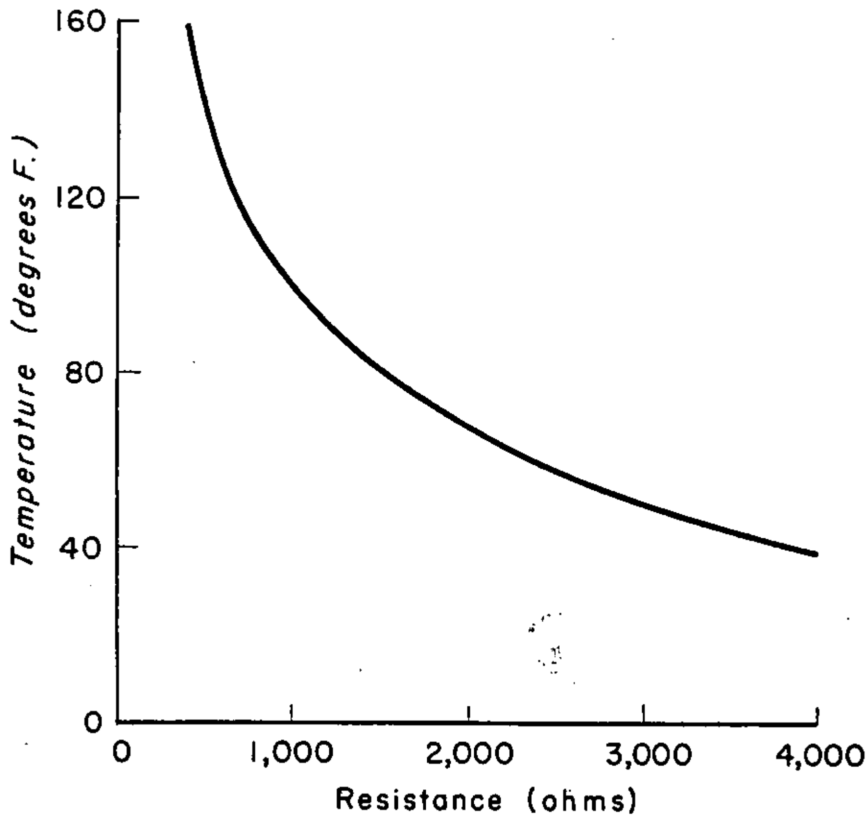

FIGURE 2.—Typical conversion curve for resistance to temperature.

meter and the temperature calculated by reading the meter, which is calibrated in ohms of resistance.

The manufacturer of the thermisters provides a chart showing a curve of the relationship between temperature and electrical resistance for the particular type of thermister involved (fig. 2). Resistance readings taken with the ohmmeter can readily be converted to temperature by use of these curves.

Glass probe thermisters may be purchased commercially from electronics distributors for about $2 each. They come in a choice of temperature ranges from –70 to 500 degrees F. The ones used here cover a temperature range of 60 to 140 degrees F. These little thermisters are extremely stable, shock resistant, and have unlimited life. They are compact and easy to use.

Over the course of the summer, temperature measurements were made with thermisters on the surface of limbs, twigs, and chunks of ponderosa pine exposed to full sunlight. The surface temperature of these fuel components reached 120 degrees when

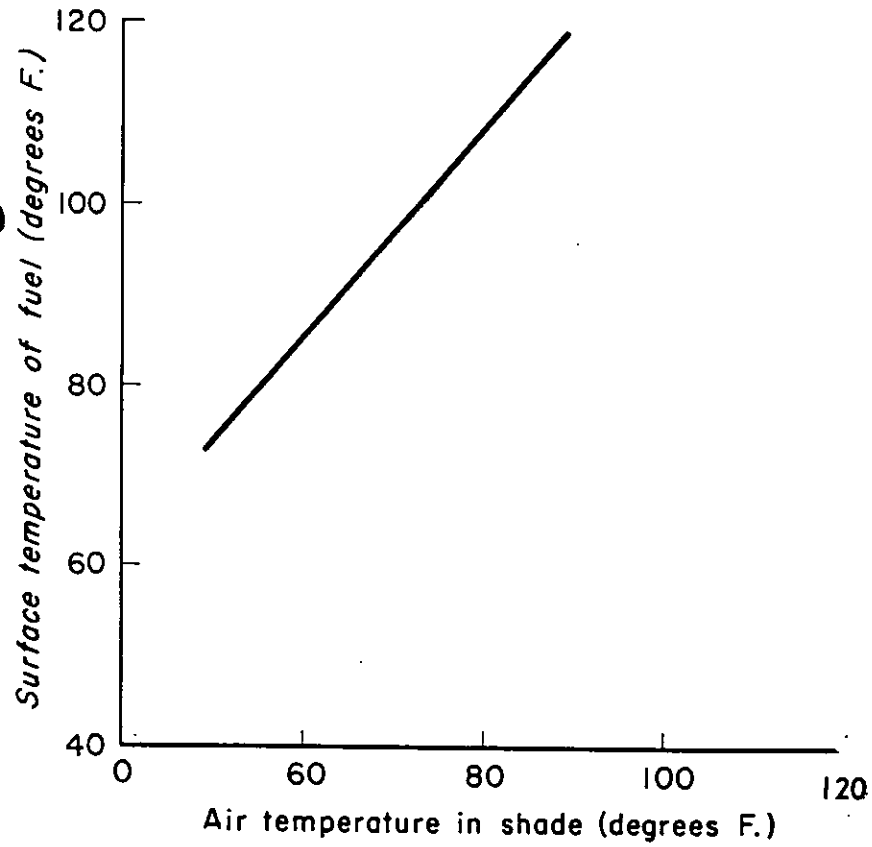

FIGURE 3.—Relationship between air temperature in the shade and the surface temperature of fuels exposed to the sun.

the air temperature in the shade of a standard weather instrument shelter reached 90 degrees; for an air temperature of 70 degrees, fuel temperatures reached 98 (fig. 3).

The temperature comparisons made between twigs of ½-inch diameter and branches about 1½ inches in diameter showed no significant difference in surface heating. The difference between air temperature in the shade and the surface temperature of the exposed fuel, however, was very significant. This difference was greatest during midafternoon and amounted to 30 degrees as a maximum. The fuels evidently absorbed enough heat during the sunshine period of the day so that afternoon readings were a little higher than those made in the morning and at noon.

The thermister is capable of following rapid changes in fuel temperature, and differences up to 5 degrees can be noted between cloudy conditions and clear sky conditions. The measurements reported here, however, were confined to periods of full sunlight.

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Colored Smoke Aids in Fire Location

During the past two fire seasons our fire crews have used smoke flares to increase efficiency in finding hard-to-locate fires. Of the flares used, the Kilgore has proved most practical as to size, ease of carrying, and smoke volume. It is 1½ inches in diameter and 6 inches long, and it weighs 4½ ounces. One end emits a bright fluorescent, orange smoke for approximately 45 seconds, and is for daytime use; the other end emits red smoke for nighttime use. This flare releases no sparks or other residue while burning, and with reasonable care is safe to use in very dry areas. We found that orange smoke rather than white or gray is easier to see against any background. A noncolored smoke is especially confusing when there are several fires in the same area.

When the fire crew has difficulty in locating a fire, it radios the nearest lookout or aerial observer of its location and intention of using a flare. The lookout or observer upon seeing the orange smoke advises the fire crew where it is in relation to the fire. If guidance is to come from the lookout, it is necessary for the smoke to rise above the trees to be seen. Thus, a crew member may have to climb a tree and release the smoke. Release of smoke from the ground is usually satisfactory for aerial detection. When a strong wind is blowing, or a large volume of smoke is needed because of a heavy timber cover, two or more flares are used at the same time.

Notification by radio is always made before release of the smoke for fire guidance. If smoke is used without notification, it is a signal for immediate help. The need for this arrangement became apparent several years ago when a fire jumped control lines and destroyed the mopup crew's radio. The crew had to drive 15 miles over bad roads for help, and much time and acreage was lost.—WILLARD J. VOGEL, *Forester, Yakima Indian Agency, Bureau of Indian Affairs.*

WILL BORATE KILL SOUTHERN TIMBER?

G. R. FAHNESTOCK and R. W. JOHANSEN
Southern and Southeastern Forest Experiment Stations

Use of the fire retardant sodium calcium borate to construct fireline has increased greatly in the West since 1956 and has aroused considerable interest in the Eastern United States.

One characteristic of borate, its toxicity to vegetation, has received little publicity, although it is mentioned in one of the earliest articles on borate as a fire retardant.[1] Since the danger of tree kill and soil sterility accompanies the use of this material, tests were established in Louisiana and Georgia to determine the extent of damage when borate is ground-sprayed for fireline construction and when it is dropped from aerial tankers.

LOUISIANA TESTS

The Louisiana tests were carried out by the Division of Forest Fire Research, Southern Forest Experiment Station, in cooperation with the Kisatchie National Forest, Louisiana Forestry Commission, and U. S. Borax and Chemical Company. Slurry containing approximately 4 pounds of sodium calcium borate per gallon of water was prepared with an injector-type mixer. A helical impeller pump, developing about 200 p.s.i. pressure, supplied water for the mixing operation and delivered slurry from storage to the fireline. The retardant was applied through 60 feet of 1¼-inch rubber hose equipped with a 6-foot pipe applicator and a U. S. Navy fog tip delivering 10 to 14 gallons per minute. All spraying was done early in December 1957.

Some lines were sprayed primarily for demonstration of fire retardant action; these also have furnished an opportunity to observe general effects of the chemical on vegetation. Additional spraying of strips and individual young trees provided more detailed checks on toxicity. Demonstration firelines received 5 to 7.5 gallons of slurry per 100 square feet of ground surface. Since these rates of application appeared to be near or below the minimum for effective fireline in heavy rough, and because a rather rigorous test of toxicity was desired, three toxicity-test strips in a heavy grass rough were given 10, 12.5, and 15 gallons per 100 square feet (fig. 1). An effort was made to cover completely all exposed surfaces of dead fuel and living vegetation.

In addition to the test strips, six trees each of planted slash, longleaf, and loblolly pine 6 to 10 feet high were crown-sprayed. On three trees of each species the entire crowns were sprayed

[1]Miller, Harry R. Sodium calcium borate as a fire retardant. Fire Control Notes 17(4): 25-28. 1956.

with about 2 gallons of slurry; on the other three trees, only half of each crown was sprayed, with about 1 gallon of slurry.

The toxicity-test strips and the intervening untreated area were planted with 1-0 loblolly pine in January 1958. By October, 95 percent of the planted seedlings on treated strips were dead, as compared with 5 percent on untreated strips. However, 88 percent of those on untreated strips showed symptoms of boron injury because heavy rains had spread the chemical from sprayed strips. Mortality on sprayed strips did not vary with rate of application.

Slash pine seed sown in March 1958 on sprayed strips did not germinate. On unsprayed strips, borate washed in by surface

FIGURE 1.—August 1958, condition of strip sprayed the previous December with 12.5 gallons of borate slurry per 100 square feet. Appearance of area was the same in October 1959.

FIGURE 2.—Contrast between wax myrtle growing on 7-month-old borate fireline (right) and branch from a normal plant.

water prevented germination on half the seed spots and caused early seedling mortality on others.

The area was replanted in January 1959, again with 1-0 loblolly. By late October, 97 percent of the trees planted in 1958 and 1959 on treated strips were dead. Again mortality was independent of rate of borate application. Only 9 percent of the 1959 seedlings had died on two check strips completely unaffected by borate, but 44 percent were dead on the check strip to which borate was carried by surface water. The three 1958 check strips had had 86, 46, and 16 percent mortality, depending on the degree of side effect from adjacent treated ground.

A heavy rain 2 days after spraying washed all visible borate off the crown-sprayed pines. The trees made normal height growth in 1958 but lost an abnormal amount of old foliage. By August the 1957 needles that had not yet fallen were dead for about half their length, and tips of 1958 needles showed injury. By mid-September dead length of new needles averaged about 2 inches on loblolly and longleaf pines and about half the total needle length on slash. All sprayed slash pines had poor color and one died, though not necessarily from boron injury.

In April 1959, the same symptoms of injury persisted, most acutely on slash pine. By October, differences between treated and untreated loblolly and longleaf pines were discernible only on close inspection, and sprayed slash pines looked more nearly normal than previously. However, 1959 height growth averaged 19 percent less on 18 trees that had been treated than on their paired, untreated controls. The reduction in growth was greatest for slash pine and least for loblolly, but the small number of trees involved precludes valid generalization. At no time was any appreciable difference noted between fully sprayed and half-sprayed trees.

Borate killed or severely injured most brushy and herbaceous vegetation on both toxicity-test strips and demonstration firelines (fig. 2). A few species, notably hawthorn, appeared resistant. Some trees on demonstration firelines were slightly injured. Early 1958 leaves of sapling sweetgum were burned at the edges, but recovery appeared complete by fall. Several longleaf and loblolly pines of small sawtimber size lost abnormal amounts of foliage; their crowns still appeared thin in October 1959. Injury to vegetation on firelines that received 7.5 gallons per 100 square feet at first appeared comparable to that on toxicity-test strips treated with 1⅓ to 2 times as much, but the 7.5-gallon treatment permitted considerable reestablishment of grass in 1959.

In January 1959, the Kisatchie National Forest planted 1-0 slash pines on a sizable area that included the 1957 demonstration firelines. By late October, 13 seedlings had died out of a row of 100 on a borate fireline, and 50 were in poor vigor. On untreated ground nearby, no seedlings had died and only 1 out of 100 had poor vigor. New leaders were either weak or absent on most young trees on the fireline, and average total height was 12.3 inches. Most trees on untreated ground had vigorous 1959 leaders; total height averaged 18.1 inches.

GEORGIA TESTS

At the Southern Forest Fire Laboratory in Macon, Ga., the effect of borate was measured at application rates of 3 and 6 gallons per 100 square feet, comparable to the effective concentration zones made when the material is delivered by a TBM (air) tanker.

The effect of borate on the germination of loblolly pine and sweetgum seed was investigated at the Georgia Forestry Commission's Seed Testing Laboratory. The seeds, 200 per dish, were handled in the same manner as in all other germination tests conducted at the laboratory except that borate was added to some of the dishes at the rate of 3 and 6 gallons per 100 square feet. The test was begun on October 28, 1958, and terminated 1 month later. None of the treated seeds germinated, as compared with 84 percent of the untreated pine and 18 percent of the untreated sweetgum seeds.

In September 1958, borate was applied at the same rates to the 1-month-old potted loblolly pine and sweetgum seedlings. In one

phase of the test the chemical was applied to the soil; in the other, only to the above-ground parts of the young trees, with the soil shielded. The soil application was more detrimental to both species than the aerial application.

Species and treatment[1]	Amount of slurry per 100 sq. ft. (gallons)	Seedling mortality (percent)
Sweetgum:		
Ground	3	74
Ground	6	80
Aerial	3	0
Aerial	6	13
Check	0	8
Pine:		
Ground	3	47
Ground	6	60
Aerial	3	0
Aerial	6	0
Check	0	2

[1]60 seedlings in check treatments, 15 in all others.

An attempt was also made to determine the effect of borate slurry on natural 2- to 3-foot loblolly pine and sweetgum seedlings. In August 1958, fifteen 5-tree pine plots with trees closely spaced were established. Five treatments were replicated thrice:

1. Borate sprayed on foliage at 3 gallons per 100 square feet.
2. Borate sprayed on foliage at a 6-gallon rate.
3. Borate sprayed on the ground at a 3-gallon rate.
4. Borate sprayed on the ground at a 6-gallon rate.
5. Check plot—no treatment.

None of the pines died within 9 months following treatment, but there was evidence of some slurry effect, the greater from the aerial application. The extent of injury ranged from minor needle kill to slight growth retardation on most treated trees, with complete growth inhibition in several of the aerially treated trees.

The sweetgum seedlings were not closely spaced in the forest, as were the pines. Thus plots could be made up of only one or two trees. The treatments were identical to those imposed on the pine plots but were replicated 4 times.

Borate had considerably more effect on sweetgum than on pines, although none of the gums were completely killed. Again aerial application caused the greater damage; almost all of the trees suffered some stem kill or partial defoliation. Growth was somewhat reduced by the ground application.

The contradiction between the effect of ground and aerial applications on wildling and potted seedlings probably can be explained best by the limited area of ground application around the wildlings. An area 3 by 3 feet with the wildling stems in the center was subjected to spray. Since the root system of a 2- to 3-foot seedling undoubtedly occupies considerably more area, it is probable that only part of the roots were exposed to the borate. In the pots, by contrast, all roots were confined within the appli-

cation area. This reasoning is supported by the fact that an aerial drop of borate slurry on a small sawtimber stand of longleaf pine caused considerable mortality in all size classes, not to mention kill-back of palmetto and gallberry (fig. 3). Other studies have established that the maximum concentration reaching the ground from such a drop is 3.5 gallons per 100 square feet.

FIGURE 3.—Timber killed by 220-gallon borate aerial drop. (Photograph by Georgia Forestry Commission.)

CONCLUSIONS

In the tests in Louisiana the heavy applications of borate required for fireline construction rendered soil unfit for pine planting or direct seeding for at least 2 years. Heavy rains washed some borate to untreated areas, thus extending the toxic area. Height growth of crown-sprayed pines was still subnormal the second year after treatment.

Tests in Georgia with lower application rates of borate demonstrated the damaging effects of the slurry to all plant parts at applications as low as 3 gallons per 100 square feet. When a large area is covered at this rate, tree mortality can be expected, even in sawtimber stands.

Forage for livestock and wildlife is killed or inhibited, but the fire retardant itself is nontoxic to animals. If only emergency use is made of borate for fire suppression, the area of soil sterilization or vegetation injury will be small, probably insignificant. On the other hand, widespread use of borate could result in more than acceptable damage, especially if the toxicity is found to persist for several years, or if local conditions permit surface water to spread the chemical.

MOBILE LOOKOUT

H. K. HARRIS
Forester, Missoula Equipment Development Center,
U. S. Forest Service

The mobile lookout shown in figure 1 was designed for easy installation on any observation point on a road or truck trail. It is intended for use where continuous or nearly continuous observation is required for temporary hazards, such as logging operations, slash or blowdown areas, or where other special observation is needed. The trailer may also be used by work crews or for other supplemental housing.

A complete home on wheels is provided. The dining and living area is arranged to convert quickly into a spare bedroom. Table and cushions can be made into a bed faster and easier than the davenport used for this purpose in many commercial units. A gas heater is located at the right near the stair ladder that leads to the cupola. The kitchen area is equipped with a conveniently located gas range, refrigerator, and sink, and a back bedroom has bunk beds to the right and left of a center aisle.

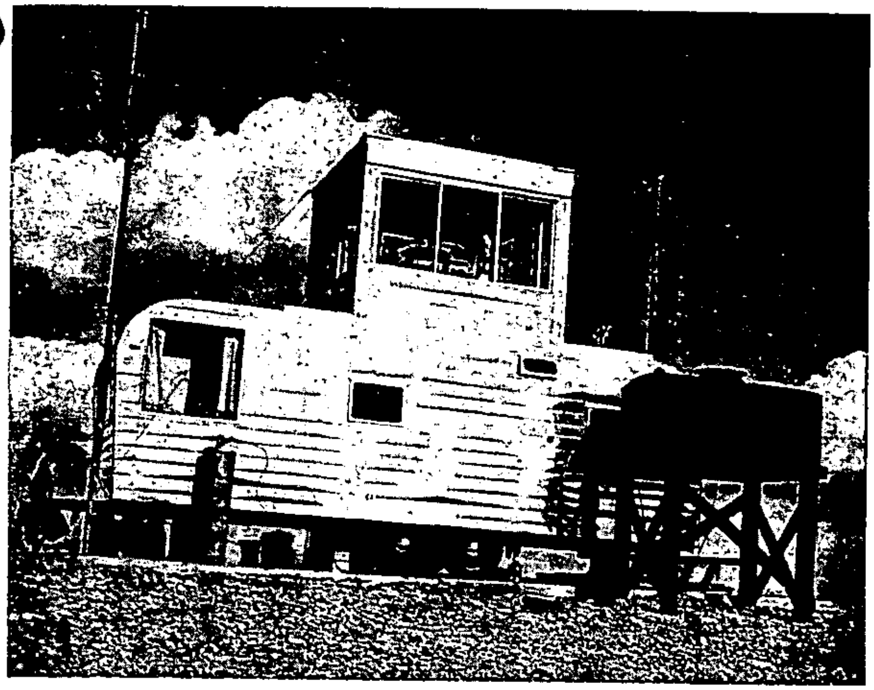
This home on wheels also has toilet and shower facilities, a gas water heater, and a good-sized wardrobe-type storage closet. They are located near the center of the trailer to provide proper weight distribution and structural strength. Although the furnishings and interior of the living quarters are not as elaborate as many in commercial trailers, they are adequate.

The design of the cupola is of special interest. This part of the trailer has hinged walls that fold compactly into a hatch on the roof. When the walls are folded, the ventilated cupola roof becomes the hatch cover. Metal-sash windows in the cupola can be opened, and they can also be quickly and easily removed to reduce the weight of the walls when the cupola is being folded or raised. Attachments are provided at the corners of the cupola roof for light guy wires, to steady the trailer at windy locations. The roof of the trailer is a flat-deck type for ease in raising or lowering the cupola.

Trailer weight is well distributed on the wheels, and dual wheels and a heavy frame give reserve strength on rough roads. The 23-foot trailer body is a compromise between adequate living space and best maneuverability.

Operational tests and a season's use indicate that the design of the mobile lookout is practical. Some modifications and improvements are planned in future designs as a result of these tests and group evaluation. The most important of these are as follows:

1. Provide a simple mechanical hoist to raise the cupola roof and hatch cover. This will make it easier for one man to assemble or fold the cupola.



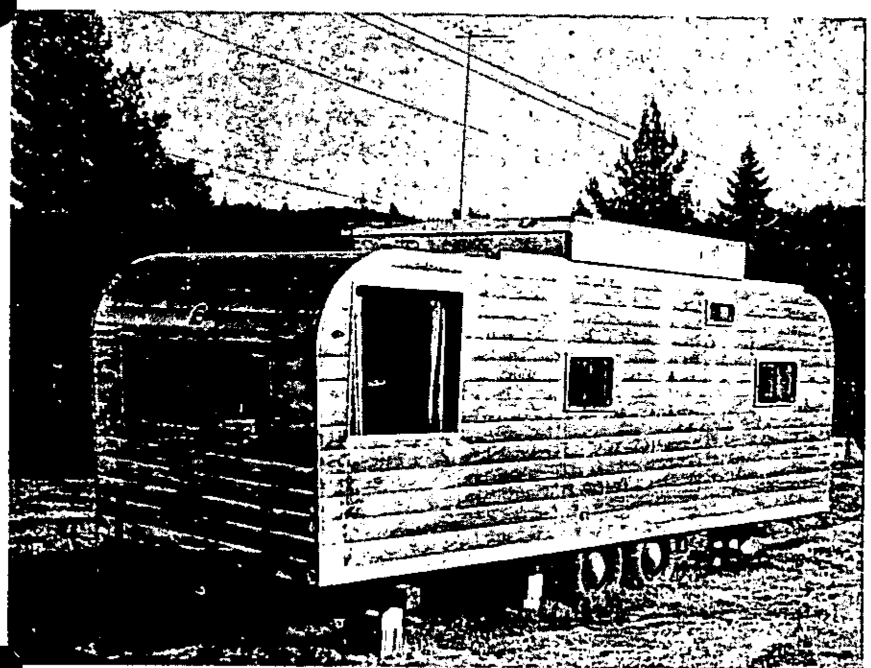


FIGURE 1.—Mobile lookout with cupola in raised and folded position.

2. Install colored plastic window visors or sunshades on all sides of the cupola to reduce glare.

3. Increase the height of the cupola windows about 4 inches for better visibility.

4. Paint the roof of the trailer with a dull paint to reduce sun glare.

5. Provide an aluminum water-storage tank for gravity water feed to shower and trailer plumbing. This will be designed as a part of the trailer roof but will require frame modifications. (Gravity-fed water from an outside tank obstructs visibility.) The storage tank will be filled only when the trailer is stationary.

6. Increase the size of the rear bedroom window to provide an emergency exit.

7. Increase the height of the front living room window for better visibility when the lookout is there rather than in the cupola.

8. Provide storage drawers under the bunk beds.

9. Include provisions for radio installation in the new trailer design.

10. Install corner guards and bumper protection for rear of trailer.

NEW FABRIC SLEEPING BAG

W. C. Wood
Equipment Specialist, Missoula Equipment Development Center, U. S. Forest Service

The kapok sleeping bag in common use has become obsolete. Its design is not compatible with present-day manufacturing techniques and better insulating materials are now available.

The Missoula Equipment Development Center has completed the development of a new fabric sleeping bag for forest firefighters.[1] It is 33 inches wide, 80 inches long with full-length, heavy-duty zipper and a 3-pound preshrunk, washable, snap-in, dacron-insulated liner (fig. 1). A preshrunk, washable, snap-in sheet is provided. The new bag has less bulk and weight and is warmer than the standard kapok. Ordinarily a 3-pound bag is adequate for summer; a 2-pound supplemental liner may be snapped in for additional warmth.

In colder weather the user can adjust to satisfactory sleeping temperatures by crawling between any of the combination of layers. In extreme cold a second supplemental liner can be substituted for the sheet. This design provides a wide range of temperature-weight adjustment capabilities, since the outer shell can be equipped with a single, 2-pound liner or a combination of

[1]Adopted as Forest Service standard. USDA Forest Service Specification No. 5100-33. Stocked by General Services Administration.

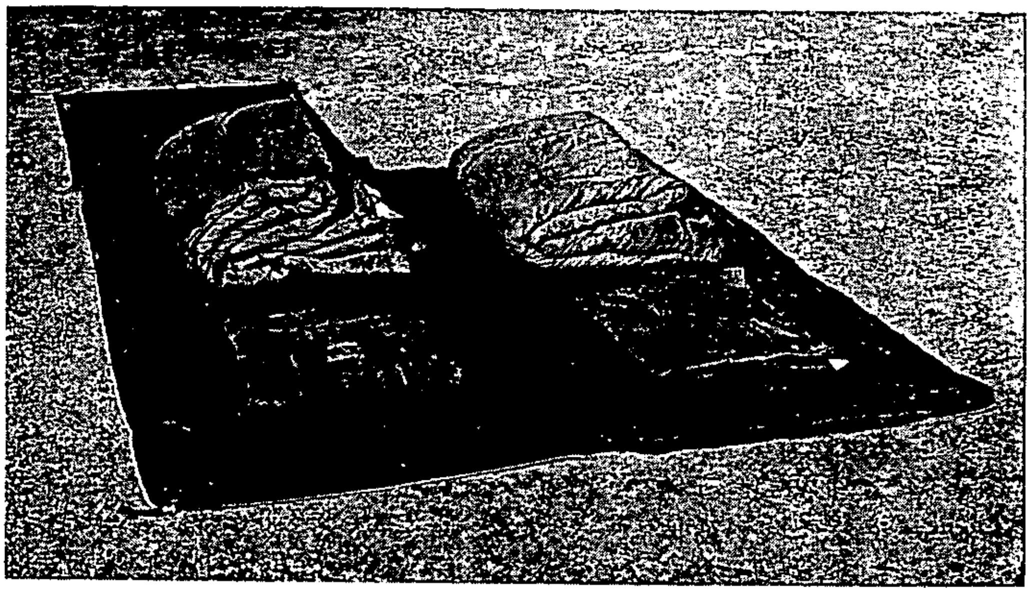


FIGURE 1.—Fabric sleeping bag components.

liners weighing 3, 4, 5, 6, or 7 pounds. The carrying bag with shoulder straps will accommodate extra clothing and personal gear when the 3-pound basic liner only is used (fig. 2).

An extensive investigation of sleeping bag use was made. Comfort and warmth requirements vary with individuals. Questionnaires were circulated to all Forest Service regions to obtain logistic information and field-use requirements. The comments received varied widely but it was obvious that a recreational, camper-type sleeping bag did not fully meet the requirements of forest firefighters. The majority favored a lightweight bag for use at minimum temperatures of about 32 degrees F.; the other 25 percent wanted a medium- or heavy-weight bag. Some wanted carrying straps, others a duffel bag or carrying case. About one-half wanted removable, washable sheets. The majority felt that an air-mattress pocket was not essential. The evaluation of field comments was based upon total use of sleeping bags in each area.

FIGURE 2.—Fabric sleeping bag in carrying bag.

The new bag is adaptable and will meet all the requirements established by the field. Certain features exceed field requirements; mainly because these added features could be obtained without penalty to cost or weight. For instance, an air-mattress pocket is automatically provided by the snap-in liner feature. An air mattress can be easily inserted between the basic liner and the outer shell. The carrying case with shoulder straps serves as a combination duffel bag and air-delivery protective container. A separable zipper allows two bags to be fastened together to form a double bed.

A bright yellow or orange top panel would impart higher visibility to expedite recovery from air delivery. This would also help locate and identify fire camps and bed grounds when viewed from the air. The use of a colored panel in the bag did not appreciably increase the cost in large-volume purchases but small unit purchases (of less than 2,000 bags) could not be made economically. For this reason materials were specified that are readily available and can be obtained by manufacturers in any quantity. To fulfill the high-visibility color requirement it is recommended that air-delivery sleeping bags be enclosed in bright yellow paper or plastic bags. Painting or dyeing a color stripe on the outer cover was found to be unsatisfactory.

PAPER (DISPOSABLE) SLEEPING BAGS

H. K. HARRIS
Forester, Missoula Equipment Development Center, U. S. Forest Service

The paper sleeping bag was developed for use by forest firefighters where the cost of transportation, repair, cleaning, handling, and storage of the standard kapok bag was likely to exceed the initial cost of the paper bag (figs. 1 and 2). It is for one-trip use and therefore termed "disposable," and was not intended to equal a standard sleeping bag in either warmth or comfort. It was designed to provide a measure of protection against chill night winds and morning dew during midsummer when fires were most numerous and crew-sized fires most common. More than 300,000 have been purchased in the past 5 years.

Improvements in comfort, moisture resistance, and packing procedures would in all probability result in increased use. For example, one Forest Service region indicated that if the disposable sleeping bag were improved in warmth and comfort, it would be used on all crew fires as standard equipment. Most smokejumpers are now equipped with disposable bags for summer use. The season of use could be extended with only slight additional

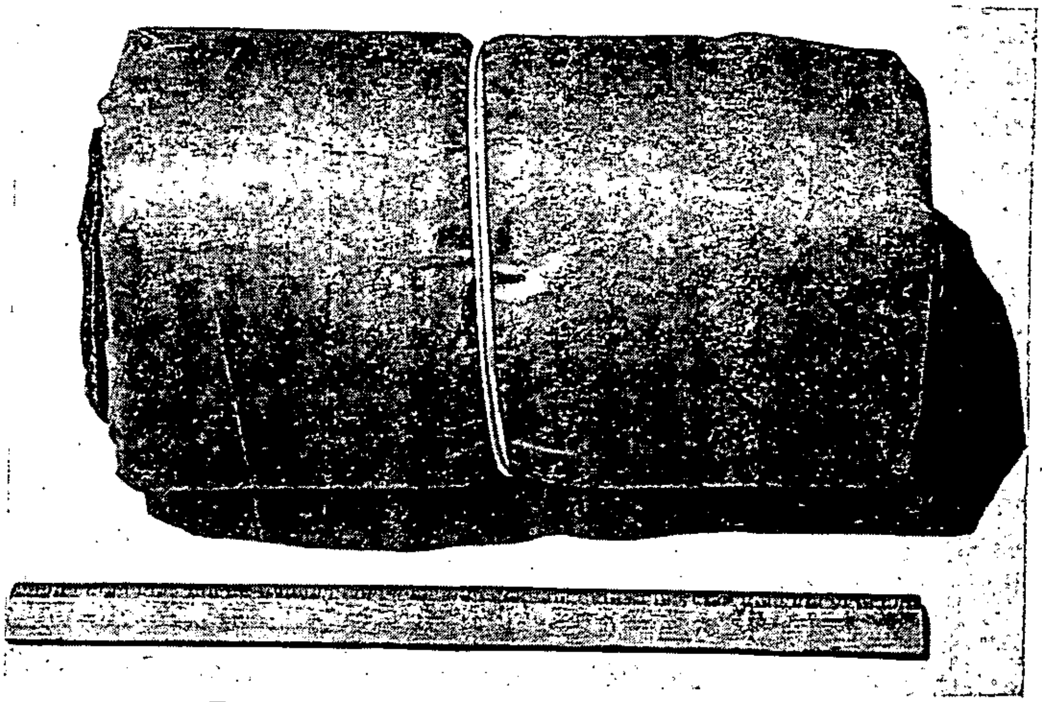


FIGURE 1.—Paper sleeping bag rolled and tied.

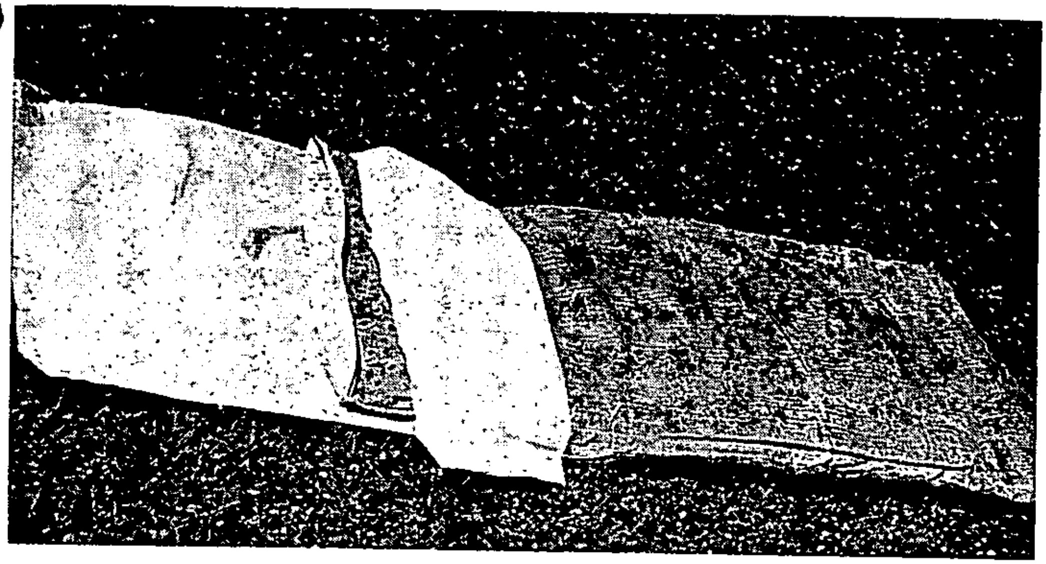


FIGURE 2.—Paper sleeping bag unrolled for use.

cost and weight. Improvements to the bag would develop other uses where the paper bag is not now considered adequate.

The improved bag would give any practical degree of warmth required for summer use. Newly developed paper products can provide a moisture barrier for the bottom of the bag. New seam designs will eliminate capillary action of present sewing. A disposable supplemental liner can be furnished for additional warmth only when needed and thus keep weight and cost to a minimum for most use. A plastic air mattress is available at nominal cost.

MONOAMMONIUM PHOSPHATE SHOWS PROMISE IN FIRE RETARDANT TRIALS

R. W. JOHANSEN
Division of Forest Fire Research,
Southeastern Forest Experiment Station[1]

Monoammonium phosphate ($NH_4H_2PO_4$) solutions applied to flammable fuels in south Georgia have successfully stopped fast-moving head fires. The material appears to be an excellent fire retardant, and has other qualities that should favor its use in fire control. The salt readily goes into solution with water when the mixture has been recirculated through a centrifugal pump for approximately 10 minutes. A fertilizer containing 12 percent nitrogen and 61 percent P_2O_5, the material is not toxic to plant life. When compared with other retardants, monoammonium phosphate (MAP) is relatively light in weight, at 9.2 pounds per gallon (18-percent concentration). Later work may show even lower concentrations to be adequate.

After preliminary small plot trials showed that asbestos slurries, borate slurries, and MAP solutions were equally effective in retarding light surface fires, a full-scale field trial was made. The materials tested were borate, 4 pounds per gallon of water; powdered asbestos, 1¼ pounds per gallon of water; and MAP, 1⅔ pounds per gallon of water. All mixtures were dropped from Georgia's TBM aerial tanker at an altitude of 75 feet and 100 feet ahead of hot head fires. Results from water drops were used as a base for rating the different retardants.

The area used for testing the materials had been recently clear cut, leaving a 10-year rough of palmetto, gallberry, and grass, in addition to lopped pine tops. Fires burned extremely hot, so hot that a 220-gallon load of water merely slowed a test head fire which ultimately consumed all fuel. An equal quantity of retardant was used for each of the comparison drops. All these drops were replicated once to check response of the set head fires. Fuel moisture was 7.5 percent or less; wind speed varied between 6 and 12 miles per hour. MAP stopped the fires completely within a short distance of the outer edge of the drop zone along a line at least 175 feet long. Borate treatment did not stop the fires, although islands of unburned material were left in the drop zone. Results with asbestos were well below expectancy, in that fuels were completely consumed by the fires. Several hours after the

[1]This article was presented as Southeast. Forest Expt. Sta. Res. Notes 137 in Nov. 1959.

drops had been made and the retardant material had dried on the vegetation, the unburned parts of the borate plots were reignited with a drip torch, whereas the MAP plots could not be reignited.

One drawback of MAP is that it is somewhat corrosive to aluminum. This condition can be corrected by adding approximately 220 parts per million of sodium silicofluoride and 20 parts per million of ammonium molybdate to the solution. An area covered with MAP cannot be readily distinguished from the air, and this presents difficulties. Tests with coloring agents are now in progress.

PUBLIC INFORMATION CENTER ON LARGE FIRES

DON K. PORTER
Fire Prevention Officer, Angeles National Forest

Whenever a large forest or watershed fire occurs near a metropolitan area of over 6 million people a heavy demand for public information is placed on the agency concerned by press, radio, television, and general public for facts about the fire. Such a circumstance arose on October 13, 1959, when the "Woodwardia" fire started in the Angeles National Forest not more than 15 miles from the center of Los Angeles, Calif. Shortly after the initial attack forces arrived at the scene, requests were being received for information at the Forest Service dispatcher's office in Arcadia and the Los Angeles County fire dispatcher's office in Los Angeles. It was evident, after the first hour of the fire, that plans for serving the news media for "average" fires would not be adequate. In each dispatcher's office, the one press phone normally manned for this purpose was not able to take the load of requests for information.

The need for a fire information center was obvious and within 4 hours after the start of the fire such a center was established at the Los Angeles County Camp No. 2 in Oak Grove Park in northwest Pasadena. This area was approximately 100 yards from the Forest Service general headquarters directing the fire control efforts. Two information officers from other national forests were called, as well as one from the California Division of Forestry, to supplement the initial information men from the Angeles National Forest and Los Angeles County. This five-man information team was in full operation, on a 24-hour basis, by the second day of the fire.

The information center was established in a garage with three telephones, two tables, 8 chairs, radio monitors, and a blackboard. The blackboard was used for posting a map of the fire area showing the current boundaries of the fire and direction. This map was changed periodically as the fire advanced. The board was also used for listing current hot spots, special items such as homes, resorts, and cabins threatened, weather forecast, names of agencies working on the fireline, names of the fire boss and other overhead, number of men on fireline, number of fire trucks, air tankers, helicopters, and bulldozers. From the second through the seventh day, October 20, when control was attained, ten to twenty reporters and photographers could be found around the information center night and day. The information and map on the blackboard provided ready facts for any press representative just arriving, and all reporters had access to the same information.

This was by no means the largest fire to occur in southern California or in the region (14,045 acres of valuable watershed burned). However, due to the close proximity of the metropolitan area of Los Angeles, with flames that were visible from the downtown area, as well as all over the county, together with the smoke covering Los Angeles, a heavy demand for information about the fire was created. In the 7-day period of the fire, the information team answered an estimated 2,500 telephone requests, gave approximately 250 radio tape recordings, both by telephone and directly at the scene, arranged for TV and newsreel interviews, directed photographers to areas of the fire where the most dramatic shots could be taken *without interfering with the suppression forces.*

As the fire increased in size it was necessary to put one or two men of the information team on the fireline to get current and accurate information on the boundary of the fire, trouble spots, and dangers to inhabited areas. These reports were 'phoned into the center as "on the spot" information and then disseminated by the other members of the team to waiting reporters and in answer to 'phone requests.

Requests for news came from the four large daily newspapers of the Los Angeles area, twenty local daily papers, ten weekly papers, twenty radio stations, seven television stations, two national and international wire services, one local wire service, four network coast-to-coast TV and radio stations, one newsreel company, and three national magazines. Radio tapes were requested by 'phone from several eastern and midwest radio stations.

The information team also provided such service as information to property owners and cabin owners who lived or had cabins in the vicinity of the fire and to utility companies who had telephone or power lines in the area. In addition, services were provided to the 2,200 men on the fireline. The "Fireline News" was published by the information section on Sunday, October 18. This 1-page mimeographed sheet carried a sketch of the fire area, the number of men, air tankers, and fire equipment, and safety messages and words of encouragement from the fire boss, Forest Supervisor, County Fire Chief, and Deputy State Forester. General news such as football scores from Saturday's games were also included. The "Fireline News" was distributed to all seven fire camps and was flown by helicopter with food supplies to a spike camp. The paper proved to be quite a morale booster.

At midpoint in the battle of the "Woodwardia" fire another fire broke out on the Saugus District of the Angeles National Forest. This fire burned some 3,500 acres of watershed land 35 miles northwest of Los Angeles. Two men from the information team were dispatched to this area and telephoned their reports to the main center where information on this fire also was given to the press and to the public.

The main purpose of an information section in any large fire organization is to relieve the fire boss and line personnel of information responsibilities and to provide a central area where factual information can be obtained. Reporters receive the facts from

such an information center without interfering with the suppression activity on the fireline. Access to the fireline activity is not denied the press, but the central point for information somewhat lessens the desire to get out on the fireline, except for photographers.

The following comment received from a national wire service while we were closing down the information center sums up the "thank you's" received from the press, "Until the past few years we had to get our fire information from some worker on the fire, 'phone a lookout station, or take comments from a passing motorist. The size of the fire would vary from 1,000 acres to 10,000 acres according to which newspaper you read."

INFORMATION FOR CONTRIBUTORS

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

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

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

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

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

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