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FIRE CONTROL NOTES

A PUBLICATION DEVOTED TO THE TECHNIQUE OF FOREST FIRE CONTROL

FOREST SERVICE - U. S. DEPARTMENT OF AGRICULTURE

FIRE CONTROL NOTES

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

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

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

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FIRE CONTROL NOTES

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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.

FIRE PLANNING: LETTER OF ACTING CHIEF OF THE FOREST SERVICE

C. M. GRANGER

Acting Chief, Forest Service

Replanning of fire control on the National Forests, more systematic and more thorough than ever before, has been undertaken by the Forest Service. Although planning is and must continue to be a never-ending process, such a special effort to coordinate and advance the techniques of fire control will lift this branch of forestry to new levels of technical efficiency, raise new problems, and open the way for new advances in this phase of conservation. The official letter of instructions outlining the broad plan to be followed in replanning fire control on these National properties is reproduced in this issue, together with the report of the Washington Fire Planning Conference.

In accordance with the recommendations of the special committee which met in Washington on November 19, a Service-wide mandatory coordinated program of fire control planning or replanning is being inaugurated. It is expected that this planning project will be completed for each National Forest and Region by March 1, 1940, except where the volume of work involved may be found clearly impossible with the funds and personnel available.

In the execution of this project, the accompanying report of the special committee will provide invaluable outline and other reference material. If instances are discovered in which the report of the committee and this letter seem to point in different directions, the point of view and line of action adopted should be controlled by this letter.

No special reports under "indices for immediate use in financial control" in the committee report will be required this winter or spring, and no work need be done under this division of the outline unless needed for Regional use.

The necessary time of qualified men should be made available for the work which is found necessary on each National Forest.

You will be expected to devote to the supervision and instruction of Forest planners and to inter-Forest coordination whatever time of qualified men is needed. If practicable, the men assigned to such Regional supervision should have had supervisor experience on a fire Forest. Such special Regional supervision should be started as early as practicable this winter. It is our belief that this job will require that there be devoted annually to Regional supervision of this project at least the equivalent of the full time of the number of men indicated in the following table:

Region 1 — 2 men	Region 2 — 1 man
Region 5 — 2 men	Region 3 — 1 man
Region 6 — 2 men	Region 4 — 1 man
Region 8 — 2 men	Region 7 — 1 man
Region 9 — 2 men	Region 10 — 0 men

The Chief and Assistant Chief of the Washington Division of Fire Control will devote all possible time to promotion and coordination of planning. The trained psychologist who is to be employed for fire prevention will contribute as much as possible to planning and the coordination of plans. In addition, Mr. L. G. Hornby and another man, not yet selected, will as soon as possible be assigned full time to the functions of leadership, inspection, and inter-Regional coordination of fire planning by the Division of Fire Control.

Definition of Fire Control Planning

Inquiry has disclosed considerable diversity of thought regarding the nature of the planning process. The special committee defines a plan as a proposed method of action. This definition is officially accepted. It establishes the nature and scope of fire control planning. Wherever in the field of fire control there is recognized any need for action, planning is required and will consist of a proposed method of action. When the proposed methods of action are coordinated and approved they become the specifications governing the management of fire control and constitute the basis for financing, inspection and general supervision.

The kinds of action required in fire control vary widely. Action of one distinct type is required for installation of improvement, plants, facilities, systems, standards and practices. In contrast to the action required for such installations is the action required for current management. While in one sense these two types of action are distinct they are also closely interwoven and inter-dependent. Definite and equally adequate planning is required for both types.

The need for action exists, and definite fire control planning is therefore

required by this letter when any difficulty or reason for dissatisfaction with expected results is recognized; when any weakness is known or suspected in any phase of fire control; when there is any question as to whether results which are satisfactory in themselves are being attained in more expensive ways than necessary; or when there is any reason for concern lest existing conditions which have not led to unsatisfactory results in the past may actually do so in the future.

Planning Means Replanning

The word planning is used throughout this letter and the accompanying outline prepared by the special committee, although a more accurate term would be replanning. With few exceptions, all National Forests have established systems of fire control based on some form and degree of planning. The work initiated by this letter will, in the main, consist of reviews, rechecks, reanalysis and replanning. Hence, it should be clearly understood that where the words plan or planning are used, it is not implied that planning is now being done for the first time; the present stage of planning involves simply the extension and refinement of planning which is now possible and logical. Planning is a continuous process to which is given varying degrees of emphasis and attention at different times. The next three years will be a period of special emphasis on fire planning in which we will consolidate our gains, coordinate our whole structure of fire control and lay solid foundations for systematic future developments.

Determination of Relative Needs for Planning

As emphasized in the report of the special committee, balance and emphasis must have careful attention in Regional planning for this fire control planning project. This point is of particular importance because so many low-danger Forests and Forests where results heretofore have been satisfactory are brought within the scope of the procedure set up by this letter and the accompanying outline.

Careful distinctions must be made in the need for planning both by areas and by different phases of planning. But although needed distinctions must be made at the outset, no area and no phase of planning should be overlooked. The committee's emphasis on this point is appropriate. There are probably a few Forests where danger is so low or reliable accomplishments are so high that no planning whatever is necessary; but this should not be taken for granted in any instance. The increasingly important part played by so-called freak fires at unexpected times and places makes it necessary to be sure of our ground before we say that what we have in the way of fire control is good enough anywhere. It is probable that some phase of fire

control is unsatisfactory on nearly every National Forest, and that some degree of planning is therefore required nearly everywhere.

As a first step, a survey should be made of the need for planning on each National Forest of each Region. Each Forest should be studied in the light of the following numbered questions. The questions are so framed that in each instance a negative answer indicates need for planning. The nature and intensity of the indicated planning can only be determined by study of the situation disclosed by the negative answer.

When these questions require reference to fire history, only those years should be used in which pertinennt conditions were reasonably comparable with present conditions. Thus, in studying the occurrence of lightning fires, at least 10 years' record should be used—more if something outstanding occurred more than 10 years ago. The significance of peak years in such occurrence should be watched closely. On the other hand, if some major permanent change affected man-caused fire occurrence for the last 3 years, the figures for those 3 years only should probably be used. Likewise, material changes in number of guards or road systems should be watched in considering area burned statistics. Where the phrase "current fire history" is used in this letter, it means that portion of fire history in which conditions affecting the specific phase of fire control under consideration were reasonably comparable with present conditions.

Since the preliminary survey involved in the following numbered questions will be useful to this office, you are requested to prepare and forward by March 15, 1937, a tabulation giving for each Forest in your Region the "yes" or "no" answers to the questions. For our purposes no qualification of the "yes" or "no" is required.

1. Is number of extra period fires as low as it is reasonable to expect without violation of good judgment in expenditure of funds to prevent extra period fires?

2. Is per cent of area burned acceptable? (As one guide, the column ".1 of 1% pro rated for year" in the current year's "Box Score" may be used. A quota for each Forest may be set from these figures. Any average loss during current fire history in excess of the resulting Forest quota must be regarded as unsatisfactory.)

3. If weather conditions have shown a tendency toward a sustained adverse change, and if acceptable results are shown under 1 and 2, can a reliable continuation of those acceptable results be expected if the adverse weather tendency continues?

4. If, due to grazing control, insect or pest infection, tree growth or other causes, fuel conditions or human use and risk have changed adversely for fire control, and if acceptable results are shown under 1 and 2, can a reliable continuation of these acceptable results be expected?

5. Has an active public support for fire prevention been developed as far as practicable with due regard for the law of diminishing returns in the use of Forest Service time and funds?

6. Is present accomplishment in reduction of man-caused fires in each cause group satisfactory to the Regional Forester?

7. If the answer to No. 6 is "No," then have man-caused fires been subjected to the fullest possible analysis to determine the "causes behind the causes" and the least expensive means of dealing adequately with those causes?

8. Are facilities and systems for detecting and reporting fires as satisfactory as they can be made without violation of good judgment in the use of Forest Service funds?

9. Is it certain that the selection and number of lookout stations (where such stations are needed) is such as to give the fullest coverage obtainable without conflict with the law of diminishing returns?

10. Is it certain that in building and planning lookout stations, roads, trails, landing fields, telephone lines, fireman and suppression squad stations, a proper degree of balance and coordination has been struck between (a) detection, (b) fireman and crew coverage, and (c) prevention—where, as is sometimes true, concessions in number and placement of men should be made for the sake of desired prevention influences?

11. Does analysis of current history of fires of over 100 acres show that dispatching was handled as well as it would have been if fuels had been classified as to rate of spread and resistance to control?

12. Have dispatching aids and practices been developed to such a degree that dispatchers send an adequate number of men to the occasional more aggressive fire but avoid overmanning the general run of fires?

13. Does the Forest now receive definite and actionable weather forecasts, particularly forecasts of high winds and lightning storms?

14. Is the Forest equipped with a satisfactory system for measuring variable fire danger?

15. Have definite plans been made to fill specific fire control positions,

including suppression squad positions, in direct correlation with numerical classes of fire danger?

16. Have definite plans been made for mobilizing most expeditiously the largest number of fire fighters which the Forest would need under extreme conditions?

17. Have all possibilities for organized cooperation by other agencies and residents on and near the Forest been fully developed for both prevention and suppression?

18. Have complete plans for transportation been developed, including roads, trails, landing fields and use of aircraft for dropping supplies and equipment?

19. Have complete plans for communication been developed, including both telephone and radio?

20. Have comprehensive plans been completed for bringing into habitual use any pieces of equipment, whether new or old, the introduction of which would be desirable on the Forest?

21. Have problems of distribution of equipment and maintenance of adequate reserves of equipment for extreme needs been solved?

22. Are prevention, presuppression and suppression jobs for all year-long men regularly listed incorporated in work plans and executed as fully as the relative urgency of each such job demands?

23. Is regular practice satisfactory in inspection of prevention and presuppression, including self-inspection and inspection by telephone, when necessary?

24. Is the supply of competent overhead for the larger fires satisfactory?

25. Has the number of fires which escape after being corralled the first time been reduced to a satisfactory extent?

26. Is present practice satisfactory in the systematic study and cure of the cause behind the cause in the cases of fires of over 500 acres?

27. Is habitual action in the organization and management of men and machines on the control line satisfactory?

28. Are rates of held line production per man hour normally all that should be expected?

29. Is turnover of short-term employees satisfactory?

30. Have principles and policies followed in determining wage rates been developed satisfactorily?

31. Have systems of discipline and recognition for good work been developed satisfactorily?

32. Have the possibilities been exhausted for necessary lengthening of employment periods on fire work by employment on other work by the Forest Service or other employers?

33. Is the annual income of short-term protection men sufficient to provide a reasonably satisfactory standard of living; also to prevent size of annual income from defeating reasonable stability of the short-term force?

34. Do all men who must be depended upon for some phase of fire control receive satisfactory training for the duties they may be called upon to perform, including those arising from unusual or extreme conditions?

Plan the Planning Job

Regions may wish to insert additional items in the preliminary survey represented by the foregoing numbered questions. When completed, this survey will, in a broad way at least, identify planning needs by Forests (or parts of Forests) and by more or less distinct phases of fire control. With perspective and identification of planning needs thus provided, something of a general plan and schedule should be formulated in order that all divisions of the planning work may go forward in reasonable correlation. Other things being equal, the most time-consuming parts of the project should be started first. Necessary financing and assignments of men must be arranged. General and special instructions for the Regions must be issued.

The place of Research units and individuals in the program should be covered by agreement with the stations on specific job assignments and financial arrangements. Major contributions have already been made by Research in certain vital divisions of planning, and this branch should play an important role in the special planning project if given proper support.

FIRE PREVENTION

Because of the complexity of prevention problems and the diversity of forms of prevention work, it is easy to fall into confusion and poor use of time. Selectivity and economy of effort are indispensable, both in the study of problems and in planning for action. Mere quantity of effort expended in prevention means nothing unless the effort is directed by research which uncovers the key points at which effort may be employed most effectively.

Understanding of the "cause behind the cause" is often difficult to attain, but the initial steps in prevention planning should include the best

possible search for such a grasp of prevention problems where man-caused fires are a factor of any consequence. It is not enough to say that people are careless. Why are they careless? What are the influences which make people careless in some ways and not in others? What habits and attitudes result in carelessness with fire? How did such habits get started? Are there instances where such habits have been corrected? If so, why and how?

When we have to deal with incendiary, industrial or other causes where the element of carelessness is not dominant, it is equally important to search out and identify as clearly as possible the ultimate root cause in order that curative effort may be applied intelligently.

Patient and intensive study is required wherever occurrence of man-caused fires is of any consequence. In the East and South major emphasis in all fire control planning should of course be put on prevention. In some of the older units occurrence may have been so reduced by successful prevention effort that special measures are needed to keep public and Forest Service attitudes from becoming relaxed and complacent. No uniform methods of study can be prescribed. Methods must be devised to fit particular situations and the theories and ingenuity of the individual officers responsible for attempting to overcome the baffling difficulties in prevention. Intensive case study of representative instances will often be helpful. Where the resident year-long population is heavy, a carefully planned prevention census will unquestionably be found advisable. Where resident population is sparse, or where man-caused fires are largely started by outsiders or by accident, a very detailed classification of fires by causes and sub-causes may be a better approach than the census method.

It should be recognized that here and there, particularly in the East, we have already completed amazingly effective prevention undertakings, despite the heavy odds against us. Some of these instances have been reported in FIRE CONTROL NOTES. In a sense, we cannot hope to do much better jobs than we have already done in places. Our task is to find ways of doing equally good jobs in less time than it has required heretofore. If we say that in some of our prevention pioneering it has taken 15 years to reach an acceptable objective, it is reasonable to expect that under similar conditions and with the aid of present advantages we should accomplish equal results in 5 years. Generally speaking, our purpose should be to accelerate the process of changing human attitudes and practice which has been going on for many years.

Many phases of prevention have three interrelated aspects—Forest, Regional, and National. When it is recognized that certain situations cannot be met by Forest planning alone, the service, functions and action needed

from Regional and National offices should be specified separately for each, as definitely as possible. Such identification from the Forest standpoint of specific needs for Regional and National action will provide valuable controls for prevention plans for these wider fields.

Prevention planning should be carried to at least the extent indicated in the following numbered paragraphs. Each paragraph covers a separate unit of prevention planning, and should be prepared separately in order to facilitate Regional and National coordination.

1. *Oral appeals, salesmanship, personal influence.*—Formulate the best that can now be set up to cover facts, ideas, arguments and methods of presentation to be used for best results by guards, District Rangers and others who have opportunities to influence residents, visitors and community leaders, both individually and as groups. Go as far as possible in determining what local people really think about fire control, why they feel as they do, and in what ways they are most susceptible to influences for fire prevention. Take advantage of any new light or guidance which may be obtained from any source. Give particular attention to preparation of material and plans for systematic training of guards who meet the public.

2. *Active cooperation with psychology departments of Universities* should be planned, looking to better understanding of human behavior and focusing particularly on possibilities for changing habits of carelessness in the use of fire. Forest plans should specify the dominant aspects of prevention which need study from the psychological angle. Arrangements with Universities will usually best be made as a part of the Regional plan*

3. *Cooperation by other agencies and individuals.*—Classify all individuals, agencies and organizations (including organizations of local cooperators) who might be helpful; determine how they might reasonably

*The following resolution was passed by the Regional Foresters' meeting in Washington in December, 1936:

"In seeking the most effective means of reducing the number of man-caused fires, it is the policy of the Forest Service to make certain that the knowledge and techniques of modern applied psychology are drawn upon to the fullest possible extent.

"In addition to such professional psychological service as the Washington Office may provide in carrying out plans adopted by the Spokane Fire Control Meeting, it is expected that Regions will establish active cooperative relations with psychology departments of universities.

"By taking pains to interest and inform teachers of psychology regarding our fire prevention problems, helpful professional advice may often be obtained in the study and treatments of habits, emotional attitudes, and reasoning processes of regional groups which are responsible for fires.

"When teachers of psychology are familiar with our prevention problems, the psychological aspects of carelessness and incendiarism will naturally be used as subject matter for undergraduate and graduate work.

"By means of this additional relationship with educational institutions we will obtain a fruitful new source of advice in fire prevention; teachers will be helped by the introduction of a new type of problem for professional use in teaching; graduate students will often do research work of value to us; and fire prevention will take its place alongside of education, advertising and industry as a suitable field for expert application of the principles of psychology."

contribute to prevention; plan definitely the best ways to obtain their active support; and specify what is to be done to organize, inspire and direct such support.

4. *Formulate a well-considered closure policy*, and if it seems wise to use closures, specify as definitely as possible when and how they are to be employed.

5. *Investigation.*—Intensive inquiry following fires should be planned for whenever there is a local population which could be influenced efficiently in this manner. When such follow-up is appropriate, plans should specify as definitely as possible how Rangers or others should approach residents in the vicinity of a fire and how complete their canvass should be of residents who might have information or be susceptible to such an approach.

6. *Law enforcement.*—Consider need for special training of guards and rangers and need for Regional or Forest specialists. Determine attitudes of local law enforcement officers and enlist their interest. Specify definitely what should be done in whole field of law enforcement.

7. *Schools* often afford the best way to influence adults as well as the best chance for better future attitudes on fire. Survey the prevention situation from the school angle, search for more effective ways of working, and specify what is to be done.

8. *Special material.*—Survey the chances for effective influence by use of printed matter, radio, movies, news bulletins to cooperators, and letters, and the relative local value of different media. Specify what should be done, including the contribution needed from Regional and National sources. Formulate definite plans for employing these media effectively with particular reference to signs, posters and local papers.

9. *Presuppression organization.*—If there is any occasion to use prevention patrolmen or entrance guards, then the work to be done, periods, equipment, building, selection and training of men, etc., should be covered by definite and detailed plans. If there is no occasion to use such methods, what should the short-term presuppression organization contribute to prevention? Lookoutmen have important prevention functions to perform, but too often this has not been recognized or planned for. Prevention possibilities from presuppression employees should be worked out thoroughly and specific plans formulated.

10. *Debris-burning prearrangements.*—Where fire is used for land clearing, facilitating cultivation, pasture improvement and such hazard

reduction as brush, grass and trash clearing around houses, complete arrangements must be made for minimizing this risk through cooperative control. Plans should involve establishment of a system of notification by postcard, phone or other means. Specification may well be made of safety equipment required to be on hand.

11. *Special hazard plans.*—It is worse than useless to clutter plans with data about physical hazards when nothing practical can be done about them. On the other hand, no special hazard should be overlooked when planned action is feasible—whether action looks to actual reduction of the hazard or special presuppression attention. 1936 experience places heavy emphasis on such things as small sawmills and village dumps. Sawmills are notorious for burning waste in ways which easily result in conflagrations when conditions are bad. Safety conditions at such mills are often under our control only to the extent that we supply ingenuity, courage and persistence.

Such special hazards and all similar ones should be surveyed with discrimination and imagination. When it is practicable to clean up or reduce such hazards or emphasize them in presuppression plans, specify clearly what is to be done and by whom.

12. *Legislation.*—The role of legislation should be neither over nor under valued. If analysis shows that the time is ripe for more stringent legislation, whether municipal, County, State or Federal, specify the needs and plan the sequence of steps to be taken in promoting public support and obtaining enactments. If analysis shows that educational effects may be produced with desirable efficiency by legislation not designed for immediate strict enforcement, then plans should be worked out with even more care. For either form of legislation, close collaboration with legislative authorities, public-spirited organizations and individuals is essential and should be planned for specifically. Samples of county and municipal enactments now in effect will probably be made available next spring by the Forest Committee of the National Fire Protection Association.

13. *Needed action by Regional and National offices* should be summarized in one chapter for convenient use by such offices and the formulation of Regional and National prevention plans. This chapter should indicate what type of films, radio programs, news releases, exhibits, pamphlets, posters and other printed matter will be most effective in meeting the local problem.

14. *Current revisions* of prevention plans and systematic searches for better methods or new or neglected opportunities should be covered by

plans designed to insure that both planning and action will be kept alert and up to date. No standard method of planning for continued constructive thinking can be laid down, but at the very least some provision should be made for systematic collection of hints or techniques derived from current publications, suggestions of local men or experience of others. A scheduled period for annual study of this file and the year's experience with man-caused fires should be planned. Failure to sense and act on opportunities for effective prevention should be made much less frequent by such planning.

15. *Prevention research* should be provided for definitely. At the best, prevention planning at this time will be handicapped by inadequate knowledge. Any real attempt to plan prevention will disclose the need for further study, experiments and tests. As such needs are recognized they should be covered by definite working plans designed to supply the needed knowledge and methods. In some instances, planned research needs to be initiated to determine the limits to prevention effort which may be dictated by the law of diminishing returns.

16. *Job analysis and administrative work plans* should be considered and definite standards and procedures set up which will insure that prevention jobs are duly considered when such analyses are made; also that prevention work is executed as fully as demanded by its relative importance.

PRESUPPRESSION

Conditions vary too widely to permit many general specifications for such planning. Coordination must be attained largely through work on the ground by Regional and National men assigned to that particular function. Techniques for determining time standards, when needed, will be worked out by Mr. Hornby.

Cooperation

In order to satisfy the requirements of this fire control planning project there must be:

1. A survey of the presuppression services which could be rendered by actual or potential cooperators, both as individuals and as organizations. In places where cooperation has been neglected this survey will require imagination and some reference to what has been done elsewhere. Even where cooperation has been highly developed it should be searched carefully for opportunities for better leadership, better organization or better forms of management.

2. Definite plans should be drawn for bringing cooperation to a satisfa

tory level in every respect. Particular attention should be directed to ways and means of keeping cooperation alive during the life of the CCC, and definite provision should be made for keeping cooperative spirit and organizations ready to spring into effective action if and when the CCC drops out.

Detection

One important specification is that detection should be so planned that reasonably adequate detection service can readily be supplied when danger reaches the worst stage known in previous fire history. For low danger Forests, where no paid lookout service is normally needed, this may mean no more than careful selection of peaks (or valley locations) to which men might be sent quickly in times of need. Lookout structures and telephone lines might not be called for; radio may be provided instead of a telephone line; but the points need to be selected in advance, and trails or other provisions made for reaching the selected locations quickly.

Under other conditions, plans for periods of extreme danger will take quite different forms, such as: fully equipped lookout stations, when they are likely to be occupied a few weeks every year; crude towers or trees rigged for easy climbing; detection patrol systems ready to throw into action when smoke closes in; or plans for use of planes after lightning storms or when smoke closes in.

The general underlying theory is that we should be prepared with suitable facilities and plans designed to cope with any degree of danger which has ever occurred in the past—even if the extreme danger should last for only a few days per year or occur only once in ten or more years.

No standard method can be prescribed for selection of lookout stations. If any other conditions are as difficult as those in Northern Idaho and Western Montana the methods developed by Hornby may be employed. In conditions exemplified by some Colorado Forests nothing may be warranted beyond an overhauling of the system of cooperative detection to make sure that it is well designed and can be tightened up at will in particularly dangerous periods.

When current fire history shows that variations in rates of spread and resistance to control are essential considerations in placement of lookout stations, such variations should be determined, mapped and considered in such detail as the particular situation commands. The most intensive form of survey yet used is that developed by Hornby and described in his book.

Whatever method is used for selection of lookout stations, planning for the more intensive systems cannot be classed as satisfactory unless there

is good coordination between detection, fireman and suppression squad placement, transportation, travel time and prevention (where the prevention value of presuppression men should be given consideration).

It is also specified that hour control standards in satisfactory planning must deal with corralling during the first work period rather than with travel time only.

Placement of Firemen and Suppression Squads

If it can be done without violation of good judgment in the use of public funds the system should be engineered to corral 100% of fires within the first work period, not later than 10 a. m. of the day following discovery. When this is not found possible, the intensity of the system should be lowered so as to corral the highest per cent which the system can be designed for without violation of good judgment in the use of funds.

The last two paragraphs under detection apply here also.

Transportation

The use of airplanes needs emphasis. The landing field chance should be surveyed systematically, even on low danger Forests, and plans for needed and practicable developments carefully drawn. Many meadows, fields and mesas may, upon examination, be found usable at no expense except for proper marking. In other instances clearing and grading, even at high cost, is necessary and justifiable. Definite landing field plans should be worked out.

The next issue of FIRE CONTROL NOTES will carry the latest techniques and instructions for dropping supplies and equipment from moving aircraft. This form of transportation is important not only in major fire Regions, but also on low danger Forests where the infrequent bad fire may involve an insoluble transportation problem unless airplanes are employed.

Air transportation and dropping of supplies may be essential even when roads, trucks and pack animals are plentiful. When supplies are needed in quantity a few miles from the end of a road but at a point reached only by a steep, difficult climb, airplanes may be the only means of supplying transportation which will be satisfactory in terms of speed and quantities delivered. Such transportation may also be cheaper than any other. With the possible exception of a very few units (Humboldt? White Mountains?) every National Forest should be mentally prepared to use such air transportation without delay in the event of unexpected need. Plans should be drawn which will insure such preparedness. Plans should also specify where planes may be obtained and what steps will be taken annually to re-

new such arrangements as may seem appropriate with plane owners.

In order that planes may be available when needed, it is important that charter flying services, when located in or near National Forest towns, be given all possible encouragement. Conditions influencing the business of such small concerns are such that they are usually barely able to survive. When they disappear for lack of business our resources for transportation to fires are seriously impaired. It is important that we do everything we can to aid them in getting business and thus encourage them to hang on and *keep their equipment up*. In our own work we should search for every possible legitimate way of giving employment to such planes. In case of doubt as to the best form of transportation to use in fire fighting, employ planes. This will mean economy as well as efficiency in the long run. A section of the fire control plan should deal definitely with the problem wherever it is in any way an issue. Fiscal regulations and Comptroller's decisions should be kept in mind when they are pertinent.

For protection road and trail planning, modifications of the Norcross-Grefe method will no doubt be developed as the planning of utilization, recreation and through roads proceeds. Road planning in future will aim at well-integrated systems serving all needs rather than specialized service to different activities.

Communication

The time is ripe to plan definitely on the use to be made of radio and the total number of sets required for a complete installation of radio.

Under some conditions it will be necessary, as a matter of planning, to design an ideal system of telephone and radio communication before planning changes to be made in existing lines and other facilities. Such designing of an ideal system will require careful consideration of the problem of centralization vs. decentralization in dispatching, which is referred to later under Dispatching.

In general, the communication planning process requires that a survey be made of communication troubles, both present and potential. The results of such a survey will control the amount and forms of analyses which should be made and the needs and problems which should be covered definitely by the communication plan.

Weather Forecasting Service

Current fire history should be scrutinized and specifications formulated for the practicable service the Forest should receive. Deficiencies in present forecasting service should be defined and supporting evidence assembled.

Individual Forest planning cannot go much further than to arrange for presentation of definite needs to higher authority. Planning from that point on must be taken up by Regional and Washington offices and will involve negotiations with the Weather Bureau, efforts to get increased appropriations for the Weather Bureau, cooperation, etc.

Danger Meters

The western portion of Region 1 and the Central Idaho Forests of Region 4 are now equipped with complete and reasonably satisfactory systems for measuring integrated danger and controlling the strength of protection force thereby. All other Regions (except Region 10) are pushing the job. Wherever practicable, Experiment Stations are furnishing expert service. Weather-gauging equipment needed for control of the whole problem is being purchased and installed. The work of identifying and weighting the particular set of elements which should be integrated to obtain reliable danger ratings for different Regions and parts of Regions is under way in places.

One time-consuming task which only administrative men can perform is likely to be under-emphasized and allowed to drag. One of the very first steps toward a danger-rating system must be taken by administration. The number of intervals or classes of danger which it is desirable to recognize in planning different degrees of strength of force must be determined by administration. This, when done, will guide Research men in their work. Then the specific stations to be manned for each recognized danger class must be worked out. This requires much detailed planning, which must not be allowed to falter.

If it has not already been done, a plan should be drawn up specifying and scheduling each step involved in the production of a tested and reliable danger meter system for each Region—or part of a Region where one meter will not serve an entire Region.

SUPPRESSION

In suppression, as in presuppression, conditions vary too widely to permit more than a few planning specifications of universal applicability. Coordination must be attained largely through work on the ground by Regional and All-Service specialists.

Dispatching

This phase of suppression assumes greatly increased importance because of the emphasis now placed on corralling fires within the first work period. Until our techniques are greatly improved, dispatchers will be under pres-

sure to overman 99 fires out of 100 in order adequately to man the occasional unusually aggressive fire. The financial results of such overmanning might be serious—particularly if we should lose the CCC and have to depend on hired fire fighters.

Unfortunately, an extreme "resistance to control" is encountered when we attempt to improve our techniques for determining the number of men to send to fires. The facts which should guide dispatching decisions in this respect are extremely elusive. Repeated tests have shown wide disparity in decisions, even when all the facts we now are able to work with are known. The difficulties involved in determining numbers of men to send to fires demand that an attack on this problem be given high priority in scheduling the fire control planning job. At an early stage of the planning process a working plan should be drawn up to cover the research, experimentation and testing which must be gone through in the development of satisfactory techniques.

Important as it is, the determination of number of men to send to a fire is only one of many angles of dispatching.

For use in training and otherwise, the job of dispatching should be analyzed and standard practice instructions set up. Particular attention should be given to definition of responsibilities of dispatcher, District Ranger, Supervisor's office and Regional office in general, and with respect to fires of different sizes. Standard practice instructions should also cover as fully as possible all that can be planned by way of insuring completeness of dispatching action, precision in bringing men and tools together at the same time and place, and smooth functioning between fire boss and dispatcher.

Under some conditions, the values of Ranger District dispatching clearly outweigh those of centralized dispatching for a Forest or group of Ranger Districts, but this is not universally true, and the controlling conditions must be carefully examined in each case and decisions as permanent as possible be reached on this point.

Critical Analysis of Larger Fires

Comprehensive fire planning necessarily deals with the danger of all kinds and sizes of fires. The total number of fires is usually so great that in interpreting fire history for planning purposes fires must be grouped in various ways and subjected to statistical analyses. All this is appropriate and necessary, but such approaches are not designed to extract from the history of the larger fires all the significant guidance a fire manager needs For example, a heavy fire loss may arise from specific and sometimes wide-

spread weaknesses in training, dispatching or prevention practice, inspection, etc., which urgently need action by fire control management; but such weaknesses are likely to be obscured by undue reliance on purely statistical treatment of fire history. Such significant aspects of fire history can be disclosed by supplementing statistical analyses by another approach These aspects are most effectively uncovered and emphasized by critical board of review or other study and the formulation of considered judgments regarding the cures for larger fires.

Although the annual total of National Forest fires has mounted to around 16,000, it is still entirely practicable to put the larger fires under the microscope for individual study. 75% to 95% of our annual loss in acres is due to less than 100 fires.

Definite plans should therefore be formulated for searching review and analysis of each larger fire. "Larger fires" may be defined by reference to local conditions and the necessity of keeping the number so studied small enough to avoid superficiality in such analyses, but the line between "larger" and "smaller" fires should not be placed above 500 acres.

In order to accelerate the use of such analyses and considered judgments in local, Regional and National planning, please report to the Chief by March 15, 1937, on each 1936 fire of over 500 acres. Each fire should be reported on separately, and the report should give the name of the fire and the Forest on which it occurred. This will enable us to connect each report with the one already made on conversion of energy into held line on fires of over 500 acres.

Each report should be made by the Supervisor, with the help of those best qualified to supply detailed information, and should have the approval of the Regional office.

The report may be brief, but should reflect careful thinking on the specific fire and the best, easiest and cheapest ways:

1. To prevent a fire such as the one in question from occurring at all (in the case of preventable man-caused fires), or
2. To prevent a fire such as the one in question from reaching 500 acres in size, or
3. To control a future fire under similar circumstances at smaller size than that reached by the one in question.

In studying fires of over 500 acres, attention should be directed first to what may be called management factors. Was the large fire due to lack of experience, lack of training, errors in training, errors in dispatching, fail-

ure to use the right method for the circumstances, poor selections of guards, poor inspection, failure to follow instructions, etc.? After consideration of the part management factors may have played, attention may be turned to what may be called physical factors. Was the outcome due to lack of roads or other physical facilities involving expenditure which, in order to avoid such fires, would still be necessary even with all management factors functioning satisfactorily?

In thinking out the requested report it should be assumed that funds and authority would be provided for any safety measure the analyst believes wiser from the standpoint of the public interest then it would be to accept the risk of such a fire. It may be helpful to consider the task of the analyst as that of writing a prescription which will prevent a repetition of such a fire or reduce its size. The prescription will usually include more than one ingredient. If so, list them in the order of their relative importance. Make your prescription first in the form of trenchant paragraph headings embodying the basic idea involved in each ingredient. Afterwards, elaborate each paragraph heading as much as seems necessary to convey your reasons for believing that this ingredient, together with any others named, would effect a cure in the best, easiest and cheapest way. If an ingredient which may vary in form or intensity (such as better training, better dispatching, or more roads) is included, be as definite as possible in describing it in the paragraph heading or the elaboration thereof. Say training in this or that specific respect and indicate how best it may be given. Say better dispatching in this or that specific respect and indicate how it may be obtained. Say how much more road work would be required, and at what cost, for better suppression of a fire as illustrated by this case. Be sure to state the increase, if material, of cost involved by an ingredient, for the entire area which logically should be treated to prevent recurrence of such a fire anywhere within the area; avoid giving an answer applicable only to a little piece of the Forest where this particular fire occurred.

Distribution and Reserve Stocks of Supplies and Equipment

This perennial problem should be treated as systematically and conclusively as possible. Inter-Forest and inter-Regional problems should not be overlooked. Disciplined imagination should be employed in planning for the infrequent situation in which the lack of adequate readily available stocks proves ruinous. Schemes for having reserves carried by dealers should not be neglected.

Held Line Production

Formulate definite working plans for searching in this field for causes

and remedies for the usual low rates of production. The initiation of systematic experiments and tests will be expected as a part of the general fire control planning project. Plans should provide for continuation of such experiments until, in practice, normal production rates are brought up to the rates found to be reasonably attainable by competent experimentation.

SUPERVISION AND ORGANIZATION

At least the following numbered items are required as a part of the planning project:

1. Survey and analyze the spirit and confidence prevailing in the organization; locate weaknesses, if any; search for policies, principles and devices to strengthen zest and feelings of satisfaction; and formulate specific plans for improving the organization in this respect.

2. Search for tendencies, actual or potential, toward lack of balance in supervision (over attention to suppression with under attention to detection, over emphasis on prevention with under emphasis on service of supply, etc.) and formulate and install specific principles, standards and schedules for use of time, which will serve as safeguards.

3. Identify essential services which can be dependably provided only if specialists are employed (dispatchers, staff men, men with technical training and free to concentrate on fire, warehouse men, etc.) and formulate definite plans for the use of such specialists.

4. Check the flow of work and allocation of responsibility between members of the organization and formulate needed adjustments and definitions of job responsibility. Give particular attention to the difficulties, actual or potential, between functions of dispatchers and District Rangers; District Rangers and Assistant District Rangers; and District Rangers and staff men in the Supervisor's office.

5. Check the extent to which supervisory functions are discharged and members of the organization kept in best frame of mind by use of telephone to supplement the more time-consuming forms of contact. Plan and formulate standards of approved practice in this respect. (See also under Inspection.)

6. Check the methods employed for incorporating all kinds of fire control jobs in work plans of appropriate officers; also the extent to which planned jobs are actually carried out; and formulate plans and standard practice which will correct deficiencies disclosed and establish desired betterments.

PERSONNEL

Expert personnel management is, of course, the heart of effective fire control, just as in any other organized activity. The same general principles apply alike to fire control and other personnel. It would be inappropriate to require special planning which should be covered by general personnel planning. There are, however, certain important special aspects of the management of fire control personnel which must be handled as a part of fire control planning. These have to do with the large short-term organization, the spirit and competence of which is so peculiarly important in this activity. At least the following numbered items should be covered specifically in Forest and Regional planning.

1. Analyze the turnover of short-term men statistically, comparatively and by investigation of individual cases. Consider particularly the extent to which the best men leave.

2. Open up the whole question of wages for short-term fire personnel. Consider particularly the problem of annual income of our short-term men; the extent to which their total income makes possible a decent standard of living; past, present and probable future chances for outside employment during our inactive seasons; and possible remedies which might be prescribed. Evolve principles and formulate definite plans. Region 1 has completed a study of these problems, and a copy of the resulting report has been sent you. This report does not go into detail on one important point—the possibilities within existing financial set-ups for remedying the existing bad situation.

3. Obviously, fire control plans are not the place to set up schedules of penalties, but the question of discipline cannot be neglected in work where, as in fire suppression, the performance of a single individual, with no close supervision possible, may have such far-reaching results. The problem is not one of punishment for failure by an individual. We cannot escape responsibility for performance by the whole organization; and what the organization as a whole is prepared to deliver is directly influenced one way or the other by what we do when individuals fall short of what is reasonably to be expected, considering efficiency of training, clarity of instructions and other considerations. We cannot in any way evade responsibility for what we do or do not do when men falter on the job, leave fires before they are out, fail to follow instructions, leave their duty assignments or fall into other failures which are so often the cause of serious losses.

The fire control plan should deal fully with the problem of discipline and recommend specific policies—particularly policies aimed at *prevention* of failures.

4. The problem of adequate overhead for larger fires must be dealt with and definite plans formulated. Aside from the training aspects of this problem the plan should provide for the most appropriate way of shifting and mobilizing men, including cooperators, as required by large fire jobs, and should plan for any Forest or inter-Forest flying squadrons which analysis shows should be organized.

TRAINING

Planning for training becomes involved in highly technical aspects when an attempt is made to go far below the surface. It is not to be expected that fire control planners will be qualified always to handle the more technical phases. An inter-Regional committee is now working on these phases of training, and it is expected that the resulting All-Service handbook on fire control training will be available by the spring of 1937. This publication should serve as a training Bible for planners and fire control managers. Much of the detailed planning for training may well be postponed until this handbook is available for guidance.

In the meantime there should be a thoroughgoing analysis of training needs. Local records and unrecorded experience should be searched for clues to deficiencies in performance which are traceable to deficiencies in training; also for clues to constructive developments in thinking and management which might be encouraged by practicable training processes.

Training should not be thought of merely as something needed by guards. If we could take a thoroughly objective view it would probably be clear that, vital as training is for guards, they need it less than other men responsible for fire control; and that the higher one goes in the organization structure the greater the need for fire training.

There has grown up an understandable tendency to think that since we regularly go through certain motions of training—guard training at least—that fire control training is in a reasonably satisfactory stage of development and needs no special emphasis. Nothing could be further from the truth. Current fire history discloses that in certain respects the training we give is actually a liability rather than an asset; and even the best we do by way of fire training has glaring deficiencies, as will be disclosed by any objective appraisal of the effect and adequacy of the fire training given. Fire training is seriously under-emphasized, and the danger of over-emphasis is very slight instead; but the need for advances in technical competence in training is greater than the need for longer periods in guard or other training camps. Technical competence probably cannot be attained

without more fire training specialist service, both Regional and Forest. More of such specialist service is demanded by the sheer volume of the job of training guards, executives, including dispatchers and CCC foremen and superintendents. When the forthcoming handbook is available and planning for training can get fully under way, the need for fire training specialists on individual Forests or groups of Forests should be considered; also whether there is any chance to put training on its feet without the aid of one Regional fire training specialist in each of Regions 2, 3, 4, 7, 8 and 9 and two such men in each of Regions 1, 5 and 6.

Other major fire training problems which should be covered by positive programs to be planned after the handbook is issued are:

Number of days of training to be given new guards.

Advanced training for veteran guards. (So year-long employees won't have to be pulled from a distance to supply overhead service on fires which could be rendered by properly trained guards.)

Training of cooperators, particularly for suppression overhead jobs.

Development of forms of training designed as best possible substitutes for experience—an increasingly serious problem.

Training possibilities in inspection.

Overcoming our aversion to drills and tests as training processes.

Training in techniques of prevention contacts.

Safeguards against misuse of discussion method in training.

Safeguards against defeating training by overlarge doses in one lesson.

INSPECTION

Sometimes it seems that the most baffling problem in inspection is to select the key facts, key situations and pivotal standards, inspection of which will yield the information management needs without consuming an impossible amount of the time of inspectors and inspectees. At other times the dominant question is how to get inspection to go on from the very necessary stage of friendly visiting and bore in, bear down on standards and exhibit the kindly but searching force that characterizes good inspection. More often, perhaps, the chief cause for perplexity is the difficulty in getting inspections made at all, or made according to plan and schedule; or the number of instances when good inspection is followed by faltering executive action.

These problems, and others associated with them, should be covered by systematic analyses of the fire control inspection situation on each Forest and definite inspection plans, procedures, schedules and standards drawn up.

Inspection outlines and systems used in different Regions should be reviewed. Some of these are highly developed, although they often include an amount of detail best suited to self-inspection outlines.

Self-inspection, a relatively new development, should be given heavy emphasis. Outlines, standards and questionnaires prepared for this purpose should, of course, be in complete detail. Selectivity is not in point in self-inspection systems, although very much in point when inspectors start their work by referring to self-inspection records.

The preparation of self-inspection systems compels executives to be clear and definite in what they require of their subordinates. Such systems represent the height of fairness to employees; they make for material economy of time in personal or office inspections; and they should go far in tuning up a fire control organization to the highest pitch.

Fire control planning cannot be accepted as complete until self-inspection forms and systems have been worked out for at least all classes of guards, District Rangers, men who have had charge of fires and the Forest Supervisor. The best self-inspection system is the one initiated by the man who is to use it on himself.

Inspection by telephone has proven invaluable as a supplement to personal inspection or as a substitute therefor when emergencies prevent adherence to regular inspection schedules. Plans should specify full use of this method.

Careful study should be given to inspection as a training vehicle. The best attainable integration of training with all forms of inspection should be sought by formulation of definite policies and practices.

Particular attention should be given to inspection of the suppression of small fires. Mistakes which may easily be overlooked in the handling of small fires often prove to be the seeds from which grow important mistakes on large fires. Provision should be made for close analysis of a random sampling of suppression of small fires.

EQUIPMENT

From a survey of current fire history, unrecorded experiences and observations and consideration of all types of equipment now used, identify equipment needs not now met satisfactorily.

Formulate definite plans designed to overcome the inertia which retards the use of better equipment already available or in use elsewhere (machine tools, horses and plows, improved hand tools, etc.).

Formulate working plans for any specific new developments found to be needed.

UNITED STATES DEPARTMENT OF AGRICULTURE
FOREST SERVICE

O
Fire
Fire Planning Conference

Washington, D. C.,
December 18, 1936

MEMORANDUM FOR THE CHIEF

Attached is the report of the special committee, which met in Washington from November 19 to December 9, to explore the possibilities of developing a method for the equitable distribution of fire control funds between Regions according to their needs.

Early in the conference it became evident that to show actual needs of the Regions, systematic fire control planning capable of correlation between Regions was essential before any progress could be made toward consideration of the financial control phases. Therefore, the first work was directed toward outlining the major elements essential to fire control planning. This done, certain of these elements, which the committee judged could be used temporarily by the financial manager, were selected and included, together with units of expression as a section of the report.

For so complex a subject, involving so broad a field, it was obviously impossible in the short time available to cover in detail all the ramifications of the subject of fire control.

It was the general consensus of opinion that while the treatment of the problem of fire control planning and the setting up of elements for use by the financial planner had by no means been exhausted by this group, that worth-while progress had been made toward correlated Service-wide treatment of fire control planning and financing. It was considered that this furnished a foundation on which to build future work.

It was the opinion of the committee that this combined meeting of research and administrative men, from both the East and the West, was extremely valuable in providing a common understanding of fire control problems. There was a general expression on the part of the men attending that the meeting was very beneficial to each as individuals.

The group felt that since some Regions were not represented, and all Regions might wish to have the opportunity to express their ideas on the general subject and certain details thereof, the report should be circulated to all Regions and Experiment Stations for comment. Comment by the Chief's office on the committee's report was considered desirable.

General conclusions and recommendations have been included in the first part of the report. The recommendations cover specified items upon which additional study should be concentrated in order to provide data essential to fire control planning and financing. Special mention was made at many points in the report as to the need for coordination and correlation by the Chief's office of fire control planning.

GEORGE M. GOWEN,
Chairman.

Enclosure

REPORT OF THE WASHINGTON FIRE PLANNING CONFERENCE, NOVEMBER, 1936

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REPORT OF THE WASHINGTON FIRE PLANNING CONFERENCE, NOVEMBER, 1936

Purpose:

The objectives of this conference, as stated in the Chief's letter, O-Fire, of November 10, 1936, were to:

"1. Initiate a review of methods and procedure for making fire planning studies with a view to prosecution of such further studies in a manner which will permit the results to be comparable between regions, at least from a fire financing viewpoint.

"2. Determine, list and define the major indices to
   a. Fire prevention
   b. Presuppression

"3. Outline a method for measuring the absolute and relative need in each region, for each index, for the fire prevention and presuppression job as a whole. (a) For temporary—immediate—needs, (b) for more permanent—long-time—fire financing.

"4. Outline a procedure for assembling such factual data as is determined should be assembled this winter.

"5. Outline adjustment of present record systems, where judged necessary, to provide a uniform development in all regions; this will serve annually to strengthen the financial basis."

The meeting convened in Washington, D. C., November 19, and adjourned December 9. Members in practically full-time attendance included:

Region 1: Stockdale, Gisborne (N. R. Mt. Exp. Sta.)
Region 3: McKenzie
Region 4: Shank
Region 5: Gowen (Chairman), Curry (Calif. Exp. Sta.)
Region 6: Campbell, Matthews (P. N. W. Exp. Sta.)
Region 7: Oakes, Beck, Stickel (N. E. Exp. Sta.)
Region 8: Brooks, Nelson and Abell (App. Exp. Sta.), Harper (So. Exp. Sta.)
Region 9: White

Regional Foresters Kelley and Show, as well as Loveridge, Scott and Headley of the Washington Office, contributed many valuable ideas and suggestions.

SUMMARY

Conclusions:

1. Fire control planning based upon uniform consideration of similar elements should be applied in all Regions. This will expedite attainment of Forest Service fire control objectives and serve as a measure of the financial needs of each administrative unit.

2. Fire control plans must consider both the permanent and temporary elements of fire danger. The permanent elements, which may differ from place to place, are (1) normal occurrence rate, and (2) fuel types as determined by rate of spread and resistance to control. The temporary elements are those which vary from time to time, such as (1) abnormal occurrence, (2) weather, and (3) fuel condition, evaluated through rating fire danger

3. Such systematic fire control planning as has been done in the past has given disproportionate emphasis to presuppression. In the future more emphasis should be given to (1) prevention, and (2) suppression, in order to attain proper balance.

4. Adequate training in all phases should be provided for in the fire control plans.

5. To provide a general guide for the allocation of fire control funds by the Chief, a list of indices has been prepared for use until such time as measured needs, based upon standardized fire control plans, can be developed. (See Sec. IX.)

6. Strength and speed of attack are recognized as coordinate factors in planning the placement of men.

7. The burned area objectives set up by the Regional Foresters' conference of 1930 should be retained, subject to amendment as more reliable data is obtained and to the time control limitations of the Forest Service fire control policy of 1935.

Recommendations:

1. Because of the complexity of the techniques of fire control planning, and the wide divergence of conditions between Regions, centralized correlation of all phases of fire planning is considered necessary. Comparable application of the plans will be expected to follow.

2. The discussions of this committee showed clearly the lack of knowledge and hence the need for further study of the economics of fire control from the standpoint of the operation of the law of diminishing returns.

3. Immediate work in developing methods of measuring and rating fire danger is urgently needed in all Regions not yet having satisfactory methods. There is need for a natural scale of fire danger rating into which each Regional scheme will fit. Research work in the immediate future should be pointed in that direction.

4. Determination of the period of employment of temporary fire control men (where needed) should be made by each Region on the basis of fire danger ratings and the social security income required to maintain a reasonably experienced and well-trained force.

5. It is recommended that the terminology of fire control be studied and standardized through a prompt revision and expansion of the Forest Fire Glossary.

6. Practical field studies should be made of all significant physical and psychological factors affecting man-power output in the various fire control jobs to the end that measures can be taken to increase efficiency. The results of such studies are also needed as the basis for fire control planning.

7. Further study is needed to determine the level of fire danger which should logically form the base for current annual appropriations of funds. Some of the alternatives are: (1) average annual load for a 10-year period; (2) work load for the average bad season; (3) work load of the normal or model season.

The detailed report which follows this summary is a generalized, composite guide to fire control planning.

The present meeting of fire control and fire research men has been the first all-Region assembly for discussion of fire control finance and planning since the Regional Foresters' Washington conference of March 17 - April 9, 1930. Except as to the time limit objective which guides this report, the principles of the 1930 report are still valid. The present report, however, shows the results of six years' additional thought and experience by (1) outlining the complete field more thoroughly, (2) going into detail more specifically, (3) adding several new methods to the technique of fire control planning, and (4) basing its recommendations to all Regions upon actual experience checked by repeated use in one or more Regions.

It is the responsibility of the Regional Forester or the fire control manager to use this report as a guide for the development of his outline for revision of old fire control plans or for the preparation of new plans for his unit. In analyzing the fire problems, in no case should the consideration

of any of the elements listed in this report be omitted. Each element should be weighed and given proper emphasis to determine its relative importance in meeting the fire control objective for the individual region involved. Other elements should be searched out and included, in their proper places, in the outline which he prepares for his fire control planning work. Proper balance must also be maintained between the process of planning and the execution of the plan.

I. General Consideration of Problems

Early in the conference it was agreed that sound fire control financing is dependent upon systematic fire control planning. The group, therefore, attempted to discover and enumerate the elements in fire control planning which are common to all Regions, and which can be measured and correlated. It was also recognized that adequate planning must precede satisfactory financing, but that until sufficient time has elapsed in which to develop a usable plan, some temporary scheme must be developed for using the outstanding elements as a basis for allotments. (See Section IX.)

It was also agreed that the volume of work involved in fire control planning, as viewed by this conference and set forth in this report, is such that the cost of assembling and compiling adequate data may amount to as much as one cent per acre on certain units.

There are certain fundamental principles on which any sound scheme of fire control planning must rest. Planning is a continuous process calling for repeated revisions. Planning is never static. It is defined as a proposed method of action. However, as used in this report, it must be thought of not merely as the formulation of a set of procedures, but also as embracing the all-important field of planning the actual executive management essential to put fire control plans into operation and to keep them operative to the highest possible degree of efficiency. It is, of course, understood that once fire control plans are approved, provision should be made to execute them. Comparison between administrative units is often necessary for budgetary control as well as for measurement of progress. The plan structure of all units must therefore be of sufficient similarity that the various stages may be recognized and compared between units.

It is also often necessary or expedient to compare various minor elements of the plan between one administrative unit and another. This makes it necessary to express these elements in analogous terms and develop them from data of similar value.

This outline endeavors to set forth the basic elements which must be considered in the construction of any fire control plan. Many of these are closely inter-related and must, in actual planning, be considered concurrently. The list of elements here given is not presumed to be complete, but an attempt is made to arrange those now recognized to be of major importance in logical sequence in which they should be considered when plans for new areas are being considered or old plans being overhauled. It is recognized that many of the steps suggested cannot be completed until some work has been done on the ensuing phases of the problem. Each of these elements must be broken down into much greater detail as planning progresses, depending on the Regional needs, but this is the function of the Region or local unit.

It is the responsibility of the Regional Forester or fire control manager to weigh the relative importance of each of these elements in meeting the fire control objectives for his Region. He must not only give each element its proper degree of emphasis in the development of a plan, but he must maintain a balance between the process of planning and the execution of the plan.

It is evident that the most perfect balance that can be obtained between the various phases of planning and plan execution will, in the long run, result in the most economical fire control and the least damage.

It is believed that the application of executive judgment to this outline as a guide will assure the Chief that all Regions are developing plans on a sound and comparable basis.

In the completed plan, or at any stated stage in its development, each of these factors will include a number of items which must be expressed in quantitative terms susceptible of cost analysis. Existing plans, records and systems should be used insofar as they are basically sound and adequately designed to accomplish the objectives set up.

Special reference is made to L. G. Hornby's report, "Fire Control Planning in the Northern Rocky Mountain Region" (September, 1936). It is a valuable treatise on fire control, and should be reviewed by all fire control planners, affording, as it does, a comprehensive picture of the fire control problem. The approach used by one region in dealing with a specific situation is well exemplified in the report.

II. General Policy and Objectives

A. *Fire Policy*

The Forest Service Fire Control policy adopted at the Regional Foresters' meeting on April 20, 1935, is stated as follows:

> "The approved protection policy on the National Forests calls for fast, energetic and thorough suppression of all fires in all locations, during possibly dangerous fire weather.
>
> "When immediate control is not thus attained, the policy then calls for prompt calculating of the problems of the existing situation and probabilities of spread, and organizing to control every such fire within the first work period. Failing in this effort the attack *each* succeeding day will be planned and executed with the aim, without reservation, of obtaining control before ten o'clock of the next morning."

In transmitting this policy to the field, the Chief stated:

> "No fixed rule can be given to meet every situation; the spirit implied in the policy itself will determine the action to be taken in doubtful situations."

B. *Prevention*

An essential objective of fire control planning and action is the reduction of man-caused fires to the lowest practicable minimum.

C. *Cooperation*

A major objective should be to develop cooperation to the fullest practicable extent in all phases of fire control.

D. *Allowable Burned Area*

Subject to the policy stated under A above, and pending development of sound basis, standards of allowable burned area will be those established at the 1930 Regional Foresters' conference.

III. Prevention

A. *Objective*

Sustained effort is necessary to accomplish the following objectives, placing prevention on a parity with other phases of fire control work:

1. Reduction of the number of man-caused fires by causes to the lowest practicable minimum at the least cost and hold gains made in reduction efforts.
2. Reduction of the danger of serious fires starting due to presence of excessive amounts of inflammable debris.

B. *Essential Elements*

The job consists of currently making risk and hazard surveys and prescribing methods for:

1. Minimizing risk in each class of causes according to the classification used in form 929.
2. Minimizing dangerous or excessive accumulations of fuels which are likely to contribute to the start of serious fires.

C. *Standards*

1. For human risks it will be standard practice to—
   (a) Survey, analyze and classify all risks to determine
      (1) Occurrence zones
      (2) Time and length of risk season
      (3) Causes
      (4) Classes of people responsible
      (5) Sources of people responsible
      (6) Motives and reasons
   (b) Remedies as required by analysis of (a) above:
      (1) Educational projects.
         (a) Lectures and demonstrations
         (b) Personal contacts
            1. Local residents
            2. Influential citizens
            3. Group contacts
      (2) Closures and restrictions.
         (a) Absolute closure
         (b) Smoking
         (c) Camping
         (d) Fire tool requirement
         (e) Registration
      (3) Enforcement of Federal regulations and local laws as applied to general public, industrial and Forest permittees.
         (a) Advance contacts with officials
         (b) Investigation
         (c) Prosecution
         (d) Maintain adequate "suspect" record
      (4) Cooperation with and through state, private and other Federal agencies.
      (5) Systematic recurrent inspection of prevention practices.
         (a) Within the Service
         (b) Industrial

(c) Permittees
(d) Other users

(6) Promotion of special fire control legislation.

(7) Examination of possibilities for securing advice on man-caused fire problem from Psychology Departments of Colleges and Universities.

2. For physical hazards it will be standard practice to—
   (a) Survey, analyze and classify all physical hazards
   (b) Prepare and execute plans for timely action in each hazard zone to remove or neutralize each hazard
      1. Industrial operations
      2. Camp and picnic areas
      3. Slash areas
      4. Snags and debris
      5. Roadside strips
      6. Streams and lake shores
      7. Abandoned buildings and sawdust piles
      8. Town dumps, defective flues, etc.

3. Prepare and maintain by annual revision adequate maps showing fire control boundaries and by suitable legend, the location, class and degree of intensity of each risk or excessive physical hazard. Explanatory tabulations and other written records will be maintained for use in future analyses and for reference

D. *Time of Year*

Determine by analysis of risks and hazards the proper time of the vear to conduct preventive measures. Certain phases of the prevention job should be recognized as year-long in character.

E. *Method of Measuring Volume of Work*

Volume of work will be determined by use of usual analysis and work plan methods for both year-long and temporary personnel. After correlation with other activities the needs for special salary and expense items for prevention can be calculated. Maps showing zones of occurrence and fuels are essential to accurate measurement of volume of work.

As one factor in measuring the total prevention job the unit "total user days" is recommended for use. In computing total user days the rural residents of the Forest will be counted for every fire day of the year. The figure thus obtained will be added to the total of transient user fire days on the area, which will include the Forest

and protected area in both instances. The term—Rural residents as here used includes all residents living in isolated dwellings and in communities of less than 500 population. The number of user days will be computed for the established and emergency fire season. For expressing relative effectiveness of fire prevention, the ratio of fires to user days is recommended; *e. g.,* one fire per 70,000 user days. This unit may be computed not only for all man-caused fires, but also for any individual class or cause as number of user days per smoker fire.

1. The following list is suggestive of factors which may be considered in determining the job load in man days of work required, and cost of the prevention effort to meet needs analytically determined under item C 1 a above.
   (a) Railroad
      (1) Number of RR Companies to be contacted
      (2) Number of RR officials and employees to be contacted
   (b) Number of forest camps and intensity of use
      (1) Pleasure seekers
      (2) Picnickers
      (3) Hunters and Fishermen
      (4) Campers
      (5) Berry Pickers
   (c) Transient Use
      (1) Hunters
      (2) Fishermen
      (3) Tourists
      (4) Motorists
      (5) Campers
   (d) Number of Forest Permittees
      (1) Grazing
      (2) Summer Homes
      (3) Industrial Operations
         Timber Operators
         Resorts, filling stations, etc.
   (e) Number of potential debris and range burners
   (f) Number of industrial plants and number of officials or employees to be contacted
      (1) Sawmills
      (2) Quarries

(3) Naval Stores
(4) Mines

(g) Number of influential citizens and cooperators to be contacted
(1) Leading business men
(2) Public officials
(3) Heads of stock associations
(4) Heads of other Forest permittee associations

(h) Number of Federal, state and local law enforcement and judicial officers to be contacted
(1) County attorneys
(2) Justices of the Peace
(3) U. S. Commissioners
(4) Fire wardens
(5) Sheriff, Constable and Deputies
(6) U. S. Marshal and Deputies
(7) U. S. Attorneys and assistants

(i) Number of sign stations to be maintained
(1) Periodic replacement of signs
(2) Preparation of signs

(j) Number of school contacts to be made
(1) Grade—city and rural
(2) High Schools
(3) Universities and colleges
(4) Private schools
(5) Indian schools

(k) Number of other group contacts to be made
(1) Chambers of Commerce
(2) Luncheon Clubs and Civic organizations
(3) Stock Associations
(4) Lumberman's Associations
(5) Permittee Associations
(6) Natural History and Archaeological Societies
(7) All group meetings where forestry and its allied subjects are involved

(l) Quantity of prevention literature material to be prepared and distributed
(1) Maps
(2) Slides

(3) Movies
(4) Forest pamphlets
(5) Signs
(6) Exhibits
(7) Placards

(m) Number of newspapers and periodicals to be furnished with prevention material
(1) Prepared articles
(2) Contacts

In addition to the above items, the supervision of Forest Service Prevention personnel must be recognized in work plans and in determining the total prevention job load. For example:

a. Number of prevention guards to be supervised
1. Contact men
2. Camp ground custodians
3. Registrars
4. Prevention patrolmen

b. Number of Forest Service law enforcement men

c. Others

F. *Responsibility*

Individual responsibility for accomplishment should be included in the body of the prevention plan. From job load analysis, the manpower and money needs for carrying out the plan will be determined. The plan should show the number of prevention guards needed, such as:

1. Contact men
2. Camp ground custodians
3. Registrars
4. Prevention patrolmen

Responsibility for prevention work should be specifically assigned to each grade of employee within the sphere of his influence. The administrative work plan for each individual in the organization should indicate specifically the fire prevention jobs assigned to him.

The employment of a specially qualified law enforcement officer to conduct investigations and assist in the presentation of court cases is recommended where the volume of work justifies. The number of these and the need therefor should be clearly shown in the plan.

G. *Cost Analysis*

IV. Presuppression

A. *Statement of problem.*—Determine by analysis of best available data the intensity of presuppression plans needed and the importance of this activity in relation to prevention and suppression.

B. *Objectives.*—Application of the general fire control policy (II above) to specific phases of presuppression planning and to local conditions.

C. *Prerequisites to Acceptable planning.*—Before detailed presuppression planning can be undertaken, certain basic information must be obtained. This will include occurrence, fuel types, and other elements of fire danger.

1. *Fire Occurrence*

Objective:

To consider and recommend means of classifying and presenting information on the occurrence of fires as a basis for fire control planning.

Recommendations:

As a means of comparing the total volume of fire business between units, the use of the total number of fires per 100,000 acres per annum is recommended as an occurrence index for all areas within the protected boundary. The committee recommends the preparation of individual spot maps for each important cause of fires on each forest. From these spot maps, risk zone maps showing the areas of high fire occurrence requiring special prevention and presuppression effort should be constructed.

Fire occurrence zone maps should be constructed from the preceding 10-years' record of man-caused fires and from the preceding 20-years' record of lightning fires, where sufficient records are available. Where the records are not available for these periods, shorter periods may be used. These data should be revised and recompiled by semi-decades ending with the figures 4 or 9 (*e. g.*, 1935-1939).

The committee recommends the use of the unit, number of fires per thousand acres for ten years, as the proper unit to describe the fire intensity factors of fire occurrence zones.

As indices of the factor of intensity of fire occurrence the fol-

lowing are recommended: (1) Maximum number of fires in any one 24-hour period; (2) Maximum number of fires in any 48-hour period. Where desirable, these indices may be computed separately for man-caused and for lightning fires. These can be applied to any administrative unit where a comparison is required.

Seasonal variation in fire occurrence is best shown by the statistical averages by causes as obtainable from the present statistical sheets A-K.

2. *Fuel Types*

The term "fuel type" is used to designate a combination of *rate of spread* and *resistance to control*. Fuel type boundaries may or may not coincide with boundaries of cover or silvicultural types.

Data should be obtained from all available sources, such as silviculture, range survey, land classification and fire records, and from personal knowledge of field men. It will sometimes be necessary to supplement this by field examination to complete or check the data.

a. *Rate of Spread:*

This should be expressed in chains of perimeter per hour between discovery and the time when work began. Use all available records for all fuel types—1927-1936 inclusive—and, if desired, data from experimental fires. Use only records of fires reached within 6 hours after discovery. Suggest that form for presenting rate of spread data should follow Figure 19 in the report: "Fire Control Planning in the Northern Rocky Mountain Region," by L. G. Hornby, Sept., 1936. Leave decision as to selection of what constitutes average bad spread to a National coordinator. Determine class intervals with *suggested* mid-points of 2, 4, 8, 16, 32 etc., chains per hour.

Factors in determining rate of spread—Slope, aspect, soil type, exposure to prevailing wind, density and character of cover type, size, quantity, and disposition (arrangement) of fuels.

It is suggested that in the most complex fuel types in some regions it may occasionally be necessary to give a separate classification to units of area as small as 40 acres. Much

larger units are recommended where fuel types are uniform over large areas.

b. *Rate of Held Line Construction* should be stated in chains of held line per man-hour based on average skill of overhead, normal efficiency of labor, sound tactics and the most productive available equipment and machinery. Normal efficiency of labor is interpreted to mean that degree of hourly efficiency expected in a short working period of six hours or less.

Rates of work may be determined from best available records, from estimates, or from experimental fires.

Class interval mid-points suggested are: 0.1, 0.2, 0.4, 0.8, 1.6, 3.2, etc., chains per man-hour.

Factors determining rate of held line construction are: Slope, soil type, density and character of cover type, size, quantity and disposition (arrangement) or fuel, physical condition of man or men; also size and character of crew and amount and qualifications of overhead and the number of hours which the man or men will work. It is suggested that fuels be classified on the basis of expected held line output of men working in shifts of not more than six hours.

3. *Fire Danger Rating*

a. Introduction

The Glossary defines fire danger as "the sum total of the fire factors—risk, hazard, inflammability, liability, controllability, and safety—which determine whether fires will start, will spread, do damage, and whether and to what extent they can be controlled." The present-day conception of fire danger departs somewhat from this, and indicates the need for redefinition.

This committee considers it desirable to retain the term fire danger to express the general summation of all factors influencing the fire problem. The committee recommends, however, the recognition of two component parts of total fire danger to be expressed by the terms (1) permanent dangers and (2) temporary dangers.

Permanent dangers should include all phases of fire danger which are, for a given area, relatively unchanging, as the

topography, fuel type, exposure to prevailing wind, etc. Temporary dangers will include under this classification all factors which vary from day to day, resulting in variations of danger within the season and from year to year. Such factors would include all weather elements, fuel moisture content, and variable man-caused risks.

The rating of fire danger is considered in this section of the report to be the rating of temporary dangers only. More specifically this report deals with the rating of fluctuations in the ignitibility and combustibility of forest fuels as influenced by weather factors together with the rating of fluctuations in the number and effectiveness of fire-causing agencies.

b. Objectives

The main objective of fire danger rating is to gauge the existing or impending danger of fires starting and spreading for any given local condition.

Some of the advantages accruing from the use of an accurate fire danger rating scheme are listed below.

(1.) It is an indispensable aid to the administrator in planning and currently adjusting his organization to meet the fluctuating fire load, and results in more effective use of fire control funds.

(2.) It permits the classification of units on the basis of total fire danger, thus laying the foundation for the equitable distribution of funds to Regions, Forests, and Ranger districts.

(3.) It serves as one guide in fire dispatching, enabling inexperienced men to gauge the size of the fire suppression job.

(4.) It serves as a guide to special prevention measures (closures, patrols, etc.).

c. Discussion of fire danger rating schemes—

Complete and accurate methods of rating fire danger are dependent upon intensive research on the basic factors controlling the ignition and combustion of forest fuels. The lack of full and detailed information on these subjects prevents the

adoption at this time of any standard method of rating fire danger.

Experience has demonstrated, however, that our present information of fire factors is such that we can, for given localities, establish methods of rating fire danger which, though empirical and admittedly not infallible, are still invaluable as administrative guides

The committee recommends, therefore, the development of fire danger rating schemes for all units on which fire danger fluctuations are recognized as a material factor in management.

d. Standards

At the present stage in the development of fire danger rating schemes it would be undesirable to attempt to establish detailed standards.

The recommendations of the committee are therefore confined to the establishment of the following general guides:

(1) In all studies on the rating of fire danger, an attempt should be made to identify and measure all factors which have a significant influence on ignition and combustion.

(2) Fire danger rating should be based on adequate sampling; *i. e.*, data should be gathered from sufficient stations to provide a sensitive indicator for each unit rated.

(3) Fire danger ratings should be expressed numerically and accurately described to permit later coordination between regions and other units.

e. Responsibility

In discussing responsibility, three phases of fire danger rating are distinguished: first, the development of the fire danger rating scheme; second, the development of comparable classes of administrative action; and third, the establishment and operation of fire danger stations.

The first step is logically the responsibility of forest research, while the second and third are mainly the responsibility of administration. It is important, however, that both agencies work closely together to develop a satisfactory method of rating.

f. General

(1) The close connection existing between fire weather fore-

casting, weather statistics and fire danger rating should be recognized. Development of satisfactory methods of danger forecasting will, in all cases, be dependent upon the establishment of a satisfactory fire weather service.

(2) A need exists for closer coordination and correlation in the development of fire danger rating methods on the part of the Washington office. This involves both administration and research.

D. *Standards*

After making an inventory of the job to be done it is essential to set up standards of performance and placement of facilities to accomplish the objective. For each phase of presuppression planning there must be standards for:

1. Time control

(a) Definition: The speed or combination of speeds with which action must be taken on a fire subdivided by the following time elements: Report, Getaway, Travel, and Control in a given fuel type in order to attain the Forest Service fire control policy and to keep within the allowable limit of burned area. It is used as a measure of the necessary intensity of man-power placement and may be a variable, depending upon strength of attack.

(b) Objectives

(1) To specify elapsed time standards which will achieve the fire control policy in all fuel types.

(2) Subject to the fire control policy, the burned area objectives shall be those set by the 1930 Regional Foresters' conference, and later amendments to them.

(c) Description of Job:

The job of determining elapsed time standards is essentially one of analyzing the records of the organization to determine for each fuel type the speed and strength of attack necessary to meet the objectives listed above. Different methods of statistical analysis have been used to obtain this information. The committee does not feel that any definite technique of analysis can be set up at this time, but should be established by the Chief's office as soon as possible.

In addition to elapsed time standards for initial attack, standards must be developed for first follow-up crews, and also standards for the small percentage of fires which will require large crew follow-up. It is recommended that the determination of elapsed time standards be made by first determining fuel types, and secondly by transferring to the fire records the proper fuel type classification. The fire records can thereafter be sorted on the basis of fuel types and elapsed time determinations made.

(1) Elapsed time standards should be set up by fuel type.

(2) The fuel type classification used will be applicable to all Regions.

(3) Similar fuel types must have similar elapsed time standards under similar classes of fire danger. The job of coordinating the elapsed time standards between Regions is the duty of the Washington office.

d. Methods of measuring volume of work:

The volume of work will vary with the complexity of the fuel types, the area involved and the amount of statistical information available. The committee recommends the use of 1927-1936 records where available. Where records do not extend over the past ten years, all reliable records will be used.

e. Responsibility:

The nature of the job calls for centralized control, which will rest with the Regional Forester. He will call upon Research for those phases of the undertaking which require the services of qualified men in that organization. Coordination between Regions is essential to the proper determination of elapsed time standards, and is the responsibility of the Washington office.

2. Maximum degree of coverage (justifiable degree to which standards will be met).

E. *Plan of accomplishment*

This will include cooperation with other agencies, federal, state and private; correlation of the presuppression activity between these agencies, between other phases of fire control, and between other

elements of total job load; selection, training (see Section VI), organization and supervision of personnel. For all those fires which occur in spite of prevention effort, and, using the now available data as to occurrence, fuel types, fluctuation of fire danger, standards of performance, etc.; prepare detailed plans for placement of men and facilities in accordance with the following:

1. Detection

a. Objective:

It is the purpose of planning detection to keep elapsed time between origin and discovery of fires at a level which will meet the fire control objectives for all fuel types at the least cost.

b. Description:

The detection job includes the contribution made in discovering and reporting fires by all guards, forest officers and cooperators needed to meet the objective above.

c. Standards:

Standards to meet the above objectives will be derived from the fuel type and elapsed time data. Such standards must be set up and coordinated between units. For:

(1) Per cent of area which must be directly visible by fire danger zones.

(2) Maximum size of blind areas allowable.

(3) Allowable area and allowable frequency of intermittent detection.

(4) Required personnel qualifications and training to obtain the degree of performance assumed in making detection plans.

(5) Necessary shelter and equipment—The facilities required to meet these standards will depend upon—

Atmospheric visibility as determined by uniform instrumental methods

Topography

Occurrence of fires (intensity, distribution, and causes)

Availability of reliable cooperators.

d. Time of Year.

The measure of the time element in the detection job (the length of time that varying intensities of detection are neces-

sary) should be gauged by the current fire danger rating, including current visibility. The number of detection units on the job have to be varied from time to time based on fire danger ratings.

e. Method of Measuring Volume of Work:

(1) Planning Phase:

The tools one needs to work with—

(a) Make fire occurrence studies and maps

Intensity, Size, Location, Cause } Determine necessity for the kind and intensity of a planned detection system

(b) Make fuel type maps

(c) Set up elapsed time specifications

(d) Determine range of visibility standards by adequate (uniform) instrumental methods

(e) Survey and analyze all existing detection facilities—physical and personnel

(f) Provide for use in determining relative costs of developments a list of standard costs of detection improvements

(g) Make visible area maps

(h) Build the detection plan, using all the above items as tools to work with, and correlate with other phases of fire control planning. The following indices can be used to determine the volume of work involved in the planning of detection: Number of acres to be protected by fuel types

The difficulty of the topography and cover as they affect field phases of planning

The volume of work increases, with the intensity of detection required to meet the major objective.

(2) Investment phase:

Provide necessary physical facilities on the basis of the above plan.

(3) Operating Phase: (See also Sec. VII)

Provide:

(a) Selected man power
(b) Training
(c) Inspection
(d) Service
(e) Maintenance

} To the degree of performance assumed in the plan

The indices of the total volume of work in the operating phase are: number of stations, station months, and man-months required to meet the original objectives set up.

(4) Responsibility

The planning phase requires special personnel to work on a regional project basis.

The operation phase is the direct responsibility of the local administrative personnel—both regular and short-term.

2. Placement of men for first attack

The time control considerations which arise from occurrence, fuel type, and fire danger determinations govern the placement of men (locations and numbers) for first attack. This is closely allied to detection, communication and transportation planning, and must be considered concurrently with them. The dividing line in the plan between strength of first attack and reinforcement action depends on the level of danger designated as *"average bad conditions."*

3. Reinforcement plans

After adequate plans have been made for reasonable speed and strength of first attack there still remains the probability that reinforcements will be needed. Plans must therefore provide for follow-up action at the speed and strength necessary to meet *worst probable conditions*. Plans for reinforcement must take account of:

a. Man-power (including recruiting, training (see Sec. VI), dispatching, supervision)
b. Service of supply
c. Transportation facilities (rolling stock, equipment, etc.)

4. Transportation and Communication Planning

Having established elapsed time standards, transportation and communication planning is the determination of the combination of man-power, transportation and communication plant and facilities that will meet these standards adequately at a

minimum annual cost. Transportation and communication planning are coordinate parts of fire control planning as a whole, and must be so treated. They must be considered at all times in their proper relation to all other phases of fire control planning.

The Norcross-Grefe general outline (Washington office Circular ER—Investigations—Transportation Planning for Protection 3-18-32) is believed to be the proper approach for transportation planning, simplifying and short cutting (with the prior approval of the Chief's office), where the magnitude of the problem requires less detail than indicated in this outline. Regions 5 and 6 have worked out communication plans, either or both of which merit examination, at any time this phase of fire control planning is being considered in other Regions. There is need for a coordinated method or scheme which will accomplish for communication planning what the Norcross-Grefe method does for transportation planning.

Recent developments in aircraft and radio broaden the field of transportation and communication planning and should be given full consideration in these phases of planning.

5. Equipment and supplies

Fire control equipment, such as autos, livestock, tools, bedding, and food, should be maintained adequate to meet the demands of average bad fire danger. In some cases this can be done most economically by using central warehouses, garages, and remount depots. Choice of the method and of the quantity of equipment and supplies must depend upon (1) possible peak demands, (2) geographical distribution of Forests, (3) available transportation facilities, and (4) local markets at which emergency purchases can be made. Choice of the character of equipment and supplies will depend upon fuel types, methods of fire fighting, etc. It is therefore impossible to recommend standard procedures for use in all Regions.

The development and evolution of fire control equipment must be given a definite place in fire control planning. Some elements of this are Service-wide, some Regional, and some restricted to individual National Forests. The report of the 1936 Spokane Conference on fire equipment should be consulted.

F. *Present status of accomplishment*

Review potentialities and limitations of present organization and fa-

cilities. What are the additional needs to carry out the plans and fulfil the main objective?

G. *Cost to complete, maintain and operate the plan*

After plans have been prepared to meet the objective, and after the present situation has been compared to that proposed by the plan, the next step is to determine the cost of carrying out the plan (1) from an investment standpoint, including probable replacements, and (2) as to cost of operation. There is the direct tie between fire control planning and budget control.

V. Suppression

The committee recognizes suppression planning as an essential part of the complete fire control plan. Statement of general fire suppression principles and practices should be made by Regional Foresters through handbooks and current instructions. Where conditions dictate, these principles may be set up for parts of regions or groups of forests.

Interpretation and application of these fire suppression principles should be obtained for each forest through the medium of fire suppression plans. Only those phases of fire suppression not included in presuppression planning should be considered in the suppression section of the plan.

The following list of elements is illustrative of those considered essential to a fire suppression plan:

A. *Objectives*

1. Forest Service Fire policy
2. Area objectives by types
3. Regional objectives
4. Local objectives

B. *Analysis of Fire Suppression Problem*

1. Current and periodic analyses of fire suppression action
2. Tabulation of fires by size classes
3. Use of fuel type maps and weather factors to define suppression difficulties

C. *Detailed Methods of Calculating Probabilities*

1. Use of fuel type data
2. Other methods where fuel type data unavailable
3. Current Fire Danger Ratings
4. Use of fatigue factors
5. Skill of overhead
6. Type and use of machinery and special equipment

D. *Plans of Organization*

1. Mobilization
   a. Overhead
   b. Fire fighters
   c. Special units
   d. Selection and training
   e. Equipment
2. Scouting and communication
3. Service of supply

E. *Strategy, Tactics, Techniques*

1. Enumeration of recognized good and bad practices of handling fires under local conditions
2. Recognition of local variations in fire weather

VI. Training of Personnel in Fire Control

A. *Present Needs*

1. The securing of adequate prevention, presuppression and suppression action requires that all personnel responsible for the administration of fire units have a thorough understanding of all fire control problems applicable to their units and sufficient basic training to properly cope with these problems as they arise.

   At present, due to emergency conditions, rapid turnover of personnel, addition of new units and extension of the scope of Service activities, there exists throughout the Service a situation which places a large percentage of our District Rangers and other responsible officers in the position of directing and administering units of high fire danger with far too little basic fire control training. In some instances, inexperienced and inadequately trained personnel occupying responsible positions are not fully qualified to recognize fire problems, much less devise means to cope with such problems.

B. *Objectives:*

Recognizing the foregoing, the Service objective should be to:

1. Develop and place in effect an adequate training policy
2. Provide adequate training facilities
3. Definitely reach, through training, all personnel responsible for action in prevention, presuppression and suppression activities

C. *Personnel to be trained, and recommended methods to be employed for each class*

1. Methods for training fire control personnel
   a. Group training
      (1) Regional fire training schools
      (2) Forest fire training schools
      (3) District fire training schools
   b. Individual training (in Place—on the job)
   c. Details: (Primarily for observation and training)
      (1) Inter-unit details (District—Forest—Regional)
      (2) Temporary assignment to large going fires
   d. Written instructions
      (1) Handbooks
      (2) Special memoranda
   e. Inspection and analysis of past fires
      (1) Analysis of individual Forms 929
      (2) Forest Boards of Review
      (3) Regional Boards of Review

2. Personnel to be trained and methods to be employed
   a. (1) Regional office, Administrative officers, Training officers, Fire Specialists and Dispatchers, supervisors and supervisors' staffs
      (2) Methods to be employed: Items a, c, d, e, under C. 1. above
   b. (1) Supervisors and Staff (including Forest Dispatchers) and District Rangers
      (2) Methods: Items a(2), a(3), b, c, d, e(1), e(2), under C1 above
   c. (1) Assistant District Rangers
      Dispatchers
      Guards
      Project Superintendents, Foremen of Work Crews and Technicians assigned to Ranger Districts
      Cooperators
      (2) Methods: Items a(3), b, c(2), d, under C1 above
      The number of personnel to be trained and the intensity of training to be employed on each unit will be governed by intensity of the fire control problem of the

unit. This shall be determined by problem analysis and the classification of the units; *i. e.*, "acceptable," "marginal" or "critical," in accordance with established methods. The specific technique to be employed should be left to the judgment of the Fire Specialist working in cooperation with the Training Specialist. Broadly, the types of training to be used are:

3. Demonstration
   Care and use of suppression tools and equipment and machinery
   Care and use of lookout station or detection equipment
   Care and use of suppression fire weather instruments
   Suppression action on mock fires
4. Lectures or, preferably, discussion on fire control technique, using charts and maps of past fires
5. Individual instruction incident to inspection
6. Written instructions

D. *Plans*

Training is a recurrent job of major importance. As such, it should be given proper consideration in formulating fire control plans. It should be programmed and directed from the top down; *i. e.*, a definite training program should be developed and prescribed by the Regional Forester under guidance of the Chief, and the Regional Administrative and protection officers should take an active part in its application. Findings and recommendations of the Portland Guard Training meeting of December, 1936, should be consulted in preparing training plans.

E. *Costs*

The costs of adequate training should be determined or provided for in the fire control plan.

VII. Essential Elements Applicable to All Phases of Fire Control Work

The fact that certain subjects were not treated in the same detail as others included in the preceding pages of this report does not in the least minimize their extreme importance in the whole scheme of the fire control subject.

Many of these elements, which were briefly mentioned in the report, must be given complete consideration in preparing fire control plans, in executing these plans, and in laying financial plans therefor.

Insufficient time was available to the group to give adequate and specific consideration to the multitude of details on which depends the success of the preparation or execution of fire control plans.

These essential elements, which must not be overlooked, and which must definitely enter into the plans and subsequent action, are:

1. *Adequate Supervision*
2. *Adequate Inspection*
3. *Proper Organization*
   a. Study incident to
   b. Determination of
   c. Use of
4. *Service of Supply*
   a. Fire warehousing facilities and personnel
   b. Special regional fire transportation facilities. Pack-stock, etc.
5. *Special personnel* (other than 1 a above)
   Telephone and radio operators
   Clerks for handling
   Dispatchers and ranger alternates
   Packers
   Other personnel
6. *Contributed time of the regular force to the fire control job*
7. *Job Load Analysis*
   Of all of the work entailed in fire control planning and their execution, those portions which are of ranger caliber should be provided for the ranger work plan. The same applies to all other units for which work plans are prepared. Too often in the past important phases of this work have been neglected or delegated to wholly unqualified subordinates.

VIII. Units of Measurement

A. *Prevention*

As a factor in measuring the total prevention job, the use of the term "total user days" is recommended. In computing total user days, the rural residents of the Forest will be counted, together with the visitors to the area. Rural residents will be considered, all residents living in isolated dwellings and in communities of less than 500 population, including children of school age or over. Each day spent by a rural resident on or adjacent to the protected area is considered a user day.

User days will be computed only for the fire season and the classes of users shown separately, as: rural residents, transients stopping on the forest, and transients merely passing through.

For expression of relative effectiveness of fire prevention, the ratio of man-caused fires to user days is recommended; *e. g.*, one fire per 70,000 user days. This unit may be computed not only for the total number of fires, but also for any class or cause as number of user days per smoker fire.

B. *Law enforcement*

The use of the unit, *number of actionable fires* for each Forest, is recommended as an index of law enforcement activity required.

C. *Fuel type classification* should be based on

1. Rate of spread expressed in *chains of perimeter* per hour.
2. Resistance to control expressed in *chains of held line per man-hour.*

D. *Costs of fire control*

The costs of fire control should be expressed, for comparative purposes, in terms of *cents per acre* of each recognized fuel type protected. This unit may be used to express total costs of fire control or costs of any phase, as prevention or presuppression.

E. *Reporting incendiary fires*

For purposes of standardizing the reporting of incendiary fires, the following procedure is recommended:

1. Where all sets burn together and are suppressed as one fire, all will be reported as one fire. This should be eventually covered by standard instructions for preparation of Form 929.
2. Where the suppression of the individual sets is accomplished, all will be reported as one fire, except in cases where more than ¼ mile separates the individual sets or there is more than 1 hour of difference in discovery time. In the latter two cases, two or more fires may be recognized.

F. *Visibility and visible area*

It is recommended that the term visibility be used in fire control only in the description of atmospheric opacity or clarity, and that the term visibility map be abandoned as a term applying to a map showing the area which can be seen from a lookout point. *Visible area* and *visible area maps* are recommended as terms to be used in referring to areas which are directly visible from lookout points.

It is recommended that the present Glossary definition of *direct visibility* be abandoned and that areas directly visible be defined as all areas where either the soil or the vegetation cover is visible. All other areas should be considered invisible.

The use of the term indirect invisibility as defined by the Fire Glossary should be discontinued.

IX. Indices for Immediate Use in Financial Control

The foregoing outline lists the elements that a fire control planner must consider. The end result is a plan which the budgetary officer should be prepared to finance. Both the fire control and financial planner, however, need some general indices of the magnitude and complexity of the fire control problem expressed in tabloid form, and this is especially true until complete plans have been prepared, following the prescription of the 1936 meeting.

The indices which follow are believed to be a minimum list: (Forest units may advantageously be segregated into two or three groups, representing high, medium and low hazard).

(1) By forest units, for each year in the last decade:
   (a) Net area of National Forest Land
   (b) Gross area of National Forest Land
   (c) Portion of gross area not covered by Forest Service Protection facilities (acres)
   (d) Area outside National Forest protected by the Forest Service
   (e) Protection Area—Items (b) minus (c) plus (d)

(2) Average number of fires per 100,000 acres per year of protection area for the decade subdivided by:
   (a) Lightning
   (b) Man-caused—subdivided as shown on sheets A-K

(3) The maximum number of fires per 100,000 acres of protection area in any one year of the decade

(4) The trend in occurrence rate expressed as increase or decrease in number of fires per annum for 2(a) and (b)

(5) Average area burned per 100,000 acres per year for:
   (a) Net area
   (b) Protection area (Refer (1) (c) above)

(6) (a) Number of extra period fires for each year of the last half of the decade

(b) Number of extra period Class C fires for each year of the last half of the decade

(7) (a) Average length of fire season (in days) during which the average fire organization is maintained

(b) Months of the year in which the normal fire season occurs

(8) (a) The per cent of protection area that is seen by paid guards or other dependable detection force, when the average detection force is on duty

(b) Same as (a) except for maximum force

(9) (a) Area in acres expressed by rate of spread types in terms of chains per hour

(b) Area in acres by resistance to control types expressed in terms of chains per man hour

(10) (a) Weighted average travel time for first attack with average fire control force on duty

(b) Weighted average travel time for reinforcement attack

(11) (a) Number of one-man units of guard equipment per 100,000 acres of protection area

(b) Man-equipment for first attack crews per 100,000 acres of protection area

(c) Reserve man-equipment for heavy reinforcement action per 100,000 acres of area

(d) Passenger vehicles (including light trucks) owned or normally hired (for guards) per 100,000 acres of protection area

(e) 1½-ton trucks (or heavier) owned or normally hired per 100,000 acres of protection area

(12) From the annual "Activity Expenditure Record" show, exclusive of Regional office expenditures, the total expenditure for each of the past 10 years: See VIII 1, e

(a) Prevention and presuppression

(b) Activity 36 (fire equipment)

(c) Average expenditure per acre of protection area for (a)

(d) Same as (a) except substitute suppression for P and P

(e) Average expenditure per acre of protection area for (d)

(f) Ratio of (a) to (d)

This will automatically furnish an indication of the total area subdivided into critical, marginal and acceptable forests for a Region.

Two, three or four worst years should be segregated from the other years in a decade in order to get a figure for the normal year, and normal financing. The Washington office will designate the number of bad years to segregate.

(13) (a) Number of stations occupied per 100,000 acres with normal fire control force
(b) Same as (a) except for maximum force
(c) Number of station months operated per 100,000 acres of area with normal fire control force
(d) Same as (c) except for maximum force
(e) Number of man months operated per million acres of area for normal year (see last paragraph of 12)

(14) Amount contributed from cooperation or other special funds, segregated by:
(a) ECW
(b) ERA
(c) State and timber protective associations
(d) Other

(15) Special major items applicable to a particular Region will be given special consideration. Included in this category are such things as Region One's remount depot, Region Five's tank trucks, Region Nine's boats and tractor-plow outfits, etc.

(16) Total user days

(17) Number of actionable fires

(18) Maximum number of fires
(a) Any one 24-hour period
(b) Any one 48-hour period