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Ideas advanced in the section Suppression Financial Policy, pages 19-21, have served as part of the foundation of economic theory of wildfire management.

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FIRE SUPPRESSION

DISTRICT 5

U.S. FOREST SERVICE

May 1, 1916

by Roy Headley

CONTENTS

	Page
Progress	1
Possibilities	1
Causes for Prevention Waste	2
Preorganization of Suppression Resources	3
Advance Instructions to Rangers and Guards	4
Classification of Firefighters	8
Treatment of Different Classes	9
Fire Companies	9
Individual Cooperators	10
Labor Agents	10
Tools and Equipment	10
Food Supplies and Utensils	11
Transportation	14
Small Fires	15
When the Smoke Rises	15
Selection and Training of the Fire Boss	16
Suppression Financial Policy	19
How Many Men	21
The Getaway	25
Travel Time	26
The First Man at the Fire	26
Where to Camp	27
Communication	27
Organization at the Fire	28
Duties of Suppression Officers:	
Fire Boss	29
Quartermaster	31
Division Bosses	32
Patrol Bosses	32
Crew Bosses	32
Where to Begin Work	33
Continuous Line	35
Shifting Men Along the Control Line	36
Laying Out the Control Line	37
Strength of Line	39
Backfiring	41
Throwing Dirt	43
Use of Water	43
Pooling for Fire	44
Systematic Resting of Men	44
Day and Night Work	45
Reorganization When Control Line is Completed	46
Patrol of Control Line	47
Care of Men	49
Time Keeping	50
Payments to Fire Fighters	51
Report of Liabilities and Vouchering of Bills	52
Commissary	53
Medicine and Medical Services	54
Compensation for Injuries	55
Care of Property	55
Terms Used in Fire Suppression	55

FIRE SUPPRESSION

Progress

The increasing effectiveness of suppression practice is shown by the fact that in 1915 fire suppression cost one-third as much as in 1914, and damage to Government property was kept down to one-fourth the 1914 figure. The seasons were approximately equal in danger. Is further progress to be expected?

Possibilities

Like all rush jobs—especially big rush jobs—fire suppression is accompanied by much unavoidable waste of effort, money and property. It must be admitted, however, that a large part of the usual waste is preventable. The present average efficiency is probably less than 50 per cent of the efficiency which will be attained within a few years.

Every member of the Service has an opportunity—and responsibility—for contributing to this progress. The following program may be followed by everyone from Guard to District Forester, and every man who follows it may be certain that sooner or later he will contribute his full share to the evolution of a fire suppression practice of the highest efficiency.

1. Accept no result or method as best, even for the present, until by critical study and honest comparison it is found superior to any other. Always remember too that this season's best is likely to be surpassed somewhere next season.

2. As often as possible analyze the process of suppressing different fires to determine whether different parts of the process possessed varying degrees of effectiveness.

3. When any method or result or part of a result is found to be of high or low effectiveness, pick it to pieces to discover the reason.

4. When a conclusion is reached as to the reason for high or low effectiveness, try out the conclusion at the next fire by practical test, and if the conclusion is verified, pass it along for use elsewhere.

Causes for preventable waste

What are the more common causes for waste of effort, money and timber in fire suppression?

Excitement is the enemy of effectiveness. A fire is an awe-inspiring thing and the roar, smoke and flame too frequently shake the nerve and judgment. Intelligent caution has its place, but nothing more than the roar of a flaming tree or a small watershed sometimes produces what is really a panic in the minds of fire bosses. Everyone has heard otherwise levelheaded mountaineers say "If it gets across the road all the men in the county can't stop it." Everyone has also seen just such fires cross and then be controlled quickly and with comparative ease where some cool head got hard steady work substituted for scare. Barring always high continuous winds, there is no such thing as a fire which cool, hard work, properly applied, will not corral in a few days with a few thousand dollars.

A panicky state of mind frequently expresses itself by piling in abnormal numbers of men, when the real need is ability to so lay out work and manage men that the forces already on the ground will deliver a reasonable output of held control line. Shove enough men out on a fire and even without supervision they will unavoidably deliver one effective lick out of a possible hundred or thousand and eventually the fire will be controlled; but fires should be suppressed by work economically and effectively applied rather than by men, money and loss of sleep.

Beginning in the wrong place is responsible for some of the biggest failures the District has had. The judgment is sometimes warped by an instinctive desire to find the hottest side of a fire and fight it.

Detached control lines or failure to construct continuous line is another practice which is responsible for much waste. There are cases where it pays to go on ahead and construct a section of detached line to hold some powerful point of fire, but success at this requires accurate information and high skill and nearly always involves considerable risk of losing line. Many failures have come from this cause.

Lack of executive control and executive fore-thought is another common defect. Too frequently part or all of a suppression crew really manages itself, with results the same as when any other body of men lacks a controlling head. It is no disgrace to lack confidence in one's ability to manage the work on a fire and place some qualified subordinate

in charge, but it is a mark of inefficiency for the responsible officer to fail to arrange in some way for adequate supervision of all work in accordance with a definite all-around-the-fire plan. There can be no excuse for failure to lay out work far enough in advance to keep things moving without jerks and delays. In these days no one can expect to have standing as a good fire boss if plans for the night are not made and orders delivered before the night crew is ready; or if plans are not perfected and orders ready for the reorganization which should occur immediately after a control line is completed.

The management of a suppression crew offers a field for the highest grade of executive thought and action as well as for experience and hard work. Modern standards and traditions require head work and seldom can be fooled by substitutes in the form of exhausting labor with shovel and ax, going without sleep for long periods or the simple statement that "the fire jumped the line."

Preorganization of suppression resources

In general all forces and facilities which may be needed on any fire should be so organized in advance that the process of starting action is easy and simple and done so quickly that it calls to mind the familiar act of pressing a button to set in motion a powerful and complex piece of machinery. The detail or intensiveness of such preorganization should vary to suit the circumstances, but the passage of a few prearranged words of instruction should be all that is required.

1. To start instant and perfectly coordinate action by one or more Forest officers.

2. To start with the minimum practicable get-away time any needed residents living on or near the Forests, their action being in accordance with definite written or verbal contracts with the individual resident or the group of which he is a member or with a labor agent.

3. To start any necessary shifting of Rangers and Guards on the Forest or the District.

4. To start agents collecting and forwarding any necessary number of men from distant labor centers, each agent and laborer acting under a contract of hire about which there can be no dispute later.

5. To start merchants or emergency supply depots at putting up shipments of supplies or tools, using prearranged lists which include articles or quantities regularly carried in stock.

6. To start suitable rail, motor, wagon, or horse transportation at work moving men and supplies as needed and acting in accordance with prearranged contracts, either verbal or written. Such contracts should often be with transportation agents instead of with individual owners.

It will be considered a mark of inefficiency when available men, supplies and transportation have to be called into action without the benefit of previous arrangements which will save the time and energy of the dispatcher.

Available men, stocks of supplies and transportation facilities should be listed for each Ranger District just before the opening of each fire season and these lists posted in a conspicuous place near the telephones at Ranger District headquarters and each fire control station. All this, however, does not call for excessive or overbalanced effort on pre-organization. For example, careful contracts with one labor agent and one garage man would be the most appropriate means of making the entire labor and transportation resources of Redding available to the northern Forests. Such resources will seldom be called upon, and to attempt to deal directly with men and car owners would create an element of an unwieldiness which would increase rather than lessen the burden on the officer assembling men in the event of a fire.

Furthermore, in incendiary communities intensive preorganization may merely whet the desire for pay checks, and actually cause fires. Discretion is necessary to prevent costly over-organization.

All preparatory arrangements made with merchants, garagemen and labor agents lost their snap and go if not made constant use of. Constant use is not probable or desirable, so that the necessary stimulus must be provided by a revival of such arrangements as a definite part of the preparation progress each spring. This freshening effect will be accomplished through the annual visit of the proper Forest Officer to these men to revise lists, rates, etc.

Advance Instructions to Rangers and Guards

Any protection organization which rises above mediocrity will include the issuing of definite advance instructions to each Ranger, Lookoutman, Fireman and Patrolman. Well ahead of the opening of the fire season the Supervisor will furnish each District Ranger with the plan of protection to be pursued within his district. Such plan will be in the form of written instructions, and will include a complete statement of the organization to be provided for the protection of that district and a discussion of the local application of this Manual.

The District Ranger will be directly responsible for the work of the Control Force (all short-term protection men) within his District. Through personal touch he must instruct, inspect and encourage.

At the opening of the fire season each year as the men are put on the job there are many things which should be told them, whether they be entirely new to the work or men with a record of several seasons. Whenever practicable the men should be advised to report to the District Ranger's headquarters on the morning of their appointment day. This day or days should be given over to detailed and prearranged instruction of the men by the District Ranger. Such instruction to Guards shall consist of general enlightenment on the spirit and purposes of the work and established methods of fire protection. Specifically it shall consist of definite local instruction as to the type of users and how to handle them, sign-posting, personal appeal methods, the territory in which a man will fight fire under different circumstances, patrol camps, routes and schedules, the communication system, the use of forms, etc.--in fact, the whole fire protection plan for the unit involved. Questions should be invited and answered in detail; there should be left no unanswered questions as to policy and procedure.

On this training day each Guard will be given his right and complete set of equipment, and no doubt left in his mind as to the use to be made of it. The following check list is complete, and by reference to it the District Ranger can select the appropriate set of articles for each Guard:

EQUIPMENT CHECK LIST

Patrolmen and Firemen

Tools

- Ax
- Boy's Ax
- Belt Ax and Sheath
- Belt Knife and Sheath
- Shovel
- Rake
- Hoe
- McLeod Combination Tool
- Mill Files

Forms and Stationery

- "Systematic Fire Protection"
- Fire Suppression Manual
- Diary Book
- Forms 26
- Time Forms (Firefighters)

Forms and Stationery (continued)

Fire report forms
Heliogram forms
Forms 878
Purchase order book
Copies of pertinent fire circulars
Pencils, pens, paper, envelopes, etc.
Map of division
String map for headquarters
Transfer case, pasteboard

Publicity Material

Maps for distribution
Campers' Handbooks
Six Rule Cards
Game Law Cards
Tin and cloth signs
Paper fire signs
Nails for posting
Travelers' Register

Miscellaneous Articles

Badges
Canvas carrying case
Forest Service martingale
Uniform
Farrier's outfit
First Aid packet
Lamp or lantern
Canteen
Water Bags
Flag, U.S.
Heliograph, either type
Portable telephone
Forest Service key
Broom
Thermometer

Lookoutmen

Tools

Ax
Shovel
Mill file

Forms and Stationery

"Systematic Fire Protection"
Fire Suppression Manual
Diary Book
Forms 26
Heliogram forms

Forms and Stationery (continued)

Lookout Report Forms
Copies of Pertinent Fire Circulars
Pencils, pens, paper, envelopes, etc.
Map of Forest
Transfer Case, pasteboard

Publicity Material

Maps for distribution
Campers' Handbook
Six Rule Cards
Game Law Cards
Travelers' Register

Miscellaneous Articles

Badges
Canvas Carrying Case
Fire Locator
Locator Board and map
Binoculars
Goggles
Uniform
First-Aid Packet
Lamp or Lantern
Canteen
Water Bags
Flag, U.S.
Heliograph, either type
Forest Service Key
Broom
Thermometer

The tools set down in the above list are in addition to the regular supply of fire-fighting tools which may be provided for each headquarters.

It should be understood that each Lookout Station is provided with certain furnishings; the Lookoutman's equipment, set down in the above list, is in addition to such furnishings.

Certain important preparatory measures stand out most clearly. They are listed herewith, and any Forest Officer may expect disciplinary action if a fire alarm finds him delinquent in such respects.

1. Firemen and Lookout Firemen within hearing of telephone or call day and night except when on a fire or

absent for reasons approved and provided for in instructions issued or approved by Supervisor or District Ranger.

2. All necessary tools on hand, sharpened, tight on the handles and, together with canteens, files, candles and other equipment, assembled in such a way and at such place or places that not a second is lost looking for them and no unnecessary time is required in loading or starting with them.

3. Horses saddled during such hours of the day as may be appropriate to the conditions.

4. Where crews of from one to three or four men are likely to be used, lunches of non-perishable stuff for at least 24 hours should always be packed in kyacks, cantinas or other suitable container and ready for instant loading.

Classification of Firefighters

It is common observation that every community or fair-sized crew contains men who can and will do three or four times as much work as others. Too little attention has been given to careful grading of possible firefighters and the formulating of the proper methods of dealing with each class.

The men of any community may be divided into classes, each possessing the qualifications listed below:

Class A: Men worthy of complete confidence; exerting a well-recognized anti-fire influence, possessing superior physical ability and power of endurance. Men who on a control line "work on their nerve", or who will do so if given proper inducement. Men who have the experience and personality to succeed as Crew Bosses (not merely Crew Leaders.)

Class B: Trustworthy men equal to those of Class A, except that they do not possess the qualifications of successful Crew Bosses or have not as yet had an opportunity to prove them.

Class C: Trustworthy but ordinary men.

Class D: Shirkers; disorganizers; men without proper shoes; men who are from inexperience or inclination disinclined to respect authority and orders; men suspected of incendiary tendencies or of nursing a fire; men not trustworthy for any other reason.

Treatment of Different Classes

Class D men should never be hired when it can be avoided. There are circumstances which make it necessary to hire about every known type of Class D men, but the necessity should be clear. Responsible officers should expect to have to justify the presence of a Class D man on a control line.

It is sometimes good policy to make no secret of the fact that a man's work has caused him to be regarded as undesirable on a control line. More often it is good policy to talk it over in a frank, friendly way with the Class D man himself. No more effective instrument will ever be devised for control of men and affairs than the frank, friendly discussion of a delicate subject.

Provision should be made when possible for the weeding out of Class D men from crews assembled at labor centers. If labor agents are not qualified or cannot be trusted to reject the unfit man, a Forest officer may be sent to pass on transient laborers collected by agents.

Fire Companies

The organization of volunteer forces into companies having officers and plans for concerted action has two prime advantages. In case of fire it relieves the Forest officer of detail. It also has a psychological effect of the greatest value. The team work and coordination of action has a fascination to which few men are immune.

Successful fire companies are now common on most of the Forests. The form of organization and contract vary greatly and need not be treated here in detail. Where there is any advantage to be gained by organizing cooperators into a company it should be done.

Fire companies, like any other organization, are likely to decay unless there is continual positive effort to keep them healthy. Systematic study and inspection are necessary to eliminate members who fail to act wholly in the interest of the Government. Inspection has sometimes revealed fire companies which have degenerated into institutions for getting easy money for members of the company or their friends. To detect and correct such conditions should not require District Office inspection.

To perfect fire companies in speedy assembling in response to an alarm, fire drills are very desirable. The advantages and practicability of such drills should be studied

and tried out when the Supervisor is sure that some positive good may be accomplished along this line.

Whether or not fire drills are made use of, stimulus should be provided by holding a company business meeting each spring.

Individual Cooperators

Every able-bodied resident on or near the Forest is a potential fire-fighter. With reasonably efficient preorganization the value of fifty well-distributed residents approximates the value of fifty regular firemen, and costs perhaps one-tenth of the cost of the regular force.

Written agreements with individual cooperators are often not worth while. Definite verbal agreements are indispensable. Will the cooperator go to a fire when called? Will he go without being called? At what rate will he be paid? Will he use his influence to prevent fires from starting? Will he serve as an emergency patrolman and at what rate? All these questions should be definitely settled with every potential fire-fighter, and the discussion should be made the occasion for making another friend for the officer and the organization--or for intensifying warm personal relations if good feeling has already been established.

Labor Agents

There should be coordinated action in organizing facilities for securing labor at important Valley towns when two or more Forests must depend on such a common labor center. Before the opening of the 1916 season a District plan will be formulated and announced by circular.

Tools and Equipment

Fire-fighting tools and other equipment should be secured before the beginning of the season and placed on the Forest in sufficient numbers to equip the local labor supply or to provide for the largest number of men likely to be employed if the entire local labor supply is not normally required. If tools and equipment for any fire are required in excess of this local stock, they should be secured ordinarily from one of the three emergency supply depots maintained at Sisson, San Francisco and Los Angeles.

The proper placing of tools requires close study and nice judgment. Where transportation is by automobile or truck, tools should be stored at the source of labor supply. Under other conditions tool caches have to be placed and

quantities fixed with respect to all the factors of each case.

If caches are located at Forest Officers' headquarters, whether they be improved District Ranger Stations or Firemen's tents, the tools should be grouped and placed under shelter. In such cases special boxes are seldom necessary.

When it is advisable to cache tools at points away from such headquarters, one of the following two types of cache is recommended:

1. Log or shake toolhouse, 6 x 6. In remote regions where the cost of bringing in special boxes or chests from the outside would be prohibitive.

2. Galvanized iron kiosk, 33" in diameter and 6' high, manufactured by the Northfield Iron Co. of Northfield, Minn., and known as Kiosk #2. To be used along roads, at towns and other settlements and occasionally at Ranger Stations; in fact, at all accessible or semi-accessible places. If necessary, this type can be packed without difficulty. In durability, weather-tightness and appearance it far excels the lumber box. It should be painted bright red. This kiosk, with railroad freight added, costs approximately $23. In the long run it is the most economical type.

When the location of a cache is such that the public will be expected to make use of it in case of fire, box car seals should be used in fastening the door and the tin sign (form 460) placed thereon. If, however, there is strong probability of theft of tools, or the cache is located in such a place that its use will be entirely by Forest Officers the door should be locked with a Forest Service padlock.

The number and kind of tools and other articles stored at each point should be determined logically and not by accident. Type of cover in the neighborhood should to a large extent influence the type of tools. The outfit at each point should be made a matter of record and a copy of the list placed in each cache or storeroom. Without fail the equipment at each point should be overhauled, put in perfect edge and repair and brought up to the designated number before each season and immediately after each fire on which it was used.

With proper preoganization nothing more than a few very brief orders should be necessary to equip a crew.

Food Supplies and Utensils

Food caches are sometimes a necessary evil. They should not be used unless the necessity is clear.

Food and utensil lists for fire crews are given herewith:

Fire-Crew Ration List, 10 men

Article	Unit	Days				
		1	2	3	4	5
Meat along:						
Fresh meat	Pounds	20	40	60	80	100
Canned or cured meat	"	12	24	36	44	52
Meat combined:						
Fresh meat	"	10	20	30	40	50
Canned or cured meat	"	6	12	18	22	26
Bread, crackers or flour						
Bread	Lb. loaves	9	18	27	36	45
Crackers	Pounds	6	12	18	24	30
Flour	"	8	16	24	32	40
Baking Powder(if above amount of flour is used)	"	½	½	1	1	1
Lard	"	1	2	3	4	5
Sugar	"	4	8	12	16	20
Sirup	Quarts	1	1	2	2	3
Coffee, ground	Pounds	2	4	6	8	10
Tea	"	½	1	1	1½	1½
Milk, Canned	10¢ size cans	3	6	9	12	15
Butter	Pounds	1	2	3	4	5
Fruits, dried or canned						
Dried	"	2	2	3	3	3
Canned	Quarts	3	6	9	12	15
Rice	Pounds	2	4	6	8	10
Beans	"	3	6	9	12	15
Potatoes	"	10	20	30	40	50
Onions	"	1	2	3	4	5
Tomatoes, canned	lge. can	3	6	9	12	15
Macaroni	Pounds	1	2	3	4	5
Cheese (American)	"	2	4	6	8	10
Erbwurst	"	½	½	1	1	1½
Pickles	Quarts	½	1	1	1½	1½
Salt	Pounds	1	1	2	2	2
Pepper	Ounces	2	2	4	4	4
Dish Towels (cheesecloth)	Yards	3	3	5	5	5
Twine	Balls	1	1	1	1	1
Hand Towels	Number	3	3	3	3	--
Candles	"	3	6	9	12	15
Soap (hand, Sapolio & laundry	Bars	2	3	4	4	4
Matches	Boxes	1	2	3	3	4
Paper bags		12	24	36	48	60
Total Weights. .		138	229	369	485	587

Fire-Crew Camp Equipment

Utensils	Number of men					
	5	10	15	20	25	30
Knives, Table	7	18	24	30	36	36
Forks, Table	7	18	24	30	36	36
Teaspoons	7	18	24	30	36	36
Spoons, Stirring	1	2	2	3	3	3
Plates	7	18	24	30	36	36
Cups	7	18	24	30	36	36
Milk Pans (dish ups)	1	4	4	4	4	4
Dish Pans	1	1	1	2	2	2
Fry Pans	3*	4	4	5	5	5
Stew Kettles (½-gallon)	2	3	3	3	4	4
Meat Forks	1	1	1	1	1	1
Canvas Water Pails (2-gallon)	1	3	3	3	3	3
Butcher Knives	2	2	2	2	2	2
Stewpans, Assorted	2	3	3	3	3	3
Can Opener	1	2	3	4	5	5
1-gallon Coffee Pot	1	--	--	--	--	--
2-gallon Coffee Pot	--	1	2	2	3	3
Dutch Ovens	1	1	2	3	4	4
Meat Saw	--	--	1	1	1	1
4-gallon Stew Kettle	--	--	1	1	1	1
2-gallon Stew Kettle	--	--	1	1	1	1
Lanterns	1	2	3	4	5	5
Weights	40	80	120	160	200	240

* Small

Copies, adapted to fit local conditions or stocks, should be in the hands of every merchant who may be called upon. Small stocks are easily exhausted by the demands of a fire crew, and definite information should be had as to the size of each stock and how additional supplies may be secured in case of need.

It is seldom practicable to secure competition by the informal bid method in purchasing supplies for an actual fire. Furthermore, the immediate necessity of suppressing a fire creates and exigency which makes it possible to buy without informal bid.

When practicable, it is often profitable to ask merchants in advance to name discounts they will allow for various quantities of fire food supplies, and business can be given to the one offering the best terms.

Occasionally a merchant is guilty of overcharging or of stimulating incendiarism in order to make business for himself. Such a man should be patronized only in case of absolute

necessity. Food supplies should be purchased elsewhere and cached, if necessary, to avoid buying from him.

In ordering grub an over-supply or wrong proportions are most unworkmanlike, and are more common than the equally bad mistake of an under-supply. Orders should always be placed from balanced ration lists. If there is any chance that an officer will ever be without a ration list in his notebook, he should fix one in his head. Lunches of canned stuff even should be bought from tested lists recorded in the notebook or in the head instead of from inspiration and judgment, which may or may not come while one is leaning against the counter trying to think. Lunch stuff is often so poorly bought that a man or a saddle horse is forced to do pack-animal service in carrying stuff intended for two or three meals only.

Food for animals is in many cases as important as food for men. Preparation should therefore include a survey of the hay and grain supply of the region. The resulting lists should cover quantity, kind, location and price.

Transportation

Here again the time-consuming work should have been done previously and recorded in the advance instructions for the season.

All the available means of transportation suited to the locality should be listed and definite to contracts entered into with the owners or transportation agents as required by the circumstances. Competition should be used regularly in arranging for motor transportation where more than one motor-driven vehicle is available. Competitive bids have resulted in rates as low as twelve cents per mile for a five-passenger automobile. The rates usually paid for automobiles are from twenty to forty cents, varying with the type of roads to be traveled and the type of car. The best practice is to invite bids and pay on the basis of a rate per mile, with a supplemental rate per hour for waiting time.

The most rapid means of transportation usable and available should be used as a matter of course. Nevertheless, a little calculation is sometimes necessary to insure the type of transportation best suited to the particular circumstances.

Automobiles have their place in fire suppression, and their proper use has resulted in a distinct general reduction in travel time. But there are many instances where the use of horses or men's legs would have accomplished the same or better results. When the location of a fire becomes known, the Dispatcher must decide immediately which conveyance is the most

advisable. His choice must be governed entirely in judgment based on the competitive travel time which would result from the use of each and the difference which the possible saving in travel time may be expected to make in the all-around success with which the fire is handled. The mere fact that an auto travels faster once it gets started is no criterion. In many instances, if a man had used the time spent in waiting for a machine in lighting out across country on horseback, he would have reached the fire sooner than he did.

Assuming in any case that the travel time would be practically the same with either autos or horses, preference should be given the latter for two reasons: they cost less and they can be put to many good uses at the fire.

Small Fires

The purpose of fire protection is first, to prevent fires from starting, and second, to catch any that do start while they are still of one, -two- or three-man size. Necessarily much space in this Manual is given to the handling of large fires. It should be remembered, however, that small fires and few men should be the rule. Large fires sometimes occur from reasons beyond the control of Forest Officers, but the first two questions which will be asked about any large fire or large suppression expense are (1) How did it get to be a large fire? and (2) Is the size or cost of this fire due in whole or in part to lack of efficiency on the part of the Forest Officers concerned?

When the Smoke Rises

Report time is defined as the time which elapses between the moment the fire is discovered and the moment of receipt of report by a man equipped to start to fight it.

If the message must pass through a Dispatcher other than the man designated to go to the fire, report time is divisible into three periods. The following is an example:

Lookout Man Discovers Fire:
Notes time and local conditions) and with instrument determines) location of fire) Should not exceed three minutes

Lookout Man Rings Telephone:
Gets Dispatcher on line and delivers full message) Should not exceed two minutes

Dispatcher Rings Telephone:
Gets Fireman on line and delivers message and instructions) Should not exceed three minutes

Fireman rings off:

If the message is direct from the Lookoutman to the man designated to go to the fire, one of the three periods is eliminated. Report Time should not exceed eight minutes. It may take longer than a three-minute period for the Lookoutman to determine whether the smoke is from a fire which must be fought, but within three minutes from its appearance he should have its bearings and start to report, so that the Dispatcher and Fireman may be getting ready. If a Lookoutman seems slow or inattentive he should be checked up with test fires.

When an alarm is turned in every man affected should perform the duties falling to him with the rapidity and assurance born of perfect familiarity with advance plans.

No matter where the District Ranger, Fireman and volunteer Firemen may be or what they may be doing at any particular minute, a report from a Lookoutman should proceed without delay and in accordance with well-understood plans to the man authorized and responsible for starting action--the Dispatcher. The Dispatcher may be the man who is to go to the fire himself alone or with one man following him, or he may be the man who will later take charge of the crew at the fire--the Fire Boss. On the other hand he may be the Supervisor or District Ranger who will start action but not go to the fire himself. The functions of the Dispatcher and the Fire Boss should be never be confused.

In order that the functions of the Dispatcher may be discharged properly two things must have been attended to. Any man called upon to act as Dispatcher should have (1) learned the country in as much detail as practicable and should know the essential parts of the fire plan by heart, and (2) a fire call should never find him out of hearing of the phone or out of calling distance if some is at hand to answer the phone.

With his string map and the bearing of the fire reported by one or more lookouts the Dispatcher determines where the fire is. From the Lookoutman's report on the size of the fire, together with what the Dispatcher knows or can find out about the character of the country, cover, etc., the Dispatcher decides how big and how difficult a job it will be under the conditions of heat and wind then present, and is then ready to select the Fire Boss, decide how many men should go, what grub, tools, equipment and transportation is necessary, and issue appropriate instructions.

Selection and Training of the Fire Boss

On one- or two-man fires the Fire Boss needs only to have the capacity for hard protracted labor and ability to direct effectively the efforts of himself and one other man if a second man is sent. The nearest man should be sent, of

course, but if two men go the most capable one should be designated as Fire Boss in such a way that both he and his helper know who has the responsibility and the authority. With more than two men on a job the functions of the Fire Boss become of extreme importance.

The qualifications of possible Fire Bosses should be studied and if possible checked up, so that when a fire requires three or more men the most capable available man will be selected, and if the qualifications of the best man at hand are not up to standard some competent man can be started for the fire with orders to take charge as soon as he arrives. A list of possible Fire Bosses should be made up for use of men who will have to make the selections.

The District Ranger should be the most effective Fire Boss in his District. The quality of his work should, however, be determined by inspection, comparison and checking. It should not be assumed. If his fire boss work is inferior this fact should be recognized, and he should not take charge of bad fires. If the District Ranger is not the most effective Fire Boss in the District he should bend his efforts to perfect himself of the art. If after determined effort he is still unable to deliver acceptable results on a fire it may be a question whether with such a lack he is fitted to remain in charge of a Ranger District. Management of a suppression job presents about as difficult and important a task as falls to the lot of Forest Officers. Not all men can excel at it, but it is doubtful whether any Ranger is qualified to take charge of a District in Class A hazard area who is not reasonably proficient at the art.

When under special circumstances the selection of a Fire Boss Lies between two or more District Rangers, and there is no marked difference in their qualifications, the Ranger in charge of the District where the fire occurs will always be designated as the Fire Boss.

A District Rangers should be present at as many fires as is consistent with his other duties. Few men are so skilled that they need no further practice. No two fires are alike, and each one presents new problems and offers opportunity for progress in suppression efficiency. On the other hand, the District Ranger is the business agent of the Forest Service and must necessarily spend much of his time traveling his District on administrative and other work. He cannot always be within reach of quick communication, and this is not necessary if the protective organization of his District is what it ought to be. The protective machine, if properly constructed and tuned up, will handle all small fires when constructed and tuned up, when the District Ranger is absent or it is not good business for him to drop what he may be doing. When a suppression job becomes or promises to become too difficult for effective hand-

ling by the best available Fire Boss the District Ranger should go to the fire at once. If he is the most competent Fire Boss he should take charge upon reaching the fire—unless he wishes to let the man in charge get experience or show what he can do. If the District Ranger is not the most competent Fire Boss he should make it clear that he is not taking charge and then should spend his time studying the fire, the work done and the results, in order that he may improve himself in the art of the Fire Boss. If the fire is not serious he may take charge to get training, even though not the best qualified man on the fire.

The Dispatcher should always know how to reach the District Ranger wherever he may be. When necessary messengers should be used freely to reach a District Ranger who is working away from a phone line.

The Protective Assistant Ranger should be next best fire boss to the District Ranger. If he is not he should not be Protective District Ranger. He should go to and take charge of all fires in the absence of the District Ranger, unless the size of the fire and the distance to it make it an obvious waste of effort. The Protective Assistant Ranger may direct a Guard or volunteer Fireman to act as Fire Boss when it is desirable to give the man in question a chance to show what he can do.

When the Supervisor or Deputy is present at a fire there is often uncertainty as to who is in charge of the fire. Without exception the same rule should govern as with District Rangers, except when a less capable man is given a chance to get experience and show what he can do. The most competent man should be in charge. Often the District Ranger's greater familiarity with the country and the habits of fires in that locality makes him the better Fire Boss without any discredit to the Supervisor or Deputy. Neither should the Supervisor assume himself to be the better Fire Boss. His ability in comparison to that of the District Ranger should be determined by scrutiny and comparison of results. Advance plans should as far as possible indicate when the Supervisor or Deputy will act as Fire Boss. When circumstances arise not covered by the advance plans and instructions, it is the duty of the Supervisor or Deputy to make it clear just who is in charge.

Under no circumstances will a member of the District Office act as Fire Boss unless directed to do so by the District Forester or requested to do so by the Supervisor. A member of the District Office may, if authorized by the District Forester, give his time to observation of the fire, the work done and the results, but unless so authorized he should report to the Fire Boss and follow orders. Failure to subordinate himself to the Fire Boss or failure to obey orders will be disciplined just as quickly in a District Officer as in a Guard.

Many Rangers in charge of a fire hesitate to act with freedom and individuality when a superior officer is at the fire. It is sometimes felt that disregard of the ideas of a superior officer may result in a black mark against the Ranger. This feeling is natural, but it interferes with efficiency. Any man's judgment and power as Fire Boss is impaired when he tries to decide and do what he thinks best and at the same time conform to the ideas of a superior officer present. The following statement of policy should get matters right:

While acting as Fire Boss any Guard, Ranger, Deputy, Supervisor or other officer has, so far as that fire is concerned, the full authority and responsibility. Everything relating to the fire should move in accordance with his judgment and orders and nothing should move otherwise. Advice and suggestions should be asked from officers of superior rank when the Fire Boss desire them, and should be followed as much or as little as the Fire Boss thinks best. No time or consideration should be given to advice or suggestions which the Fire Boss does not desire to listen to. The Fire Boss may be replaced at any minute by the ranking officer on the job, but while in charge has sole authority and responsibility. He may be discredited for failure of his work, but such action will, so far as is humanly possible, be based on consideration of facts and not influenced by the judgment of any superior officer whose ideas were not followed.

When the Dispatcher has made his selection of a Fire Boss, the next question is how many men are needed. The decision must be in line with a definite financial policy for fire suppression.

Suppression Financial Policy

The following principle from a recent work* applies perfectly to fire suppression:

> "Perfect efficiency requires that the means employed for the accomplishment of a result shall be neither more nor less in quality, quantity or cost than is just sufficient for the purpose. The use of excessive means is only less unworkmanly than the use of insufficient means."

The purpose of fire suppression is to prevent destruction of values owned by the Government and cooperators when destruction can be prevented at a cost less than the values in danger of destruction.

From the foregoing may be deduced the following rules and principles which should govern in District 5:

* "Business Administration" – E. D. Jones

1. The regular prevention organization should be used to suppress all fires occurring inside the Forest boundary, except on lands owned by non-cooperating owners of private lands the owners of which are prepared to handle their own fires. When a reported fire is not to be fought by the Forest Service the owner of the land should be notified. Addresses of such owners should be kept on file by the Supervisor to permit prompt notification in the event of a fire.

2. Expenditures from the fire-fighting fund will be made with the sole object of protecting values owned by the Government and private owners giving satisfactory protective cooperation.

3. It is sometimes necessary to use the prevention forces and expand suppression funds on fires on private lands in order to suppress a fire which, if not controlled by the Forest Service, will spread until it must be suppressed at greater cost in order to prevent destruction of Government or cooperative values of consequence.

   Before expending suppression money on fires on lands owned by non-cooperators or owners who should be able to handle their own fires, it should first be determined that by doing so the expense of protecting Government and cooperative values will be less than if some other plan is followed.

4. On the Santa Barbara, Angeles, Cleveland and Monterey Forests the values are public values even though a portion of a watershed is in private ownership. The ownership of land should therefore have no bearing on the organization of suppression jobs.

   Different suppression plans are required for different types of country, in order that the foregoing policies may be applied. Each Forest should be studied to determine just what degree of intensiveness should be used under different conditions. For example, it should be pre-determined how much money, if any, will be spent in suppression fires on shotgun additions.

5. Effectiveness per man decreases rapidly as the size of a suppression crew increases, and usually cost per man increases with increase in numbers. The smaller the crew, therefore, the smaller the cost to construct and hold a given length of control line, but, of course, the longer the time.

6. The emphasis should be on prevention of damage rather than on prevention of burnt acres. Suppression jobs should be so organized always that the sum of damage to Government and cooperative values plus the cost of suppression will be at a minimum. A $500 suppression charge on a fire which destroyed $50 of values would be all wrong <u>if</u> a $300 suppression charge would have resulted in only $100

damage. There would be a difference of $150 in favor of the $300 plan of suppression. On the other hand a $500 suppression plan on a fire with a $1000 damage would be all wrong if an $800 suppression plan would have resulted in a $600 damage. The difference would be $100 in favor of the $800 suppression plan. This principle frequently calls for the deliberate sacrifice of Government land in isolated tracts or on the fire side of a ridge or stream at which an inexpensive control line can be constructed or maintained.

7. Except on the Cleveland, Angeles, Santa Barbara and Monterey, no money should be spent to keep down burnt area in fields of pure brush. It is necessary to be sure, however, that the stand is pure brush. Even very scattering reproduction means that the process of converting the brush cover into timber is started. Its destruction is frequently as much or more of a loss than the damage done by a fire in a mature stand.

8. Except in southern California fall and early spring fires burn lightly, flaring up only in spots. The damage is much less than by fires in the middle of the season. This calls for fewer men, less cost and a risk of larger acreage than would be acceptable in summer. The principle of minimum total damage and cost should be carefully applied. The seasonal factor must be considered.

9. Economics which mean larger burned acreage or delay in quenching fires should be modified more or less by the fact that in the event of a gale of wind the chance for a disastrous conflagration is increased by every acre bearing live fire. The time and character of the day must be considered.

10. Any men engaged on any fire should be worked to a reasonable limit. The danger of damage may not be sufficient to warrant the excessive effort expected on bad summer fires, but no fire is harmless enough to permit taking it easy. Dawdling on patrol instead of steady work cutting snags and covering fire may be responsible for much useless expense.

How Many Men

The answer to this question must always be a matter of judgment. But "a matter of judgment" without a foundation in calculation and reason is not judgment at all, but pure guess. The number of men sent to a fire is too often determined by precedent or the number of men which happens to be available. Adequate preorganization requires the building of a protective machine which by the more pressing of buttons will throw large numbers of men on a fire. In the event of a fire it is easy to confuse the need for men on this particular fire with a desire to press the button and see the wheels go round. One of the most difficult and also one of the most important elements in the successful manipulation of

a powerful organization is knowing when not to use it. It is certain that where large numbers of men cannot be gotten or are not used, fires have been handled with a fraction of the men and cost that were used on other similar fires where an abundance of men and preorganization were available, and with no corresponding increase in damage.

How can the question of "How many men for this fire?" be answered consistently and with due regard to all the factors? The following method, with the developments growing from experience and modified to suit local conditions, will eventually substitute systematic calculations for loose guessing. The presentation of the method necessarily assumes a fire without non-cooperating private land complications.

1. When any number of men are available, and the expense of transporting them to the control line is negligible, the crew should be as large as can be worked to good advantage. The quicker the work is done the less there will be to do and the quicker the fire will be quenched and disposed of as a potential disaster in the event of a gale of wind. Two limiting factors must be considered, however: (a) It is simply a waste of money to employ more labor than can be handled by the available competent overhead. In addition to other necessary bosses there must be one competent Crew Boss for not more than each ten laborers. To permit laborers on the line in excess of the capacity of the overhead is to make the mistake of fighting a fire with men and money instead of work intelligently directed. (b) Even with perfect supervision the effectiveness per man decreases rapidly after more than one seven- to ten-man crew is employed constructing a line at any one point. Men are in each other's way, and a larger per cent of time must be spent walking.

A safe rule to follow is to calculate the necessary number of men as directed below and then take from 25% to 100% more, provided it is certain there is sufficient competent overhead to keep the average results per man reasonably close to what would be secured by the normal crew.

It is seldom that the time going and returning from the fire and expense of transportation is negligible. The foregoing deals with those rare cases; the following deals with ordinary cases.

2. Forget the conception of fighting a fire. Think of it as a job of constructing and patrolling control line. The difference is vital. True, the idea of fighting a fire has attractive elements; there is in it the heroic, the fun of a game, the taking of chances and much of the spectacular. It also has elements which make for waste and inefficiency. Fire suppression, regarded as a rush job of constructing a special type of trail, is without glamour; but this conception makes

for construction of held line with the speed and efficiency which would exist on a rush trail job. This is what is desired.

3. Deal with a suppression job in two parts: (a) corralling and (b) patrolling.

4. Deal with labor on a control line in terms of the arbitrary suppression man-day, consisting of eight hours of paid labor.

5. Deal with the size of a job in terms of miles or fractions of a mile of held line necessary to corral a fire. Include roads, ditches, bare ridges or dead fire edge which surround a fire when corralled, even though not worked by the crew.

6. For each locality fix a standard number of hours during which it should be planned to corral a fire. As an average District standard eight hours should be allowed from the beginning of construction to the completion of the control line, unless modified by the Suppression Financial Policy, paragraphs 5, 6, 7 and 8.

7. From experience, test and calculation determine the number of man-days per mile required to construct and patrol, while being constructed, control lines in different types of country and under varying atmospheric and seasonal conditions.

8. From experience, observation and test determine what length of control line will be required by a fire which is corralled eight hours (if that is the corralling time adopted) after the work is started. Travel time must of course be taken into consideration in calculating the length of control line necessary, eight hours after the first work is done.

9. Having the above, the process of fixing the number of men may run as follows:

"It is 2 p.m. and hot, with but little wind. It will be 4 p.m. before the fire is reached. Eight hours later will be midnight. The fire will spread rapidly until evening and then slowing till midnight. From observations on other fires I judge that this fire will cover about 160 acres by midnight and that will require about two miles of control line. It will take about ten man-days per mile to corral where that fire is, and since the fire will require about two miles of held control line it will need twenty men."

Or:

"That fire will be reached at 2 p.m. Fire spreads slowly in there and at 10 p.m. it will not exceed five acres. Control line is easy to construct there and does not require over eight man-days per mile. One-fourth mile of control line will surround the fire, so I need one man only to follow me."

Or:

"I cannot reach that fire before 7 p.m. The country is too rough to work after dark. I can only get in two hours' work tonight, but I can start again at 4 in the morning. It is an 8-hour trip to get to the fire, and I want to avoid the expense of transporting any men and grub not actually necessary. There is no danger of a rapid spread of fire there, so I can give myself all day tomorrow to corral the fire. If we work on our nerve tomorrow we can't stand more than 12 hours of it, so that if we begin at 4 a.m. the control line must be completed by 4 p.m. With 2 hours this evening and 12 hours tomorrow I have 14 hours in which to corral the fire. The lookout reports the smoke as small and there is no wind. In that country the fire should not exceed 40 acres by 4 p.m. tomorrow. One mile of control line will therefore be required. Line in there ought to be built at the rate of ten 8-hour man-days per mile. The job therefore requires 10-man-days to corral, but each man is good for 14 hours or 1 3/4 man-days. Six men can deliver 10½ man-days in 14 hours (6 x 1 3/4), so I will want five men besides myself for line work. I will need a cook and horse wrangler in addition."

The method is probably too elaborate to be applied in detail by the Dispatcher after the fire is reported to him. It can, however, be made the basis for careful advance estimates of the proper number of men to send to fires in different types of country and under different conditions of wind, heat, etc.

In order to fix the number of men required for any fire job there must be an estimate of (1) the rate at which the work can be done, (2) the extent of the job, and (3) the time in which it must be completed. The proposed method eliminates wild guessing at these factors in a bunch and substitutes a process of isolating each element of the problem and applying to each the best knowledge and judgment which can be brought to bear on it.

From experience to date it is most useful to exclude cooks and transportation men in computing the man-days of labor per mile of held line. All others should be counted—Bosses, laborers on construction and patrol (until the control line is completed), messengers on the fire, water bucks and lunch carriers.

Except in rare instances the number of men sufficient to corral a fire is sufficient to patrol and hold the completed line. If the completion of the line requires labor so exhausting and prolonged that later patrol requires fresh men these can ordinarily be sent for during the construction of the line.

On lightning or other fires which are certain to be easily controlled with not more than one-quarter mile of line, one man is sometimes sufficient. In all other cases the first man should always be followed by at least one other man.

In average country the construction of a mile of held line should not require more than ten man-days, if reasonable efficiency is attained. The fact that from 16 to 50 man-days per mile are often used calls for more effective use of labor, and as a general rule fewer men should be employed.

While the method of deciding how many men to send to a fire is a matter requiring time for careful study, the actual decision must be made within a minute or two, which is all a qualified executive requires for a correct decision when he knows what he is doing.

After the number of men is settled the next questions are tools, equipment, grub and transportation.

The Getaway

Notwithstanding all that has been said on the subject, the getaway frequently discloses a lack of preparedness and a disregard of the value of speed. It should be a universal rule to prepare for and require the utmost reasonable getaway and travel speed in getting at least one man to a fire. It is nearly always possible to get one man to a fire much sooner than a party can reach it. The only acceptable reason for less than the maximum speed by the one many is that automobile transportation is possible and it is decided that the fire will require the services of at least one automobile load. In that event it is sometimes better practice to permit a little delay in the getaway of the first man in order that the automobile shall not make the run with less than its normal load.

There is always danger that something may be left behind in the hurry of the getaway. There are eleven things to be thought of when a fire is reported, and all but the last three should be provided for every fire. Committing these eleven things to memory will insure against forgetfulness and inefficiency by the Dispatcher or any man who may have to start out a crew from a fire camp. They are:

1. Men
2. Tools
3. Sharpeners
4. Water Containers
5. Bunches
6. Grub
7. Lights
8. Transportation
9. Cook
10. Utensils
11. Bedding

When everything is ready for the start the Dispatcher and the Fire Boss should briefly check over the plans and instructions to make sure that every foreseeable contingency is provided for and that there is no misunderstanding on any point. This last conference is unnecessary if the Dispatcher is also going to be Fire Boss, but it should be clearly understood that the functions of the Dispatcher and the Fire Boss are entirely distinct. Each has definite authority and responsibilities which do not overlap. The Dispatcher is in charge up till the moment of the start to the fire, after which the Fire Boss is in command. The Dispatcher may consult with the selected Fire Boss when deciding how many men to send, etc., but the responsibility for right decisions and prompt action rests squarely on the Dispatcher. After the start, neither the Dispatcher nor any other officer should meddle or take any action, except in accordance with prearranged plan or under instructions from the Fire Boss.

Travel Time

There are still a few men who do not recognize the imperative necessity of the utmost practicable speed in going to a fire. When a flatfooted walk calls for all the power and endurance a horse can put forth without injury, that gait is permissible; otherwise a faster gait is expected.

Knowledge of the country and the fastest routes of travel is essential to speed and economy of effort.

The First Man at the Fire

No matter who is the first man to reach a fire he should always remember that there are three things to be done and done in the following order:

1. If possible, determine the cause of the fire and if caused by human agency make a rapid search for evidence of how and by whom the fire was started. Tracks, abandoned camp fires and other evidences of human activity bearing on the fire should be noticed quickly but with all the power of observation the man can bring to bear. If any fresh clue of this kind is secured, but circumstances demand that the man's attention be given first to the suppression of the fire, great care should be used to preserve the evidence for future use. More headwork in determining and dealing with the causes of fire will slowly but surely decrease the amount of strong back work required to suppress fires.

2. After the foregoing task has been disposed of, the next thing is to size up the fire. Ordinarily this requires a trip around the edge of the fire, but this may not be necessary if, because of the smallness of the fire or the lay of the land it can be seen just where the fire has gone, what it is going into and what it is doing. Furthermore, when the first man knows he must meet and take charge of a crew or must furnish

needed information to the Boss of an incoming crew, it may be necessary to dispense with a complete sizing up of the fire in order to connect the partial information secured with an incoming crew.

3. The third task is to control the fire. The first man should stay with the fire after reaching it unless the circumstances dictate that he should leave the fire to follow up a clue as to its cause. Except on lightning or other easy fires, which it is certain one man can handle without help, the first man should regularly be followed by at least one other man, so that it will never be necessary to desert a fire to go for more men or supplies, or stop work after a fire is once reached. Time is sometimes spent running back and forth for help, grub and tolls which, if applied directly, would deal with the cause, size up the fire and control it without help.

Where to Camp

Camps should be convenient to the control line rather than on water or level ground. As much as 30 per cent of the energy of a crew is sometimes wasted going to and from wrongly placed camps. It is cheaper and better practice to have water bucks pack water to a camp than to have a whole crew wear itself down packing only a few pounds of moisture under each man's belt. As many camps should be established as may be necessary to serve all the men on a fire. As a crew pushes a line ahead on a big fire, a camp should be kept close behind it if the country is rough.

Communication

Except on small, easy fires, communication between the fire and the outside world is desirable. The Fire Boss may need to send for more men, tools or supplies. The District Ranger's office, the Supervisor, the District Forester, and sometimes the Forester need to know the facts if a fire grows in size or difficulty. The means of communication should be fitted to the circumstances. Often permanent telephone lines may be tapped if portable phones are at hand. Message should be sent by packers and other men going and coming from a fire. Fire Bosses should train themselves to the habit of frequently scribbling notes reporting progress and prospects on the fire. Most men find this difficult because their minds and time are absorbed with the handling of the fire. Some effort is required to form the reporting habit, but its usefulness more than repays the effort. Men should be taken from control line work without hesitation when there is no better way to accomplish needed transmission of information or orders.

An emergency wire telephone line into the main camp is a great convenience, but is so seldom needed that it does not pay to equip every Ranger District with emergency telephone outfits.

Organization at the Fire

It is important first that certain basic principles be recognized. The organization on any fire must be fitted to that particular fire. Furthermore, during the process of suppression the organization must be constantly adjusted to the changing requirements. The functions of various overhead agencies need to be clearly defined and every Forest Officer should be familiar with the duties of each position, so that when the Fire Boss directs a Ranger to act as Quartermaster (for example) the man selected knows without being told just what his duties, responsibilities and authority are.

It has been found that to go further than this and create a preliminary paper organization, specifying the men who shall fill each position on a paper fire, is to do important organization work in the wrong way and at the wrong time. Preorganization should furnish the Fire Boss with plenty of competent men who know the different overhead functions around a fire, but to weld these units into a suppression organization is a duty which can be properly discharged only at the time of the fire and by the Fire Boss. To attempt to relieve him of this duty serves merely to cramp him by overorganization.

Sharply drawn lines of authority and responsibility and military discipline are inseparable in successful fire suppression, and it must be remembered by all that the lines of authority and responsibility on a fire do not necessarily coincide with the lines drawn for other work. A district Ranger Fire Boss may be removed only by the Deputy Supervisor, Supervisor, or by order of the District Forester. Until he is removed, every man working on the fire, from temporary laborer to District Forester, is expected to follow orders from the Fire Boss and follow them implicitly and without argument. Failure to do so will be regarded as insubordination.

When practicable, lines of authority on a fire should be closely observed, and orders given to the proper officer rather than to his subordinates. This is not always expedient, because it may be necessary for the Fire Boss to

give orders direct to a Crew Boss or Patrol Boss. It is seldom necessary, however, for anyone other than the Crew Boss to deal directly with the members of his crew. Just as far as possible the seven to ten-man crew should be the unit of organization.

The suppression overhead officers, one or all of whom may be required, are as follows:

Fire Boss
Quartermaster
Division Bosses
Patrol Bosses
Crew Bosses

Duties of Suppression Officers

Fire Boss

On difficult fires the quality of the Fire Boss's work very largely determines efficiency. Superior head work on his part may easily equal the result-getting power of all the laborers on the job, while by losing his nerve or failing to think straight or give orders clearly he may be responsible for slips requiring the labor of hundreds of men to catch up. He is responsible for results, and everyone working on the fire is responsible to him directly or indirectly.

On any fire, big or small, it will be his duty to formulate a definite plan of action. He must decide just how all work should be done and when. He will be expected to issue orders in sufficient number and with sufficient detail and clearness to insure the carrying out of his plan. Work not done in reasonable conformity to a definite plan and orders from the Fire Boss is a sure sign that the Boss is not big enough for his job. In formulating his plan the Fire Boss should ask or refuse to listen to advice or suggestions from anyone, as he may think best.

He will spend as much time at the control line and around the fire as may be necessary to ascertain through his own senses what the fire is doing, how the work is going and how the work should be applied. No system has been or probably will be devised which will collect and transmit information with even reasonable accuracy to a Fire Boss located away from a fire. In order to plan and direct effectively, the Fire Boss must see with his own eyes, hear with

his own ears, and even occasionally with his own hands. This usually requires that he spend much of his time traveling around the fire. When fires get beyond a certain size it is obviously impossible for the Fire Boss to see everything at close range, but he should travel as much and see as much as he can without excessive demands upon his physical powers. On such fires it is sometimes good practice for the Fire Boss to spend a large part of his time on some commanding point crossed by the control line from which he can see all or the greater part of the fire. Under no circumstances should he take a permanent position in an office or even in the main fire camps.

He should keep the Quartermaster as completely informed and instructed as circumstances require or permit, so that the Quartermaster may act intelligently on matters which must be decided without references to the Fire Boss.

Without an adequate messenger service, the Boss of a big fire cannot travel as he should and at the same time deliver orders and information which will keep everything moving in accordance with his judgment. Regardless of the number of men it takes, the Fire Boss should use as many messengers as he needs. On big jobs, messages should ordinarily be in writing, and for the protection of everybody these messages should be preserved and filed with the other records of the fire.

On small fires, the Fire Boss should work with his hands as well as his head. Ordinarily, he will set the pace for the crew. If the size of the fire and the crew increases, travel and supervision make increasing demands on the Fire Boss's time and strength. Necessary head work and travel should never be interfered with by manual labor, no matter how important the latter may seem. Furthermore, a big fire should never find the man in charge unable to function properly because he has exhausted himself by manual labor on the fire while it was small. When a Fire Boss is sick or all in from overwork or loss of sleep it is a confession that he has made serious miscalculation or is too small a man for his job.

The Fire Boss should have as many men for assistants or relief as he thinks necessary. By avoiding waste of effort, a seasoned man can work from 14 to 16 hours a day and still be at his best. On a long job there is usually from eight to ten hours each night during which the man in charge needs to do a little because work or patrol is running smoothly under instructions issued the evening before.

It is therefore seldom necessary to have a night man alternating with the Fire Boss, and this is fortunate because the transfer of authority usually makes for complications. On the other hand, the Fire Boss may need several assistants during the day or night. A Supervisor in charge may do well to keep an experienced Ranger always by him for counsel, or a Ranger in charge may wish to keep the Supervisor with him constantly for the same reason.

Quartermaster

When the size of a job requires it, the Fire Boss will appoint a Quartermaster who will headquarter at the main camp. The Quartermaster is next in authority and responsibility to the Fire Boss and should be a man of judgment and experience. He will be a permanently located and immediately accessible representative of the Fire Boss, and will act on all matters requiring the latter's attention when immediate action is necessary and the Fire Boss cannot be reached without delay. The Quartermaster should also relieve the Fire Boss of as much work and responsibility as he can carry without danger of departing from the plans of the Fire Boss.

In addition to his duties as a representative of the Fire Boss, the Quartermaster will be in charge of any of the following activities which must be carried on:

1. Ordering, transportation, and cooking as may be necessary to provide the men with grub, tools, and equipment at any point on the control line.

2. Keeping of any necessary records, including time records when time is kept from one or more camps instead of by Crew Bosses.

3. The commissary and all stores for issue to the men.

4. Communication.

Ordinarily, after a job has lasted a day or two but few men will be coming to the main camp for meals. One of the important duties of the Quartermaster will be to organize cooks, grub, and pack sack or other transportation, so that as crews get more than a half-hour's travel away from the main camp a sub-camp can be kept on the control line right at the heels of the crew or bunch of crews which may be working together.

The Quartermaster should make the main camp his headquarters, but he may need to travel frequently around the

fire or to points away from the fire, when the presence of the Fire Boss in the main camp will permit him to leave.

He should be furnished with as many competent assistants as he may need.

Division Bosses

When the size of the job requires it, the Fire Boss will appoint Division Bosses to take charge of all activities on a definite section of control line. Ordinarily, not more than two Division Bosses will be required – one for each side of a fire. Fires do occur, however, where there should be a Division Boss for the rear, one for each side, and one or more for the front. When Division Bosses are required it usually will be necessary to have two for each section of line, one for day and one for night.

Patrol Bosses

The Patrol of constructed line is not only of sovereign importance but the nature of the work requires continual shifting of men. Whenever the length or difficulty of a line makes impracticable for the Division Boss to give adequate personal supervision to both line construction and patrol, a Patrol Boss will be appointed. He may be a Crew Boss directing his own crew only, or he may have several crews under him each with its Crew Boss. It will be his duty to personally direct the patrol of a section of completed control line between two definite points or between a fixed point on one end and the construction crew on the other.

No work on the control line calls for higher skill than that of the Patrol Boss. Perhaps the greatest wastes in fire suppression are due to either excessive or insufficient patrol. The requirements are constantly changing, and the best of fire-fighters may easily go wrong in estimating the present or future power of a fire. Ordinarily, the Division Boss should make frequent trips over the completed line even though a Patrol Boss is employed.

In addition to clear head and plenty of nerve, the Patrol Boss should have an excellent pair of legs because he must travel almost constantly.

Crew Bosses

Ordinarily, a crew should number from seven to ten men. Under some circumstances, a Crew Boss can handle more than ten men, but the number should never be larger than will

permit close supervision of each laborer by the Crew Boss. While the Crew Boss should work with his own hands, his more important duty is to see that the men under him keep at it and do their work right. Many Crew Bosses fail because they dislike to give orders. A few well-placed words of instruction by the Fire Boss or a division leader may have an important influence on the Crew Boss's work. If necessary, he should be told in a clear but courteous way.

1. To follow instructions.

2. To rest his men five minutes out of every half-hour and see that they keep going the rest of the time.

3. To see that his men do what he wants them to do and in the way he wants it done. Orders are usually most effective if preceded by "will you" or "it is better to do it this way" or "the Boss wants us to do it so and so".

4. To work himself as much as his other duties will permit, setting the pace when he is working.

5. To keep his crew together and stay with them – eating, sleeping, working with them and keeping their time unless he has been definitely told that it is being kept by a camp timekeeper.

Forest officers, if competent, should be used as crew leaders as long as they last. Class A men come next, and should they be insufficient it is always possible to pick the most promising men from a bunch of laborers.

Where to Begin Work

Some of the worst failures in the history of the District have been traceable to starting work at the wrong point. The controlling laws and principles are no more difficult to determine in this plan in other similar fields which have been explored and charted. The discussion which follows is not the last word, but expresses what has been discovered by recorded experience to date. No man will be held responsible for failures arising from intelligent application of the principles laid down; neither is he required to follow them; but he will be held responsible for failures which follow deviation. On the other hand, when a deviation is followed by success, this fact indicates an exception which should be carefully considered and reported to the District Forester. The exceptional case may lead to the discovery of a new principle or an important development of old ones.

The four possible places to start work on a fire are (a) the rear, (b) the front, (c) a point on one of the sides which threatens the destruction of comparatively high values or is approaching an area where control would be comparatively difficult or expensive, and (d) the point where the suppression crew first reaches the edge of the fire. The point for beginning work should be selected in accordance with the following principles:

1. By beginning work at the rear, the danger of losing control line is reduced to a minimum and the main source of the heat and draft of the fire is gradually but effectively withdrawn. When sufficient men are available to make up two efficient crews, work may be started at the rear and pushed simultaneously forward on both sides; or work may proceed from the rear along the side where the greatest suppression cost or damage is threatened and thence continuously on around the fire till the point of beginning is reached. Unless there are clear reasons for doing otherwise, work should always be started at the rear and should proceed along one or the both sides until the control line is connected up.

2. A successful line across the front will often keep down the sum of damage plus the cost of suppression. Work should be started on the front when the three conditions stated below are all found to exist:

(a) When, considering power of the fire and size of available suppression forces, there is a good chance of holding the front of the fire with the proposed line

(b) When by holding the fire on the proposed line there is something clear worth while to be gained – such as lower suppression cost or protection of high values owned by the Government or cooperators

(c) When there is no danger of losing all or part of the proposed line by sprouts from the uncontrolled sides.

3. When more than enough men are available to make up two efficient side crews, a front crew may be started on a detached line across the front, Provided, 2(a), 2(b), and 2(c) above are found to be facts.

4. Occasionally a side of a fire may be found to be threatening to enter a comparatively bad tangle or an area where comparatively high damage or rapid spread will occur.

Work should then be started at this point on the side, provided, 2(a), 2(b), and 2(c) above are found to be facts.

5. Fires, small or on level ground, often have no recognizable front or rear and no point which ought to be worked first under 4. When this is known, work should be started at the point closest at hand. Also where a crew reaches a fire before the Fire Boss or any other competent man has had a chance to size it up or when the fire has no pronounced rear, it is often good practice to start the crew at work on that part of the edge which is closest at hand. Their work may have to be abandoned as soon as adequate information is secured, but there is little to lose and perhaps a good deal to be gained by constructing some line in the meantime. On the other hand, it is sometimes sheer waste of valuable energy to work men before the Fire Boss has had a chance to formulate a plan. The Fire Boss must determine whether it is better to start work immediately or send the men to the shade until he is able to secure a basis for intelligent action.

Continuous Line

To the man who conceives a suppression job as a fight it is discouraging to construct control line along the side of a fire and be unable to keep up with the fire. He is inclined to drop the work on the side and go to the front where more fighting is to be had. With few exceptions this practice results in more burned area, greater cost, and delay in corralling the fire. Failures due to letting a point of fire run are not nearly so likely as failures due to loss of time, strength, and control line on account of running back and forth to fight the more active points of the fire.

On large fires bunches of men are sometimes sent out in different directions each with orders to take a certain road or side or end. It usually requires supernatural powers to get concerted action or a reasonable output of held line per man, following this sort of a plan. It is far safer to concentrate the line construction crews into one, two, or perhaps three, each constructing continuous line, and forget for the time what the fire is doing ahead of each construction crew.

It must be recognized, however, that fires often burn in very irregular shapes and different sections of the edge often present rapidly changing characters. A fire may burn in strips and have several fronts or may be particularly dangerous on certain sections of its edge. The front of a fire may start down hill

and require that work be dropped on the side in order that the front may be checked while it is temporarily easy to handle. Many such circumstances arise which call for construction of detached line, but before a good Fire Boss leaves his continuous line work he will be sure (1) that he can hold the proposed detached line, (2) that there is something worth while to be gained by leaving the continuous line, and (3) that the proposed work will not be made useless by some sprout.

Shifting Men Along the Control Line

When any number of men are bunched on line construction the passing of crews along to new work ahead often becomes an important problem.

The most common method has been designated the hand over hand method. By this method, when a Crew Boss completes a section of line he takes his crew past and a short distance ahead of the crew which has been leading his. Later, he is passed, in the same way, by crews which have completed a link of control line and forging ahead. This method works well except in the densest brush or on steep ground where a crew must stop work while being passed.

Another process is called the one lick method. By this method one man leads and his work amounts to little more than blazing the way. There is no overtaking of the men ahead, and each man as he passes along the line does his share. The last man in the procession puts the finishing touch on the control line by a lick here and there. Any reasonable number of crews can be worked in this way without the waste of time incident to the passing of men as in the hand over hand method. It is difficult, however, to keep a string of men working and moving in right relation to a string of men working and moving in right relation to each other. In theory the one lick method is perfect; in practice it is efficient only when the number of men is small and each man is accustomed to the method.

A combination of these two methods is quite possible. It is called the bore and spread method. A small number of men tunnel into the brush by the one lick method; other crews follow and, working by the hand over hand method, widen and clear the control line to the desired width. These following crews usually can pass each other without the waste of time attending the pure hand over hand method. The bore and spread method has much to commend it, particularly when a considerable number of men must be worked in one construction crew and the control line is

through dense brush.

Nothing in the instructions under "Continuous Line" requires that men be worked so close together that they are in each other's way as they work. Elbow room or ax room must be provided, but this can be done without any necessity for the kind of scatteration which is attended by the dangers of detached line.

Laying Out the Control Line

The location of the control line largely determines the acreage to be allowed to burn and the success or failure of the constructed line as well as the cost to construct. The Fire Boss should always direct the policy to be followed in laying out a line, and when his other duties permit he personally should lay out the line in detail.

When it is proper to begin work on the front, it is frequently good practice to locate the line on a ridge or road or trail some distance ahead of the fire, but with this exception the idea of backing off to a strategic line where a heroic effort is made to subdue the advancing flames belongs more with forest fire fiction and moving pictures than with efficient suppression.

Where a line must be placed on or near the top of a ridge it should if practicable be placed just over the top from the fire side. This usually allows the fire to spend part of its force before it reaches the line and offers a better chance for backfiring if that is to be done.

As a general rule, when work is started at any point other than the front, it is the best practice to keep as close to the edge as conditions permit. The reasons are –

1 – The danger and expense of backfiring is often avoided.

2 – The fire along the control line will become quiet sooner and require less patrol.

3 – Unless the control line is kept close to the edge or successfully backfired, there is always the risk that patches on the inside of the line may remain unburned for some time and then suddenly flare up and develop power which will sweep across the control line.

Exceptions to this general rule should be made –

1 – When the cost of the control line will be materially less if it follows an easy ridge, road, trail, ditch, creek, or other natural line near the edge and it is certain that this line can be held by backfiring or otherwise.

2 – When the length of control line can be materially decreased by cutting off and backfiring unburnt patches or bottle-shaped pockets and it is certain that the backfired line can be held.

3 – When a fire is burning down a slope so steep that a gutter trench will not catch the rolling fire.

Logs, treetops, snags, stumps, or any debris which will make a relatively hot fire should be left outside the line whenever possible. Often when the line cannot be run conveniently between a snag, etc., and the fire, it can be prevented from catching fire and making trouble by constructing a clean wide fire-trail around it.

The Fire Boss or Division Boss should prospect ahead of the construction crew and know the ground and cover far enough ahead to avoid mistakes in the general direction and location of the line. One of these officers or a Crew Boss should always be with the construction crew and determine the location of the line in detail. Sometimes it pays to keep the location of the line blazed ahead of the construction crew.

When a fire is burning down a steep slope it is frequently next to impossible to hold a control line on the slope and parallel with the contour of the country. If rolling fire too large to be caught by gutter trenches may be expected, the line may be run at right angles to the contours until a creek or other depression is reached which will catch and hold the rolling fire. There is an important knack in laying out these and any other lines which run at or close to right angles with the contour of steep ground. Wherever possible, such lines should not run straight up and down the hill but should incline a trifle to one side so that as fire rolls and bounces down along the control line it will tend to roll farther back into the fire.

A control line along the bottom of a ravine should be placed a few feet up from the bottom and on the side opposite the fire whenever this is necessary to prevent rolling fire from crossing the control line.

Strength of Line

Two Principles can be laid down:

1 – A standard of strength of line should be adopted by the Fire Boss, and every feet of line should be made to conform as nearly as practicable to this standard.

2 – The standard of strength should be just sufficient to hold the fire if given reasonable patrol after construction.

It is useless to prescribe in feet or inches any width of right of way or width of fire trail. Such standards divert attention from the essential factors, which are the power of the fire and the resulting necessary strength of line. Width of right of way, depth and width of fire trail, shape of fire trail, must vary constantly with variation in slope, nature and density of cover, wind, heat, time of day, backfiring, plans, etc., in order to give each foot of line an equal chance of holding.

If the number of men engaged on a line varies materially the strength standard must be changed because a two or three-man crew will construct line with less variation in strength than a ten or fifteen-man crew. In order to bring every foot of line up to the adopted standard, a ten or fifteen-man crew must be directed to make a line a little stronger than just sufficient, in order to allow a margin of safety. There is one alternative method which has much to commend it; the large crew may be directed to make the line of just the degree of strength adopted as standard and then the Patrol Boss or some other competent man may be given sufficient help to enable him to find and make safe the places which a crew of any size will inevitably leave below standard.

It is sometimes a good risk to push a weak line rapidly and take a chance on being able to get back and make this line solid as points of fire burn up to it. This should not be done unless there is something definite and worth while to be gained by taking the chance and offsetting the loss of time and strength in traveling back and forth.

For a ground fire which is not throwing sparks, the right of way should not be wider than sufficient to enable men to get through and work on the fire trail comfortable. If there is any dead brush along the line, there must be frequent patrol to catch the sticks which will burn off at

the bottom and cause trouble by falling across the control line. The fire trail on such a fire need be no wider than is necessary to get a continuous clean line of mineral earth permanently exposed.

Walking along the line tends to pull litter in on the clean fire trail, and there must be width enough to allow for this.

For a crown brush fire, the right of way must be sufficiently wide to prevent the flames from reaching anything inflammable as they over the control line. It is often well on such fires to cut the right of way wide enough to enable patrol men to dart by a flaming spot when after a spark which has fallen across the line.

On a fire which throws sparks it may be worth while to cut the right of way from five to ten feet wide, particularly in brush so dense that patrolmen cannot see or get onto sparks as they fall beyond the right of way. It must be remembered, however, that any fire which is sparking badly is almost sure to throw sparks beyond the limits of any possible right of way. It is often better practice to cut a comparatively narrow right of way and then when the danger comes place a number of patrol men at various distances from the line to watch for and jump on sparks as they fall. Spark troubles are largely avoided by starting work at the rear and working close to the edge of the fire.

Unwarranted variations in the strength of the control line are common causes for fires that "get away". When an unusually thick patch of brush is encountered, the right of way needs to be wider than through the easy going.

Failure to dig clean through rotten wood is a frequent cause of trouble. The fire trail should be extra wide and extra clean in such spots, no matter how much work it takes. Rotten wood and stumps and logs on the green side of the line should be covered with dirt when there is any danger that sparks will reach them.

Without exception, when a control line must be run on the hillside below a fire, a gutter trench should be used. A gutter trench made with one cut of a hoe has more strength than a fire trail three feet wide without the gutter – and the gutter trench is much easier to build. When shovels are the only available tool for making gutter trenches, men should be shown how to stand with backs to the fire and use the shovel as a spade. Often, two motions – one downward push with the foot and one backward push on the handle –

will turn out a furrow which looks somewhat like a furrow plowed in sod and does the business perfectly on moderate slopes.

Rolling fire can be prevented to a great extent by swinging logs and large sticks so that they lie at right angles to the contours. When practicable, it is often worth while to dig graves and bury big logs and chunks which may roll and cannot be handled otherwise.

No standing snag or hollow or inflammable tree between the fire's edge and the control line should be allowed to catch fire if it can be prevented with reasonable effort. When it is seen that such a snag or tree cannot be prevented from catching fire it is often good practice for the construction crew to take time to cut it down.

The Fire Boss must keep constantly under his eye and in his mind the varying power and character of the fire, and out of an infinite number of possible methods of work and types of control line must select those which in his judgment will produce nearest to the necessary strength of line. On stubborn fires or where there is much at stake he may properly make sure of success by exaggerating greatly the width of the right of way or fire trail or adopting other special measures. Possible tactics under different circumstances can and should be thought out and discussed at every opportunity, but in action the Fire Boss must simply draw on his stored knowledge and skill. Fires cannot be fought by a blue print.

Backfiring

Backfiring is expensive, and for that reason it is desirable to avoid the necessity for it by placing the control line so close to the edge that no backfiring is required. This is frequently inexpedient, however, and the possibility of backfiring arises.

Backfiring is generally discredited, but this is due to the experiences of misuse. Properly used, it is a method of great value and no more dangerous than starting work on the front of a fire.

Backfiring should never be resorted to in brush when the backfire burns down hill as a light surface fire leaving the crowns of the brush to feed a crown fire which may rush up hill and cross the line later. Ordinarily, the control line is wrongly placed when there is any occasion for such backfiring.

If the line is started at the rear and close to the edge, the entire fire may usually be corralled without need for such backfiring. If for any reason it is necessary to construct a line some distance up the hill above a fire, and down hill backfires cannot be made to take hold and burn clean, try setting backfires down in the brush from ten to a hundred feet from the control line. If this will not work, then the control line might as well be abandoned at once and a better location selected. A chance to backfire up hill may often be secured by properly laying out the control line.

Backfires should never be set in timber or brush except from a natural or constructed control line.

Backfires often fail to work or become a positive menace because set at the wrong time of day. A hot backfire is not necessarily anything to be afraid of. If the wind is right and backfires are necessary at all, the heat of the day is the best time, particularly if there is any danger that backfires may not take hold when it gets cool. Timidity is often responsible for failure to backfire when backfires are necessary and safer than not to backfire. When the wind is wrong it is desirable to delay backfiring, but even under these conditions it is better to start and attempt to hold backfires than to attempt to hold a powerful main fire.

On the other hand, backfires are dangerous tools. Their use calls for a combination of experience, caution, nerve, and intelligence. Only experienced men should be allowed to set backfires. Generally speaking, no backfiring will be undertaken without direct orders from the Fire Boss; he may order this done under the immediate direction of a Division Boss, a Patrol Boss, or one or more Crew Bosses. Amateurs usually do more harm than good.

When the fire is too hot or running too fast to permit placing the control line close to the edge, it is usually necessary to backfire any strip left between the control line and the edge, in order to give the control line the necessary degree of strength.

The danger that a fire line will be crossed by a backfire is usually greatest just after the backfire is started. Therefore, when practicable, backfiring should be done before the construction crew get far ahead, in order that necessary help to control a break can be secured from the construction crew without delay or unnecessary travel. Backfires can be set close after a construction crew which is

working down hill, but it is necessary to be very cautious when the control line is progressing up hill. Backfires may gain power and sweep up the hill and lap across the control line, or even burn on ahead of the construction crew. If there is time it is safer to wait till the completed line reaches the top of the hill and then backfire from the top down.

Fire draughts often can be taken advantage of in backfiring. A strong wind from the west on a control line will become a strong draught to the west when a hot fire burns to a certain point west of the control line. A skillful man may use this fact to backfire successfully directly against a strong wind. Often a hot fire started between the control line and the fire will serve to draw backfire heat and sparks in the desired direction.

Everyone has seen backfiring done with safety and effectiveness after experienced men declared backfires to be folly. On the other hand, everyone knows of backfires which have made more trouble and expense than the main fire. There is a lack of exact knowledge and experience in the use of the power of fire as an aid in suppressing fire. There is need to replace unreasoning fear and suspicion of backfiring with exact knowledge of what a backfire will and will not do and how it may be used to advantage under varying circumstances.

Throwing Dirt

Like backfiring, Throwing dirt is a method most useful but often abused. When a fire is so hot as to threaten to cross a control line it can be deadened and regulated by throwing dirt. A brush crown fire of considerable power can be checked in the same way if the heat will permit getting within throwing reach.

On the other hand, it is a waste of time to throw dirt on the edge of a fire in lieu of a proper fire trail. Throwing dirt in this way is responsible for many fires that “Jump the line”.

Use of Water

When water is convenient it may be used to advantage in a number of ways. It is particularly useful in putting out fire in standing trees, logs, and stumps. Fire extinguishers and hand pumps may sometimes be used to advantage

when they happen to be available.

Experiments with water pumping and transporting apparatus have not as yet shown them to possess sufficient value to warrant any stock of such equipment.

Feeling for Fire

On nearly every brush fire some section of the edge will be wholly or partly out by the time the control line reaches it. To take advantage of dead fire edge keeps down suppression cost and greatly increases rapidity of line construction. Such places are very deceiving, however, and many failures are due to more specks of live fire unobserved when the section of dead edge is worked.

There is only one right way to work dead or partly dead edge. An experienced man is required, and he must be willing to crawl into the most difficult places. Where it is not absolutely certain that the fire is entirely out, the hand must be used to feel along the edge of the fire. If this is done in a workmanlike manner no live fire will be overlooked and left to make trouble later. Any spots of live fire should be corralled by an extra strong control line each end of which connects with dead edge.

Systematic Resting of Men

It has been scientifically demonstrated that on certain kinds of hard labor men accomplish more if rested for definite periods at regular intervals. No investigation has been made to determine the proper rest period and intervals between rests on suppression work. No research is necessary to know what systematic rests should be practiced regularly. In the absence of exact information it may be said that men should be rested five minutes out of every half-hour, and Crew Bosses should be so instructed. "Take a five" is a well-known expression on log drives and other exhausting work and may well be adopted as the regular method of telling a suppression crew to rest until the Crew Boss says "All right, fellows."

In addition to being scientifically right, systematic resting has another important quality. By ordering definite periods of rest, the Crew Boss strengthens his hold on his crew and has a much better chance to get from his men hard steady work for the other twenty-five minutes of the half-hour.

Day and Night Work

Night work has the following advantages:

1 – Heat of the fire is less and it is easier to work close to.

2 – The air is cooler and men do not sweat so much or drink so much water.

3 – A chain of line tonight may prevent the necessity of a mile tomorrow.

4 – Sparks across the line may be more easily detected.

5 – Favorable night winds may sometimes be taken advantage of.

Its disadvantages are:

1 – In the absence of strong moonlight the work and walking must be done without light enough to see well even with lanterns or other artificial lights to supplement the light of the fire. This means waste of effort and danger of leaving weak places in the control line.

2 – Men usually have worked the day before or if they rested they did not sleep properly. Daytime is the normal time for work. A tired, sleepy man is not much use.

3 – It is easier for men to hide out or soldier.

4 – More can be accomplished often by working on till pitch dark comes, sleeping till an hour before daylight, and starting work with fresh vigorous men at the break of day. The power and heat of a fire is at the lowest ebb from 1:30 to about 5 a.m.

5 – In rough country it is dangerous to the men.

Night work is often necessary, but it is seldom profitable unless

1 – The men are fresh or have been rested during the preceding afternoon or evening, and

2 – There are plenty of lights or good moonlight, and

3 – There are plenty of rested Bosses to keep up enthusiasm and keep things moving, and

4 – The ground is level enough to permit night work without danger to men.

Night patrol is usually necessary but it must be managed with great care. Waste of strength and money is very easy. The men should be selected with discrimination. Many men who do well in a construction crew cannot be trusted to keep moving and alert on night patrol. The most trustworthy and strongest-willed men are needed, and they should be rested before going on duty and each man should have a section of line or a particular point for which he is held responsible.

Men often desire to go on night construction or patrol because they can roll up a large number of hours and at the same time so manage their work at night that the strain will not be distressing. This should be closely guarded against. Any ordinary man is ready to drop with fatigue at the end of twenty-four hours of real work on a control line. If he is worked that long he should be in a state of indifference to time or money or anything but sleep and rest.

On long jobs any night men should be rested during the day. Double shifts should be avoided.

Reorganization When Control Line is Completed.

When the control line is completed the natural tendency is for everybody to breathe a sigh of relief and watch the fire and take it easy. This is where the Fire Boss must act.

The completion of the line can be anticipated always, and the Fire Boss should have his plan perfected and orders delivered or ready to deliver when the fire is corralled. It may not be wise to lay any men off at once or even to let any men go to camp, but when the line is connected up there should be an immediate redistribution of men around the fire and everyone not exhausted should be set to covering up fire, cutting snags, etc., as well as patrolling and watching for sparks.

As time elapses after completion of the line the need for patrol and the danger of trouble should be carefully gauged and constant adjustments made as the fire quiets down.

While men should be laid off as rapidly as possible, it is short-sighted economy to take any unreasonable chances. All the men retained, however, should be kept at work. Men simply patrolling should be given definite beats of sufficient length and required to keep moving. Time not required for patrol should be spent working inward from the control line smothering or burying all live fire.

Patrol of Control Line

In the computing the amount of labor required to corral it is necessary to lump line construction and patrol up to the time when the control line is completed. Men must be shifted constantly from construction to patrol, and the reverse, and it is impracticable to keep the record of labor on each activity separate. After the control line is completed, all the remaining work on the fire is properly regarded as patrol.

Patrol both before and after corralling is, however, a distinct activity of great importance and both divisions will be discussed together.

Successful patrol has two prime essentials:

1 – Supervision by a Fire, Division, or Patrol Boss who knows what is and what is not necessary and who has the capacity to express his knowledge in suitable shifting and control of men and work.

2 – Men who have an eye for smoke, and the physical and mental power to keep moving.

When the construction crew has completed a certain length of line, one man should be detailed to patrol that section. The length may vary from a few rods to a mile according to the power of the fire, the strength of the line and the amount of backfiring, snag cutting, etc., to be done. The ends of the patrol beat should always be definitely fixed, although the front end of the beat just behind the construction crew may be a moving point such as the last man in the construction crew.

As the fire dies down the first patrolman can handle a longer beat, but the new line being completed requires the detail of more patrolmen. Constant watching and adjusting are necessary. Without close supervision serious waste is certain.

The length of a patrol beat should be determined by the frequency with which the beat or any part of it should be inspected. If a beat should be watched constantly it should be no longer than can be seen from one point to the beat. In such a case the patrolman does not need to walk but he must use his eyes continually. No matter how inflammable the cover may be, if a spark is seen as it lights and a patrolman can reach it within a few seconds there seldom needs to be a break.

If a section of line should be inspected every five minutes, make the beat long enough to require five minutes of slow walking or climbing as the case may be.

When a fire needs only two inspections a day, a patrolman can handle several miles of line if the going is at all reasonable.

The length of beats must be modified more or less to allow for any work required inside the line and also sometimes to provide sufficient men to handle a break without leaving other beats unwatched.

Men should seldom if ever be allowed to bunch two or more in a place. If the fire is dangerous, use plenty of men but keep them separate. Story-telling contests are less likely to occur, and furthermore one man can see about as much as two from a fixed point but two men stationed a chain apart can each keep their eyes busy to good advantage.

Signals should be arranged so that needed men can be summoned by the use for lungs instead of legs.

Snag and tree cutting may or may not be left to the patrol force. Circumstances should control. It is perhaps better practice to have such work done by a special gang as construction progresses or after it is finished. Patrolmen should always be required to work any stumps, logs, or other work designed to strengthen the line but which can be done to advantage by one man. Such work breaks the monotony and strain of walking back and forth.

Saws should be a part of the equipment when any amount of snag or tree cutting is expected. Powder may be used if a supply together with a man who knows how to use it happen to be available.

No matter how solid a line may seem it should not be left without regular and systematic patrol. It should be covered once a day at the very least.

When the fire is thought to be entirely out and it seems useless to keep anyone on it longer it should be inspected for one or two days longer it should be inspected for one or two days longer for good measure. Someone will be held responsible for any fire which gets away because the fire was left too soon without any patrol.

Care of Men

Observance of the following principles is necessary to safeguard the men on a fire.

The safety of all men engaged and any settlers or travelers concerned should always be in the front of the minds of all officers from Fire Boss to Crew Boss. It is the especial duty of the Crew Boss to keep his men together and look out for their lives and welfare under all circumstances.

There is always danger in front of a crown fire in either brush or timber. Timber crown fires are rare, but when one starts it is necessary to be sure that the men can be gotten away. It is not dangerous to work in front of a brush crown fire if close to the end of a control line which is not in danger of being swept over. The chief danger is being caught in thick brush or a pocket of rocks without any easily passable way out.

The only danger in the rear of a fire is from rolling rocks or logs. This is a serious danger, however, in precipitous country.

There is no danger on the side of a fire if reasonably close to the end of a control line which could not be swept by sudden change in the wind.

There is never any danger on any side of a ground fire unless there is danger that it may suddenly become a crown fire and excepting the danger of rolling rocks and logs and falling trees.

The following signal will be adopted for use by Forest officers in this District:

A series of shots, generally the gunfull, as close together as possible – "The fire is in dangerous condition. Run!"

A police or other sharp-toned whistle may be used for this purpose. Furthermore, if the Fire Boss considers it

advisable under the conditions, he may arrange with Division of Crew Bosses a simple system of whistle calls to facilitate quick movement of men along the line.

Time-Keeping

Time should be allowed for travel to the fire from the point where men were hired or from the point from which men started to the fire, if they come under general agreement. Time spent in town awaiting the gathering of a crew should not be included unless men are held waiting through no fault of their own.

Time should be allowed for travel from the fire to the point started from, but no time for returning travel should be allowed if the man leaves without the approval of the officer in charge and before the job is finished or if dismissed for inefficiency. A time limit should be set for the trip between the fire and the various sources of labor supply, taking into consideration whether the men walk or ride, and this time limit used for all men coming from the same place.

At the fire, pay should be allowed only for time men are actually at work or going to and from camp to their work. Time spent in camp should not be allowed. Beyond one hour no time should be allowed when men are rested on the control line, unless it has been decided advisable to hold them as reserves pending a probable emergency call. Under such circumstances their time may be paid for, even though they do little or no actual work. It should be clear, however, that the men are held because some competent Boss deems it necessary. No time should be allowed when men hang around on the line after they have been told to go to camp or lie down and sleep.

When men furnish horses or other means of conveyance to the fire, payment should be made for the use of such animals or vehicles as a separate matter. Such services should not be covered by allowing additional firefighting time.

Time should always be kept on the looseleaf notebook time report form. Forest officers who may have to act as Fire Bosses should never be without a supply of these forms during the fire season.

On small jobs the Fire Boss should himself keep the time. As the number of men increases, other arrangements must be made. Time may be kept by the Quartermaster or an

assistant to the Quartermaster, or Crew Bosses may be provided with forms and each required to keep the time of his men. If Crew Bosses keep time their records should be checked over by a higher officer at every opportunity.

Without exception, each man's time should be gone over with him at the end of the job. It is better still to do this at the end of each shift. Differences should be discussed in a spirit of fairness, and when the decision may be easily one way or the other the men should be given the benefit of the doubt. At the same time, unwarranted liberality not only wastes public funds but loses the respect of the man who profits. If the beginning and end of each shift or period of work is noted accurately and promptly and the records are shown to the men at the proper time there need be neither waste of money nor dissatisfaction on the part of the men.

Whether time should be allowed to permittees should be determined by the terms of the permit. In case of doubt the permitee's time should be turned in with the word "Permittee" written across the time slip. This will call the Supervisor's attention to the case, and he will decide whether payment should be made.

Payments to Fire Fighters

When laborers are residents, they are usually willing to wait until their checks can be mailed to them by the District Fiscal Agent in San Francisco. Every effort should be made to forward time slips to the Supervisor's office immediately after the close of the fire. When any considerable number of men are laid off, their time should be forwarded and payrolls prepared by the Supervisor's office, even though another payroll will be necessary for the last men to leave the fire. The preparation and forwarding of payrolls should be given precedence over all routine work in the Supervisor's office. The same precedence is given fire labor accounts in the District Fiscal Agent's office, with the result that checks are ordinarily mailed from San Francisco on the first working day following receipt of payrolls.

When transient labor is used it may be necessary to pay them immediately. When the number of men demanding immediate payment is small and the officer on the ground has sufficient funds, payment may be made in cash and a receipt taken. The Forest Officer may then include such items in his expense account. The receipt should, if possible be a sub-voucher

(form 4a) and should cover the number of hours each day and the rate paid. The following statement should be noted on the form: "Cash payment made under unforeseen public necessity. Transient labor in need of funds to leave the community."

When for any reason this method of paying transient fire-fighters can not be used, or when the number of transient laborers is sufficient to justify a trip by a disbursing officer, one will be sent on request from Sisson, Los Angeles, or San Francisco.

When bona fide employees of a lumber company or other employer of labor are used on a fire, payment for services of all the men may be made to the employed as contractor instead of to the individual laborers. The 5-A voucher should be stated in favor of such company, in the following manner:

"For services of employees of this Firm furnished the Forest Service for fighting the Snake Root Fire, as follows:

August	3	– 7	men	12	hrs.	each	84	hrs.	
″		– 2	″	8	″	″	16	″	
″		– 1	man	5	″		5	″	
″	4	– 8	men	11	″	″	88	″	
″		– 5	″	9	″	″	45	″	
″	5	– 4	″	5	″	″	20	″	
″		– 1	man	8	″		8	″	
					Total		266	″	@ 30¢ per
							hour,		$79.80

Report of Liabilities and Vouchering of Bills

It is of the utmost importance that liabilities be determined accurately and reported to the Supervisor promptly; also that the vouchering of bills proceed without delay. Failure to make accurate and prompt report of all liabilities against the fire-fighting fund causes serious trouble. District Rangers should give this work first claim on their time after a fire is out. When Rangers are delinquent in this respect, Supervisors should require that purchase order form books furnished by the Property Clerk be used when an order is placed with the Ranger District for any supplies or transportation. If necessary, other disciplinary measures should be taken. Good business methods are indispensable in handling fire-fighting liabilities.

Commissary

At large fires a field commissary is a necessity and should be located at the main camp. It will be in charge of a Forest officer acting in the capacity of Quartermaster. The commissary will, so far as necessary, be the depot for all stores – those purchased for direct use by the Forest Service (food supplies and equipment) and those held for issuance and sale to laborers (clothing).

Regulation A-7 provides that firefighters may be furnished necessary articles of clothing, the cost of same to be deducted from their wages. If the demand justifies it, the officer acting as Quartermaster will secure from the merchant in purchase orders (books of such forms furnished Forest officers) the necessary stock of clothing. The articles should be listed in detail. An agreement will be entered into with the merchant that after the fire has been extinguished and the crews have been discharged, any personal supplies which have not been issued to firefighters and which are undamaged will be returned to the merchant and a Form 5A voucher will be prepared and certified covering the net purchase.

When a firefighter is issued personal property from the commissary, the Quartermaster (or Forest officer in charge of Commissary) will fill out forms 414 and 414a; care being taken to list all articles so issued and to note the firefighter's number. The firefighter will then sign both forms as receipts in order hat proper deduction may later be made from the wages due him. Form 414 has been prepared primarily to cover purchases made direct from the merchant by the laborer, but since such direct purchasing will seldom be advisable this form (414) will be used as directed above. It will be prepared in the same way as though it were to go to the merchant.

As soon as possible after issuance of supplies to a firefighter, the form 414 should be attached to the duplicate (yellow) copy of the purchase order used in purchasing the commissary stock, and the 414a should be attached to the firefighter's time slip.

At the close of the job when the time is being made up care must be taken not to overlook any purchases charged up to firefighters. If the wage payment is made by payroll deduc-

tions for such commissary supplies will be shown on the payroll. In the column headed "Amount" will be given the net amounts due each man. The deductions will be noted under "Remarks". The forms 414a, hitherto attached to the time slips, will now be attached to the payroll to support the notation of such deductions. If wage payment is made in cash and form 4 reimbursement account is used, show on form 4 the net amount paid each man and support it by subvoucher form 4a which in addition to the notation previously mentioned should show the total amount due for wages and the deduction for supplies issued. To such subvoucher shall be attached the signed form 414a listing the articles for which deduction is being made.

Form 4A, covering the net purchases, will be prepared and sent to the merchant for signature. When this is forwarded to the District Fiscal Agent there should be attached the forms 414 covering the issuance of all supplies to firefighters.

It is advisable to confine clothing commissary purchases to one merchant, in order to avoid complications in this accounting system. If, however, purchase must be made from more than one, the respective stocks must be kept distinct and separate in the commissary, and when articles from both stocks are furnished one man separate forms 414 and 414a must be prepared to cover the purchase from each.

After the payment transaction has been completed the supervisor will prepare and certify to a complete list showing the number of each article sold for which deductions have been made from the wages of the men. This certified statement will be sent to the Property Auditor to be checked against form 939c. For 858 for any balance unaccounted for will clear the record.

The value of supplies furnished to any firefighter should ordinarily not exceed the amount of wages to his credit. Where necessary to issue articles of clothing in advance of commencing work, the value of the supplied should be limited to the smallest possible amount practicable, and credit of this kind extended only in cases where there is every reasonable assurance that the firefighters will fulfill their labor contract.

Medicine and Medical Services

The Agricultural Appropriation Act for the fiscal year 1916 provides for the purchase "of medical supplies and services and other assistance necessary for the immediate relief of artisans, laborers, and other employees engaged

in any hazardous work in the Forest Service." Under this Act it is possible to buy medicine, pay doctor bills, and pay transportation charges for injured firefighters. Such expenditures should be limited to those actually needed to give "immediate relief". This usually means the expense incident to giving the injured firefighter first aid treatment and getting him to the nearest town.

Compensation for Injuries

The compensation act provides for the payment of wages (including the value of meals if furnished in addition to wages) to men injured in Forest Service work. Immediate report of injury, and subsequent reports as provided in the special instructions covering the procedure in such cases, should be sent to the Supervisor.

Care of Property

At the close of each fire someone should be designated to make thorough search for tools and equipment used on the job, gather up everything, and see that it is put in proper shape and returned to place. Standard kits and tool caches should be replenished, if anything has been lost or destroyed on the fire.

While the care of tools and equipment should never interfere with thought and action on more important aspects of the fire, it is nevertheless possible to keep loss of tools and equipment down to a very low figure. Regular painting and marking with U S F S brand to prevent theft and habitual reasonable care in issuing and checking in tools will do wonders.

Terms Used in Fire Suppression

Discussion and clear thinking about fire suppression theory and practice and the giving and executing of orders require a fire suppression terminology which is now lacking. The following terms should be understood and used by every man having to do with fires.

The front
The rear
The right side
The left side
Sprout

The edge
Main camp
To spot out
Control line
Right of way
Fire trail
Gutter trench
Held line
Cost per mile of held line
Strength
To make a line solid
Corral a fire
Power
Lookout fireman
Guard
Dispatcher
Fire Boss
Quartermaster
Division Boss
Patrol Boss
Crew Boss
Fire companies

THE FRONT of a fire is that section of the edge of a fire which is burning or is likely to burn more rapidly than other sections.

THE REAR of a fire is that section of the edge of a fire which is least likely to spread if not worked. Usually lies on the windward side of a fire. May be merely a point instead of a section of fire edge.

THE RIGHT SIDE of a fire is that part of the edge between the rear and the front and to the right of an observer standing at the rear and facing the front.

THE LEFT SIDE of a fire is that part of the edge between the rear and the front and to the left of an observer standing at the rear and facing the front.

SPROUT – A rapid running fire, shooting sprout-like from the rear or sides of the main fire; usually burning parallel or nearly parallel to the main fire. Most common on steep hillsides and in brush fires.

THE EDGE of a fire is the outside of a fire, or any part of a fire which has not been worked systematically.

MAIN CAMP – On a large fire more than one camp is necessary. The one used as headquarters by the Fire Boss and Quartermaster is designated as the main camp.

TO SPOT OUT is to follow closely a fire's edge which is wholly or partly dead, searching for live fire and constructing suitable lines around any spots which may be found to have live fire.

CONTROL LINE – The line on which work is done to stop an approaching fire. Coincides with the edge of a fire when the fire goes out of itself.

RIGHT OF WAY – When a control line must be constructed through brush or young stuff, the swath cut will be known as the right of way.

FIRE TRAIL – The strip scraped or dug to mineral soil.

GUTTER TRENCH – A ditch dug on a slope below a fire; designed to catch rolling stones, small chunks, and other rolling fire.

HELD LINE is control line which when the fire is out has not been crossed by any fire which required the construction of new line connected with the original line. When sparks start little fires across a line, that line is still counted as held if the new fires are stamped out or surrounded by held lines which do not connect with the original line.

COST PER MILE OF HELD LINE is the total cost of the fire as shown on the individual fire report, divided by the total length of held line expressed in miles or fractions of a mile.

STRENGTH of a line is the power a control line possesses to resist being crossed by the fire. In the interests of economy and speedy control of a fire, a line ordinarily should be built with such variations in width and other specifications that it has uniform strength throughout its entire length. The degree of strength to be maintained in constructing a given line is a question of nice judgment. Ordinarily, the greater the strength of a line the greater its cost in money, time, and energy. The ideal degree of strength is that which carries maximum promise of holding the fire with minimum expenditure of men for patrol and for controlling fires jumping the line.

TO MAKE A LINE SOLID is to bring it up to the degree of strength adopted by the Fire Boss as standard for the job.