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FIRE CONTROL NOTES

A PERIODICAL DEVOTED TO THE TECHNIQUE OF FOREST FIRE CONTROL

FOREST SERVICE • U. S. DEPARTMENT OF AGRICULTURE

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Volume 3 Number 3

FIRE CONTROL NOTES

A Quarterly Periodical Devoted to the TECHNIQUE OF FIRE CONTROL

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The value of this publication will be determined by what Forest Service officers, State forestry workers, and private operators contribute out of their experience and research. The types of articles and notes that will be published will deal with fire research or fire control management: Theory, relationships, prevention, equipment, detection, communication, transportation, cooperation, planning, organization, personnel management, training, fire-fighting methods of reporting, and statistical systems. Space limitations require that articles be kept as brief as the nature of the subject matter will permit.

Address DIVISION OF FIRE CONTROL
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ADAPTING THE CONFERENCE TO FIRE CONTROL TRAINING

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It is true, as the author says, that contributions on training have been very limited. This is a reflection of lack of balance in fire-control thinking and practice. One of our acute needs is to build up the body of understanding, skills, and practice and bring training up to the relative level of advancement attained in aerial delivery of supplies or construction of detection improvements, for example. The author takes up one training device which we have used with more enthusiasm than judgment. If his article provokes others challenging accepted practice or reporting suggestive experience in training for fire control, this vital activity may begin to catch up.

Possibly "more line has been lost" in use of the conference than in other training methods.

Some 20 years ago inquiring minds recognized the potential training value of the conference, analyzed its pattern of procedure, and formulated what might be considered a set of rules for conducting a conference. Forest officers have used the conference method to some extent for the last few years in connection with guard training and with overhead in suppression training. Results have varied from highly satisfactory to a total loss.

So the questions: What are the more common criticisms of the conference as it has been used in fire-control training? What are the underlying reasons contributing to unsatisfactory results? What adaptation can or has been made to increase its efficiency as a training tool?

The enumeration of the following criticisms, it should be clearly understood, is not a blanket indictment of all past conference training, but rather a necessary step in seeking ways for improvement:

1. Some conferences do not begin anywhere, go anywhere, or end anywhere.
2. The procedure is too time-consuming.
3. Conferees lack experience in or knowledge of the subject in which training is intended.
4. The conference leader puts a question on the board; after which he frantically attempts to record everything that is said. No summarization is made. It ends, leaving the question, "So what?" in the minds of trainees.
5. The leader does most of the talking.

Certain key reasons must be more or less responsible for all of the criticisms listed. Personal experience and observation indicate there are three reasons of major importance:

(*a*) Lack of training and experience in conducting a conference.

It is difficult to determine just when and where and how the conference method of training was chosen and first used in fire-control training. It seemed applicable for certain training situations, and in the course of time instructions for conducting a conference appeared in training handbooks. But, as a rule, conference leaders in fireguard or suppression training have not received any great amount of training in either planning or conducting a conference. As the time for the guard-training camp approaches, instruction assignments are made. Certain instructors are faced with leading a conference. One type, the optimist, says, "It's a cinch." He makes no preparation. Refer to criticisms 1, 2, 4, and 5 for the probable outcome. The second type, very conscientious, makes a plan for his conference so rigid that no alternatives are considered or tolerated. He finds that conferees do not react the way they were supposed to, nor say what the plan calls for. Refer to criticisms 2 and 5 for the probable outcome. The third type comes through and does a pretty good job, and it is said that he has natural ability.

(*b*) The conference leader, both in planning and execution, is more concerned with conference technique than training objective.

Forest officers want to do things right. They want to lead a conference properly. With limited training and experience they are, in some respects, in the same fix as the student flyer taking his first few lessons. He is so occupied with the mechanics of flying the ship, "keeping the nose on the horizon and the wings level," that he loses all sense of direction and destination. With continued instruction and practice, conscious attention given to controlling the ship decreases and proportionate time is gained for selecting route of travel and destination.

The thinking of the forest officer leading his first few conferences is probably along this channel: "I have to lead a conference"—his preparation; "I am going to lead a conference"—his performance; "I am leading a conference." All of this submerges the principal idea, "I have a training job to do and I will make use of the conference in attaining my objective." Instruction and supervised practice are partly the answer, but a clearer perception of objective is needed, which leads to the final reason for criticisms of the conference method of training.

(*c*) The lack of a tangible objective for training in such subjects as fire prevention, the duties of a foreman or fire-camp manager, and strategy as applied to fire suppression.

Training of this type differs from training in how to use a shovel or an axe in that it is, for the most part, mental training. In practice, it involves sizing up situations (analysis), planning, and action.

A safe approach in training is to begin with the premise that thought precedes action, and that day-to-day action is governed more than is realized by *past experiences*. Where an individual's own experience is lacking or limited, he turns to someone who has had the experience which he believes will be helpful. A logical conclusion is that the decisions made, the action taken in any given situation, will be correct in proportion to past experiences in similar situations. Where experience is lacking, the most valuable guide to correct action is lacking.

A tangible objective for training, then, may be simply to design training situations which will provide the learner with simulated real experiences which he can use as a guide to correct action in the performance of his job.

In such an approach to training it is evident that the most careful consideration will have to be given to plans and physical preparation. The measuring stick for effectiveness of training can be easily applied: Is the learner being given experience in analyzing problems, sizing up situations, making observations, reaching conclusions, making d·cisions, taking action in circumstances which approach the actual as nearly as possible?

The conference method has a useful place in a training program designed to simulate real experience, but it must be used only as a training device—as the occasion demands, dropped for some other method, and used again. There is great need to break away from the stereotyped manner of conducting a conference. There is greater need for making the training situation more realistic. In this connection, it is possible to make use of sketches, relief maps, enlarged aerial photographs, moving pictures, models, cases, problems, and field demonstrations. The use of these devices, of course, takes preparation, but of what value is a training program that does not get results?

The following illustrations have been designed to show how a program simulating real experiences might be carried out:

On the subject of fire prevention.—Planning begins with an analysis of the situation. Certain facts are known, such as: Over one-half of all fires are man caused—by different types of people, and for different reasons. Further analysis determines types and reasons. The problem is to find a hub to which the spokes of a prevention program can be anchored. It is a trait of human nature to consider any proposition in terms of, "How is this going to affect me"? To be successful, the fire-prevention program must in some way sell a *gain*, rather than a *loss*, in personal advantage.

The objective of training is to give forest officers a background of experience in (1) analyzing and classifying prevention problems, (2) finding solutions which offer a gain in *personal advantage* to individuals or classes of people, and (3) the salesmanship to put it over. Preparation for group training to reach this objective will include assembling a variety of *cases* (real or hypothetical), *problems*, *solutions*, and method of *transmittal*.[1] The conference method can be used in group analysis of problems, examining given solutions of problems, analyzing proposed solutions of problems, and proposed method of transmittal by individuals of the group. During this training process, the conference would simply serve as a device to guide and stimulate thinking toward the right answer. Advance assembly of material as suggested saves time, otherwise frequently wasted, in focusing group attention on a specific problem. Most important, it leaves in the minds of the group a feeling of having participated in what amounts to an actual experience.

Foremen play an important part in the fire-suppression job. They direct the work of from 25 to 50, or more, fire fighters. All have observed, or perhaps conducted, foreman-training conferences where the instructor placed on the board this question: "What is the foreman's job?" Duties were listed and maybe their relative importance discussed. Such procedure would be all right as a starting point in

[1] Transmittal means the manner in which the idea is conveyed, such as through personal contact, addressing a group, printed material, pamphlets, posters, etc.

foreman training, but too often that is all there is to it. In terms of experience on which the foreman can draw in actual practice, there is almost nothing.

There are ways of doing a better training job. For example, the formen is concerned with "fire-line location" and "adequacy of fire line." Instead of talking about it, why not in advance of training build a piece of fire line in relation to a plainly marked hypothetical fire boundary and, for instruction purposes, stake it off in 100-foot units. Careful planning would make possible incorporation of both good and bad practice in location and construction of the line.

Instead of discussing line construction in the conference room, the instructor would take the foremen class over one unit of the demonstration line, at which time he would point out and give supporting reasons for good and bad practice. The class, working individually, would then inspect a unit of line and make brief notes. Later the instructor and the group as a whole would go back over the unit and discuss location and adequacy of fire line, point by point. In so doing, the instructor would in an informal way use the conference method in drawing out reasons, in promoting analytical thinking, in arriving at correct conclusions as to good practice. The procedure would be repeated for the next unit of demonstration line, and so on. The instructor's objective would be to develop the foreman's ability to size up and analyze situations, to arrive at sound decisions as to good practice; and, in effect, provide the foremen with a background of experience which would be vivid enough to be retained and which consciously or unconsciously would guide each individual in future actual situations. Training in certain other phases of the foreman's job could be handled similarly.

Fire-camp managers (*camp bosses*) are sometimes responsible for selecting the specific location of the fire camp, but are always responsible for laying it out. Again, instead of talking about these duties, and calling it training, would it not be better to get out in the field and do something about it? To illustrate: The instructor would take his group, who are to receive training as camp managers, to a previously determined location where he would describe the boundaries of a supposed fire and explain certain guiding principles on camp location and the reasons for each. Then he would take his group to two or three possible locations for a fire camp. Locations would be discussed on the ground, and conclusions reached as to the strong and weak points of each. During the discussion the instructor would use conference procedure in clinching fundamental principles on fire-camp location.

The same plan could be followed during instruction in fire-camp lay-out (the relation between location of kitchen, storage of supplies, truck yard, tool dump, bedding-down grounds), starting with the inspection of a previously laid out fire camp which would demonstrate good and bad practice. During and following such inspection the instructor would explain certain basic principles in fire-camp lay-out. To give the trainees experience, they in turn would be given the job of staking out additional camp lay-outs; after which their work would be inspected by the group as a whole under the guidance of the instructor.

Fire-suppression strategy training becomes increasingly important as the number of large fires decreases through improved fire-control technique. As in the Army and the Navy, pseudo experiences will have to be substituted for actual experience. In this training is limited to slash disposal for actual practice with fire behavior.

The critical review of action taken on past fires is a valuable training medium. The conference method can be used to good advantage in such reviews. Time will be saved if good sketches of the day-to-day maps of the fire under discussion are prepared in advance; likewise by having individual copies of memoranda outlining action taken on the fire and other pertinent data.

Greater use of enlarged aerial photographs, relief maps, or carefully prepared sketches will make problems more realistic and help each individual in the class to see them in the same light. Conference procedure can be used to promote analytical thinking by drawing out all angles of the problem involved and to crystalize conclusions as to fundamentals of sound fire-suppression practice.

The illustrations given attempt to show how the conference may be better used as an aid in training, wherein *emphasis will be placed on reaching the objective of training* rather than on the method. With adequate carefully planned preparation for each training job, the time consumed in training will be decreased and the desired results obtained.

And finally in all the planning and preparation this question should be kept in mind: Will the training proposed leave the trainee with experiences on which he can draw as a guide to proper action in the job he is going to do?

It Can Happen Here and There.—The 323-acre Sibley Creek fire on the Mount Baker National Forest was one of those fires where everything seemed to click and no suggestions are made for improved action. The days this fire was burning were extremely hot, temperatures of 110° were reached with a minimum of 15 percent humidity. The one-lick method was employed, resulting in fast corral.

In estimating the manpower for first-period control, provision for relief crews was delayed with the result that men used in initial attack were greatly overworked. The one-lick crew started at 4 a. m. and established corral at 10 a. m., but since no reserves were on hand, this same crew maintained control until 6 p. m., when relief crews arrived. While they were successful, it might easily have resulted in a serious situation from attempting to hold line with a weary crew. In calculating probabilities, serious consideration should be given to the employment of reserves to relieve the corral crew when they have achieved corral, but are too exhausted to continue. The present formula for making calculations does not specifically provide for this situation.—C. C. McGuire, acting supervisor, Mount Baker National Forest.

A New Reason for Man-Caused Fires.—The Hospital Rock fire on the Modoc National Forest was started about 4 a. m. by ranchers attempting to prevent frost damage to grain crops. The smudges they had prepared apparently did not make enough smoke, so they set a large number of fires in dry grass where they spread to national-forest and national-park land.

LARGER FIRES ON THE NATIONAL FORESTS

Roy Headley

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Among fire control men there is a real difference of opinion on the extent to which study should be concentrated on the larger fires as distinguished from all fires. Some men believe that by concentrating on the lessons to be learned from the relatively small number of fires which can be designated as "larger," much may be discovered which is likely to be missed by systems of analysis and study which include all fires. Others believe that concentration of attention on large fires is dangerous and may result in neglect of the methods and principles which are of importance in keeping small fires from becoming larger.

As is so often the case in such issues, the answer is probably a matter of proper balance. Both classes should be studied. Failure to review the action taken on even the smallest fires invites weaknesses that will let more little ones grow into big ones. But larger fires have characteristics peculiar to themselves. Management of the larger fire jobs is a rather distinct branch of fire control—and a backward branch. Failure to study the action on these larger fires invites weakness that will let big ones grow into bigger ones. These bigger ones hurt, too. Out of a total of 219,000 acres burned in 1938, 35,000 acres were lost in one fire. Seventy-five thousand acres were lost in the four largest fires.

Table 1.—*Number of larger fires and area burned by them inside national-forest boundaries*

	R-1	R-5	R-6	R-2	R-3	R-4	R-7	R-8	R-9	Total or average
Number of larger fires:										
1936	11	21	4	5	3	1	3	29	28	105
1937	4	11	7	2	1	3	1	20	13	62
1938	3	19	13	1	4	1	1	25	6	73
Average	6	17	8	3	3	2	2	25	16	80
Percent larger fires are of total fires:										
1936	0.6	1.2	0.3	1.2	0.2	0.1	0.4	0.7	0.7	0.6
1937	.3	.7	.5	.6	.1	.3	.3	1.1	.7	5
1938	.2	1.1	.6	.3	.3	.2	.3	1.0	.2	.5
Unweighted average	.4	1.0	.5	.7	.2	.2	.3	.9	.5	.5
Area burned by larger fires:										
1936	41,924	68,842	3,504	15,227	2,583	1,600	2,673	26,616	71,695	234,664
1937	1,474	12,487	4,548	2,435	410	4,048	785	13,386	8,178	47,751
1938	1,319	60,879	60,395	664	3,810	900	473	15,835	2,256	146,561
Average	14,906	47,403	22,616	6,109	2,266	2,163	1,310	18,612	27,366	142,992
Percent area burned by larger fires is of total area burned by all fires:										
1936	90.4	88.0	39.3	94.7	47.9	38.7	84.0	18.8	26.8	58.7
1937	42.4	75.9	81.8	83.4	21.0	66.6	20.5	36.5	35.8	51.5
1938	50.8	92.3	92.9	51.8	62.8	47.7	12.6	33.9	8.9	50.4
Unweighted average	61.2	85.4	71.3	76.6	43.9	51.0	39.0	29.7	23.6	55.3

Special reports are now available on larger fires for 3 years—1936, 1937, and 1938. Unfortunately, these reports cover fires of over *500 acres* for 1936 and fires over *300 acres* for 1937 and 1938. To avoid annoying repetitions of this difference in the following pages, the distinction is ignored and the term "larger fires" is used for both those over 500 acres in 1936 and those over 300 acres in the 2 following years. This fault should be kept in mind in reading the figures.

It is of some interest to note that of the total of 73 fires over 300 acres in 1938, 28 were between 300 and 501 acres. Seventeen of these were in the 3 eastern regions. In 1937, with a total of 62 fires over 300 acres, 23 were between 300 and 501 acres. Sixteen of these were in the 3 eastern regions.

TABLE 2.—*Averages of size, perimeter, output of held line, discovery time, and travel time for larger fires*

[While averages usually mean little by themselves, they sometimes disclose trends and major variations reliably]

	R-1	R-5	R-6	R-2	R-3	R-4	R-7	R-8	R-9	Unweighted average or total
Average size of fires (acres):										
1936	3,811	3,278	876	3,045	861	1,600	891	918	2,561	1,982
1937	369	1,135	650	1,218	360	1,349	785	669	629	796
1938	440	3,204	4,641	664	953	900	473	633	381	1,365
Average	1,540	2,539	2,056	1,642	725	1,263	716	740	1,190	1,361
Average perimeter of fires (chains):										
1936	1,426	1,163	1,190	1,240	467	560	633	594	1,277	950
1937	451	710	503	928	283	1,187	518	481	535	622
1938	600	807	1,519	776	563	520	295	633	372	676
Average	826	893	1,071	981	438	756	482	428	728	749
Total of perimeters of all larger fires (miles):										
1936	196.0	305.4	59.5	77.5	18.3	7.0	23.8	215.4	446.9	1,349.8
1937	22.6	97.6	44.0	23.2	3.5	44.5	6.5	120.3	87.0	449.2
1938	22.5	191.7	246.9	9.7	28.0	6.5	3.7	188.5	27.9	725.4
Average	80.4	198.2	116.8	33.5	16.6	19.3	11.3	174.7	187.3	841.5
Average output of held line per man hour from start of work to completion of control line (chains):										
1936	0.09	0.15	0.14	0.12	0.23	0.60	0.04	1.24	0.06	0.30
1937	.11	.22	.03	.11	.71	.31	.67	2.97	.46	.62
1938	.13	.07	.04	.29	.06	.10	.28	1.57	.69	.38
Unweighted average	.11	.15	.07	.17	.33	.34	.33	1.93	.40	.43
Average elapsed time from start to discovery (minutes):										
1936	146	22	12	[1] 2,816	990	30	125	33	690	540
1937	[1] 2,807	[1] 1,733	[1] 2,831	[1] 1,522	[1] 1,040	[1] 1,063	675	44	423	[1] 1,349
1938	22	74	160	5	175	1	5	75	18	59
Unweighted average	992	610	1,001	1,448	768	365	268	51	377	649
Average travel time (minutes):										
1936	57	39	50	32	72	15	63	30	73	38
1937	166	170	76	40	360	280	100	38	167	155
1938	28	399	205	10	153	15	15	24	46	99
Unweighted average	84	203	110	27	195	103	59	31	95	97

[1] Lightning fires.

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TABLE 3.—*Area burned in relation to travel time to larger fires*

	R-1	R-5	R-6	R-2	R-3	R-4	R-7	R-8	R-9	Total
Area burned by fires where travel time was 15 minutes or less (acres):										
1936	25,777	16,275	1,482	8,056	668	1,600	0	13,606	22,149	89,613
Percent above is of total [1]	55.6	20.8	16.6	50.1	12.4	38.7	0	13.7	13.5	20.5
1937	351	3,790	946	1,181	0	0	0	1,913	0	8,181
Percent above is of total [1]	10.1	23.0	17.0	40.5	0	0	0	5.2	0	8.0
1938	395	16,539	3,597	664	0	900	473	3,362	301	26,231
Percent above is of total [1]	15.2	25.1	5.5	51.8	0	47.7	12.6	7.2	0.6	12.0
Area burned by fires where travel time was more than 15 minutes but not more than 1 hour (acres):										
1936	10,667	32,541	0	2,189	0	0	1,424	11,191	32,861	90,873
Percent above is of total [1]	23.0	41.6	0	13.6	0	0	10.0	11.3	20.4	20.8
1937	0	6,019	1,260	0	0	0	0	9,651	6,020	22,950
Percent above is of total [1]	0	36.6	22.7	0	0	0	0	26.3	23.5	22.4
1938	924	18,244	6,573	0	2,318	0	0	12,473	1,573	42,105
Percent above is of total [1]	35.6	27.7	10.1	0	38.2	0	0	26.7	6.1	19.1
Area burned by fires where travel time was more than 1 hour (acres):										
1936	5,480	20,026	2,022	4,982	1,915	0	1,249	1,819	16,685	54,178
Percent above is of total [1]	11.8	25.6	22.7	31.0	35.5	0	8.8	1.8	10.2	12.4
1937	1,123	2,678	2,342	1,254	410	4,048	785	1,822	2,158	16,620
Percent above is of total [1]	32.3	16.3	42.1	43.0	21.0	66.6	20.5	5.0	8.4	16.2
1938	0	26,096	50,225	0	1,492	0	0	0	412	78,225
Percent above is of total [1]	0	39.6	77.3	0	24.6	0	0	0	1.6	35.7

[1] Total referred to is total area burned for the year by fires of all sizes.

TABLE 4.—*Area burned in relation to distance from a road to point of origin of larger fires*

	R-1	R-5	R-6	R-2	R-3	R-4	R-7	R-8	R-9	Total
Area burned by fires where point of origin was ½ mile or less from nearest road (acres):										
1936	31,779	65,029	3,504	13,798	668	1,600	866	26,099	58,992	202,335
Percent above is of total [1]	68.5	83.1	39.3	85.9	12.4	38.7	6.1	26.3	36.0	46.4
1937	351	6,899	1,416	1,181	0	0	785	13,386	6,730	30,748
Percent above is of total [1]	10.1	32.0	25.5	40.5	0	0	24.3	36.8	26.3	30.0
1938	1,319	32,402	10,170	664	502	900	473	15,835	2,286	64,551
Percent above is of total [1]	50.8	49.1	15.6	51.8	8.3	47.7	12.6	33.9	8.9	29.5
Area burned by fires where point of origin was ½ to 1 mile from nearest road (acres):										
1936	0	3,813	0	1,429	0	0	0	0	723	5,965
Percent above is of total [1]	0	4.9	0	8.9	0	0	0	0	4	1.4
1937	0	454	0	0	0	0	0	0	0	454
Percent above is of total [1]	0	2.8	0	0	0	0	0	0	0	4
1938	0	0	0	0	0	0	0	0	0	0
Percent above is of total [1]	0	0	0	0	0	0	0	0	0	0
Area burned by fires where point of origin was 1 to 3 miles from nearest road (acres):										
1936	565	0	0	0	1,915	0	1,807	517	2,011	6,815
Percent above is of total [1]	1.2	0	0	0	35.5	0	12.7	.5	1.2	1.6
1937	803	1,927	2,142	1,254	0	3,028	0	0	1,448	10,602
Percent above is of total [1]	23.1	11.7	38.5	43.0	0	49.8	0	0	5.6	10.3
1938	0	20,922	3,855	0	0	0	0	0	0	24,777
Percent above is of total [1]	0	31.7	5.9	0	0	0	0	0	0	11.3
Area burned by fires where point of origin was over 3 miles from nearest road (acres):										
1936	9,580	0	0	0	0	0	0	0	9,969	19,549
Percent above is of total [1]	2.1	0	0	0	0	0	0	0	6.1	4.5
1937	320	3,207	990	0	410	1,020	0	0	0	5,947
Percent above is of total [1]	9.2	19.5	17.8	0	21.0	16.8	0	0	0	5.8
1938	0	7,555	46,370	0	3,308	0	0	0	0	57,233
Percent above is of total [1]	0	11.5	71.3	0	54.5	0	0	0	0	26.1

[1] Total referred to is total area burned for the year by fires of all sizes.

Lessons Learned

Such an infinite variety of problems are involved in the management of large fire jobs that thoughtful men seldom fail to learn from each one something which should be guarded against in the future, something which should be done differently, some cherished belief which must be modified or abandoned. For 35 years I have been working on or observing suppression jobs, but I still learn something from every fire I reach.

Sometimes, alas, we "learn the same lesson over and over"—or do we? For example, I have learned throughout many years that there is some flaw in our management of larger fires which keeps us from getting a reasonable output of held line from a crew of a given size. Plenty of other people have learned the same thing. But, untrained as we are in the science and art of management, we have not found ways to act satisfactorily on what we have learned. Our learning has too often failed to lead to productive action.

The first essential in such matters is to grasp the need for change, the nature and importance of a problem, the chance to introduce something better. With that fact in mind, the outline for 1938 reports on larger fires requested a record of lessons learned by the man or men who had most to do with each fire. Some of the most suggestive answers received are quoted in this article. Quotations from the remainder will be continued in the next issue of Fire Control Notes. All fire-control men may benefit by the lessons learned on these fires. Perhaps these notes will help reduce the number of times lessons have to be "relearned" by different men—or by the same men. Because of lack of space, the statements of problems and lessons learned are clipped short, thus inviting the reader to do his own thinking. Publication of the conclusions does not necessarily mean that I agree.

Northern Region

Absaroka—Chico fire—429 acres.—The fire got over the line because of incomplete mop-up and men being gathered in a bunch to get water. (That lesson must have been learned a thousand times.—Ed.) The foreman in charge was a young, inexperienced administrative guard who, in his zeal to be helpful, left his crew to help on another part of the line. Had he had more experience, he would have recognized that his crew lacked training and knowledge of fire fighting, and he would not have left them. This might also be traced to the fact that the sector was too long for efficient handling by the sector boss. The country was so steep that the man in charge could not cover his whole line often enough.

More education and follow-up will have to be taken to overcome the fire risk in this locality. (Fire started by hot ashes thrown in cheat grass.—Ed.)

Furnish Forest Service overhead for crews obtained from other organizations. Locally and through the regional office get a line-up of the ability and training of fire crews outside of the Service which may be called to fight fires.

Assign more sector bosses where the topography requires it.

The regional office should continue training overhead and the forest should ask for plenty even at the risk of overmanning.

Kaniksu—Goose Creek fire—544 acres.—An organization principle was violated in that authority on the ground was divided between two heads and coordination was not effected. Two men, either qualified to handle the entire fire, were on the job. Each assumed the other to be in charge. Each aggressively worked on opposite sides of the fire, expecting the other fellow to see that balance was maintained.

Too much confidence was placed upon the ability of human beings to function on their own under emergency conditions. Much training has been given our camp bosses. They know the fundamentals of camp management, but we must not assume that they will, without actual (and much) experience, perform efficiently without fairly close supervision. Merely instructing a "trained" man to "go ahead" is not enough. I have not that much confidence in people. Further, it is not fair to the subordinate.

More attention should have been given to securing lunches for two crews. Slow delivery of supplies from warehouses was partly responsible for the delay.

Kitchen arrangements at base camp were inadequate. Four hundred men were served the first breakfast from one mess line, and there should have been at least 3 lines, which would have eliminated the confusion and delay.

More and better scouting should have been done. Scouts were inexperienced and did not arrive soon enough causing a loss of an hour or two by misplacement of two crews. On the morning of September 5 more men were sent to one sector than were actually needed, making it necessary to move them to another sector later.

The men planning the attack were confronted by a fire burning very fast and throwing spot fires ahead. Fire was in a heavy, dry, white-pine slash area which had been logged during the summer and was pushed by a 20-mile wind. It was figured that the fire would travel in a northeasterly direction, which it did to a certain extent, but not as fast as was anticipated. Consequently, more men were figured for the northeast side than actually needed. If our foresight had been as good as our backsight, more men would have been placed on the west side where there were barely enough men.

From 50 to 75 C. C. C. enrollees were used for clearing and holding down the hot spots until the trenching machine came along. Although these men did more hand trenching than necessary, the machine trenched it over again, and had no trouble in keeping up with the clearing crew. In fact, I do not believe it operated over one-half of the time, because the crew could not keep ahead. Mr. Sutliff was in charge of the machine. He and a mechanic changed off operating it, and three C. C. C. enrollees assisted in pulling. About 2½ miles of trench were built in 10 hours. Roughly, I would say that it did the work of 50 men.

Kootenai—Rocky Creek fire—380 acres.—The old story that an undetected spot fire blew up and caused this to be an extra-period fire holds true here.

In an analysis of the action on this fire by the supervisor, administrative assistant, two rangers, and an alternate and dispatcher who were on this fire, it was agreed that the 25 men who were searching for spot fires were sufficient under the conditions that existed at the time of this fire. However, a spot fire got away, and caused the second run; therefore, the number of men or the organization of them must have been at fault.

Bulldozers were used to construct approximately three-quarters of a mile of line on this fire. The main criticism was on account of some of the burning fuel having been covered with duff and dirt which added hours to the time required to do the mop-up job.

The time of arrival, the rate of spread, and the size and value of the rapid-spread area determined the action to take. I believe a bulldozer line under not too difficult topographic conditions can be constructed in less time than any other machine we have on hand. The cost of mop-up is, of course, a problem, but corral is the first job. Because of the value of bulldozers, and the possibility of breakdowns, I recommend an extra machine on a fire-line construction job.

California Region

Angeles—San Antonio fire—3,270 acres.—We were slow in completing lines on some sectors, because of using crews too large—20 men per experienced crew leader. We should have (for this particular fire, and it is true in most fall fires that spread with erratic lines and many spots) used *small* crews, 5 men to each trained fire fighter, and made sectors small enough to provide closer supervision and more effective performance.

We learned that tank trucks should be of sturdier construction and completely standardized in design and operation, permitting change in operators and parts.

Should use paid tank-truck operators who are real mechanics and not rely on C. C. C. or temporary men. We had too many breakdowns and were short of trained operators.

New Pacific Y pumps were very effective. Could use lighter pump on three-fourth-inch hose effectively.

Tractors did a real job on this fire, particularly the RD No. 8. These should work in teams with a hoist on one, and they can be put almost anywhere. The RD No. 8 is far superior to any lighter models used. We would have used these more effectively if equipped with hoist.

Contour trails built by California Experiment Station on 1,000-foot intervals (for distributing rain gages) proved to be of great value in making accessible in a safe manner many long fingers in slopovers. We feel that contour trails on 500-foot intervals will become an important part of the Angeles protection plan on extremely steep slopes and in heavy cover. They need be only foot trails cleared 18 feet wide, but kept well cleared, and must not be blind trails, but have outlets both ways for safety.

Splendid cooperation by the United States Weather Bureau in their special fire-weather forecasts during the entire fire season, and specifically during the progress of this fire, made possible a more accurate planning program for fire personnel needs and strategy to be employed (particularly on backfire work).

Records show and this fire confirms: Our late fall fires are a problem we have not met in southern California. In the absence of early rains, in September and October we get Santa Anna conditions, extremely low humidity and high wind velocities up to 50 miles per hour. These conditions sometimes last a few days—sometimes 3 weeks. Practically all serious fires in southern California for the last 10 years have started under these conditions, indicating we have pointed our efforts to the normal season conditions and gained much ground, but now we must point to these abnormal fall conditions and plan to meet them by:

1. Study more intensively, the behavior of these late fall fires.
2. Provide 24-hour patrol and lookout service. This was a night fire—as have been two or three others.
3. Make more intensive use of closures regardless of private property interests.
4. Shorten elapsed time between discovery and first action by movement of equipment and men so as to concentrate in high hazard areas and high occurrence zones.
5. Intensify use of secondary lookout points.
6. Have night suppression crew on duty, dressed and ready to go.

In summary: Put *additional heat* on every control effort we normally practice for regular summer season.

Klamath—Slide Creek fire—4,117 acres.—Points of special significance on this fire were: First, the long travel time (12 to 17 hours) of crews going into this fire, with resulting high fatigue before going on to the line; and, second, the high resistance to control on the extremely dense vegetation characteristic of the Blue Creek drainage. Also, there is a decided lack of detection in this drainage. Night control can be obtained only by additional detection, more transportation facilities (roads) and crew attack.

Klamath—Red Mountain fire—500 acres.—This fire started within one-half mile of a point approved as a lookout station, which has not been constructed or manned to date because of lack of transportation facilities and funds.

Klamath—Potato Patch fire—550 acres.—It started on unprotected land outside the forest and a deliberate sacrifice was made to utilize natural barriers to corral that portion inside the forest boundary. In other words, the logical fire-control boundary does not coincide with the actual forest boundary.

Klamath—Red Cap fire—16,196 acres.—The suppression action on this fire was characterized by insufficient manpower and overhead in the first five burning periods, then a sudden build-up of men in a belated attempt to conform to the Forester's policy of immediate control. This sudden build-up led to placing more men in the field than could be adequately serviced—with consequent loss of efficiency. For example, on divisions 1 and 2, zone B, it took 400 men (including camp workers, etc.) 4 days to build and backfire 404 chains of line. Theoretically, 400 men should have built the line in 1 day, which would have been in accordance with the Forester's policy; but actually, they lost 50 percent efficiency because of lack of food and bedding; and it is estimated that about half of the remaining effort was dissipated in too wide line construction, so 100 men fully serviced and adequately supervised could have accomplished the same job in the same time.

The lack of sufficient men in the earlier stages of this fire resulted from three main causes: First, lack of speedy mobilization of available local laborers, because the machinery for mobilization was rusty through lack of use during 5 years of complete control by use of C. C. C.; second, failure to send in outside help; and third, scattered effort of available labor over 20 other fires that were starting or burning in the district at the same time.

To summarize, it is apparent that extreme effort should be made to satisfy the requirements of the Forester's policy as to control in the early burning stages. If the job continues to increase, there should be a reasonable adjustment of manpower needs to the point where they can all be adequately serviced and supervised.

Considerable difficulty was experienced at first through not having chutes prepared in advance. Considerable time was lost in trying to build chutes to exact specifications, until the urgency of the time situation led to simplification of the method of tying that was quite satisfactory. About a 10-percent loss was experienced through breakage and loss of chutes. On the basis of this experience, and a little experimenting this loss should be considerably reduced. The most interesting thing is that food could be delivered by airplane as cheap as by pack train. Use of special cargo planes with greater payload capacity should further reduce the cost.

Radio was used throughout the campaign—both ultra-high frequency and medium frequency sets. The ultra-high frequency was the most successful because of less interference and because of capable operation of the ultra-high frequency contact station at Orleans Mountain lookout. This station successfully handled 427 ultra-high frequency messages for five different fires in 14 days. The successful use of ultra-high frequency was also aided by a special stand-by unit used in connection with the T-set on Orleans Mountain which operated a buzzer when a set in the field turned on to the Orleans lookout frequency channel. This eliminated the necessity of maintaining schedules. The failures of the medium-frequency set were caused mainly by congestion of the one or two usable channels and by the lack of trained operators.

Radio has certainly come of age as a tool in fire suppression. Future application can be aided by making the present types of sets more efficient and simple, and through the unceasing efforts to keep a supply of well-trained operators available.

The Weather Bureau fire-weather field station forecasts were used throughout the fire. The assurance of this station that certain favorable conditions would continue made it possible to plan and construct a line into the head of the Red Cap Canyon, thereby saving about 4,000 acres that had appeared to be doomed.

The marvelous "do or die, stick to the bitter end" spirit of the short-term force was magnificent. It was with a feeling of deepest regret that with the first big rain storm on October 1 I was forced to dismiss them with the expressed hope that they could find enough to do through the winter to come back mentally and physically fit to tackle another season.

Los Padres—Messenger Canyon fire—520 acres.—Additional prevention contacts might have prevented this fire. It seems that the biggest problem confronting us today is to educate the public so that it becomes a habit to be forever cautious of the dangers that exist if they are using lighted materials, whether a match to light a cigarette or the cigarette itself. The older we get the harder it is to break a bad habit and form a new one. Suggest therefore, that our efforts would be better spent on the younger generation. This suggests to us the need for more prevention effort in our schools. Too much of our time is spent with the adults when attention to the younger generation would pay more dividends in the long run.

Because of the shortage of organized manpower we need more mobile tractor-trailbuilder units to do the line-construction work. It is felt that we have not gone strong enough in this type of use to supplement the shortage of manpower on fires. The transportation problem and lack of competent operators seem to be our main obstacles at the present time.

There was just criticism of the acting dispatcher for not sending the Piedra Blanca crew first. As it turned out the Los Preietos crews were sent first and later the Piedra Blanca crew was sent and arrived on the fire ahead of the Los Preietos crew. There has been a tendency on the part of the field force to hold back the suppression foreman and crew to protect the immediate vicinity should another fire occur. Therefore, to clear up any question about this, the suppression crews and foreman are to be the first crews sent to a fire regardless of district lines. As these are our best trained men, there is more possibility of holding a fire to a small size. The dispatcher's judgment is final.

It was felt that the paper work involved to complete the forms necessary was not started soon enough with the men available. Later on, during the fire, too many high-powered men were employed on this work trying to bring them up to date. It was also felt that the accumulative report was too complicated and three men were appointed as a committee to study the possibility of a modification.

While advantage was taken of an old cabin at the fire camp, it was brought out that the location of the timekeeper in this cabin proved a disadvantage. Hereafter, he should be located out in the open as called for in the plan, where he can see the crews leaving and entering camp.

Eight 5-gallon pack cans were dropped over the fire by plane, with the following results: Four of the cans were so damaged that all the water was lost. It was felt that this was caused by the type of chute used—6- by 6-foot burlap squares. The water cans were packed in barley sacks filled with hay. It took two men 2 hours to get this equipment ready to drop.

San Bernardino—Arrowhead Fire—12,362 acres.—The Arrowhead Fire originally started in a cabin on the crest of the San Bernardino Mountain range. After very thorough investigation as to the cause of the fire, it is believed that it was due to faulty flue construction. The defect was believed to have been where the thimble fastened to the brick chimney.

Extreme fire weather conditions existed at the beginning of this fire and continued throughout. A high wind was blowing at gale force, 45 to 50 miles per hour, and the humidity was very low, about 7%.

The cabin in which the fire started had wooden, untreated shingles, also others that burned near this one. Due to the high winds the burning shingles were probably the greater cause of the many spot fires.

A prevention lesson may well be discussed now. It is very strongly believed that strict building restrictions should be enforced on private land which may be accomplished through State or county legislation. This problem may also be worked on through more frequent contacts of property owners by forest officers.

The rate of spread of this fire was extremely great during the first few hours. Approximately 8,000 acres burned during the first 7 hours or over 1,000 acres per hour.

Because of the high rate of spread it is doubtful that any means of preparedness in presuppression would have reduced the size of this particular fire. However, it was thought that we were deficient in the number of tank trucks available at the beginning of the fire and during the fire. A tank truck at Arrowhead ranger station would be very desirable and had there been one there it would have arrived on the fire about 7 minutes after the fire was reported instead of 36 minutes as was the case. Even though there had been a tank truck at Arrowhead ranger station, it is doubtful that it would have made any difference in this fire. But as a presuppression lesson we can see the importance of having favorable distribution of tank trucks.

All line constructed and lost was uncompleted line. All backfire work that was done was held although it slopped over in places. Orchard torches were used. No acreage was burned through backfiring which would not have been lost by the fire anyway.

Sequoia—Fish Hatchery Fire—500 acres.—Investigation shows that regardless of any suppression action taken after the crews arrived on the fire, it could not have been controlled while still small. This fire was simply moving too fast after it got up a headway. It is barely possible that had we been able to put about 50 men on this fire at the time the first crews arrived, the fire could have been held to a small acreage. However, there was no failure in first attack action, as the first crew traveling 10 miles, arrived 17 minutes after the origin of the fire. We feel, therefore, that the only way this fire could have been prevented from becoming large would have been for the district ranger to have taken such action earlier in the season as would have prevented the fire from starting. This might have been possible had he specifically designated a dumping ground for the use of the Kern County Juvenile Camp and had this ground thoroughly fire-proofed at the start of the season.

The fire was in very rough country where night work was difficult. District Ranger Stathem now believes that it would have been better business to have reduced his night crews in size, concentrating most of his manpower on the line during daylight hours.

The lower fire line was built paralleling an oiled road and in some places within 800 feet of this road. The reason for this was that it was believed at the time that it was necessary to do this to protect a high-voltage transmission line that was between the fire line and the road. Looking back on this, it is easily seen, however, that there was an opportunity to drop back to the road and hold the fire and also protect the transmission line with a much smaller crew, inasmuch as the line would have been easier to hold on the road.

Shasta—Salt Creek fire—1,690 acres.—The more important lesson that I learned from this fire was that it burned more rapidly at night, especially downhill, than I had thought possible, and as a conse-

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quence, the fire made an advance beyond the point where it was estimated it would be held.

I believe the establishment and actual marking of stations along the fire line which corresponded to such stations shown on the fire maps were of great practical value in laying out and assigning divisions and sectors, preventing crews from getting lost, placement of radios, dispatching specialists, overhead and packers to specific parts of the fire line.

I did not learn from this particular fire, but rather had it impressed upon me again that one of our weaknesses of prevention is inadequate patrol, and the difficulty of getting a fire bug in the penitentiary.

Shasta—Wildcat Fire—550 acres.—I have a suggestion that may or may not be worth much. It is simply that a few words of prevention be used in connection with the large cigarette programs heard on the radio. To begin with, a large percentage of our man-caused fires are smokers' fires, also millions of people listen to the good cigarette programs. My idea is to have the radio announcer when he is telling how easy they are on the throat, etc., to say these few words in conclusion—"Before throwing them away, be sure they are out." If this idea is of any value, someone in the Washington office might interview the sponsors of these big programs and see what can be done in this method of prevention work.

Another suggestion for some cheap prevention work where millions of people would see it every day, is to show a colored slide in all movie theaters between features. A slide could be flashed on the screen screen saying "Be sure your cigarette is out before you throw it away. Thank you, U. S. Forest Service."

Shasta—Big Lake Fire—745 acres.—The most important thing I learned on this fire was that in slash type cover one should never try to attack the lead of a fire if it reaches an area of more than 3 acres. One should attack the rear first and pinch it in on both sides, putting the heaviest attack on the side toward which the wind is blowing.

Shasta—Another Big Lake Fire—425 acres.—One RD tractor used on this fire built line faster than 150 men could backfire and patrol.

The advantage of plenty of high-class overhead was one of the most important factors on speed of control on this fire. On every large fire we should get plenty of overhead as soon as possible.

One of the outstanding features on this fire was the placing of saddle and pack stock on the line immediately after the fire started. I believe that saddle and pack stock should be taken to all large fires as soon as possible to save overhead from a large amount of walking and to pack water and supplies to fire fighters.

Shasta—Mount Hedron Fire—8,300 acres.—This fire originated in a grass sage-juniper fuel type in gently rolling country at a time when the wind was blowing approximately 20 miles per hour. The fire was attacked by 20 men and 2 tank trucks within 11 minutes of its origin, and at that time it was about 3 acres in size and spreading rapidly. Cooperators were immediately called upon for help, but by the time they arrived the fire was completely out of control and was heading north before a strong gale wind.

The action of the fire indicated that it probably would have been a 300-acre fire even though there had been a full camp of CCC enrollees at Leaf which was only 8 miles away. It seemed to be one of those fires that had to make its run.

The fire (a smoker fire) would undoubtedly have been prevented had the hazardous bronco grass been removed from the highway right-of-way. This is a costly thing to do and we have not been able to secure satisfactory cooperation from the State Highway Commission to enable us to remove this annual hazard.

A Tractor-Trailbuilder Sit Down.—A trailbuilder was sent to this fire (name withheld) at shortly before noon of July 19, 1938, in the third period. It sat on the truck it came on and was not used until after I arrived on the fire and put it to work building line after the fire had been lost early in the afternoon of July 19. We could not have stopped this fire then without the aid of a trailbuilder. The last line we built was in an area of heavy winter storm damage full of down timber, reproduction, and broken tops. The fire was growing and coming too fast for this line to have been built by hand in time to backfire.—(Name of writer withheld).

Airplanes and Fog on the Green Mountain 1,500-Acre Fire on the Olympic National Forest.—An attempt was made to establish airplane camps in the back country on this fire, but because of fog which filled in during the second night this was impossible. To me this is significant. Airplane use on this forest will always be uncertain because of the rapidity with which fog banks form around the mountains and because of the extremely rough topography which forces planes to fly at a height that makes accurate work very difficult.—Vondis E. Miller, assistant supervisor, Olympic National Forest.

Cooperation or Incendiarism (name of forest and writer withheld).—Local cooperators were on this fire before Forest Service men arrived. This may be a healthful condition—or it may be a very bad situation. The area was, years ago, a very bad incendiary region. Numerous men in this area were then used on various fires all season. We still have to determine whether we are beginning to experience a recurrence of that incendiary situation. If so, we should obtain the confidence of some of the locals or place a law-enforcement man in the area to reside and have him determine what we are up against. If no incendiarism exists, then the cooperators should be praised highly for their work.

RECORDING PUMPER DATA ON A TOPOGRAPHIC MAP

J. Carlisle Crouch

Chief Ranger, Crater Lake National Park, U. S. National Park Service

Too often the story is: "We eventually found water and put pumps to work. If this could have been done sooner, the first and second breaks would not have occurred." The location of water supplies as a part of advance planning and the predetermination of the efficiency of pumping equipment as described by Mr. Crouch will help to get the pumps going sooner.

Reconnaissance and scouting of the area in which a going fire is located, as well as memory and field observations made in the past have been relied upon to determine if, when, and where water may be used by means of portable, high-speed motor pumpers. Such methods of determination obviously have many disadvantages and have necessarily resulted in some lost motion and effort in fire suppression, insofar as the use of water is concerned.

To combine the use of water with other fire protection facilities and to provide a simple reference to predetermine its actual and potential use on fires, we here at Crater Lake National Park have devised and prepared a pumper-data map to be used in conjunction with other fire-protection data maps.

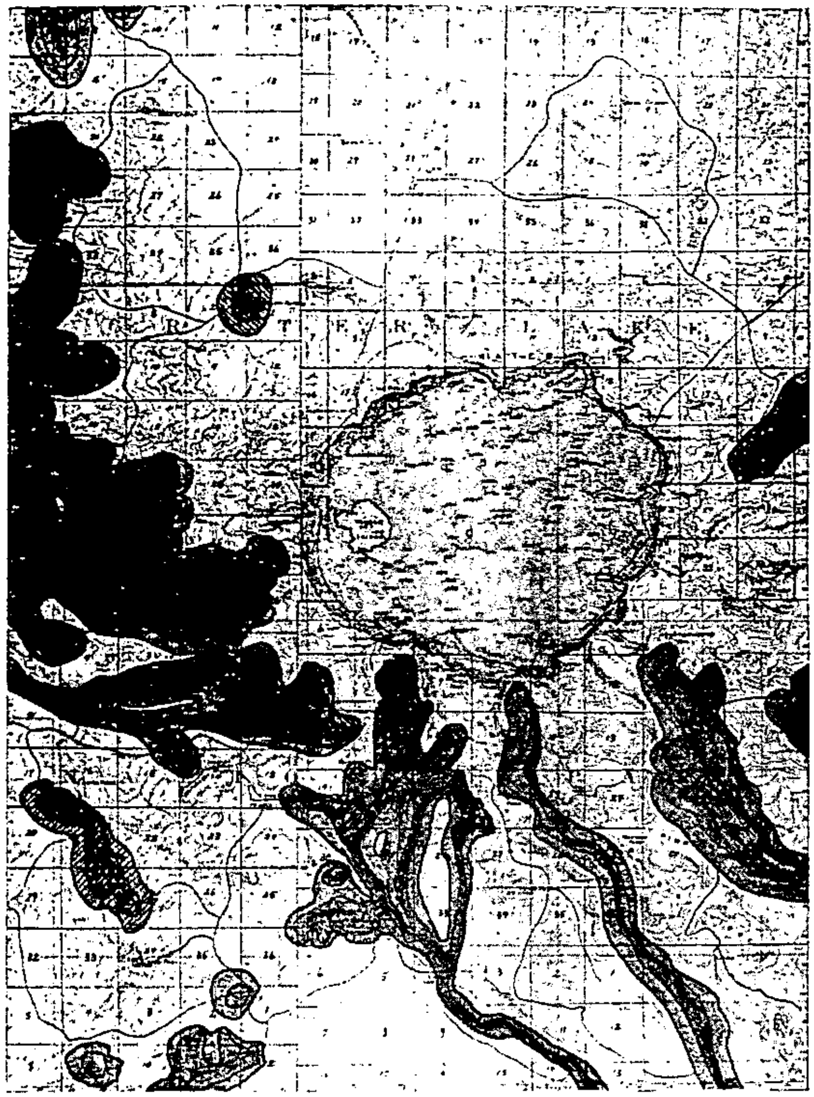
Extensive field studies were made to discover, to locate accurately, and to record sources of water suitable and sufficient for pumper use. These field data were recorded on a topographic map of the park area. Then the pumping efficiency of the equipment, based on the mean elevation of the park above sea level, was considered and tested, and this mathematical information was added to the map, so that not only was the location of the water supplies shown, but also the area which could be covered by the pumper.

The coverage of a pumper set up for action at the source of the water was determined conservatively as a horizontal distance of 1,500 feet and a vertical distance, outlet hose and with a minimum of suction, of 300 feet. The horizontal distance for the second pumper was determined as 1,500 feet, but with a vertical distance of 250 feet.

All of these data were applied to the map by means of different colors, one color to distinguish the area covered by one pump and another color to indicate the area covered by the second pump.

The map was designed for and used primarily by the dispatcher in his follow-up activities. Used in connection with the other fire-protection maps, it indicates readily and with reasonable accuracy whether or not one or more pumpers may be used, the timber types, and the ease and efficiency with which the equipment may be employed. In spite of the fact that a considerable area of the park might be reached by motor pumpers, this equipment is not substituted for fire fighters; but rather works with them, not for them.

The preparation of the map was not only interesting, but most helpful in formulating fire-protection plans. It will, no doubt, prove a valuable complement of the fire-protection data now available.



Topographic map showing pumper data. The inner darker area is located within reach of one pumper, the outer darker area can be reached with two pumpers operating in tandem. The cross-hatched areas are located within reach of water supplies which are not dependable for pump operations throughout the fire season.

LESSONS FROM LARGER FIRES ON THE SISKIYOU

L. L. Colvill

Assistant Forest Supervisor, Siskiyou National Forest, Region 6, U. S. Forest Service

A 3-day electrical storm in July 1938 started more than 60 fires on the Siskiyou—an all-time high for this forest for concentration of lightning fires in time. The spring had been exceptionally dry; winds were ruinous; the country was rough; and there was a serious lack of roads. Before the resulting "war" was over the 5 fires of more than 300 acres in size had burned over 48,000 acres—22 percent of the total area lost on all the national forests. The author was in charge of the largest of these 5 fires—the Chetco or Cedar Camp fire. Inspectors, who usually find many things wrong, could find no serious fault with his management of the job. But the fact remains that it took 26 days to corral the fire, which finally grew to more than 34,000 acres. Such fires afford priceless opportunities to learn the art of fire-suppression management.

Several important lessons were learned on the five large fires which occurred on the Siskiyou National Forest in the 1938 season:

1. *Regional office fire plan.*—These fires gave us a new conception of what constitutes "the worst probable situation," and the fire-suppression plan will require expansion to take care of another such occurrence, with particular reference to listing increased numbers of:

(a) *Pack and saddle horses.*—I believe it would be desirable for the regional office fire plan to include a list of pack stock available within the region, since it is not possible to obtain locally the number required for a situation such as developed on the Siskiyou last season.

(b) *Airplane facilities for transport purposes.*—Considerable delay was experienced in obtaining airplanes suitable for dropping supplies, and this indicates the need for more careful planning for and listing of this type of transportation.

(c) *S O S units.*—There is an apparent need for more S O S and scouting units. It would probably be best to utilize the regional office personnel for these units, since they are most likely to be available when needed. Also, in order to have men experienced in at least the key positions, suggest utilizing present S O S personnel in key positions and complete with "pick-ups" selected at time of fire from best available source. Experience for key positions is essential.

2. *We need to give more attention to the physical fitness of our fire-line overhead* when selecting and listing men in our fire plans for fire-fighting work. This is particularly true of C. C. C. foremen in charge of C. C. C. crews. Many examples could be cited on the Chetco and Siskiyou Fork fires where disability of overhead, such as weak heart, recent operations, or previous injuries of permanent nature seriously handicapped the organization of suppression crews. But probably more important is the irreparable damage to one's health which may result from the strenuous conditions required by this type of work. It is realized that the requirements of the C. C. C. camp work projects and restrictions limiting selection of C. C. C. foremen often result in a compromise detrimental to fire suppression.

3. *Leadership.*—Whenever choice permits, selection of foremen for fire-fighting work, especially C. C. C. foremen, should be based on their ability to provide inspired leadership, loyal to the management. Again, examples could be cited on the Lone Tree, Chetco, and Siskiyou

Fork fires of C. C. C. boys striking and walking off the job, principally because of poor leadership.

4. *Burning out.*—There is need for emphasis on technique of burning out fire line as work progresses, so as to eliminate the necessity for excessive clearing and width of trench.

5. *Feeding men.*—Provisioning fire fighters on the Chetco fire was not satisfactory, and suggested the need for one agency to handle all rationing. Provisioning fire fighters involves many problems characteristic only of this type of work, such as providing rations best suited to transportation, especially by pack horse and airplane, and the preparation of large quantities of tasty, wholesome food, in many cases over open fires and under adverse sanitary conditions, which requires experienced cooks seldom obtainable from a C. C. C. kitchen. Logically, since the Forest Service is responsible for the control of the fire, it should have complete control of all contributing functions, of which the provision of supplies is one of the most important.

6. *Civilian fire fighters for back country.*—Increased requirements and restrictions, dual administration, and inexperience of Army officers assigned to fire camps make employment of C. C. C. inefficient and infeasible on fires in the back country requiring pack horse or airplane transportation, and a larger number of civilian fire fighters must be depended upon to supply the necessary manpower.

7. *Camp management experience.*—Employment of large numbers of FF men requires experienced fire-line-camp managers trained in all phases of the job. The functioning of Army officers in C. C. C. fire camps has reduced the opportunity for Forest Service employees to gain experience in handling food supplies and kitchen set-up, and our efficiency has been reduced accordingly.

8. *Aerial troubles.*—New problems arose in connection with airplane transportation involving organization to meet the needs for large scale operations: Preparing chutes, packing loads, weighing and listing of contents, transportation of loads to landing fields, loading and preparation of load lists, dropping and retrieving loads, tabulating damages, and assembling chutes for return to landing field.

Dense smoke and fog over the landing and dropping fields proved a serious handicap to airplane transportation, and indicated the need for research to find some dependable device for locating the landing and dropping fields when such conditions prevail. Suggestions advanced so far include use of radio to provide communication between pilot and crew located at dropping field, operating a radio beam by use of a portable storage battery located at the dropping field, and the casting of a light beam from a semispherically shaped mirror located at the field.

9. *Need for "40-man crew."*—In rough and inaccessible areas, there is an apparent need for trained crews of physically supermen capable of sustaining themselves on the fire line for periods of several days with a minimum of S O S. Two methods offer possibilities for securing these crews. They could be hired in advance of the fire season and employed on construction work in the above-mentioned areas; or they could be hired when the need arose, in which case it would be necessary to pay a much higher rate to obtain men meeting the requirements.

Dependable airplane service would materially increase the possibilities of maintaining a larger number of fire fighters on the line continually, by making it possible to deliver cooked food and lunches to them, thus eliminating the fatigue factor of hiking to and from camp.

RETRACTING STRINGS FOR FIRE DISPATCHERS' MAPS

PAUL M. WENTWORTH

Assistant Forester, Great Smoky Mountains National Park, U. S. National Park Service

Good fire control requires perfection in mechanical aids. No one will ever know how many failures are really due to lack of mechanical gadgets that would help the dispatcher to think and act with speed and precision when his bad times come. Here is one ingenious way of providing the needed equipment.

Practically every organization concerned with fire control finds it necessary to construct a map for fire location from cross bearings received from the lookouts. Where more than two or three towers are shown on one map it is desirable to have the strings which are used for the projection of the bearings retractable. Small tape reels that work very well are available for this, but in many instances the cost is too high.

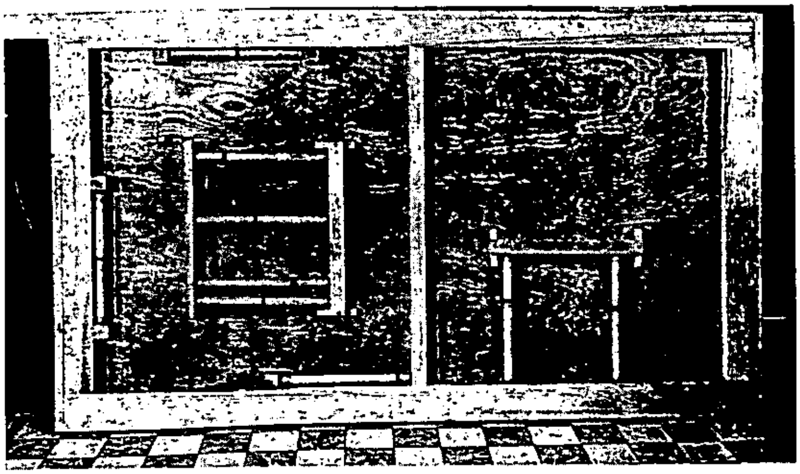
In the preparation of the dispatcher's map for the North Carolina side of the Great Smoky Mountains National Park in which nine towers were involved, the following scheme was used, which proved excellent in operation and reasonable in cost:

Short lengths of 3/16-inch diameter bronze rod were taken to a jeweler and drilled through the center with a 1/16-inch drill. The ends of this hole were carefully smoothed and rounded and the rod turned down to leave a very small flange on one end. Holes of the proper size were then drilled through the map board at the exact center of each azimuth circle and the bronze bushings pressed into place with the flange on the map side. Exact centering of the mounting hole is absolutely essential to maintain the accuracy of cross bearings and it was found necessary to use a drilling template to do this job correctly.

Good quality curtain rollers were purchased and cut as short as possible. This short length is desirable in order to eliminate as much as possible the bending of the rod when the string is pulled out. The small catches on the end were made inoperative and one roller was mounted on the back of the map board for each tower string. The rollers were located so that the proper side would be directly in line with the hole in the bronze bushing. In mounting the rollers, the regular inside type roller support was used for the end with the round pin, but the flattened end piece was inserted in a closely fitting slot in a wood block. The end of a piece of fishing line of the desired length was attached to the roller with a small tack and the remainder wound on the roller. The loose end was then pushed through the bushing and tied to a small brass ring. In attaching the rollers the support for one end was made removable to facilitate repairs or adjustments.

Using curtain rollers, the length of the strings is limited by the spring to about 6 feet. This should be sufficient in most cases, but where additional length is required it may be obtained by enlarging the size of the roller in one of several ways so as to increase the circumference where the string winds on it.

The dispatcher's map mentioned has been in use for several years and no trouble has as yet developed. Some noticeable wear has occurred where the strings pull through the bushings and it is suggested that anyone using this scheme make the bushings of the hardest material that can be drilled and turned down.



Back of dispatcher's map showing curtain rollers.

The question may arise in the minds of some as to the reason why rings are tied to the strings and not push pins as is the usual custom. There is no doubt that the use of push pins on the strings has several advantages since the strings can be pulled out and the pins pushed in to hold them very rapidly, and it can be done with one hand. Our map is constructed with a soft pine pin strip around the edge and push pins through the rings are used to hold the strings in position. In our case it was felt that rings would serve the purpose better for the following reasons:

1. The strings can be pulled out and fastened as rapidly as the reports could possibly be received.

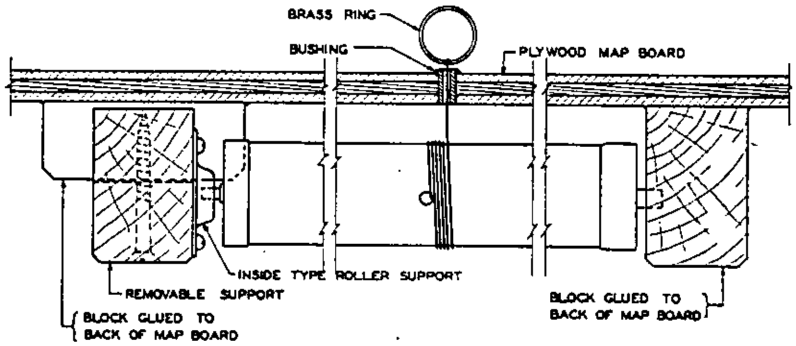
2. When the string for one tower is in use and reports on other smokes are received from the same tower, the pins can be left in place, the rings slipped off, and the string used for projecting the new bearing. By using a separate pin for this new bearing the string can either be left there or returned to its original position very quickly. This procedure can go on indefinitely and it is not unusual during dry weather in this area for one tower to report on as many as five smokes within a very short period. It is seldom that more than one smoke at a time will directly threaten the park, and as soon as other smokes are located the string is returned to that smoke in which the park is most interested.

3. With the pin slanted away from the lookout point the string always lies close to the map. With a push pin on the string it must be pushed "home" before this occurs.

4. Last but not least, one very simple knot eliminates all possibility of the string ever coming loose. Using pushpins the string must first be tied to the pin and then to the glass or metal top if one is to

be sure it will not slip off and possibly disappear behind the map board—a serious situation when things are hot.

For those who are particularly interested in costs, it is pointed out that the largest saving is in materials, and this method will be of most value to those organizations that have regular employees but little



Detail of roller mounting for retracting strings.

money for the purchase of materials. Where spare time or odd moments cannot be utilized for constructing the map the extra value of the time expended in mounting the rollers will partially offset the advantage of their small cost. Ten receding string reels can be installed in several hours, whereas the same number of rollers will require at least a day. Materials will cost about as follows:

Receding string reel (lots of 12 or more)	each	$1.50
Curtain rollers, good quality	do	.25
Turning of bronze bushings	do	.15
Fishing line, 6 feet		.03

Aerial Delivery of Supplies Being Used by State and Private Organizations.—On the Smith River fire, partly on the Siuslaw National Forest, the Western Lane County Fire Patrol Association and the State forestry department dropped something over 80 tons of supplies into their Marsh Creek base camp, two ships being in almost daily use from July 10 to July 28, 1938. Although the association and the State department obtained pack stock as fast as possible and immediately constructed necessary pack trails, they would have been unable to make even a good start in supplying necessary food had it not been for the use of airplanes. Our conclusion is, that not only is aerial delivery practical, but may even be essential in many cases where fires occur in inaccessible locations.—L. E. Garwood, fire assistant, Siuslaw National Forest.

What Spot Fires May Do.—The Rocky Creek fire on the Kaniksu National Forest was corralled at 10 a. m. of the first work period. While there was a sufficient number of Scouts looking for spot fires, and nearly 50 percent of the crew was working on spot fires, an undiscovered one about 400 feet from the main fire, got away even though 15 C. C. C.'s and a foreman were working on it 10 minutes after it was discovered.—Gordon T. Cornell, district ranger, Kaniksu National Forest.

WHAT IS "AVERAGE BAD?"

William G. Morris

Pacific Northwest Forest and Range Experiment Station, U. S. Forest Service

Preparedness means planning for whatever intensity of action may be required. But the dominant characteristic of fire danger is variability. Then how *can* intelligent planning be done? The author offers one answer to a very puzzling and important fire-control problem.

The term "average bad conditions" has been used with increasing frequency during the last 2 years to describe the fire-danger conditions for which we should lay most of our fire-control plans. The idea of making our principal plans for some level of conditions that is suggested by the term "average bad" seems to have been readily acceptable, but it has been difficult to define or describe just what an "average bad" condition is. How bad is "average bad?"

The term is satisfactory in discussions and in visualizing plans for such facilities as lookouts, firemen, etc., but when a planner actually attempts to determine the number of lookouts necessary under "average bad" visibility conditions, he must know what that means in terms of miles of visibility. Likewise, when he attempts to estimate the size of a suppression squad necessary to handle a fire at a given place under average bad wind velocity he must know what that means in terms of miles per hour. If the plans are to be revised currently, are to be checked, and are to be suitable for comparison with those of other administrative units, "average bad" conditions for which the planning is done must be established by the same yardstick.

It is suggested here that "average bad" be defined as the average of the worst half of the conditions that have occurred during a period of several years. To start with and until more records are accumulated, a 3-year period would serve the purpose.

This average of the worst 50 percent can be easily determined. Suppose we want to determine the average bad wind velocity, for example. Simply tally the wind velocity records in classes of miles per hour. Tabulate the cumulative total number of records or tallies by beginning with the lowest class and working toward the highest. From the cumulative totals pick the class above which lies one-half of the grand total number. Then compute the average of the velocities above this middle class. The accuracy of estimating the midpoint will be increased if narrower class limits are used for tallying the values near what is judged in advance to be the middle value. Very broad classes can, on the other hand, be used for tallying values near the extremes.

"Average bad" relative humidity, rainfall, or fuel moisture would be determined similarly from the average of the values below the midpoint instead of above it.

"Worst probable" is a term which has been used to signify the level of conditions with which emergency plans should be prepared to cope. "Worst probable" wind velocity might be defined as the point above which the highest 2 percent of the wind velocities have occurred in the past, and likewise "worst probable" relative humidity, fuel moisture, etc., might be defined as the point below which the lowest 2 percent of these values have occurred. This arbitrary 2 percent point is in keeping with L. H. Hornby's conclusion that about 2 percent of the fires occur under conditions which put them beyond human control during the first work period.

This point above which the worst 2 percent of the conditions occur can be determined from the same talley and array of values as those used in determining average bad wind velocity.

TANK-TRUCK STANDARDS

Fire Control Equipment Committee, U. S. Forest Service

During the meeting of the fire control equipment committee in Washington in February, a subcommittee composed of George W. Duncan, Fred W. Funke, William R. Paddock, and Ray C. Iverson discussed tank-truck standards and ways and means of developing them. This article is a brief of the conclusion reached, and will be of real interest to all users of this important item of equipment.

Standard sized trucks for fire suppression use should be the ¾-ton pick-up with four-speed transmission, and the standard 1½-ton stake body. Larger trucks for this purpose are not needed. Half-ton pick-ups should not be purchased for this purpose, but the ¾-ton trucks in some cases should be built up to the 1-ton class, and the 1½-ton trucks built up to the 2-ton class.

The tank valves and pump equipment on the trucks should be standard for the region in which they are used. The valves, pump, and power take-off should be the same size and make for the ¾-ton truck as those used on the 1½-ton truck. Then a region can carry a few spare parts which will fit all its tankers.

A unit of the type of the 6A Hercules pump and power take-off is recognized as the best transmission drive pump yet tried out for small capacity units, and it is therefore recommended that the regions use this type until some other pump is proved definitely better. For high lifts and large volume, however, the Byron-Jackson class of pump is needed, and the 3A Hercules and Panama fanbelt-driven type of pump is used where practically no lift is required, where there is low volume and pressure, and where short hoses are in use.

The subcommittee also recognized that there is need for auxiliary tanks that can be quickly loaded on any truck, the water from such tanks to be transferred to the regular power pumper or the truck equipped with such a pump as the portable type O Pacific Marine, and the water pumped directly on the fire from the auxiliary units.

It was the unanimous opinion of the group that permanent built-up pumper units should be used as much as possible. It was Mr. Funke's belief that the life of such units should be about 10 years, since the mileage traveled by such trucks is very low and most of the wear is in the motor which would no doubt have to be changed at least once in the life of the unit.

SHORT-TERM FOREST WORKERS

H. T. Gisborne

Northern Rocky Mountain Forest Experiment Station, U. S. Forest Service

When fire-research men take time out from their instruments and statistics to delve into questions of management, the "practical" men to whom management problems have been left may need to step lively to keep ahead. The author suggests some definite answers to the question: "What shall we do to make our practice more responsive to human and social needs?"

In the October 17, 1938, issue of the Service Bulletin, Roy Headley presented, "The plight of the short-term employee in the Forest Service." He stressed the unsocial policy of the Forest Service in giving its fire guards, particularly, not enough employment to permit them to live year in and year out, but just enough to tease some of them back another year and too much to permit them to get W. P. A. jobs the rest of the year.

In the October 1938 issue of Fire Control Notes, Maj. Jno. D. Guthrie flashes another red light in our faces. He stresses the indisputable fact that we are substituting C. C. C.'s for a lot of the good fire cooperators we used to have, and that if the C. C. C.'s should suddenly cease, we would find ourselves in one deep hole. The major also mentioned, all too briefly, the fact that our extended use of the C. C. C.'s to pad our first, second, and third lines of defense "was never intended in the beginning." He refrained from pointing out that this "never intended" use, for regular fire-control positions, deprives many of Headley's 5,000 or 6,000 short-term workers of much employment that we used to be able to give them.

These two dangerous practices of the last few years have combined to produce a third danger—the nonexistence of a supply of trained lookouts and "smokechasers" *adequate* for our known needs during critical fire seasons. The short-term employment now offered to temporary men ordinarily brings back only 60 percent of the trained men needed during years of *average* fire danger. The best 40 percent of those trained each year get jobs elsewhere the next year, if they can. That's a natural characteristic of "best" men. Then instead of using our double-up positions to give training and work to the many additional men that we know we will need in critical years, we do the doubling, some of it anyway, with C. C. C.'s.

Here in region 1 we have a "fire plan" for each forest which shows the number of positions to be manned and the number of men needed according to the degree of danger existing. The supervisors are definitely "for" these plans, with one outstanding and unanimous exception. They ask: "Where and how am I going to step out and get that last 100 to 150 men called for, if and when critical danger occurs, and get men with enough fire experience and training to be worth hiring?" They, the supervisors, will never be able to answer that question under our present policies and finances. The answer to that question is, however, the answer to our problem of adequate fire control in critical years.

We therefore seem to have (1) an unsocial policy toward our short-term workers, (2) too many fire-control eggs in the unpredictable C. C. C. basket, and (3) no provision whatever for an adequate supply of really *trained and competent* lookouts and "smokechasers" for use during critical fire seasons, which are the ones that wreck the good records hung up during all the other years. To a single-track fire researcher, unversed in social economics and interested primarily in assuring adequate fire control at reasonable cost, the last point is the major one. To what avail are all the fine points of silviculture, all the to do about stream flow and erosion control, all the hub-bub about campgrounds and recreational facilities, and all the brain busting over land-planning policies, unless we can first *guarantee* fire control adequate to the requirements of each of these phases of forest-land management?

The situation may be different in other regions, but here in region 1 the guarantee of adequate fire control during critical seasons is still the quicksand on which we are erecting many of our other forestry totem poles.

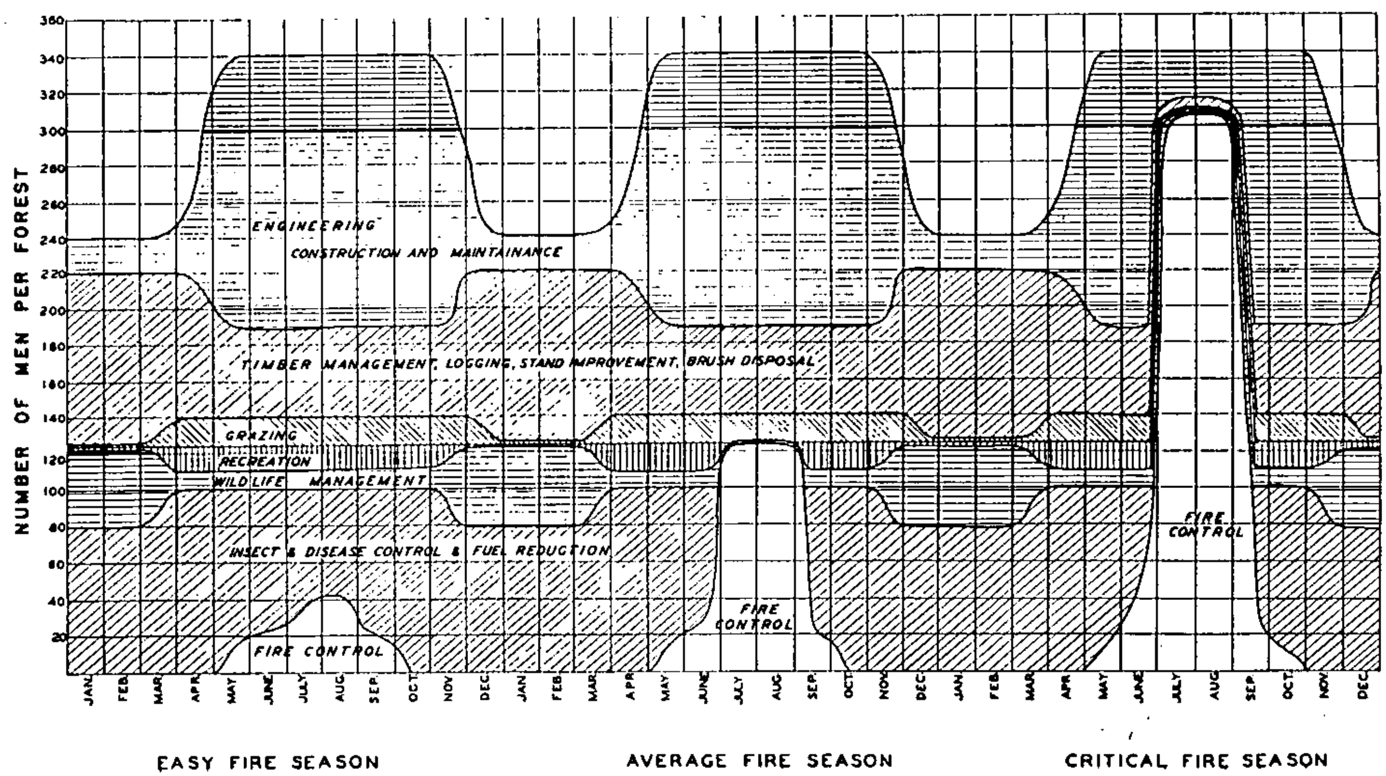
It would seem that some kind of a plan ought to be evolved which would minimize all three of these basic weaknesses. Under a socially minded government someone should have the power and the funds to rectify a social indignity affecting 5,000 or 6,000 worthy citizens; if the C. C. C.'s were not intended and should not be used in fire control except in emergencies, then that policy should be enforced, especially if it will contribute to alleviation of the bad conditions; and if the crux of adequate fire control does now lie solely in the critical season, then that is the bull's-eye at which we ought to aim. The accompanying chart may serve to indicate one possible and partial cure for all three of these present weaknesses.

The chart is intended to illustrate merely the general policy of coordination of labor between divisions of the Forest Service so that (1) adequate fire control may be assured during critical seasons, (2) all divisions may assist—and benefit—in giving longer employment to the forest fringe population, and (3) C. C. C.'s will be used for fire control only during emergencies.

In constructing the chart, the known fire-control needs of a critical season on a typical north Idaho or western Montana forest determined the maximum number of men shown. That is the bull's-eye. This maximum of 340 men includes ranger district temporary overhead, lookouts, "smokechasers," warehouse men, packers, truck drivers, cooks, and crews (held available), but does not include fire fighters. Several thousand fire fighters may be needed occasionally, but that is where the C. C. C.'s come in—during emergencies only. Some 300 *trained* lookouts, "smokechasers," and shock troop crews are needed per million and a half acres, however, whenever danger rises to class 6 and bobs back and forth between 6 and 7, if we are to guarantee adequate fire control. You cannot get *competent* lookouts and smokechasers from the C. C. C.'s. The boys are too young and inexperienced in the woods. In fact, you cannot get them anywhere without providing *training*.

To have trained and competent lookouts, "smokechasers," and crews available whenever the unpredicatable critical season smites us, requires reemployment of local woodsmen and forestry-school students

COORDINATION OF LABOR USES



Coordination of labor uses.

year after year. Can you imagine the Navy storing its battleships in dry docks between wars and then attempting to man them competently by enlistment or even draft after the enemy fleet has set sail for our shores? The Navy applies organization planning first, tactics and strategy second. We might apportion our emphasis similarly.

The other subdivisions or allotments of labor, aside from fire control, shown by the chart, are estimates and approximations at best. The seasonal give and take between divisions is the main idea proffered. It should work best, of course, if the Forest Service had a Division of Forest Protection, rather than merely a subdivision of fire control. Then all forms of insect, disease, and fire control could be coordinated, serviced, and staffed by a year-round operating organization. Every insect and disease-control man would be ready to step into his preassigned fire-control job whenever the danger rating warranted the shift. Every fire-control man would likewise have his out-of-fire-season job on insect and disease control. (No need for quibbling as to what agency will provide the "technical guidance." Merely the labor is at issue here.) Other divisions of the Forest Service, generally, would be tapped for help only during critical seasons, when each man would take his preassigned position as lookout, "smokechaser," or crew man, for which he had been *properly trained*. During average fire seasons the Division of Forest Protection might draw a few men from one or two other divisions, but during easy seasons it would be entirely self-sufficient. The present problem of time and funds for training would be solved automatically by adoption (and financing) of this major principle of coordination of labor.

The last major feature intended to be shown by the chart is the reduction of expense possible during the winter months by recognizing the fact that about one-third of our short-term workers either do not want to work through the winter or have to return to their stump ranches and homes for the duration of rigorous weather. This exodus usually starts, in this region, early in November and is completed a few days before Christmas. Along in April these "hole-up-for-the-winter" specimens begin to feel like working again. With a month's annual leave, however, probably the other two-thirds could and would stay with the job year round.

Staggering of annual leave throughout the winter would help to solve another problem in fire control by eliminating the present costly and sometimes dangerous method of granting leave during temporary lulls in the fire season.

One-Lick Method on the Cedar Camp or Chetco Fire.—One point learned was that the one-lick method of line construction can be used to advantage when only untrained civilian fire fighters are employed. Two occasions came up where we needed considerable line built in short order to stop the fire from burning an increasingly large area. On both occasions crews were organized from men totally unfamiliar with this method of line construction and the line was built in heavy brush at high speed. With more trained foremen and straw bosses, I believe it can become the most efficient method with any type of labor available.—M. M. Nelson, district ranger, Siskiyou National Forest.

HOSE-PIPE LINE FRICTION-LOSS CHART

L. W. Lembcke

Wisconsin Conservation Department

Since many thousands of feet of fire hose of various sizes and kinds are used in this country by State and Federal agencies, it is believed that the men using this hose will find helpful a chart showing relative friction loss in different sizes and kinds of hose which will give a basis for calculating the quantity of water that can be conducted through a particular hose when pump characteristics are known.

Chart A shows the approximate characteristics of a pump that meets the requirements of United States Forest Service specification M. S. F.–273. Chart B shows the friction loss in various sizes and kinds of hose and pipe. If in practice the hose is run up grade, 1 pound of pressure must be deducted for each 2.31 feet of vertical rise, in addition to the friction loss, to arrive at the total loss in pressure.

The chart is made up by plotting friction loss in pounds per 100 feet of hose against gallons per minute on log-log graph paper. The advantage of the log-log graph paper is that the scales are so arranged that the resulting graph is a straight line. Since it is known that the graph will be a straight line, fewer test points are necessary to plot the graph and corresponding readings will be more accurate.

The principal loss of head in hose or pipe lines is the result of the friction along the inner wall and among the liquid particles. The conditions which govern the amount of the friction are: (1) The diameter of the hose or pipe; (2) the nature of its inner surface; and (3) the velocity of the liquid. From the many experiments that have been made in addition to our own and from the laws of hydraulics we know that the amount of frictional resistance offered is: (1) Independent of the pressure in the pipe or hose; (2) proportional to the extent of frictional surface; and (3) varies nearly as the square of the velocity. The chart is used as follows:

Example 1.—Suppose it was necessary to lay 4,000 feet of hose to a fire (40- to 100-foot lengths). The difference in elevation is 100 feet. Using 1½-inch linen hose with a pumper capable of pumping against a head of 225 pounds per square inch, how many gallons per minute can be delivered at 25-pound nozzle pressure?

	Pounds
Nozzle pressure	25
Loss in head due to elevation	$\frac{100}{2.31}=43$
Total	68

225 pounds — 68 pounds = 157 pounds that may be used up in friction.

$\frac{157}{40}$ (100-foot lengths of hose)=3.9 pounds that may be lost in each 100 feet.

On the chart the 1½-inch linen hose graph line crosses the 3.9-pound friction-loss line at *21* gallons, which would be the amount of water that could be pumped through the hose with a pump capable of pumping 21 gallons per minute at a 225-pound head. A United States Forest Service Specification M. S. F.–273 pump should operate satisfactorily under these conditions and pumps 20 gallons a minute.

Example 2.—If 1½-inch rubber-lined hose were used under the same conditions, the following quantity of water could be pumped:

	Pounds
Nozzle pressure	25
Loss in head due to elevation	$\frac{100}{2.31}=43$
Total	68
From the chart, at *30* gallons per minute we find a loss of 3.2 pounds per 100 feet. For 40 lengths of hose we have 40 by 3.2	[1] 128
Total loss	196

From the performance curve we can see that an M. S. F.–273 pump will pump 30 gallons at 210-pound total pressure.

Example 3.—If 2-inch rubber-lined hose were used with the same pump, we could expect the following results:

	Pounds
Nozzle pressure	25
Loss in head due to 100 foot-elevation	$\frac{100}{2.31}=43$
Total	68
At 47 gallons we find a friction loss of 2.5 per 100 feet or 2.5 by 40	100
Total loss of head	168

From the pump performance curve it can be seen that the pump will deliver about 47 gallons at 168-pound pressure.

Example 4.—Now take the problem as before but increase the length of our hose line from 4,000 to 6,000 feet, using the same pump.

	Pounds
Nozzle pressure	25
Loss in head due to elevation	$\frac{100}{2.31}=43$
Total	68

225−68=157 pounds that may be used up in friction.

$\frac{157}{60}$ (100-foot lengths of hose)=2.6-pound pressure that may be lost in each 100-foot length of hose.

On the chart the 1½-inch linen hose graph line crosses the 2.6-pound friction-loss line at 16.7 gallons, the amount of water that could be pumped through the hose with a pump capable of 16.7 gallons at 225-pound pressure. Referring to the pump-performance curve, it will be noted that the pump will not operate under those conditions.

Example 5.—Suppose we try 1½-inch rubber-lined hose under this condition. From the chart we find that the 1½-inch rubber-lined hose will conduct 25 gallons with 2.2-pound loss per 100 feet.

	Pounds
Nozzle pressure	25
Loss in head due to elevation	$\frac{100}{2.31}=43$
	68
At 25 gallons the friction loss 2.2 by 60	132
Total loss	200

Referring to the pump-performance curve, we find that the pump will operate under these conditions.

From examples 4 and 5 it will be seen that under certain conditions a given pump can operate with rubber-lined hose while it cannot with linen hose of the same size, because of its larger friction factor.

[1] Loss.

CHART A

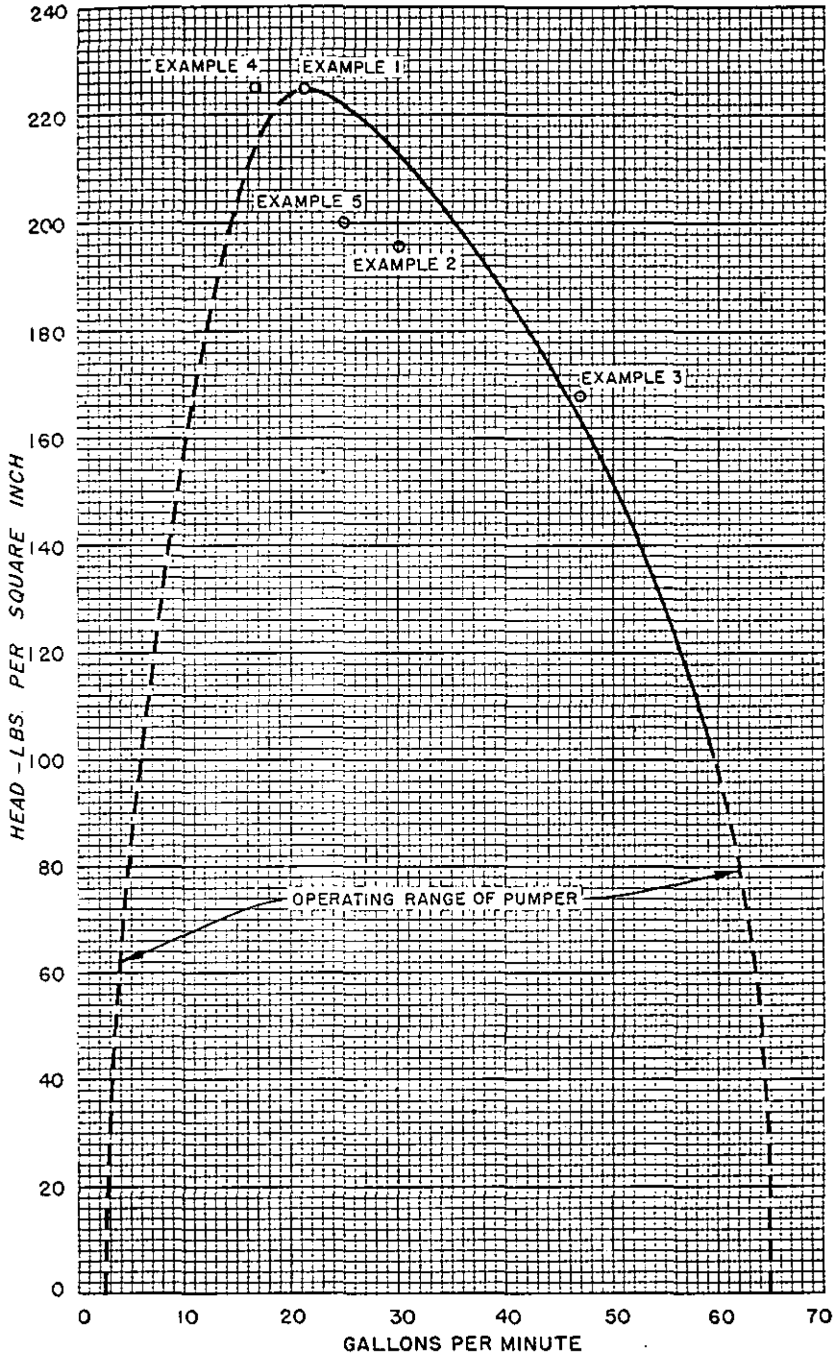


Chart A.—Approximate curve representing minimum performance of a pump meeting the requirements of United States Forest Service Specification MSF-273.

FRICTION LOSS IN HOSE AND PIPE

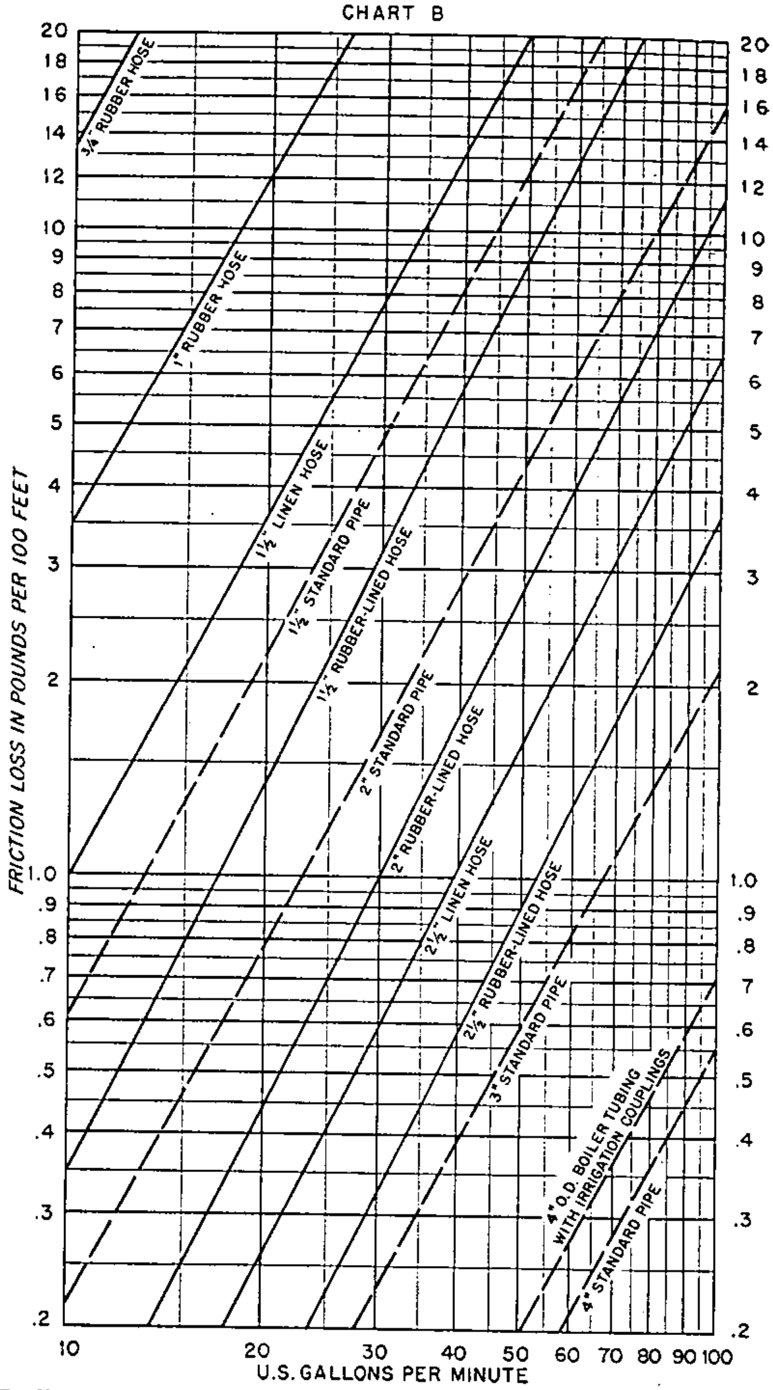


Chart B.—Shows friction loss in iron pipe; linen, and rubber-lined hose. Data from tests and other available information.

HARNEY PORTABLE FIELD LIGHTS

D. P. Kirkham

Harney National Forest, U. S. Forest Service

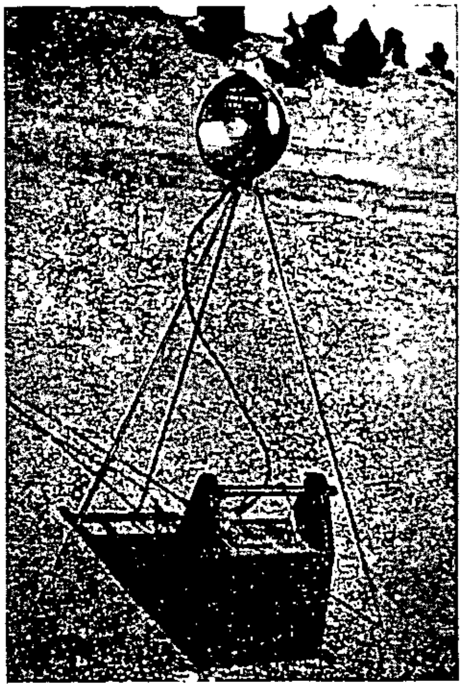
A need for adequate lighting facilities to reduce the accident hazard and permit greater efficiency in fighting fires at night, particularly wherever a considerable part of the fire perimeter to be worked has died down, has long been recognized. Lanterns are poorly adapted to such use, and in many localities in Forest Service region 2, the purchase, maintenance, and servicing of a sufficient supply of individual headlights is not feasible, particularly for the use of C. C. C. crews.

During the past year, Foreman Leo Harbach of C. C. C. Camp F-23, Harney National Forest, has been experimenting with various types of crew lights for night fire fighting. This has resulted in the development of a simple field light, which he believes will reduce the accident hazard of night fire fighting and greatly increase the efficiency of night crews in the Black Hills territory. In addition, he has modified the idea to produce a camp light and a trouble light.

The field light is portable and consists of three pieces—a tripod, a headlight, and a battery, and is designed for use on line construction or mop-up work. The headlight is an old Chevrolet truck headlight. This has been reworked and a standard drop-light socket soldered to the reflector to take the place of the regular light bulb. The socket is equipped with a pull-chain switch, the chain extending through an opening near the bottom where it is readily accessible for switching the light on and off. A standard 6-volt, 25-watt light bulb is used. The headlight is attached to the tripod by using the regular bolt that held it to the truck. The bolt goes through the top ring of the tripod and is fastened by means of wing nuts and so arranged that the light can be focused to either side. The light can be focused up or down by moving the rear tripod leg. The legs of the tripod are 44 inches high, made of ⅜-inch round iron with the ends pointed. The center of the tripod is the top washer of an old bramble tent. This was cut down, leaving six prongs extending outward for attaching the legs by means of bolts and wing nuts. The voltage is supplied by a standard 6-volt, 13-plate storage battery. Number 8 twisted, insulated wires are used for connecting the light to the battery with alligator clips and are easily attached and detached from the battery terminals.

This light can be easily moved. The tripod and light can be carried in one hand and the battery in the other, since the battery is in a plywood case with the ends and bottom made of 1-inch lumber. A handle extends the length of the battery and is 4½ inches above its surface. The battery and case weigh 40 pounds and the tripod and light 9 pounds.

By actual test, a battery fully charged will run this light, equipped with a 6-volt, 25-watt bulb, 21 hours. This is sufficient for two nights on the fire line during the short hours of darkness in the usual fire season, although to insure maximum service, it is advisable to change batteries every night. This can be done easily, since we always have trucks with fully charged batteries on all fires.



Harney portable field light developed for night fire fighting by Leo Harbach.

For actual line construction this will give a wide beam of diffused light with no glare for a distance of 300 feet, which is usually sufficient for a crew of 20 to 25 men, with another manning the light. This man directs the light where it is most needed and carries it along as the fire line is constructed. Time saved, better line construction, and the reduction of hazards by having adequate light more than pays for the extra man to operate the light. The use of this light greatly reduces the hazards of falling over cliffs or stepping into mine shafts when directing night crews to the fire line.

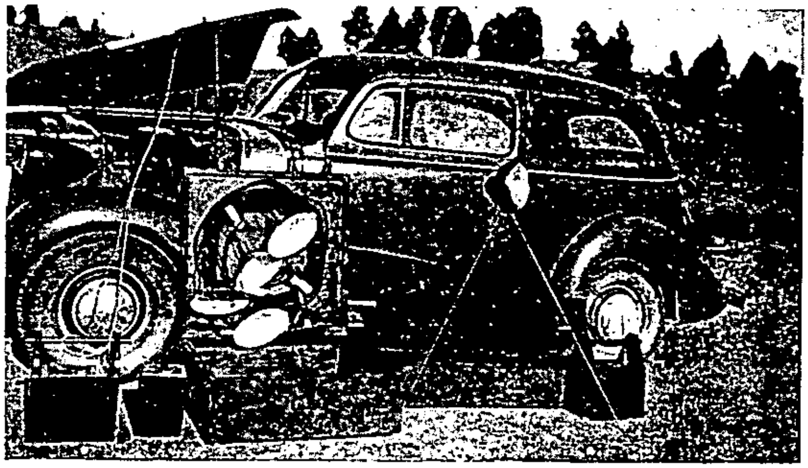
The light is also very efficient for mop-up work on the numerous small fires that occur on the Harney Forest. On a fire of 5 acres or smaller, which has largely gone black, it can be set up in the center and the light turned as the work progresses. Very satisfactory work can be done up to a distance of 500 to 600 feet from the light. In previous fires it was difficult to pick up small smokes unless there were flames or sparks. With this light, the tiniest smokes can be readily located and extinguished by the back-pack crew immediately, thereby having the fire completely "dead" by daylight.

For transportation in cars or trucks, the headlight and tripod are carried in a plywood case 12 by 8 by 46 inches, which is large enough for two complete outfits, plus extra bulbs. The battery case is just large enough to hold the battery. The sides extend about 3 inches below the top of the battery so it can be easily removed for recharging.

Adequate light for fire camps has long been a cherished dream of all camp bosses, cooks, and fire fighters. It has been a dire necessity but never a reality. It is believed that the camp light developed by Foreman Harbach meets the need. Although this light was designed primarily for use at fire camps, it is ideal for other night work, such as pouring concrete and for innumerable other jobs that must be done with a night crew.

The camp light consists of five sockets equipped with 6-volt, 25-watt bulbs, connected by means of two 100-foot No. 4 insulated copper wires. This heavy wire is used for minimum resistance. A smaller wire was tried but satisfactory results could not be obtained. Standard pull-chain light sockets are used, and are equipped with 10-inch light shades to keep the light on the ground. The lights are spaced 20 feet apart. In order to protect the bulbs two pieces of No. 9 wire are soldered at right angles on the bottom of the shade. No. 14

insulated copper wire is used for drop cords, and is satisfactory if not more than 6 to 8 inches in length. Any 6-volt battery can be used to supply the current. Since pick-ups or trucks are always available at our fire camps, a special battery is not needed. One end of the No. 4 copper is equipped with alligator clips, and the current is obtained by simply connecting one wire to the starter cable and the other to the frame of the car or truck or any bolt that will make a good ground. It does not make any difference which cable is attached



Harney field light, camp light, and trouble light developed by Leo Harbach.

to the starter cable. The far ends of the 100-foot No. 4 cables are insulated, not connected together, and a 100-foot ⅜-inch sash-cord is connected to this end for attaching to a tree or pole.

If a fire is in isolated territory and the fire camp set up away from passable roads, the lights and battery can be packed in. A battery fully charged will last 9 hours with a string of five lights, and if the engine is running and the generator set to charge 10 amps, the battery will remain fully charged.

For maximum light it is desirable to have the lights from 10 to 12 feet above the ground. This can easily be done by stringing the wire on trees or cutting suitable poles. The string of 5 lights will give adequate light for any size fire camp up to about 150 men. If desirable, 3 additional lights can be added which will make the string approximately 160 feet long. This can be installed in a semicircle over a fire camp and will give adequate light for both cooks and the crew.

The camp light is housed for transportation in a plywood case 10 by 30 by 30 inches in size. The outfit complete weighs 37 pounds. If the light is to be packed, the case can be made smaller.

Foreman Harbach has also developed a "trouble light" which can be used in case of accidents, for repairing tires, and making emergency repairs. This light consists of 12 feet of twisted insulated No. 14 sash-cord. One end is equipped with a pull-chain lamp socket and a 6-volt, 25-watt bulb, with a wire shield attached to the socket to protect the bulb At the other end of the cord the wires are equipped with alligator clips, one of which is clipped to the starter cable and the other to the frame of the car or truck. This usually gives sufficient light for any necessary night work or other emergency. If more light is needed, a 50-watt, 6-volt bulb can be used. In Government trucks which carry C. C. C. enrollees to fires or on other trips light is often needed. The trouble light comes in very handy when a truck arrives at a fire after dark and the fire cache has to be unloaded and tools issued to each enrollee. Without adequate light this is a difficult and dangerous task.

This light can be carried in a plywood case 6 by 6 by 8 inches, which is large enough for an extra bulb, screwdriver, and a pair of pliers. The trouble light, complete with box, weighs 4½ pounds. A battery fully charged will run this light 21 hours.

Heartache and Apology Department.—Does Fire Control Notes have a "heartache column?" (It is hereby formally launched.—Ed.) If so, here are the outpourings of an anguished soul. If not, here they are anyhow.

The April 1939 issue carried a note and illustration of the fine region 1 elapsed time calculator. No complaint thus far—only commendation.

On June 29, 1936, I wrote you a letter submitting an elapsed time calculator which I developed in May 1932 while at the Northern Rocky Mountain Forest Experiment Station. Mr. Godwin replied on July 1, 1936, saying, "This seems quite appropriate for use in the first issue and we will hold it along with other material we are assembling for that purpose." No complaint thus far—only commendation for you, Godwin, the experiment station, and myself.

But—My calculator was never published. And now, the improved calculator, modified from mine (I hope), has been published. No commendation now, except for region 1's new calculator—from me, only complaint.

Is Alexander Graham Bell to be forgotten because he did not develop the French desk-dial phone? (Your readers will, I am sure, see the analogy!)—M. A. Huberman. Forest Service Division of Silvics, Washington.

While Mr. Huberman writes with gracious lightness, the editors offer a serious apology for the oversight. They have something of a "bug" for giving proper credit for original creative work.—Ed.

Due-Credit Department.—The Red Cross fire-prevention program appears to be gaining momentum very rapidly, and bids fair to become a Nation-wide plank in that organization's program. As it gains in importance and becomes better known, it is but natural that the more important forest officers engaging in it will gain credit for their work, and, of course, this is as it should be. However, I hope you will remember that Lloyd Hougland on the Colville is the man who conceived the idea so far as Spokane is concerned, and who first contacted Wallis and sold him the idea. I think Lloyd should have a lot of credit, and so this note.—J. F. Campbell, Forest Service region 6.

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