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# FIRE CONTROL NOTES

A PUBLICATION DEVOTED TO THE TECHNIQUE OF FOREST FIRE CONTROL

FOREST SERVICE – U. S. DEPARTMENT OF AGRICULTURE

# FIRE CONTROL NOTES

**Number One of a Series of Publications Devoted to the**
**TECHNIQUE OF FIRE CONTROL**

***Published by***
**THE FOREST SERVICE—U. S. DEPARTMENT OF AGRICULTURE**
**DECEMBER, 1936**

The value of these publications will be determined by what you and other readers contribute. Something in your fire control thinking or work would be interesting and helpful to others. Write it up and give other men some return for what they have given you.

Articles and notes are wanted on developments of any phase of Fire Research or Fire Control Management: theory, relationships, prevention, equipment, detection, communication, transportation, cooperation, planning, organization, personnel management, training, fire fighting methods or reporting, and statistical systems. Whether an article is four lines or ten typewritten pages in length does not matter. The only requirement is that articles be interesting and worth while to a reasonable proportion of readers.

*Address* DIVISION OF FIRE CONTROL
FOREST SERVICE, WASHINGTON, D. C.

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# FIRE CONTROL NOTES OFFERS ITS SERVICES

ROY HEADLEY
*Forest Service, Washington, D. C.*

The Fire Control Meeting at Spokane, Washington, in February, 1936, gave the Forest Service Division of Fire Control in Washington, D. C., a mandate to issue from time to time a publication which would serve as a medium for exchange of information and ideas between all the groups and individuals who are doing creative work in forest fire control. On the assumption that readers will respond with ideas and information to publish, the mandate is accepted.

Over a period of 30 years since the inception of organized effort to stop the fire waste of American natural resources, impressive advances have been made. Considerable body of knowledge of the arts and sciences involved has accumulated. Systems of organizing and managing human forces and mechanical aids have in some instances attained dramatic efficiency. Fire research has won the respect of owners and managers of wild land. The advancement to date in technique entitles fire control to a place among the amazing technologies which have grown up in recent decades.

The advance of the technology of forest fire control is not, however, a completed thing. Its forward march has not even begun to slow down. On the contrary, there is good reason to anticipate a period of broader and more rapid growth. Fire control has won a large measure of public interest. Its relation to conservation of wild land resources is better understood. Financial support is increasing. A growing number of men are making technical contributions from a wider range of ability and training. More men know more about how to climb to new plateaus of efficiency in stopping this fire waste.

Future advances will come not from the work of small groups, but from the experience, thinking, and experiments of the large number of men now engaged in pushing back the frontiers of fire control. The integrated experience and study of such a body of interested men may easily yield results overshadowing all that has been gained so far.

The surprising thing is that the need for a vehicle for interchange of ideas among such men has not been recognized before. Widely scattered as they necessarily are, the creative efforts of individuals and separate groups cannot be fully effective without the aid of something which will serve as a common meeting ground, a clearing-house of developments. FIRE CONTROL NOTES aspires to render that service. It hopes to be a carrier of whatever men need to know to keep abreast of developments and trends in fire control.

FIRE CONTROL NOTES will seek to act as a channel through which useful or suggestive information may flow to each man in this field, whether he be a fire research worker attacking some fundamental of combustion, or a fire fighter, facing the flame and smoke, who discovers some new device for organizing a crew of laborers. These pages will also hope to be used as a mouthpiece for every man, whatever his job, who discovers something which would be useful to others, or who has a criticism to make, a question to raise, or an unusual fire experience to relate.

As implied by the name, "Fire Control Notes," it matters not how long or how short a contribution may be nor what angle of fire control is presented. The man who discovers some new device which can be presented in four lines owes it to himself and others to report it. Likewise, the fire research man who needs ten pages for a worthwhile presentation of his subject should share what he has learned with others who need his help or who may be needed to supply the intelligent interest required to sustain the inquiry.

The only requirement imposed upon contributions to FIRE CONTROL NOTES is that they be interesting or helpful to some group of people concerned with some phase of fire control.

FIRE CONTROL NOTES will be published intermittently as contributions accumulate. Distribution will not be limited to members of the Forest Service, but will include all who are cooperating with it in stopping forest fire waste. Copies will be sent to State forest organizations, cooperative protection associations, forest schools, Federal bureaus interested in fire control, and Canadian and other foreign organizations dealing with fire problems. Within reasonable limits, any individual who is not included in the organizations mentioned may be placed upon the mailing list by agreeing to constitute himself or herself a committee of one to discuss with friends the need for habits of care in the use of fire. Leaflets and other printed material may be obtained upon request for use in such discussions.

# AERIAL AND CHEMICAL AIDS

David P. Godwin
*Forest Service, Washington, D. C.*

The concept that forest fires can be successfully retarded or extinguished by chemical treatment from the air has been a wishful thought, since there is no built-up knowledge of possible techniques. There has been some research in the field of fire-retarding chemicals and some attempts to drop free water from a plane, but no promising recorded experience.

As a result of consideration at the Spokane Fire Control meeting in February, 1936, a decision was made to conduct studies of such thoroughness and duration as to get to the bottom of these subjects, and, if possible, build from them techniques to supplement our established suppression methods.

From the first it has been necessary to maintain a clear distinction between the chemical project and the aerial project. The former sets out to discover or develop effective chemicals and their mechanical application in fire suppression, whether such application be on the ground or from the air. The latter seeks to develop aerial technique for the fire-retarding application of not only chemicals, but water and explosives.

The chemical studies, as planned, cover the whole wide field of possible fire-suppressive chemicals. Following the Spokane meeting it was realized that that particular segment of the chemical field known as "fire foams" was an established practice in oil and urban fire suppression, and therefore was not so much a matter of study and research as one of adaptation. The proposed fire foams experiments were therefore detached from the general chemical project, which had been assigned to the Branch of Research, and was retained by the administrative Division of Fire Control.

The Branch of Research turned over to the Madison Laboratory the direction and conduct of the general chemical project, and that work is proceeding quite independent of the fire foams project.

The fire foams project is being conducted on the Monongahela National Forest in West Virginia and at the Philadelphia plant of a chemical company specializing in fire extinguishing materials. This corporation is proceeding under a cooperative agreement with the Forest Service, and two of its members most experienced in the chemical and mechanical aspects of the work have been appointed by the Department as collaborators.

The primary emphasis with both chemical projects will be upon the development of chemicals for use in our fire suppression activities on the ground. If either project in the course of this work develops chemicals or containers or other applying devices suitable for aerial use they will be passed on to the aerial project for tryout in the air.

The aerial project had been planned for Region 1, but various unavoidable delays so shortened the season that the work center was shifted to Region 5, where the work is now in progress.

A discussion at this time of any of these projects can be merely a progress report—and a meagre one at that—since actual work was not started until September and has been exploratory and groping.[1]

## Fire Foams Project

Fire foams, as generally known, are created by the mixture of two chemicals (sodium bicarbonate and aluminum sulphate), plus a stabilizer, or bubble former (such as extract of licorice root), brought into contact with water. These component parts vary slightly with the several manufacturers, but the general foaming effect is about the same. The volume of foam produced is about eight times the volume of water used.

Three methods of mixing are used in present practice, and for forest work it has been necessary to select the most effective method for the kind of application desired. The methods are:

1. One powder method—All dry chemicals are mixed together in advance and fed into one hopper above the generator, through which a single stream of water is passing.
2. Two powder method—Compound A (aluminum sulphate) and compound B (sodium bicarbonate plus the stabilizer) are fed into separate hoppers and meet as two solutions.
3. Two solution method—Compounds A and B are separately mixed with water and held in solution in storage until mixed, as with hand extinguishers.

For use with pumper and hose lines, and with tank trucks, the one powder method has been adopted as the simplest and best suited to our conditions of transportation.

For use with the back-pack rig, mixing of dry powder with the water stream is not feasible, and the two solution method has been adopted.

For use with aerial bombs, dry powder cannot be mixed quickly enough with water, so that the two solution method has been used.

In the control of fires in oil or other flammable liquids, the smothering effect of foams is the result sought. Apparently, therefore, little attention has been given in the industrial field to the possible addition of flame-

[1]During the progress of the early foam studies, and in the course of the foam experiments, many ideas, designs, and models for aerial foam containers and devices were developed. Some of these were tested in Philadelphia and West Virginia and some were passed on to the Aerial Project in California. This latter project, however, has had so short a time to find itself that discussion in this issue would be premature and could deal only with preparatory activities in flying and bombing technique. It will be covered more fully in the next issue.

retarding chemicals. For forest fuels, however, it has been recognized from the start that though we would get cooling and smothering effects from the wet foam itself, we should have some gas more potent than carbon dioxide held in the tiny bubbles. Through the knowledge and experiments of our collaborator, G. G. Urquhart, the foam compounds have been fortified or "loaded" with various flame-retarding chemicals and will be put under comparative field tests. The "load" used on the first Monongahela tests was ammonium sulphate, but others, such as sodium acetate, magnesium chloride, zinc chloride, and ammonium bromide, will be tried out in the future.

Considerable preliminary work was done at the plant of the chemical company, and the writer made several visits to Philadelphia working with our collaborators, Mr. Urquhart and Mr. Blair, in the preparation of apparatus adapted to our requirements. We had previously received the discouraging advice that linen hose, so extensively used by the Forest Service, would not be suitable for foam because its rough wall would break down the bubble structure. But this was overcome by the addition of a chemical material which lubricated the stream as it passed through, and subsequent tests showed no difficulty in this respect.

Much time was given by our collaborators to the development of the back pack rig, and the final form has not been decided upon as yet. The improvised rig used in field tests was composed of two cylindrical chambers, and mixing was accomplished by the two solution method. The pressure created by the gas formed is insufficient in itself to expel the foam with force. A carbon dioxide cartridge was therefore used. Two methods of expulsion by pressure are possible: the cartridge above mentioned and a hand air pump. The pressure type, however, has disadvantages; stronger tank construction is required, weight is added and time is lost in refilling and compressing. This has led to the development of a compact rotary pump unit weighing only three pounds. It is believed that this will eliminate the disadvantages inherent in the pressure types, and furthermore, can be used to expel foams, chemical solutions, or water from the same type of back-tank.

For the first experiments on the Monongahela an area was selected in a level open field, with adequate water supply and near a CCC camp. Later it is planned to conduct the work with running fire in natural standing forest cover, but for the first tests it was thought better to use prepared stacks of fuel. These were arranged so that the comparative effectiveness of water and chemicals could be measured with the greatest accuracy. Duff, logs, and pine and hemlock slash were used in varying composition, density, and size, but always in identical pairs.

A weather instrument set-up was made on the field, and throughout the experiments continuous record was kept of wind velocity and direction, relative humidity, temperature, and sun and shade.

For the pump and hose tests we used a Type Y Pacific Marine Pump, 700 feet of 1½-inch standard linen hose, and a specially designed light weight foam generator, with funnel hopper which in all instances must be set in the line not more than 100 feet back of the nozzle.

For the back-pack tests a "Ranger Special" bag and hand pump was used for water, and this improvised rig previously described (with 3/32 inch nozzle) was used for foam application.

Ignition was in all instances accomplished with Propane Torch, uniformly. Comparative fuel stacks were allowed to burn the same length of time and until maximum flame mass was created.

The planning of experiments, the ground layout, the personnel organization, and the recording were handled in a thoroughly efficient and fair manner by the officers of the Monongahela Forest, assisted by the local CCC overhead.

Test No. 1. Water vs. foam for knockdown of flames on smaller size fuel stacks (10′ x 4′ x 2½′). Pump and hose. Nozzle 25 feet from fire. Water extinguished flames in 70 seconds. Foam extinguished flames in 40 seconds. During foam application humidity was 10 points lower and wind 2 miles greater. Neither stack reignited.

Test No. 2. Water vs. foam in pre-treatment of "wetting down" of fuel ahead of fire. Larger size stacks (15′ x 8′ x 2½′). Pump and hose. Object: To determine comparative checking effects of liquids and the time wet-down area would resist encroachments of fire. Lee half of each stack wet down for 1½ minutes. Action here was watched and various effects recorded for about 1½ hours, but briefly the result was as follows: The wet half of the foam treated stack resisted advance of fire for 30 minutes and was never completely consumed. The wet half of the water treated stack lost its resistance in 2 minutes and shortly after was completely consumed.

Test No. 3. Water vs. foam for corralling a fire with back-pack rig. Windrows of slash 100′ x 3′, varying in width from 1½′ to 2′. Man with "Ranger Special," containing 5½ gallons water, started at one end working along line of fire, using fullest energy, was able to apply water for 6 minutes and 10 seconds, and suppress 40′ of fire line. Same man with foam rig containing 4½ gallons foam solution, working along line in same direction, was able to apply foam for 2 minutes and 10 seconds, and suppress 100′ of fire line.

This method, which simulated the effort of a man (or crew) to knock down the head of a hot fire by direct attack, demonstrated that under these conditions the foam treatment knocked down and held 48′ of fire in one minute, while the water treatment knocked down and held 6′ of fire in one minute.

Test No. 4. Water vs. foam for fire knock down. Pump and hose. Larger stacks. Hose nozzle 25′ from fire. Water knocked down flames in 15 seconds and applied for 2 minutes more. Foam also knocked down flames in 15 seconds and applied for 2 minutes more. Water treated pile reignited in 2 minutes, was completely afire in 40 minutes more, and was consumed in 38 minutes more. Foam treated pile reignited in 4 minutes, burned only with small flames in spots, and after 148 minutes (the last record taken) the entire stack had not ignited and was smoldering.

Test No. 5. Water vs. foam for mop-up with back pack rig and hand tool. Smaller stacks. Man with "Ranger Special," containing 7 gallons water, followed by man with Council Tool, knocked down flames with water in 35 seconds, pulled fuel apart with Council Tool and applied water to smoldering material for 97 seconds more. Fuel reignited in 13 minutes. Man with foam rig containing 4½ gallons foam solution followed by man with Council Tool, knocked down flames with foam in 25 seconds, pulled fuel apart with Council Tool and applied foam to smoldering material for 105 seconds more. Some smoldering and small smoke after 3 hours but no flames. These stacks proved too small for adequate comparison in the two methods. Little indicated except efficacy of foam in preventing reignition.

Test No. 6. Water vs. foam for mop-up with pump and hose, back pack pumps and hand tools. Larger stacks. Water from hose applied for 2 minutes to knock down flames. Followed by 4 men with water-filled "Ranger Specials," 2 men with Council Tools, and 2 men with shovels, who pulled fuel apart and mopped up for 4 minutes, 5 seconds to get the last smoke. On comparable stack, foam from hose applied for 2 minutes to knock down flames. Followed by 2 men with Council Tools and 2 men with shovels (no back-pack rigs), who pulled fuel apart and, although only small smokes visible, mopped up for 3 minutes, 5 seconds. Shovel mop-up by scooping up ground foam and applying to smoldering material. More foam than necessary had been applied by hose men.

Since the completion of these first experiments others have been conducted and others planned. Profiting by experience, tests within the next six months should produce definite conclusions which can be supported by rules of application and by specifications of chemicals and apparatus. It is early for conclusions but certain effects were so obvious that they may be set down:

1. A gallon of water mixed with a pound of foam compound is more fire suppressive than a gallon of water.
2. Foam compounds can be "loaded" with flame-resisting chemicals to make them more effective. This phase of the work deserves much more attention.
3. Back pack foam rig shows great effectiveness in knock-down and mop-up work. Every effort should be made to perfect it mechanically without too much weight.
4. With back pack rigs these tests showed a ratio of 8 to 1 in effective footage of line, as between foam and water treatment.
5. Back pack foam rig eliminates the considerable fatigue of hand pumping and gives the operator a psychological boost, induced by confidence that he has a new power back of him.
6. Whatever performance is secured through use of pump and hose line is equally possible with tank trucks.
7. Pre-treatment of fuel ahead of fire to check the advance and pemit line building may create a new technique. Foam permeates, clings, and remains, while water vaporizes.
8. Foam will probably be more effective than water as an aid in back firing.
9. If foam is used at the head of a crew as knock-down agent the men will be given a break to get in and hold the partially suppressed fire.
10. Foam, sparingly applied, is an effective mop-up substance. Any surplus on the ground can be applied with a shovel.
11. Reignition after application is much slower when foam is used than when water is used.
12. Only when foam is used in comparison with water in differing, natural fuels on going fires will all of its faults and merits be determined.
13. Packing heavy chemicals up to the head of a hose line or to back-pack refilling points in rough country is a disadvantage to be considered.
14. Foam can only be an auxiliary, and its relative use-position to established tools and methods will determine its final importance.

# CHEMICALS IN FIRE CONTROL

FROM THE FOREST PRODUCTS LABORATORY, MADISON, WIS.

The Service has this year initiated active work in an effort to learn whether chemicals have a place in forest fire control and suppression. Work on chemical phases will be centered at the Forest Products Laboratory, where studies on fireproofing of wood have been carried out and where a trained staff of chemists is available. Field tests will be made in cooperation with the various experiment stations and the Division of Fire Control.

Work has been started along the following lines:

(1) A survey of the literature on the subject, particularly on the application of chemicals to fire fighting; (2) a preliminary survey of chemicals for the purpose of picking the most promising ones and determining concentration for field trials; and (3) participation in field trials being made under the supervision of the Division of Fire Control of foams that are in use in other fields of fire suppression. At the earliest possible moment the Laboratory will undertake field tests in cooperation with the experiment stations.

The review of literature is revealing a dearth of scientific information on the subject and the need for research as a basis for the work. A preliminary comparison of chemical solutions with water has been started using a method devised by a Denmark investigator, F. Folke, in which a given quantity of wood of similar size and arrangement is ignited and allowed to burn until a definite amount of material is consumed. The quantity of water and chemical solution used and the time required for extinguishing give numerical comparative values. From the laboratory tests chemicals will be selected for field trials.

The project involves many problems aside from the actual choice of chemicals, such as the most effective method of applying them; adaptation to different fuels, forest conditions, and field equipment; effect of chemicals on equipment, etc. These will be investigated as the work progresses.

# FIRE BEHAVIOR STUDIES ON THE SHASTA EXPERIMENTAL FOREST

John R. Curry

*California Forest and Range Experiment Station*

Studies of rate of spread and fire behavior take many different forms—which is as it should be. It is a large subject and fire executives will not be able to manage suppression jobs with assurance until the complex forces which make fires run swiftly or slowly are better understood. Here is a brief statement on the methods being used in California in the study of the subject.

How big will a fire be under given conditions of time, fuel, moisture, wind, and slope?

Is there a natural law governing the combustion of fuels in the open; can it be defined?

What are the physical characteristics of forest fuels that control their tendencies to carry fire under given conditions of wind and moisture?

Do small fires spread more rapidly with increase in time, provided other conditions remain constant?

The solution of questions such as these is the final purpose of the major program of forest research being conducted on the Shasta Experimental Forest, an area dedicated to the study of problems in forest fire control in northern California.

Questions of the relative importance of such studies may be raised. Would it not be more productive to study directly methods of fire suppression, fire prevention, or hazard rating? Will not studies in these latter fields be more productive of concrete results than studies of the more general subject of fire behavior? These questions were carefully considered before these present studies were begun. Under many conditions, indeed, it may be preferable to concentrate upon studies of more direct application. It does appear, however, that without a better understanding of the principles controlling the behavior of fires, we are seriously handicapped in our attack upon the problems of more direct practical application. If the laws governing the rate of spread of fires were clearly understood, we could approach the whole fire problem with greater confidence and with increased opportunities for success. While California has many baffling problems in all fields of fire control effort, there is a unanimity of agreement among both administrative and research men that research should in general concentrate on fundamental aspects of the fire problem. If these principles can be clearly defined, there is a conviction among all that fire control practice will be greatly benefited. It is felt that knowledge of the behavior of small fires is not only desirable but unquestionably essential to the proper distribution of fire control effort on the National Forests of California.

The approach to this study has consisted in starting over 300 small fires in the most uniform conditions available, second-growth ponderosa pine stands, principally on level ground. Fires have been studied under all conditions of wind and moisture experienced during these seasons. They have been allowed to spread for periods varying from 10 to 30 minutes or longer, with an average period of 22 minutes. On each fire a record of wind and moisture conditions is kept, together with a record of the perimeter of the fire at each two-minute interval. In addition, a quantity of descriptive information is obtained.

In analyzing the data, three basic factors—wind, moisture content, and time—have been found to have an important bearing on the dependent variable rate of perimeter increase. Because of the lack of any method of quantitatively evaluating the effect of variations in fuel conditions, the plots used have been carefully selected for uniformity under the assumption that by this method the fuel factor could be disregarded. On a portion of the fires studied on slopes, the slope factor was, of course, taken into consideration. The results of the analysis are not as clear cut and as convincing as desirable, but indicate plainly the importance of the factors considered in influencing perimeter increase. A summary of the work accomplished to date will be published as soon as possible.

The analysis has shown that further refinements in the techniques of measurement is necessary, if we are to fully evaluate the effect of all factors. Consequently, present research is being concentrated on individual studies of the wind, moisture, and fuel conditions to obtain methods of precisely measuring these factors.

The plans for future work involve, first, the development of satisfactory techniques of factor measurement and, second, the extension of the study in the pine type as well as to other more complex types. Preparations have already been completed for test fires in the brush type.

Experiments of this character, aimed at the evaluation of basic factors, are characteristically difficult of attack and are productive of results only after long study. On the other hand, if the fundamental relationships existing between the factors which control fire spread can be defined, all phases of fire control effort will be benefited.

# NORTH WINDS AND NATIONAL FOREST FIRES IN CALIFORNIA

The following account of October fires which received national publicity has been taken from a report by Regional Forester S. B. Show.

Constant touch with the Weather Bureau confirmed our belief that Region 5 was entering one of the most dangerous fire periods in its history and that we would be very fortunate if we could emerge from this situation without a blackened record.

Local Weather Bureau officials have worked up the following summary of the weather conditions that brought about the acute fire situation beginning October 14, and continuing to the morning of October 17:

"The fire-weather situation which began on October 14, 1936, was one of the severest and at the same time most clearly typical that has come under the observation of the district forecast office at San Francisco. It began with an invasion of the far western portion of the continent by a transitional Polar-Pacific air mass, which was associated with the rapid development over the Western States and adjacent ocean of a huge anti-cyclonic system, successively centered as follows:

"October 14 about 600 miles west of San Francisco.
"October 15 about 200 miles west of Columbia River Entrance.
"October 16 over southern British Columbia.
"October 17 over Wyoming.

"Neither the anti-cyclone nor the air mass of which it was composed would in themselves have evolved the acute fire situation attributable to them in this instance, had it not been for the cyclonic circulation which developed on the south side of the high pressure field, viz., over Southern California. This development took place on the 15th and reached its apogee on the 16th, when the pressure gradient may be inferred from the following: Highest pressure on Pacific Slope 30.52 inches at Kamloops, B. C., and lowest 29.64 at Yuma, Arizona. This gradient was clearly implied by the winds, which on both dates were NE fresh to strong over Northern California, and locally of gale force where topography required. As is always the case with northeast winds at this time of year, the relative humidity was extremely low, a fact which, in view of the unusual wind velocities, explains the extraordinary contemporary fire situation in Northern California, particularly over the northern Sierra and the northern Coast Range, which were directly athwart the path of the strongest winds.

"Both the advent and the termination of the general hazard were easily predictable by means of synoptic meteorological data. The coming of the anti-cyclone with its north to northeast winds was very evident as will be seen by inspection of the fire-weather forecasts for California on the 14th and 15th. The termination of hazard was governed by the cyclone which, developing over Southern California, caused general rains in that area from the 16th to 19th, and whicch, by traveling northwestward, introduced a marine air mass of high vapor content to the northern portion of the State. This air mass movement was evident by noon of the 16th, when assurance was given that by Sunday (the 18th) the fires in the central Sierra would be easily controlled if not altogether extinguished."

In addition to the information submitted by the Weather Bureau, we wish to add that accurate wind instruments registered wind velocities as high as 70 miles per hour on the Sierra and up to 80 miles per hour on the Tahoe Forest.

This extremely high wind, coupled with the fact that lesser velocities from 40 to 60 miles per hour were maintained for over twelve hours beginning the evening of October 15, resulted in broken communication lines and left forests without communication to their lookouts, guard stations, and suppression crews, and on the Sierra Forest communication by telephone between Northfork and Fresno was out for over ten hours. This break in one of the most essential tools of fire protection was partially corrected by radio during the early period of the high winds with a complete communication setup by means of radio as soon as the organization could be effected, which was within an hour or two.

Roads closed by as many as 50 fallen or broken trees per mile added to the difficulty of reaching the fires with man power.

The following fires started during the early stages of this period:

| *Forest* | *Location* | *Cause* | *Area* |
|---|---|---|---|
| Sierra | Bretz Mill | Burner | 1,200 A.—Private |
| " | Whiskers | Camp Fire | 900 — " |
| " | El Portal | Power Line | 900 —Govt. |
| " | Goodman Ranch | " " | 4,000 —½ Govt. |
| " | Mitchell Ranch | " " } Burned | |
| " | Church Ranch | " " } together | 8,000 —⅓ Govt |
| Tahoe | McKenzie Mill | Burner | 23,000 —½ Govt |
| " | Plumbago Mine | Unknown | 3,000 —Unknown |
| " | Remington Hill | " | Negligible |
| Stanislaus | El Portal | Sierra fire jumped river and burned | 400 —Govt |
| " | Tuolumne Lumber Co. | Unknown | No area inside |
| Eldorado | 3 Fires | Power Line | Negligible |

No severe damage to Government timber resulted from the Sierra fires.

The most disastrous fire was the one started from the McKenzie Mill near Westville. This fire traveled almost due west from Westville to Iowa Hill, and during a 12-hour period burned a total area of 23,000 acres, which practically cleaned out the timber on the ridge from Westville to Iowa Hill, a distance of over 12 miles. Approximately 25 million feet of Government pine timber were killed outright by this blaze, with lesser losses to Government timber scattered in smaller patches throughout the interior boundaries of the burn. It is estimated that approximately 100 to 150 million feet of timber were killed by this fire, about two-thirds of which were private.

Timber Management has already looked over this area with a view to salvage operations.

The Tuolumne Lumber Company blaze, near the Stanislaus, destroyed the entire lumber yard (approximately 6 to 10 million feet of lumber). The mill, however, was saved.

On the Sierra, 1,100 men with the necessary complement of overhead and equipment corralled all six fires by the evening of October 16, less than 24 hours after start. The Stanislaus and Eldorado suppressed their fires during the first work period.

The Tahoe forces, approximately 900 strong, could not handle their large 23,000-acre fire until the wind had died down. This fire did not quit crowning for over 12 hours. They did, however, place a corral line around it as soon as the weather conditions made it possible to hold what lines they were able to build.

The efficiency of the Army in establishing rationing facilities and the cooperation by outside agencies were high lights of the campaign. Though the record looks bad, yet we feel that we came out of one of the most serious and trying situations that Region 5 has experienced in years, with losses much less than we would have had if we had been unprepared and had not been waiting for just such a situation.

More emphasis can well be placed on training temporary men to submit accurate reports. We believe that when the reason for reports is driven home, *i. e.*, that the study of the reports is fundamental in determining ways and means of getting better fire action and saving of time, then the men have been the necessity for reports and a long step has been taken toward getting more accurate ones.—District Ranger M. B. MENDENHALL, Cabinet.

## WHAT HAPPENS WHEN THE DREADED EAST WIND FINDS CLEARING FIRES BURNING IN OREGON

The following account of the fall fires in Oregon and the part played by the Forest Service is taken from a report by Regional Forester C. J. Buck:

On September 26 a strong east wind, coupled with low humidity, caused a large number of disastrous fires. The worst situation was outside the National Forest in Coos and Curry Counties in Oregon, where the extremely bad fire day found many unextinguished fires on ranches and in slashings. The east wind spread these fires over considerable areas, burning the town of Bandon, with 11 lives lost and property damage of about $2,000,000. In addition, some 50 families living on ranches throughout the area were burned out, and there was a considerable loss of livestock.

Final figures are not yet available on the acreage burned, but a rough estimate of the area in Coos and Curry Counties is between 90,000 and 100,000 acres. According to reports, very little mature timber was damaged, but reproduction up to 20 inches in diameter was destroyed, including a considerable amount of Port Orford cedar.

Upon an examination on the ground, I found that there were a large number of uncontrolled fires in Coos County within the State protective area, handled in cooperation with the Coos County Fire Association; and that the situation was fraught with possibilities of further disasters to towns and communities. The State forces were very evidently strained far beyond the limit, and a recurrence of bad east-wind fire weather would threaten everything in Coos County. I therefore made two proposals to the Governor: one, that the Forest Service would immediately undertake a survey of the situation about the larger towns and settlements, make definite plans for the protection of lives and property within those towns, and would devote the services of 500 CCC to this work until the emergency should be over. The other proposal was that the Forest Service would immediately take over fire fighting on some 175,000 acres additional of State protection area lying immediately outside and approximately six miles distant from the north boundary of the Siskiyou Forest. This area had between 20,000 and 30,000 acres burned over and some 12 or 15 uncontrolled fires. The extent and number of fires was unknown. Visibility conditions were very bad, so that scouting was the only possible method of obtaining the location, size, and number of fires.

The Governor accepted both proposals, and the Forest Service, under proposal one, immediately moved into headquarters at Coquille, Oregon, and with eight experienced fire suppression men began the development of plans about the towns of North Bend, Marshfield, Myrtle Point, Coquille, Port Orford, etc., began mop-up work on threatening fires near the towns and started the construction of fire lines. This work, which is still going on, is being done in cooperation with the mayors, fire chiefs, and other city officials. The work itself may result in the prevention of a considerable loss of property and lives at the present time in case of recurrence of extremely bad fire weather. Coos County has as yet received but little rain, and the work is still going on. As a result of the progress of this work to date, the Region has determined that similar advanced fire suppression plans and possibly some fire line construction work will have to be planned out for many towns and settlements within the National Forests. An effort will be made to have town authorities carry on such work, and in any case the preparation of advanced plans will show what is to be done in case forest fires threaten the communities.

At the present time, October 6, the fire situation is still bad in Coos and Curry Counties. Forested lands in these counties are closed to entrance by the people, with the result that hunters cannot operate. But little rain has fallen. The fire suppression work on the additional area taken over from the State is proceeding nicely, and it is hoped that within three or four days these fires will all be under control. Some 1,800 men are now at work on the State area in Coos and Curry Counties and about 100 men within the National Forest protective area, where all fires have been under control for several days. Only a thousand or two acres of National Forest land have been lost.

It may be stated here that one of the prime causes for the destruction of Bandon, Oregon, which is almost completely burned—some 300 or 400 houses, homes of 1,500 people—was the tremendous amount of Irish gorse on the streets of the town and in its outskirts. This plant was introduced several decades ago from Ireland and has attained an unusual size and vigor at this point. It is highly inflammable and carries fire long distances.

It is evident that the preparation by the Region of various fire prevention plans about towns and settlements, at least within forest protective areas, will reveal conditions of this character and bring them sharply to the attention of the city officials.

## FOREST RADIO PLAYS VITAL FIRE ROLE

From an October News Release Report on Use of Radio in Western Oregon Fires.

The important part played by Forest Service short wave radio in meeting the recent forest fire crisis in southwestern Oregon was related this week by Forest Service Chief of Fire Control J. F. Campbell and Radio Engineer A. G. Simson, who have just returned to Portland from the fire area.

These men state that a radio communication system covering hundreds of miles of fire front and coordinating through the Forest Service fire headquarters at Coquille, Oregon, kept the fire base in continual touch with remote areas where hundreds of men worked and where accidents or sudden "flare-ups" called for immediate attention. Short wave radio, though not a substitute for telephone, supplemented the telephone system in districts far from established communication.

"At the Sandy Creek fire, which was a bad one," said Campbell, "large crews moved into the woods over narrow trails. Pack trains carrying daily supplies were swallowed up so far as the outside world was concerned. Under the old system foot sloggers over miles of trails would have been the only means of delivering messages, and these messages might involve the safety of lives or urgent need of shifting forces. Portable short wave radio stations met the need and kept headquarters in immediate touch with this as with all other fire points."

Some 50 short wave radio stations have been in use in the fire area, according to the Forest officials. One central control station systematized the work of these stations giving quick clearance to urgent messages but calling for the routine business from some 10 strategic fire camp stations in regular rotation at least once every hour. Food, equipment, and other needs were promptly attended to in this way.

When the telephone system went out after the burning of Bandon, Forest Service short wave stations were installed by State police at Bandon and at Coquille, restoring vital communication with the Bandon district.

"This was a country full of fires," said Campbell, commenting further on the situation. "The Sixes River fire alone had a circumference of 68 miles. The Forest Service scout unit had to patrol these fire lines and keep headquarters posted on the dangers and progress of the blazes. Immediate action was needed. Without these small portable radio stations that could be set up anywhere in the woods the effort at fire control would have been much less effective. Radio undoubtedly helped save many acres of forest and possibly saved human lives."

Simson and Campbell report that forces are being reduced in the fire area, but that the communication system and fire crews will be needed till rain comes. The most popular portable radio, they said, was the small P F model weighing about 16 pounds and easily carried in a back pack. These Forest Service radios now generally used in forest work are Northwest products, having been developed at the Forest Service Laboratory in Portland, Oregon.

I should like to suggest the idea that on large project fires we would accomplish more by:

1. Doing line construction from 6 p. m. to 10 a. m., with patrol only from 10 a. m. to 6 p. m.
2. Dividing the available man-power into three crews, each working for one successive 8-hour period.

I believe that crews high-balled for 8 hours at night and during the forenoon will produce more held chains per man day than a crew working from daylight to 6 p. m. This would mean three crews working on the line each 24 hours, but considering travel time, each crew would be working at least 10 hours per shift. Personally I should like the opportunity to try the scheme. With the large amount of man-power that was rushed to fires during the past season, three 8-hour shifts would have been available from any fire camp.—District Ranger M. B. MENDENHALL.

# RINGSIDE SEATS BY RADIO

F. V. HORTON

*Forest Service, Portland, Oregon*

Sometimes we wish that the public could get the feel of what happens on our fire lines. Listeners might become prevention crusaders if they could get the story, hot from the fire line by radio. It can be done. The author describes one such broadcast from the Sims fire in Oregon in 1935 and suggests alternatives.

The Oregonian, KGW and KEX, ran a wire into our station, KBAA, at our Forest Service radio laboratory in Portland; that is, they connected their transmitter with our receiver at KBAA. We broadcast from the fire line over our regular equipment, using an M set; a pick-up was made in our Portland laboratory, and fed into the special wire to KGW, where it was rebroadcast on the station's regular frequency. This arrangement could only be made where the commercial stations were willing to go to the trouble and expense of such a hookup, and even then, the rebroadcast system is not too good in the summer. The two transmitters amplify the noise, and fading is experienced, etc.

A far better arrangement would be to inform the public of the frequency of our Forest Service transmitters, and endeavor to have them pick up the broadcasts directly. Of course we would lose considerable, both in coverage and in publicity, by using this latter method.

It was necessary to have one of our radio engineers at our Portland station handle the rebroadcast; that is, to monitor and see that everything was functioning properly. I would hesitate to attempt such a broadcast unless I had competent men such as our own radio personnel to handle it.

A word about the actual broadcast itself might not be amiss. In the first place, I believe it would be inadvisable to attempt to broadcast from all fires. I believe that a broadcast would only be justified where either the fire was of extraordinary proportions, or was of immediate importance to a large number of people. The Sims fire was a particularly good one on which to base a broadcast. Perhaps it will serve as an example.

The Sims fire was incendiary; it was on the watershed of the university town of Eugene, which, by the way, owns its own power plant. The nearby McKenzie River has been publicized for years from the standpoint of fishing and recreation. That made the setup one which would demand immediate attention from a rather large audience, since everyone in Eugene or who might have been interested in the McKenzie would feel that they were suffering a personal loss.

The broadcasts from the fire line itself are extremely difficult: first, because they have to be somewhat extemporaneous; even at the best only a rough outline of the broadcast can be prepared in advance. It is essential that the man broadcasting have a good command of words, a good sense of the dramatic, and considerable imagination. He must find for each broadcast at least one human interest episode, and this of course means that he must recognize these when he finds them, or be able to elaborate on some small episode which actually has happened. On the Sims fire, when one of the fire fighters was killed, the regrettable affair was dramatized by stating that his mother would probably receive the news of his death by way of the broadcast. This was literally true, since there was no opportunity to communicate with her before the broadcast went on the air.

I believe it would be disastrous to attempt broadcasts through local radio stations unless the fires were real spot news. There is a possibility, however, of publicity through informing the public that by listening on a certain frequency at a certain time, they may be able to pick up the Forest Service sets operating on the fire line, and then use a few minutes of the day to relate events and give a description of what is happening on the fire front.

Designers and developers of fire plows tend to think in terms of great weight and power because, perhaps, of failure to begin by asking four questions, the answers to which should serve as the starting point for invention.

1. What is a fire line for?
2. How wide must a fire line be?
3. How deep must it be?
4. How important is the weight of the tool and the tractor required to pull it?—Roy Headley.

# SPEEDING UP FIRE-LINE CONSTRUCTION BY THE ONE LICK METHOD

Kenneth P. McReynolds

*Rogue River National Forest, Region Six*

Everybody deplores the slow speed at which fire line is usually constructed and recognizes that many fires get away because of inefficiency in converting available energy into held line. Too often the proportion of men on the line who are actually working or even moving is absurdly low. The fault lies not with the laborers, however, but with the men responsible for organization and planning. The following paper delivered at the Spokane Fire Control Meeting in February, 1936, tells what was done about it in one place during the 1935 season. Developments of the season of 1936 will be reported later.

In his letter of May 25, 1935, the chief summed up the situation in regard to the speed of fire trench construction as follows: "I am unable to regard our customary standards of held-line production as due to anything but our own deficiencies as students, organizers and executives. We have made some headway in the development of machine tools which are of great importance in the speeding up of held-line construction and for increasing the output of held line per man-hour. But when it comes to the techniques of organizing and managing men for a high-speed hand tool job of line construction, I must admit that my feeling is that we are much nearer to where we were in 1910 than to where we ought to be today."

In the same letter the following suggestion was made: "If in our thinking we could break clean away from our accustomed habits and take a fresh start, what would we set up as the inescapable limitation upon the speed with which a line can be constructed from a fixed point on around a fire through a stand of heavy chaparral, for example? Aside from the question of safety in working men, is there any inescapable limitation upon our speed under such circumstances except the limitation upon the speed which one man can make when floundering through a heavy stand of brush, making a slash with his brush knife each step or so? Could we not, if we mobilized sufficient properly organized and directed men behind him, widen and complete the clearing, do whatever trenching is necessary and even under some circumstances complete the backfiring at rates per hour which would not fall too far below the speed per hour made by this head man? Incidentally, this head man should, of course, be changed (with the rest of the crew) from time to time if the task was to make the maximum attainable speed from some single point at which a line could be started."

During the course of training in the CCC camps on the Rogue River National Forest, the system as outlined in the chief's letter was first given a trial on a mock fire.

The selected site of the proposed line construction was up a 25-50 per cent slope of a ridge covered with dense manzanita and scattering ponderosa pine.

It was difficult under those conditions to determine the number of men necessary to construct a completed trench and keep up with the lead man. Consequently, there were entirely too many men used on this first trial.

The crew consisted of 192 enrolled men and leaders, four foremen, and two other facilitating personnel. The men were organized, trained in the use of tools, and the system was discussed with them. Otherwise, so far as fire suppression was concerned, they were a green crew.

The distribution of men and equipment was as follows:

1. Leader.
2. Forty-eight axmen, two sets of fallers.
3. Fifty-six men with hoes, 16 with Kortigs.
4. Fifty-six men with shovels, four sets of fallers, four extra axmen.

The hoes and Kortigs were worked in the same manner as the axes, each man as he continually moved forward or paused only a moment added some work on the actual trench. None of the axmen or the men with hoes were permitted to pass each other.

The lead man located 3,300 feet of trench in 45 minutes, and when he finished, the trench was practically completed behind him or was within a few minutes afterward. The speed of completed line was approximately 31 links per man-hour. While this does not include backfiring and patrolling, two important factors were brought to light. First, at least 25 per cent of the men were unnecessary and did not have an opportunity to work at all. Second, the trench was completed in approximately the same time as it would have taken to move the men in, using the sector method, and to distribute them on the fire line.

The following day at another CCC camp, with practically the same type of personnel, the system was tried again. This time the crew consisted of 154 enrolled men and leaders, four foremen, and two facilitating personnel. This demonstration fire line was located in a light Douglas fir type with moderate amount of underbrush.

The tools were in proportion to those used on the previous day. In this case the results were 40 chains of trench completed in 25 minutes, or at the rate of 60 links per man-hour. However, this did not include backfiring and patrolling. But again, at least 25 per cent of the men were not needed.

The third trial was on an actual fire. In this case the ground cover was practically pure brush, mainly very dense manzanita, on a 45 per cent slope. The crew used on this fire was trained in this type of organization.

split, 25 working on a side. One crew used this "one-lick" system, and the other the sector system. The one which used the sector system completed 24 links per man-hour, while the other made 72 links per man-hour.

The system was used in a more or less modified form on small fires during the season, but in the latter part of August on the Rainbow Creek fire this system of organization produced some real results. The events which led up to this case were as follows:

*First:* The men had not been trained in the use of the system, except that it had been discussed with the foreman.

*Second:* The entire crew had been working all day the day before. They were on the fire from 10:00 p. m. to 8:25 a. m. the night previous. They were off the fire line only nine hours during the day previous to the actual demonstration and consequently were not in the best of condition.

*Third:* The ground was very rocky. The cover was thick snowbrush, both dead and alive, and true fir reproduction which varied from scattered trees to thickets. The topography was rolling, 5 to 30 per cent slope.

The crew, consisting of 60 enrolled men and leaders and two foremen went on the fire at 5:11 p. m. At 7:30 p. m. they had constructed, backfired, and were patrolling two miles of fire line. The crew then was able to patrol and hold this sector and, in addition, with the aid of a brush-plow unit mounted on a "35" Cletrac, also completed, backfired, and held an additional mile of line until 3:00 a. m. the following morning.

The speed of held-line construction for the first two miles was 118 links per man-hour, or 37 links per man-hour for the entire shift, which was a far longer period than the men should have worked.

**Those tests have brought out several points:**

*First:* The number of each type of tools for a crew of a given size will be the same as though the crews were working in sectors. The type of tools will, of course, also vary with locality, cover, etc. In general, the axes are ahead, followed by the hoes, then snag-fallers, shovels, and torches. Backpack cans, a few shovels, and several sets of fallers should, of course, be used with the advanced portions of the crew to cool down hot spots and get the bad snags, etc. Also, some axes should be held back with the shovels to assist in strengthening the trench and to catch spot fires. The main part of the saws to buck out logs and fall remaining snags will be with the patrol crew in the rear.

*Second:* The crew should not be allowed to string out. They should be kept as close together as tools can be used safely. This will keep the fire from breaking through the crew. So far as it has been able to determine at the present time, there is no more danger of the fire breaking through the crew, or perhaps not as much, than when the crews are working in sectors.

*Third:* It does not seem advisable to give strawbosses or section leaders tools. They have all they can do to see that the men are properly distributed, to keep them moving and working at the same time, and to look out for the safety of the men. The latter is particularly important with the system, because the men get no opportunity to watch for rolling rocks, logs, and falling snags. If the strawboss is permitted to have tools, he is inclined to slight this responsibility. He should be given a canteen of water and otherwise left free to direct the work of his crew.

*Fourth:* Water bucks with large containers should be started near the front of the crew where at intervals they can step aside and fill the squad canteens as the crew passes by them.

*Fifth:* Sufficient men should be added to permit dropping of patrol and backfiring crews, or to make up a separate crew to take over immediately behind the trench crew.

*Sixth:* The system so far as can be determined can be used with crews from small squads up to 100 men, depending upon cover, etc.

**The disadvantages of the system as brought out to date are:**

*First:* Crews must be trained more thoroughly than for other systems. They must know individually what a completed trench looks like.

*Second:* It is difficult to keep the men moving and working at the same time. There is a tendency for the men to stop and work, then when moved to go too far before stopping, or slowing up to work.

*Third:* The system is a man-killer. There is no opportunity for them to rest. If one man stops, he is holding up the rest of the crew behind him. It is believed that four hours or less will constitute a work shift on this type of organization. If there are not sufficient men available to control the fire at this rate of speed within this period, the speed should be slowed up, so that the men will be able to continue through the desired period of time.

**The merits as brought out by the tests made thus far are:**

*First:* A decided increase in speed of line construction per man-hour. While it is not expected that this rate of speed can or will be maintained on the average, it is believed that a decided increase in the amount of held line per man-hour can be expected in cover types that are similar to those where the tests were conducted.

*Second:* That the same amount of work is accomplished early in the control period rather than being prolonged over an eight- to twelve-hour shift; naturally, this reduces the ultimate amount of work necessary.

*Third:* There is a decided decrease in the amount of time used in shifting men. There is always a tendency for the men to slow up when passing other crews.

*Fourth:* The elimination of the main part of the crews passing each other while working makes for less accidents caused by tools.

*Fifth:* That except for the first few men, they are not fighting the brush. This enables the men to put the maximum energy on actual trench construction.

*Sixth:* The crews in dense brush can start from a fixed point on the fire and complete a trench to another fixed point as quickly as they can be taken in and placed on the fire by sectors.

There is a considerable amount of experimental work to be done on the system, but so far as the dense brush type or the open timber type is concerned, where there are a few snags and logs to contend with, it is believed that the system certainly merits consideration.

There has been no opportunity to make tests in either the typical Douglas fir type or in old burns covered with a large number of snags.

In some ways the organization is not new. It has in a modified form been used for years. However, the addition of two factors, that is, keeping the entire crew moving forward practically 100 per cent of the time, and the almost entire elimination of men passing each other, has surprisingly increased the speed of hand-tool trench construction per man-hour.

## METHOD FOR MEASURING FIRE LINE

With no physical reason to account for it, everybody has seen line production vary widely from hour to hour. Sometimes, also, reports of line produced on a big job run to totals that are incredible considering the size of the fire. A foreman's legs sometimes insist on short steps when measuring the day's production. Furthermore, men with cruiser training would have to learn pacing all over again in order to measure surface distance instead of horizontal distance; and it is surface distance that is wanted in measuring fire lines. The following article on the subject is quoted from the Northern Region News.

Use of a trail measuring wheel to ascertain the amount of fire line constructed each day on 100- or 200-man sectors, where the measuring job is large, is suggested by Stanford H. Larson, District Forest Ranger on the Bitterroot National Forest. This, he contends, would free the sector boss of the task and permit him to direct his attention more fully to more important phases of fire fighting.

It is true, Mr. Larson points out, that the pacing of constructed line each shift is the job of the fire foreman. Experience, however, has shown, he declares, that usually the sector boss must do this. Few men, he said, are capable of pacing well.

Mr. Larson, stressing the advisability of limiting the use of the measuring wheel to the larger units, has this to say in discussing his suggestion:

"If we get down to cases, what does the sector boss have to gauge his actual speed of held-line production? He uses fuel type, time, and distance (chains of line constructed) as his gauge. This he reduces mentally to chains per crew-hour or man-hour. He wants and needs a close check on this throughout the day while work is in progress and not merely at the foreman conference in the evening after the day's work is done. If his output is lagging, he must know how much and where, and know it at the time so that it can be corrected at once, not the next day. If he is going to have an accurate gauge of output to guide him in intelligent supervision, then he must have an accurate measure of current production.

"I consider it highly important that a sector boss know, for instance, that at 8:00 a. m. he had actually built 100 chains of fire line after working 100 men three hours in a medium-resistance fuel type. This he would not know unless current production had been measured. Would it not be of value to know, for example, that under the same conditions Crew No. 1 had constructed 37 of the 100 chains while Crew No. 3 had produced only 18 chains? The sector boss must know these things, not merely suspect them, as he had in the past. If we are to speed up line production, we have to know and see that every unit of effort is applied where it should be. The sector boss must have an accurate current measure of accomplishment for the following reasons:

"1. To gauge output of his unit as against what is possible for the fuel type.
"2. To gauge production of individual crews within the unit and so detect weaknesses not apparent from casual observation.
"3. To aid in the development and to substantiate technique in line building that will speed up production at the time, not on the next fire.
"4. To insure the use of proper methods.

"Then there is the matter of wholesome competition between crews. The introduction of the measuring wheel would eliminate human errors in measurement and would put all record of accomplishment on the same basis. The mere sight of the device would have a wholesome effect on every man along the fire line. . . .

"The fire boss would also have a reliable picture of daily accomplishment by sectors. Like the sector boss, he would have accurate data on which to base his job analysis and plan of action instead of often erroneous estimates garnered at the expense of many hours of overhead time that would better be spent on supervision of line production.

"Increasing the accuracy of the daily held-line estimate report would be only a fraction of the benefit accruing from the use of this instrument. It is the accurate, undistorted measure of current production used in practical job analysis, at the time, for the express purpose of bettering the next hour's output that counts big. If this basic data can be obtained easily and at the same time give the overhead more time for intelligent planning and supervision, it can't help but speed line production."

# ROAD SPEED COMPASS

A. A. Brown

*California Forest and Range Experiment Station*

In making a transportation plan one of the time-consuming items is the showing of "coverage" on a map. By coverage is meant the area that can be reached within given time limits by a combination of automobile and foot travel, and is dependent upon the average attainable speeds on roads with autos and cross country by foot travel. To simplify and speed the work of plotting coverage, bow compasses were converted to "road speed compasses" by the addition of an index pointer and an accurate scale so graduated that by setting to the mileage distance from a station the compass radius would equal the map distance that could be walked from the mileage distance point within the given time limit. In most cases an average walking speed was determined for a considerable territory and road speeds of 10-12, 15-18, 20-25, 30-35, and 40-45 miles per hour were scribed on a set of five compasses.

In use, mile points were located on a road map from previously obtained road log data and arcs were drawn around these points with a compass calibrated for the road speed, and set at the miles distant from the station concerned. These arcs were then tangently connected so that the coverage figure contained its maximum area. The resulting tapering figure has as a minor axis at the guard station the cross country distance that could be walked within the time limit, and as a major axis along the road the distance that could be traveled by auto within the same time.

When road speeds change, the compass in use must be replaced by one calibrated for the new road speed. As the distance walked is a fraction of the time not used for automobile transportation, the setting of the new compass to the same radius as the old will reveal directly on the scale the number of miles that can be traversed on the new road within the given time limit, as well as the walking coverage that will be obtained.

This simple device is illustrated in the sketch shown (Fig. 1), and was developed as an aid to the transportation planning project recently completed for Region 5.

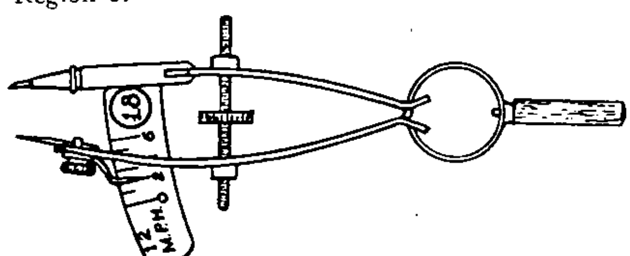


Fig. 1—Compass used in computing "coverage."

# FOREST ROADS OR FOREST FIRES

C. J. Buck

*Regional Forester, Forest Service Region Six*

The following article has been submitted for publication to the Pacific Sportsman.

With such an obvious drive as that of the past few years for emergency relief employment it is small wonder that at least part of the public suspects that many recently constructed roads were not needed but rather were "concocted" to provide work. Nor is the public inclined to discriminate between those projects which it believes were partially "concocted" and projects which for years had been essential parts of carefully worked out plans crying for completion.

Typical of the popular skepticism in certain quarters is a recent editorial in the Pacific Sportsman deploring the fact that recreationists now seek in vain for sylvan territory not traversed by roads. It attributes the "road building craze" in the National Forests to the desire of rangers for the comforts and luxuries of travel. It concedes that some roads are needed in the mountains, but contends that roads have been laid in areas where nobody goes or is ever likely to go, and that there is no need to honeycomb the forests with arteries that are not justified by travel. It raises the question of what will become of the wild life of the forests with the country crossed and crisscrossed with unnecessary roads.

In so far as its statement applies to the Pacific Northwest, the Pacific Sportsman has fallen into pardonable error both as to the facts and their interpretation. Let us deal not with State highways through the National Forests, but only with roads for which the Forest Service is primarily responsible. Some 3,600 miles of these roads have been built in the National Forests of Oregon and Washington since the advent of the CCC. If any road system ever was worked out according to a definite scientific and economic plan this is true of the system of which these CCC forest roads are a part. The central aim was not the comfort of rangers or others but the protection from fire at the lowest cost, of the 26 million acres within the National Forest boundaries of the two States.

The plan for the system originated in 1928 to avoid just such haphazard road building as uninformed critics now suspect. The actual procedure for the National Forests was laid out in 1930-1931, based primarily on the control of fire within time limits which would mean the prevention of large forest conflagration and the holding of burned acreage to a minimum. Careful and comprehensive study of past fire records was made. From this it was possible to set up periods within which fire in any given type of timber or country must be reached if it is to be controlled without serious loss. This means that every area in the National Forest has its limit set for the allowable time from the "spotting" of a fire to the arrival on the ground of suppression forces. The lookout system, the telephone system, and the road system between them carry the burden of the requirements shown by the survey. The greater the reduction in detection time effected by a better lookout system, the less the burden on the road system which must help deliver fire fighters on the ground within the set period.

Fire suppression involves the first line of defense, consisting of one or two fire chasers for immediate action, and the second line of defense made up of varying sized crews drawn from outside and depending on larger trucks to speed them to the vicinity of the blaze. There is no romance about this grim business. The first hour or two after discovery of a fire usually determines whether the flames will be confined to a negligible area or break out into a real forest annihilating blaze. It is the old war formula or the city fire department formula over again, of "getting there first." Horses and trails are more picturesque, no doubt, but horses had to give way to motors, and of course motors meant roads.

So it was that before the CCC came into existence the Forest Service in Oregon and Washington had mapped its necessary truck roads, 20,825 miles of them, of which only 75 per cent are as yet completed. Waiting with the certain knowledge that large areas for which it was responsible had insufficient fire protection till these roads could be built, the Service welcomed the advent of the CCC with open arms. Upon the Tree Troopers devolved the job of building roads, which incurred some criticism but which added immeasurably to the protection of the forests. The roads they built were not boulevards for convenience. They were the vital arteries which, along with the equally vital telephone nerves from lookout stations, must be counted on to save the forests in the hour of need.

Nor was the present protection plan limited to the lookout, the telephone, and the road system. It called for 35,284 miles of trails, of which nearly 85 per cent are already built. These trails extend like blood vessels from the road arteries extending up from important stream courses or following strategic ridges. Even these trails cannot attempt to cover the ground or lead fire fighters to the exact location of a fire. It does not take great imagination to understand how easily both roads and trails are lost in these North Pacific forests, embracing, as they do, the most rugged and mountainous country, innumerable ridges, yawning canyons, baffling thickets, a grand expanse of unharnessed distance.

It must not be assumed that the Forest Service has not weighed carefully the increased fire hazard to be expected from roads and trails. Unquestionably the hazard is somewhat increased by greater travel in the forest, but it has been found that such travel is better concentrated and better controlled because of trails and campgrounds, while the danger of major conflagrations is immeasurably lessened. Lightning, which is a prolific cause of fires in the mountains, finds its way into the forest, trail or no trail, and the recent road and trail additions have made it possible to combat lightning fires quickly and effectively.

In direct answer to those who still believe that at least some forest roads are built without any excuse other than the convenience of officials and to furnish employment to the CCC, let it be definitely stated that when any new road is proposed the first question asked is: "Is this road on the fire protection plan?" If not on the plan, the proposed road has to run the gauntlet of the most searching scrutiny. Its approval is always weighed on the scales of its importance to fire prevention. As a result few roads are built "outside the plan," and few if any have been based on administrative convenience or 100 per cent for the accommodation of recreationists. The main objective of the Service is the protection of the forests, and until the protection plan is fully realized there is small likelihood of undue interest in other construction.

Now, a word of understanding to the "road haters." Every wilderness lover appreciates that a multiplicity of roads does destroy wilderness charm. It is for this reason that roads have been barred from the 1,446,360 acres set aside as primitive areas in Oregon and Washington. The Forest Service has taken the lead in establishing these wilderness sanctuaries in many parts of the National Forest, at the same time taking into account, however, that the attraction even of these areas is threatened unless fire protection roads are brought within reasonable striking distance of their boundaries. The real need for permanent primitive areas is not being neglected, nor is the protection of game and animal life.

Game and wild life fortunately are not long disturbed by roads. Game animals are coming back in the East in greater numbers than existed in the virgin forest days. Evidently protection and ample forage are more important to them than roadless solitude. Forest fire, on the other hand, is the arch enemy of wild life, as anyone who has followed in the track of a fire will agree. Though Pacific Northwest forests have a comparatively enviable record in fire loss, the figures for the 10 years up to 1933 show that this great destroyer of forests and forest denizens had devastated in Oregon and Washington an area equal to a small Eastern State. What is the answer of the sportsman to this record? Can the Northwest continue to see its forest land, the home of its wild life, burned over at the rate of 400,000 to 500,000 acres a year?

The proposition finally is this—born from the disheartening history of forest lands in the Northwest and throughout the country: Shall we have protected forests with roads, or unprotected forests without roads? The lesson of the past is so plain that it cannot be missed. It is supported by thousands of cases which have been classified and become the scientific basis for policy and action. The protection of the forest demands speed in putting out fires, and speed in these days of motor vehicles means roads. As the honest tree surgeon said to the patrol whose favorite elm was being destroyed by decay: "This tree surgery will hurt the looks of your tree somewhat, but without it in a few years you will have no tree at all."

We find that a number of our lookouts are borrowing field glasses from neighbors, and buying them from their own funds because they feel that they can increase their efficiency thereby. We strongly urge furnishing reasonably powerful field glasses, believing that such costs will be well paid by quicker detection.—District Ranger F. E. Brown, Cabinet.

## Test No. 3.

Principal Container: 3 mail sacks, tying all three together at top.
Contents: 15 emergency rations, five to each bag as in Test No. 2.
Total Weight: 84 lbs.
Drop: 300 feet to hard packed field.
Damage: Emergency ration sacks torn slightly.
1—8 oz. can pork and beans, 3—8 oz. cans grapefruit, 2—2 oz. cans coffee } Damaged, no value.
All other items, including principal containers, undamaged
Target Miss: 60 feet.

## Test No. 4.

Principal Container: Mail sack lined with 11 lbs. excelsior.
Contents: Improvised mess outfit for 20 men, containing:
2 kettles, aluminum, No. 883.
20 tin plates.
2 pans, fry, large.
4 pans, dishup, large.
20 tin cups.
20 table forks.
20 table knives.
25 dessert spoons.
3 tablespoons.
2 can openers.
1 dish towel
1 soap, laundry.
1 knife, butcher.
1 lifter, pot.

Plates, cups, and dishup pans were nested in the two kettles. Forks, knives, and spoons were tied in separate bundles and a sheath covered the butcher knife. Kettles were placed bottom to bottom and smaller items distributed through the packing material.

Weight: Mess equipment, 26 lbs. Filler, 11 lbs. Container, 3 lbs. Total 40 lbs.
Drop: 300 feet to hard packed, rocky field.
Damage: None, except slight bending of kettles, fry pans, and dishup pans—all 100 per cent serviceable.
Target Miss: 60 feet.

## Test No. 7.

Four baby shovels thrown loose, without cover or ties, from 200 feet altitude to hard packed soil. Target miss 50 feet. No damage.

## Test No. 8.

Three pulaskis thrown as in 7. No covering or ties except hose sheaths on blades. Target miss, 50 feet from shovels. No damage.

Tools in tests 7 and 8 fell slowly with a spiral motion and did not scatter to any extent.

## Test No. 10.

Principal Container: Mail sack, tied tightly at top.
Contents: 4 lbs. rice in flour sack, tied loosely.
4 lbs. beans in flour sack, tied loosely.
1 lb. box raisins in 5 lb. cloth sack.
1—5 lb. box dried fruit in 10 lb. cloth sack.
3 lbs. rolled oats in original paper sack placed in 9 lb. sugar sack.
1 can corn, 1 can veal loaf, 2 cans Vienna sausage, 2 cans sardines } Placed loosely in burlap sack.
Total Weight: 28 lbs.
Drop: 300 feet to meadow grass field.
Damage: None, except slight bending of some cans.
Target Miss: Not directed at target.

### Test No. 11.

The same articles as in Test No. 10 were resacked, plus one emergency ration, and dropped from approximately same height to a well packed gravelly field. Total weight: 33 lbs.

Damage: One can grapefruit and one can hash broken open, the latter being suitable for immediate consumption. Principal container sustained 6 inch rent. Other cans more bent than in first drop, but none admitting air.

### Test No. 12.

Emergency ration enclosed in a burlap sack tied loosely, dropped as in Test No. 10, was in perfect condition.

## SUMMARY

| Test | Class of Supplies | Drop (ft.) | Weight | Target Miss (ft.) | Per Cent of Load Lost | Container | How Prepared |
|---|---|---|---|---|---|---|---|
| 1 | Food supplies | 375 | 57 | 60 | 4.2 | Sack, mail | Tied loosely |
| 2 | Emergency rations | 275 | 53 | 125 | 2.0 | Sack, mail | Tied loosely |
| 3 | Emergency rations | 300 | 84 | 60 | 5.4 | Sack, mail | Tied loosely (3 sacks) |
| 4 | 20-man mess outfits | 300 | 40 | 60 | None | Sack, mail | With 11 lbs. excelsior |
| 5 | 1-man S. C. outfits | 375 | 35 | 200 | * | Pack cover | Tied tightly |
| 6 | Fire tools | 300 | 21 | 75 | None | Pack cover | Tied tightly |
| 7 | Baby shovels | 200 | .... | 50 | None | None | No wrapping |
| 8 | Pulaskis | 200 | .... | 50 | None | None | No wrapping |
| 9 | Fire tools | 200 | 198 | 200 | None | Mail bag | Tight—parachuted |
| 10 | Food supplies | 300 | 28 | No target | None | Mail bag | Tied loosely |
| 11 | Food supplies | 300 | 33 | No target | 1.5 | Mail bag | Tied loosely |
| 12 | Emergency rations | 300 | 5 | No target | None | Sack | No preparation |
| 13 | Emergency rations | 300 | 5 | No target | None | Sack | No preparation |
| 14 | Emergency rations | 300 | 5 | No target | None | Sack | No preparation |

*This test might be considered a 100 per cent failure, as fire tools were broken.

After the foregoing, including the summary, had been written, we had a fire on the forest which was supplied almost exclusively by airplane. The equivalent of three days' rations for 50 men and 25 beds was dropped on this fire in timber, and the total loss amounted to two cans of jam, 15 pounds of prunes, and 15 pounds of beans, the latter two items being scattered so badly that salvage was not worth while.

We are entirely convinced that getting supplies to men by airplane is feasible under practically all conditions; that it is not only feasible, but for 50 per cent or more of this forest it is probably cheaper than any other method of supply. The secret of getting supplies to the ground seems to lie entirely in the preparation of loosely prepared containers. Kapok beds can be dropped with negligible damage except for the occasional bundle that might be ripped or torn from landing in trees. They are invariably dropped in bundles of five each, which is about the limit we can push out of the doors of the planes we have available.

# AIRPLANE VS. MULE AND TRUCK TRANSPORTATION

H. M. SHANK

*Forest Supervisor, Idaho National Forest, Region Four*

At the Spokane Fire Meeting in February, 1936, Region 1 of the Forest Service exhibited methods of tight packaging of fire fighting materials to be dropped from the air at fire camps remote from landing fields. Later, the specifications for such tight packaging, a very laborious process, were written up and distributed and used in varying degrees on various National Forests. In June, a suggestion (probably first advanced by District Ranger Dan LeVan of the Idaho National Forest) led to initial experiments with the loose package method—a totally different principle In the following article Supervisor Shank reports in detail a part of the further specific tests made in July and gives a summary of a total of 14 tests with his comments and conclusions. Later in the season further tests of the loose package method were made in Region 6. It is hoped that by the season of 1937 complete instructions for loose package dropping from aircraft will be made available for easy use by anyone who may suddenly find himself in the dilemma of needing fast transportation of fire fighting materials and nothing to do it with but an insufficient number of pack animals.

## Test No. 1.

Principal Container: Mail sack, tied tightly at top.

Contents:
- 6 lbs. bacon in 25 lb. misprint bag, tied loosely.
- 5 lbs. pancake flour in 25 lb. misprint bag, tied loosely.
- 5 lbs. sugar in 25 lb. bag, tied loosely.
- 5 lbs. beans, dry, in 25 lb. bag, tied loosely.
- 4 pkgs. raisins in 25 lb. bag, tied loosely.
- 5 pkgs. fruit, evap., in 25 lb. bag, tied loosely.
- 7—1 lb. cans brown bread
- 6—4 oz. cans Vienna sausage
- 6—¼s sardines
- 6—8 oz. cans pork and beans
- 1—No. 2 can corn
- 1—No. 2 can string beans
- 3—8 oz. cans jam
- 1 tall can milk

(Thrown loosely in principal container containing six small sacks listed above.)

Total Weight: 57 lbs.

Drop. 375 feet to hard packed soil on 30 per cent slope.

Damage:
- 1 can corn
- 1 can pork and beans

} Bursted, no value.

2 cans brown bread, punctured but 100 per cent salvage value.
Principal container sustained 2 inch rent.
All other items in perfect condition.

Target Miss: 60 feet.

## Test No. 2.

Principal Container: Mail sack tied tightly at top.

Contents: 10 emergency rations (R. 1), weight approx. 5 lbs. each, plac at random in above container.

Total Weight: 53 lbs.

Drop: 275 feet on hard packed, rocky field.

Damage:
- 4—8 oz. cans grapefruit
- 3—2 oz. cans coffee

} Damaged beyond use.

- 2—1 lb. cans brown bread
- 1—8 oz. can hash

} Broken but fit for use.

Principal container sustained 12 inch rent.

Target Miss: 125 feet.

# USE OF MIL SCALE BINOCULARS IN FIRE DETECTION

John R. Curry

*California Forest and Range Experiment Station*

The mil scale, as found in military binoculars, may be used for roughly calculating the sizes of objects seen at known distances or the distance at which objects of known size are removed from the observer. The mil is equal to 1/1000 of a radian; in other words, 1 yard at 1000 yards, 2 yards at 2000 yards, etc.

The mil scale in binoculars has been used in the California region to estimate the size of going fires. Although the arithmetical computations involved are simple, to standardize procedure and to eliminate chance of error, the alinement chart shown (Fig. 2) was designed to make the calculations. Dispatchers and lookouts are furnished with these charts.

The readings obtained give only the diameter of the fire in a plane at right angles to the observer's view. To determine the full size of the fire, it will be necessary to obtain measurements from more than one lookout. It is believed, however, that these measurements are much more satisfactory than simple guesses of acreage by lookout observers.

Fire finders can, of course, be used for the same purpose. Their use is governed, however, by the limits to which they can be read accurately. By enlarging the object 6 or more times, binoculars may be used to obtain readings on smaller objects as well as more accurate readings on larger objects.

Inasmuch as the mil scale is not an expensive addition to a standard binocular and interferes in no way with its normal use, it is felt that all binoculars purchased for detection purposes should be so equipped.

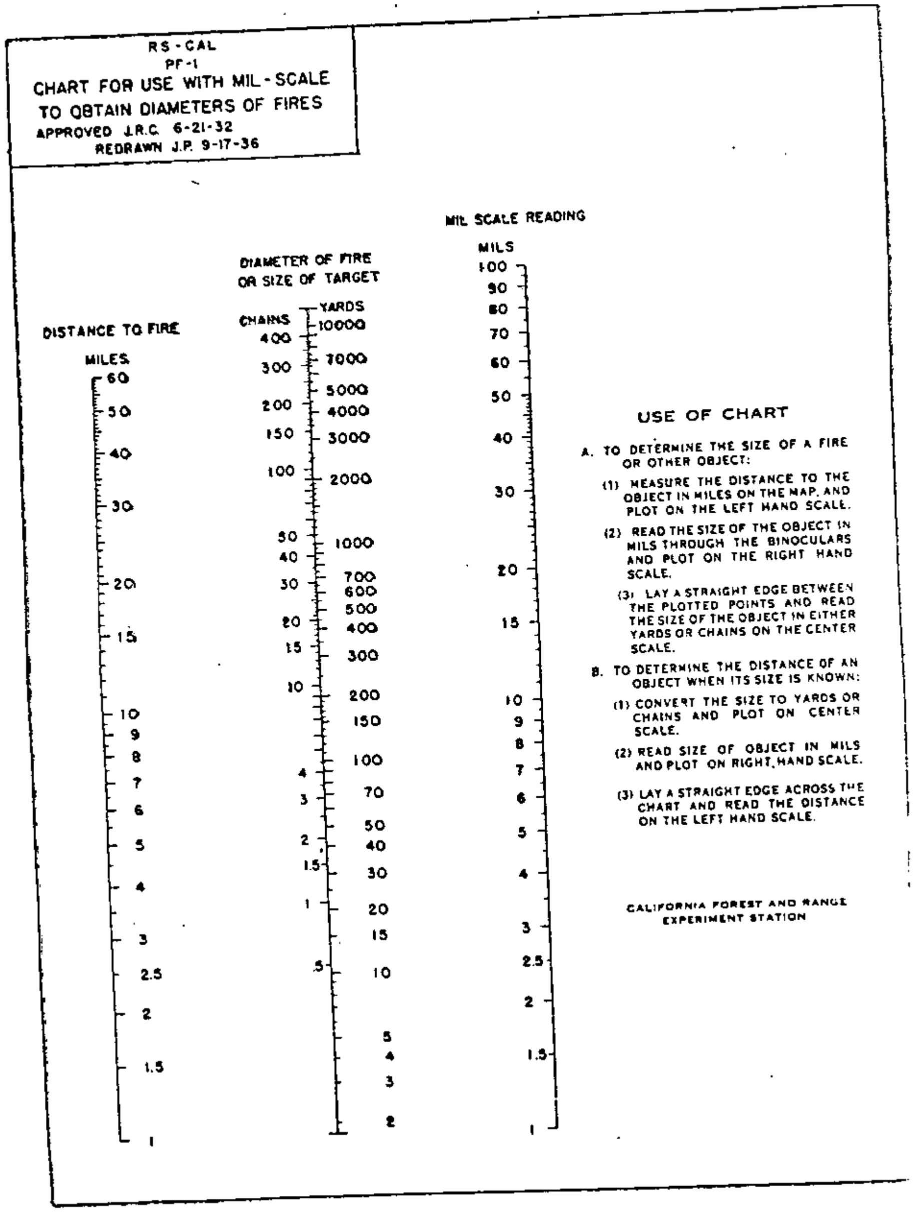
RS - CAL
PF-1
CHART FOR USE WITH MIL - SCALE
TO OBTAIN DIAMETERS OF FIRES
APPROVED J.R.C. 6-21-32
REDRAWN J.P. 9-17-36
DISTANCE TO FIRE
MILES
DIAMETER OF FIRE
OR SIZE OF TARGET
CHAINS
YARDS
MIL SCALE READING
MILS
USE OF CHART
A. TO DETERMINE THE SIZE OF A FIRE OR OTHER OBJECT:
(1) MEASURE THE DISTANCE TO THE OBJECT IN MILES ON THE MAP, AND PLOT ON THE LEFT HAND SCALE.
(2) READ THE SIZE OF THE OBJECT IN MILS THROUGH THE BINOCULARS AND PLOT ON THE RIGHT HAND SCALE.
(3) LAY A STRAIGHT EDGE BETWEEN THE PLOTTED POINTS AND READ THE SIZE OF THE OBJECT IN EITHER YARDS OR CHAINS ON THE CENTER SCALE.
B. TO DETERMINE THE DISTANCE OF AN OBJECT WHEN ITS SIZE IS KNOWN:
(1) CONVERT THE SIZE TO YARDS OR CHAINS AND PLOT ON CENTER SCALE.
(2) READ SIZE OF OBJECT IN MILS AND PLOT ON RIGHT HAND SCALE.
(3) LAY A STRAIGHT EDGE ACROSS THE CHART AND READ THE DISTANCE ON THE LEFT HAND SCALE.
CALIFORNIA FOREST AND RANGE EXPERIMENT STATION

Fig. 2

# VERTICAL ANGLE FINDER

A. A. Brown

*California Forest and Range Experiment Station*

In the use of panoramic pictures, there is a need for obtaining vertical angle measurements. Many of the fire finders used in the California Region are not equipped with vertical angle scales. It is not difficult to work out vertical angle graduations on open sight alidades, but it is difficult and rather expensive to provide for exact leveling of the table or fire finder to permit accurate vertical angle readings. For this reason, instead of putting graduations on the alidade sights, a simple vertical angle reader was developed as a supplementary instrument.

A photograph of an instrument made for use in Region 5 is shown (Fig 3). The vertical angle graduations are drafted on a templet fixed

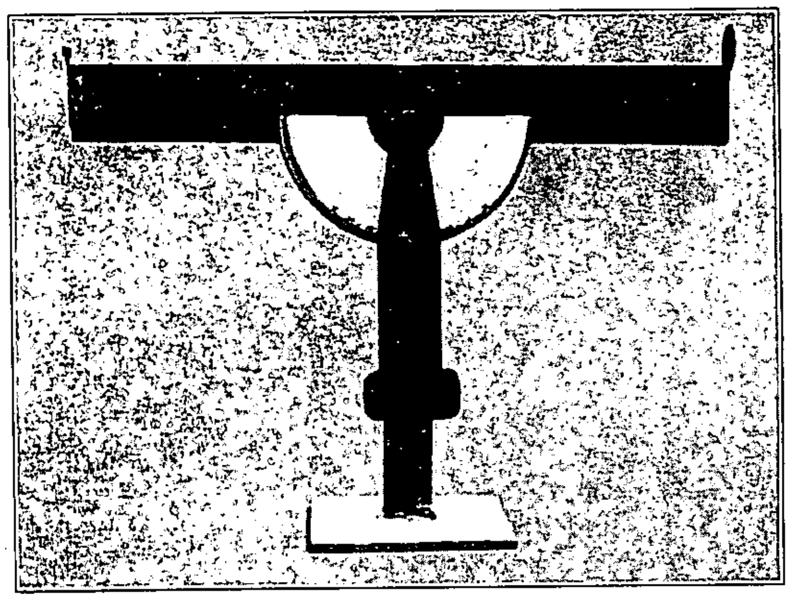

Fig. 3

immovably to the axis of the sight bar and at right angles to the main axis of it. A pendulum, consisting of a brass strip weighted at the end with lead, is pivoted to hang freely over the graduations. An opening is cut to expose a sector of the dial, leaving a pointer in the center. The whole is so constructed that the sight bar is horizontal when the pointer is at zero on the dial. The pendulum arrangement then assures that the zero point will be vertical to a level surface regardless of whether the surface on which the instrument rests is level or not. The sighting device is a peep sight with a horizontal edge at the end removed from the eye. The instrument as built could be considerably improved, but the principle is a useful one if a cheap instrument that can be furnished in considerable quantity is needed.

This simple instrument was designed by Nelson Salmon, ECF Technician employed on detection planning work, and a number were made up for Region 5 under his supervision.

Detailed specifications can be furnished if desired.

## EQUIPMENT IN REGION 6

In its report for the summer quarter, Region 6 (Portland) lists the following items on which some work has been done during the season.

1. A Killefer fire plow directly connected to the tractor and without a wheel carrier. Olympic.

2. A better Killefer plow of the wheeled type. Deschutes.

3. A high pressure spray pump, designed to operate with a small quantity of water, has been developed on the Wenatchee Forest for use on grass fires. This has not yet been thoroughly tested, but apparently is satisfactory.

4. A double disk fire plow intended for attachment to tractors has been designed and is now being constructed.

5. During the past year there has been developed, with the assistance of the Division of Engineering, a horse trailer designed for attachment to ranger pick-ups, which it is felt will be of practical value to rangers in handling fire and administrative activities.

6. Experiments have been made with the Wolf saw which indicate that such a saw with a 36-inch blade can be used satisfactorily to fell Douglas fir snags up to 72 inches in diameter.

# RECEDING STRING REELS FOR DISPATCHER MAPS

A. A. Brown

*California Forest and Range Experiment Station*

These instruments, which are an adaptation of Dietzgen tape reels, are made by that company and are available to Forest Service offices on order through the Supply Depot, Government Island. They are small, enclosed spools mounted on a shaft fastened to a coil spring (Fig. 4). They are wound with silk fishing line, which is threaded through a tube of 1 or 1½ inch length. As received, a bead on the end of the line prevents the

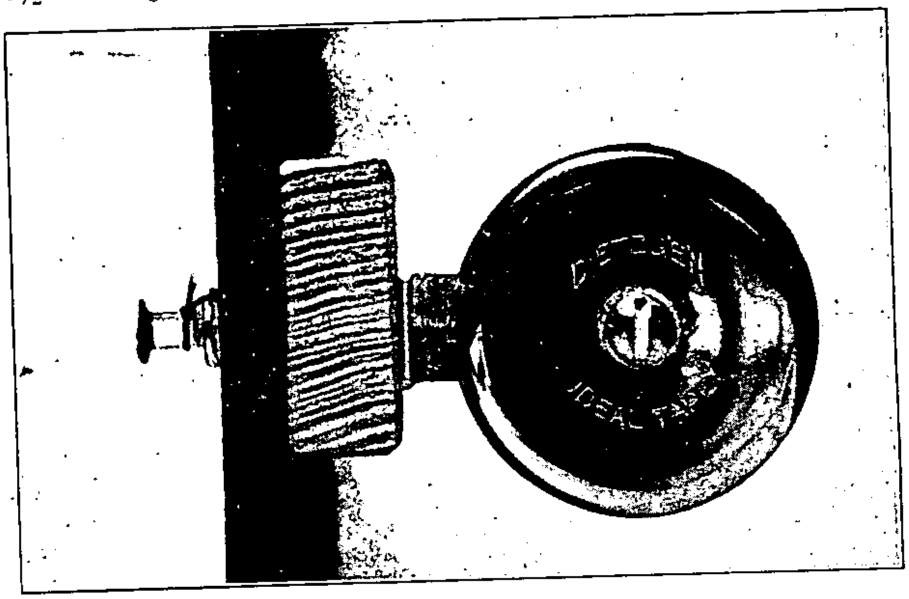


Fig. 4

spring pulling the string inside the spool. The tube screws into the spool, so is removable. The open end of the tube is slightly enlarged into a smooth rim which prevents the tube pulling through the mounting when inserted from the front. In mounting these on a map board, a hole of exactly the same diameter as the tube is centered at the lookout location on the map. The tube is unscrewed and inserted into the hole from the front or thread end. The string is then restrung through it, a glass-headed push pin attached, and the reel screwed to the threaded end of the tube until it fits snugly against the back of the map board. If the map board is not of thin material, it becomes necessary to put in a block or to chisel out the wood to permit a snug bearing when the reel is screwed upon the tube. On the face of the map, the opening of the tube is inconspicuous. At the back of the map it is desirable to provide a protecting frame to avoid bumping the reels. A sample string reel mounting is demonstrated by the attached photographic print.

These reels have been used in the development of seen area dispatcher maps for all Region 5 National Forests.

I should like to recommend that six of the new "J" axe brush hooks, of the design shown in the accompanying sketch (Fig. 7) be substituted for that many of the double-bitted axes now in the 25-man outfits for fire fighting. My trail men have used these "J" axe brush hooks nearly all summer and found them to be the best tool of its kind put out. They state that the axe portion is just as efficient as a double-bitted axe and also the best brush hook yet made.—District Ranger F. E. BROWN, Cabinet.

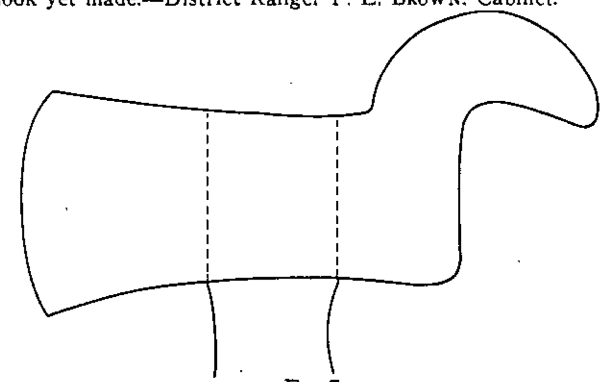

FIG. 7

## A DIFFERENT FIRE LINE PLOW PRINCIPLE

Two illustrations (Figs. 5 and 6) are given of a new type of fire line plow developed during the past season on the Superior National Forest. The wavy looking outer edge of the vertical portion of the wheel is sharp (for cutting) and is composed of a very hard metal welded to the outer edge of the steel. Although the pictures do not so indicate, Superior plow changes are fairly difficult. The hitch mechanism, a vital point with this

Fig. 5—Type of furrow produced by plow. Action is very similar to Killefer 77. In this particular type of plowing the Killefer 77 cannot be drawn faster than in second gear. This plow will travel in high. The picture also shows construction detail of moldboard assembly from rear. Stability is indicated in this picture.

type of plow, has not been worked out satisfactorily. The hitch finally used will probably be similar to that employed with the Region 6 fire plow.

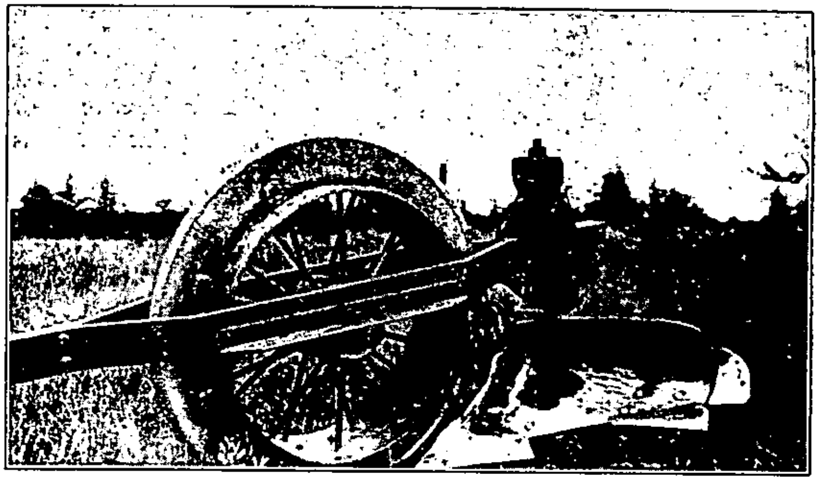

Fig. 6—Side view of Mesaba plow, showing construction details of moldboard assembly. It will be noted that the assembly has a vertical adjustment, although the picture does not clearly indicate this point. It may be seen that the wheel axle has the vertical adjustment. The cutting rim is resting on a block and is, of course, not in its natural position. The type of cutting fins which it is hoped to develop are shown attached to the moldboard.

## SWEEPERS FOR LINE CONSTRUCTION

J. H. Bosworth

*Assistant Supervisor, Cabinet National Forest*

Assistant Supervisor Bosworth, of the Cabinet National Forest, is proposing to revive the sweeper machine idea which has lost out so far in competition with schemes for making fire line with plows and brush busters. His statement regarding one type of sweeper machine for line construction follows.

My latest idea of this machine is to use about a three horsepower gasoline, air-cooled motor with an encased flexible drive shaft on which is attached a flexible steel brush about 12 inches in diameter and about 16 inches long, shaped like a bullet. Between the motor and drive shaft there would be a transmission with reversable gears. Flexible drive shafts of ⅞ inch 6 to 8 feet long can be purchased from regular stocks, and a shaft of this size will handle a 2 H. P. motor.

The machine should be made portable, and all parts possible should be made of aluminum or some other light metal.

# WHAT ARE VISITORS TO LOOKOUT POINTS INTERESTED IN?

Visitors to lookout points are relaxed and in a receptive frame of mind. A skillful lookout man has a perfect chance to imprint permanently the habit of care with fire in the woods. How shall he do it? Well, what is the visitor interested in? That should give a good starting point for formulating effective ways of spreading the gospel of fire prevention. Here is a list of every-day questions the visitor asks, according to a lookout man on the San Bernardino National Forest in California:

Now that I am up here how will I get down?
Why haven't you an elevator?
Can we have a drink of water? Can we have a glass?
Is it always so hazy? Is it ever clear
Does the wind always blow? How hard does it blow?
Oh! Do you live here?
Can we sit on your bed? How can you sleep on that bed?
Does the tower sway much?
How high are we? What is the elevation?
How high is the tower?
How many men are there on duty, 2 or 3?
How many hours do you watch? Do you look at night?
How many months do you stay here? Or—Do you stay here all the time?
I suppose they give you your vacation during the winter?
How do you get this kind of a job?
How many days do you get off?
Who brings up your water and supplies? Or—How do you get them?
Do you ever get lonesome?
Could a man have his wife with him?
Can we use the binoculars? The telescope?
What is this instrument and that instrument?
How can you see when the shutters are down?
When is the best time to come up to see the view?
What time is sunrise and sunset?
How many stations like this are there?
Do you have a telephone?
Do you ever see any fires?
How long must we wait to see a fire?
Where is Lake Arrowhead? Do they use the water for irrigation?
What is this peak and that peak? This range and that range? This place and that place? This tree and that tree?
Can you see Big Bear Lake? Can you see the desert? The ocean? Catalina? Los Angeles? How far can you see?
Were the firebreaks made by the CCC's? Where are the CCC Camps located? Are the CCC's any good?
Does it snow here?
Do you see any deer? Bear? Lions? Rattlesnakes?
Will a mountain lion kill a person? Where can we see a deer? A lion?
Does it ever lighten? Does it hit here?
Where are the Twin Peaks?
Do you have to fight fire?
I suppose you spend most of your time reading?

What do you do with all your time?
Who cuts your hair for you?
How can you take a bath in a glass house?
Do you have a horse?
Are you a ranger? What is the difference between a ranger and a forest guard?
Can you get anywhere being a forest guard?
What is the pay? Can you get married?
How do you find a fire? How far can you see a fire?
How can you see smoke in this haze?
Who cleans your windows for you?
What is the electric fan for outside?
Do you have a radio? What would you do without it?
Do you talk to yourself? May we play the radio?
How cold does it get? How warm? When does it snow?
Aren't you afraid the tower will blow over?
Do you have an aspirin? Any soda?
Can we eat our lunch in here if we take our papers with us?
Do you follow this work because you like it or do you have asthma or something?
What do you do in case of lightning?
Where can I get some wood for my fireplace? Stove?
Is it true lightning never strikes twice in the same place?
Can we smoke here? Do you have a match?
Is the lake natural? Does it look like an arrowhead?
Do you signal the airplanes? Do you send weather reports to the airports? To the airplanes?
Is it going to be a hard winter because there are lots of pine cones and acorns and the squirrels are fat?
Can we take our clothes off to take a sun bath if we go behind the rocks?
Are there any nudist colonies around here?
Has anyone ever fallen off?
How much rain do you get? How much snow?
How come all that brush is included in the National Forest?
Can we read your diary?
Is that mountain out in the valley where the smoke is a volcano?
What are the three balls going around on that post down there for?
Is that can a rain gauge?
Do you have electric lights?
Does the Government give you your uniforms, or do you have to give them back when you are through here?
Can we tie our horse to the tower?
Does the Government furnish your supplies?
Can you shoot deer whenever you want to for your meat?

# THE ETHICS OF WOODS BURNING—A KEY TO PREVENTION

W. I. White

*Forest Service, North Central Region*

It seems to me that we have been pretty generally overlooking what is probably the most potent force available for real fire prevention. This force, if once aroused, will accomplish more thorough and permanent results with many people than all the arguments commonly used in preaching fire prevention. I mean the ethical sense of right and wrong.

In many parts of our forest domain, particularly in the lower Mississippi and Ohio valleys, the economic status of the rural residents within the forests is very low. It has traditionally been so, and in spite of our various plans for social uplift, the thinking and habits of a community cannot be changed over night. Discussions of economic betterment, land use planning, conservation of resources, etc., are often entirely meaningless to an Ozark mountaineer who has been taught from the cradle to believe that what was good enough for his "pappy" is good enough for him.

On the other hand it has been amply demonstrated and reported that the residents of many of these communities of low economic status have a very deep and forthright religious feeling. Even though they may not be able to discriminate between good and poor farming practice, between wasteful and conservative use of land, they do have a well-defined sense of right and wrong.

Why not, then, elevate our consideration of woods burning to an ethical plane and consider it from the standpoint of right and wrong? A man who may not be able to see any economic advantage in allowing his woods and fields to go unburned may perhaps be brought to feel a sense of stewardship for the natural resources which the Lord has placed at his disposal. Or, allowing a fire to damage his neighbor may be placed in the same category with stealing his neighbor's cow. Throwing down a burning match or cigarette by the roadside may be likened to doing the same thing in a powder magazine.

As a means toward establishing this principle in the communities where woods burning has been done deliberately for many years, I suggest that our field men make it a point to cultivate the acquaintance of the preachers who work in the forest communities, attend their religious meetings, and definitely align themselves with the apostles of right and truth. I believe that by tactful contacts the matter of malicious or uncontrolled woods burning can be brought out into the open and mentioned specifically in meetings of this kind as an unethical thing to do, the same as lying, or stealing, or beating one's wife.

There is no question about the preacher being a leader in the sort of community of which I speak, and the local Forest Officer can make no mistake by being definitely and clearly on his side.

Certainly if the deliberate or careless setting of fires can be given a definite stamp of disapproval by the right-thinking people in any community, many other acts of trespass and evil-doing which give our law enforcement officers gray hairs will be greatly reduced also. Let's give it a trial!

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According to a clipping from the Boise, Idaho, Statesman of October 12, 1936, the Boise National Forest has installed a 1,495-pound periscope on Shafer Peak to assist in locating blazes. The periscope was borrowed from the United States Navy. A week ago several small fires were located 40 miles away with the periscope. The idea of Navy periscopes on lookout peaks is interesting. We hope the Boise National Forest will tell us about it in the next issue of FIRE CONTROL NOTES.

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# PREVENTION OF RAILROAD FIRES ON THE CABINET NATIONAL FOREST

A. H. Abbott

*Forest Supervisor*

The Cabinet has the decidedly unenviable record of having had more railroad fires in the past few years than any other Forest in the Region, and possibly more than all of the others combined. However, through active efforts to secure compliance by the Northern Pacific Railway Company with the terms of the agreement of September 26, 1921, the loss during the past few years has been very greatly reduced. The number of fires, both reportable and non-reportable, has been reduced by better than 85 per cent (the percentage being based on the number per train), and the interest of the railroad officials has been greatly increased. Since fire suppression charges are paid by the Northern Pacific Claims Department, other employees were formerly not concerned, apparently, with keeping those costs down. This attitude has been changed. The railroad officials are doing their best to improve their spark arrester devices, and are now seeking ways and means of determining if fires are due to failure of personnel rather than failure of the spark arrester devices.

Regular inspection trips along the right of way are made by Forest officers and railroad officials, and the annual meetings are not merely meetings to comply with the terms of the agreement, but meetings to devise ways and means of bettering fire prevention. The Forest Service has emphasized the value of fire prevention as an insurance against fire suppression and fire damage costs. We are also trying to put across the idea to the railroad that fire scars along the right of way are not attractive to the passengers.

The time spent by officers of the Cabinet in such prevention and presuppression work, through which the Northern Pacific Railway Company is benefited, has been brought to the attention of the railway officials, and since the company is responsible for right-of-way fires, efforts are being made to reduce Forest Service costs and have the company redeem its responsibilities.

We have mentioned the above at some length, since visitors from other Regions, where considerable trouble is experienced with fire-setting engines, have expressed considerable interest, and have taken copies of the Northern Pacific agreement, to see if some sort of similar agreement could be worked out with other railroads.

# EXTRA PERIOD FIRES

A. H. Abbott

*Forest Supervisor*

Our "pet peeve" has been extra period fires. We feel that suppression costs must be given consideration. After all, we are fighting these fires with taxpayers' money. If we have fires, as we frequently do, where there is no particular danger that such fires can spread, and where, by delaying action a few hours, we can avoid sending men into dangerous, craggy country without trails until daybreak, or avoid sending special fire suppression men when a trail crew or other crews in the course of the regular travel can reach them within a reasonable time, we believe that it is foolish to send in men solely for the purpose of suppressing such fires in order to keep them from being classed as extra period. Understand, we do not want to take any chances, but there have been a number of cases where delaying action has meant an actual saving in dollars without any chance for such fires to be over Class A size.

# ONE WAY TO SUPPLEMENT FIRE CONTROL INSPECTION

M. B. MENDENHALL

*District Manager, Cabinet National Forest*

Inspection problems bother executives responsible for inspection as well as the inspectors. How can the time be found for keeping up with inspection standards and schedules? How can the training content of inspection be increased? Do inspections merely worry inspectors or are they welcomed? When a fire executive desires more certainty that preparedness is at a higher level than he can attain by personal inspection, what can he do? A busy District Ranger gives a practical answer.

On the Plains District during the months of July and August there were 25 outlying camps which, under the weather conditions experienced, we found impossible to inspect more than once, except for a few early points, or where the need for emergency trips was clearly shown. To keep in closer touch with conditions a system of telephone inspections was initiated.

This inspection outline was made up from a list of things that were found wrong on previous inspections. A form was made up according to the attached sample. The following items were checked in detail:

Map reading, detection tests, and training.
Knowledge of country and trails.
Watch, time, and accuracy.
Check reports for adequate supply and proper use.
Diary, have lookout read certain days and suggest betterments.
Precipitation records.
Wind gauge, condition, care of.
Training visibility judgment.
Observations, how made, when.
Regular and special instructions.
Patrols, are they being made? When?
Lightning strike observations, follow up.
Azimuth back sights.
Fire pack, check items and condition, compass tied on pack, light, batteries, water bag soaked, etc.
Night lights, gasoline, batteries.
Telephone, condition, installation.
Lightning protection, house and telephone.
Condition of ground.
Extra rations.
Mapboard.
Windows, clean?
Wood supply.
Water supply.
Condition of grounds.
Maintenance needs.
Sanitation.
Subsistence supplies, when will new supply be needed?

This list may, of course, be supplemented or condensed to what each Forest officer judges necessary to make a proper check of the point.

It was found that the time necessary to do this job varied from 20 minutes to one hour per position, averaging about 45 minutes. Frequency of inspections was set at once each week. Inspection by telephone was cancelled for the week when an actual inspection was made of the point. Time necessary to carry out this work required about two hours per day for office force. Much of it has to be done in the evening on account of fire work during the day.

Although I anticipated good results from this systematic check of points I was amazed by the benefits which immediately became apparent. The men became intensely interested and on their toes, and even inspected themselves and called up for information and advice. I even overheard telephone conversations in which lookouts were conscientiously inspecting each other. Within a short time we had one of the finest examples I have ever seen of a large organization of temporary men working together to handle a difficult job.

That this system showed results was ably demonstrated by the almost military discipline, coupled with individual initiative, shown in controlling the disasters that occurred in Plains on September 4.

While I do not claim that telephone supervision can possibly equal field inspections, I do feel that when it is clearly impossible to contact lookout men at their stations at desirable intervals, we can accomplish a great deal by a systematic schedule of telephone contacts.