FIRE MANAGEMENT NOTES

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FIRE MANAGEMENT NOTES

An international quarterly periodical devoted to forest fire management

CONTENTS

A NEW NAME

In the spring of 1973, the name of this periodical was changed from *FIRE CONTROL NOTES* to *FIRE MANAGEMENT* to reflect the change in our attitude and approach to managing fire. Most of you agreed that this change was timely.

During the 3 years since then, we have had an opportunity to assess the impact and significance of our new name. We have asked for your reactions and your ideas. There has been agreement with the concept, but many of you suggested we add *NOTES* to our name to show continuity with our original name, to reflect the type of articles included, and to relieve the confusion in correspondence between this periodical and the Forest Service staff unit, which is also named "Fire Management."

We are happy, therefore, to announce that in the 39th year of our existence, we have officially become FIRE MANAGEMENT NOTES.

The Editor

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Earl L. Butz, *Secretary of Agriculture*

John R. McGuire, *Chief, Forest Service*

Henry W. DeBruin, *Director, Division of Fire Management*

J. O. Baker, Jr., *Managing Editor*

FIRE PREVENTION—ITS FUTURE

Thomas L. Price
and Eugene F. McNamara

Forest fire prevention is recognized by many as a foundation of the natural resource conservation movement of our Nation. Its continuing role in protecting the forest and rangeland is as important today in the evolving role of fire management as it was yesterday when protection from fire was simpler.

Many forestry agencies had their start, and may still have their principle function, in the prevention and suppression of forest fires. This was an important consideration in the passage of both the Week's Law and the Clark-McNary Act.

Is Fire Prevention Effective?

Has fire prevention been effective? Well, 30 years ago we were reporting 190,000 fires burning 28 milion acres (11.3 million ha) on an area less than half of what we now include as protected. Except for some major catastrophies, such as the Peshtigo Fire in 1871, the Tillamook Fire in 1933, and the Maine fires in 1947, historical records of damages are sketchy.

Now we report 127,000 fires that burn just less than 3 million acres (1.2 million ha) each year. We estimate the cost plus loss to our Nation at $400 to $600 million per year.

Fire protection has been in terms of the reduction in number of fires and acres burned. But when we look at the continuing total cost plus losses of $400 to $600 million, we still have much to do. Preventing unwanted man- and lightning-caused fires can make a significant reduction in this total cost.

Concerned about the rising costs of wildfire suppression of man-caused fires, John McGuire, Chief of the Forest Service, directed the

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View of a fire prevention failure 12 years after it occurred. The Tillamook Fire, Oregon, 1945.

FIRE PREVENTION—ITS FUTURE

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organization of a task force to analyze wildfire prevention problems and programs in the United States. A steering committee consisting of representatives of the National Association of State Foresters, the Department of the Interior, and the Forest Service, United States Department of Agriculture, was appointed. The task force had similar representation.

Prevention Analysis

In May 1975, a document entitled *Wildfire Prevention Analysis—Problem and Programs* was released jointly by the National Association of State Foresters, the U.S. Department of the Interior, and the U.S. Department of Agriculture. This 28-page document is a digest of a report prepared by the Task Force. One of the recommendations of the task force was to create a National Wildfire Coordinating Group (NWCG) to coordinate fire management at all levels of Federal and State activities. The charter officially organizing the Group was signed in March 1976.

A provision of the charter is to create several special working teams. One of these is the Fire Prevention Working Team, which consists of eight members—three members from State organizations, one each from the Bureau of Land Management and National Park Service, and three from the Forest Service.

In the NWCG charter to the Fire Prevention Working Team, the Team was instructed to use the "*Wildfire Prevention Analysis,* as a firm base of further analysis, and future action and evaluation efforts."

In addition, the Team wants to increase the exposure of and commitment to fire prevention at all levels, and develop and implement methods to produce better results in fire prevention. Preventing fires that cost millions of dollars and threaten lives and property can be achieved. Successful fire prevention projects can be personally rewarding to those who are responsible for them. In addition, fire prevention benefits the residents, community, and Nation. The failures in fire prevention conversely, cost you, the community, and the Nation.

Thomas L. Price is Assistant Director, Cooperative Fire Protection Staff, Forest Service, U.S. Department of Agriculture, Washington, D.C. Eugene McNamara is Chief, Division of Forest Fire Protection, Bureau of Forestry, Harrisburg, Pa.

Smokey is right! More "how-to-do-it" information is needed, so more fires can be prevented.

Two Efforts

An expectation of the Team is to heighten the exposure of the benefits of fire prevention so that all of us will "really want to do it." Two separate efforts along these lines are: (1) a multiagency fire prevention problem determination, and (2) the production of a basic wildfire cause-determination handbook for field use to improve the reliability of fire-cause data for better prevention analysis and plans. Planning and ac-

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Evaluation of Fire-Cause Statistics A First Step in Preventing Fires

Linda R. Donoghue

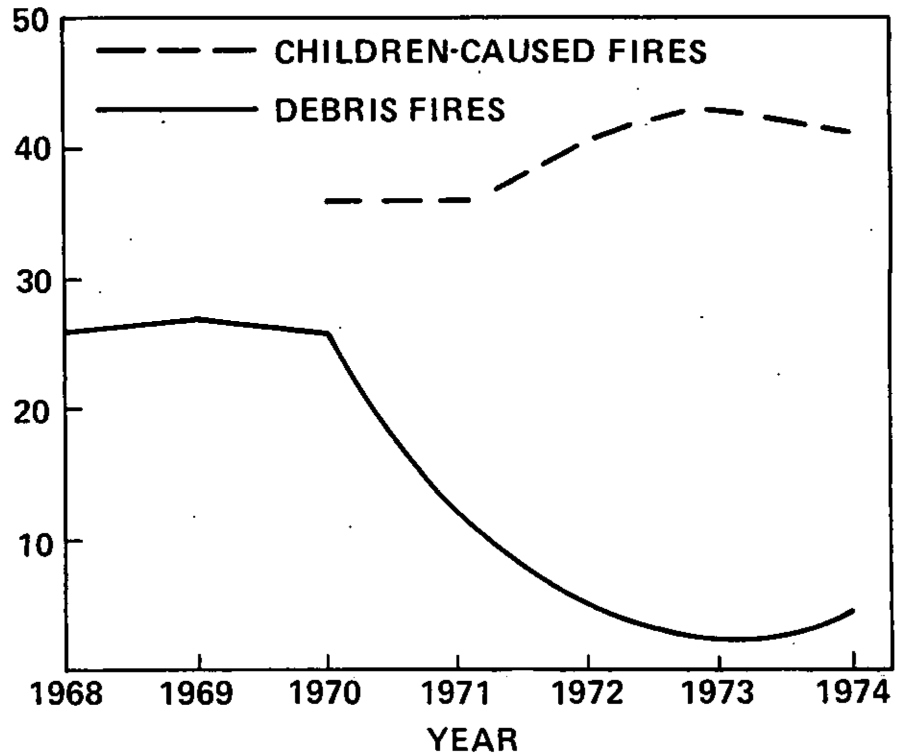

Figure 1.—Seven-year trend of debris and children-caused fires in Massachusetts (in percentages).

Fire prevention programs based on evaluation of past and recent fire-cause statistics are paying off in Massachusetts.

In 1970, 26 percent of all fires were the result of debris burning in that State. In 1974, only 4 percent of the debris fires were so attributed.

According to the Chief Fire Warden of the Massachusetts Department of Natural Resources, this dramatic decrease, which began in the early 1970's (fig. 1), apparently can be related to a) prevention campaigns undertaken during the sixties and b) a statewide regulation prohibiting open burning instituted in the early seventies. Although surrounding States experienced a decrease in debris fires during the same period, their reductions cannot compare to Massachusetts.

Linda R. Donoghue is a Research Forester at the North Central Forest Experiment Station, Forest Service, U.S. Department of Agriculture, East Lansing, Mich.

Analysis Made

A detailed analysis of the data collected by the Masachusetts Department of Natural Resources in cooperation with the North Central Forest Experiment Station regarding 200 fires in 10 Massachusetts counties indicated that adult men and women between the ages of 20 and 50 years were about equally responsible for the debris fires. Most of them were skilled or professional people or housewives having at least a high school education. The majority lived in town or generally burned debris between 11:00 a.m. and 4:00 p.m. Their debris fires escaped control more frequently in the spring (April and May) than in the summer and fall (July through September).

The analysis also showed that children (either accidentally or intentionally) were another major cause of wildfires in Massachusetts. The data show that fires set accidentally by this group were generally caused by grade school children of both sexes under 12 years old playing with matches, while those set intentionally were started by male grade school and high school students between the ages of 12 and 19 years. Children in both groups were primarily local residents living within the town and county where the fires occurred.

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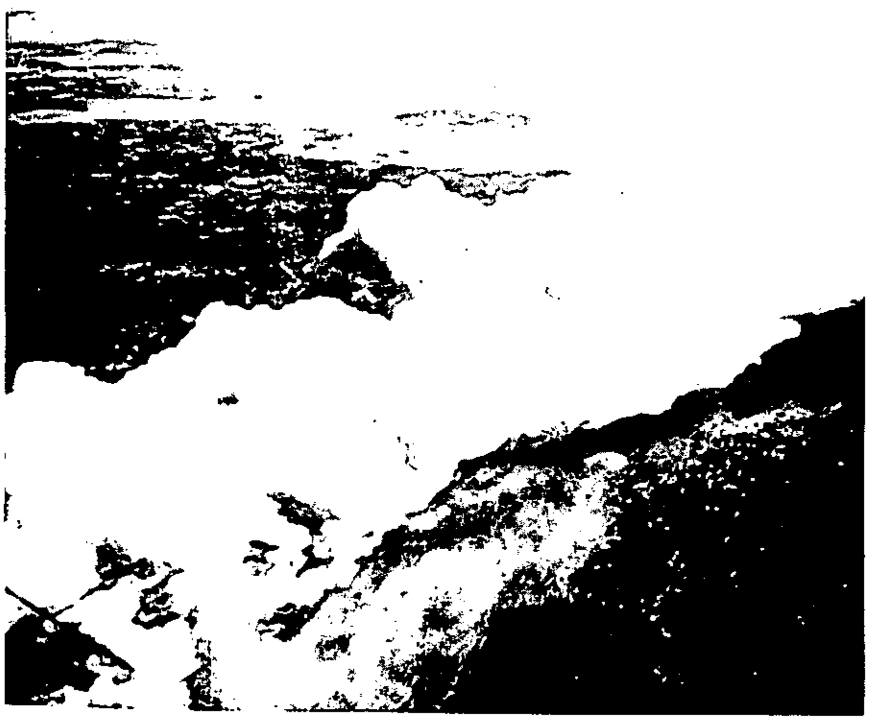
Jet Stream Influence on the Willow Fire

John H. Dieterich

On June 13–17, 1956, the Dudley Lake Fire burned 21,389 acres (8,555 ha) on the Chevelon Ranger District of the Sitgreaves National Forest in Arizona. Nineteen years later, June 17-19, 1975, the Willow Fire, burning on the same Ranger District and under remarkably similar conditions of fuel, weather, and topography, burned 2,850 acres (1,140 ha). Following the Dudley Lake Fire, Vincent Schaefer, writing in the Journal of Forestry (Vol. 55, No. 6, June 1957), summarized the relationship between the jet stream and 23 large fires in the West during the 1955 and 1956 fire seasons. His article was prompted in part by the unusual fire behavior observed on the Dudley Lake Fire, and in part by his interest in the jet stream as a dominant factor in the behavior of these problem fires.



Aerial view of wind-driven smoke column from the Dudley Lake Fire, June 14, 1956. The smoke column remained remarkably intact for several miles downward and was still readily identifiable in the vicinity of Mesa Verde National Park, 210 miles to the northeast.

As we began to put together the story of the Willow Fire, it became apparent that here was another case that could be added to Schaefer's list of destructive fires that burned under the influence of the jet stream. While there were some rather obvious differences between the two fires—the most important being in area burned—there were a sufficient number of similarities to make the two fires interesting from a direct comparison standpoint.

Description of Area

The locations of the Dudley Lake and Willow Fires are shown on the map. On the Dudley Lake Fire, 18 percent of the area was in private holdings (Aztec Land Co.) while on the Willow Fire, 41 percent of the area burned was being managed, at least in part, by Southwest Forest Industries. The Forest Service, however, provides fire protection for these lands within the protection boundaries.

Both fires were man-caused, and both occurred in terrain typical of the Mogollon Rim country—a flat to rolling landform bisected by steep rocky canyons. (The Willow Fire quartered across Willow Creek Canyon, while the Dudley Lake Fire crossed several smaller canyons.)

Fuels

The fuels appeared to be remarkably similar on both fires. Since both public and private land ownership were involved, fuel treatment standards varied from little or no fuel treatment to nearly complete treatment of slash after logging. Estimates of fuel weights were not available for the Dudley Lake Fire, but a detailed fuel inventory on the Willow Fire indicated that fuel loading, including litter, varied from 18 tons per acre (40,353 kg/ha) on the lighter areas to about 54 tons per acre (121,060 kg/ha) where slash remained untreated after heavy cutting. Even on areas where slash disposal had been fairly complete, sufficient ground and surface fuels had accumulated to support an intense fire, influenced by low relative humidities and fuel moistures and by strong winds.

Weather

Both fires burned during the middle of June—generally considered to be the most critical period of fire weather in the Mogollon Rim country. The weather pattern on the two fires, particularly with regard to the jet stream, appeared to have been generated under nearly identical conditions. As indicated by the weather data, the temperature and relative humidity conditions were not as critical on the Willow Fire, but the wind conditions were nearly identical.

One obvious difference between the two fires was in the length of time the severe burning conditions persisted. On the Dudley Fire, the strong winds continued and the relative humidities remained low for nearly 72 hours. On the Willow fire, the critical burning period was over in about 36 hours. An inspection of the 500-milibar weather map for the Willow Fire indicated that, indeed, the jet stream conditions persisted over the fire for about 36 hours. Then the winds dropped and humidities began to rise.

Two other Class E fires started and burned in New Mexico during the same 3- to 4-day period as the Willow Fire. These fires were undoubtedly influenced by the same strong winds that were passing over the Willow Fire.

Fire Intensity

Maximum fire intensities were estimated for the Dudley Lake and Willow Fires using Byram's formula (Byram 1959). Fire intensity on the Dudley Lake Fire was estimated at 15,300 Btu/s/ft (126,378 cal/s/cm) and on the Willow Fire at 12,750 Btu/s/ft (105,315 cal/s/cm). The difference between these two was not sufficient to explain the difference in final size of the two fires. More important is the fact that the Dudley Lake Fire burned as a high-intensity fire for nearly twice as long as the Willow Fire.

By way of comparison, the Sundance Fire in northern Idaho—considered a very high intensity fire—yielded an estimated maximum intensity of 22,500 Btu/s/ft (185,850 cal/s/cm) during its maximum run.

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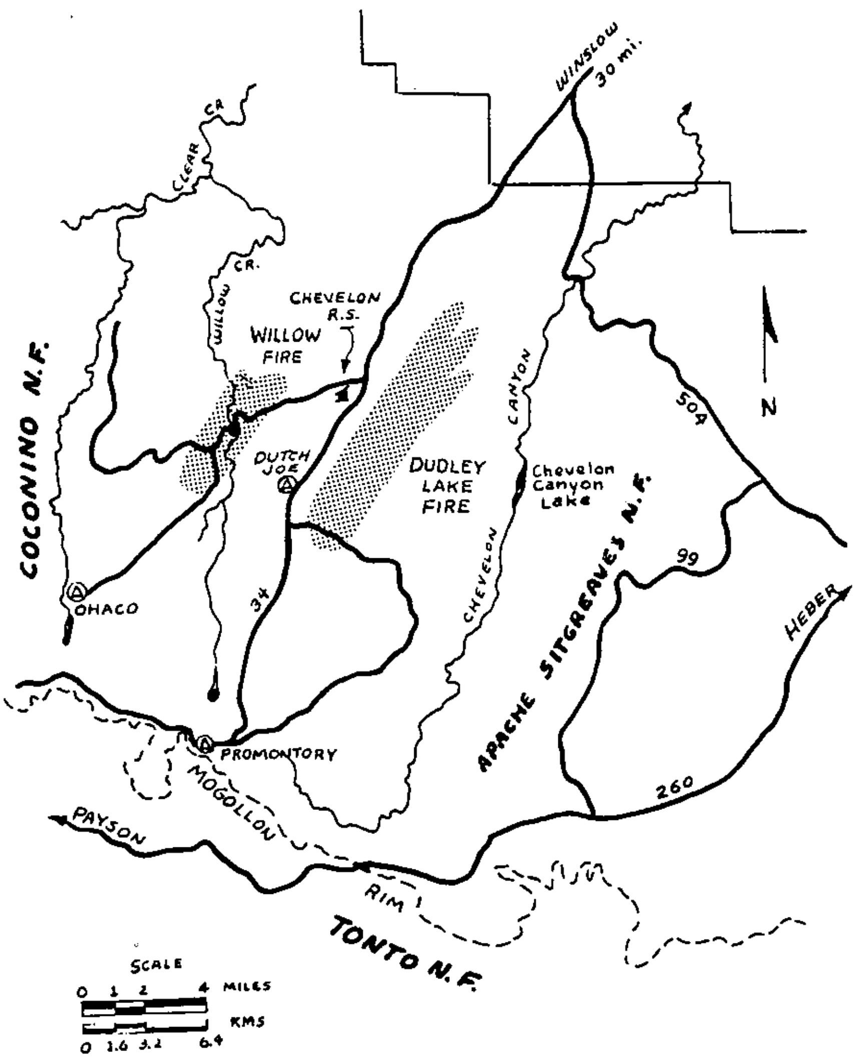

Location of the Dudley Lake and Willow Fires on the Apache-Sitgreaves National Forest.

JET STREAM INFLUENCE ON THE WILLOW FIRE

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Fire Suppression Load

There was a considerable difference between the fire load being experienced by Region 3 in 1956 and the number of fires burning when the Willow Fire broke out. During the 12-day period, June 8–20 in 1956, eight class E fires in addition to the Dudley Lake Fire were controlled or in the process of being controlled. Over 90,000 acres (36,000 ha) burned in Arizona in 1956—nearly three times the running 5-year average of 32,600 acres (13,040 ha). During the Willow Fire the Region wasn't experiencing this type of fire load; in fact, the Willow Fire was the first big fire of any consequence in the Region in 1975. Over 1,100 men were used on the Willow Fire, while only 750 men were employed on the Dudley Fire, even though it was several times larger. Fire suppression costs on the Willow Fire were estimated at nearly $700,000, four times the suppression costs on the Dudley Fire ($175,000). The per-acre suppression costs were three times as high on the Willow Fire ($245) as they were on the Dudley Fire ($82)—a fact that shouldn't surprise anyone.

There were some interesting similarities in the fire suppression measures taken on the two fires. On the Dudley Fire, only hand crews and heavy equipment were used because, in 1955 and 1956, aircraft were just beginning to be tested for dropping water on fires. On the Willow Fire, most of the suppression effort also came from hand crews and heavy equipment because the winds were so strong that aircraft use was limited to the early morning hours.

In summary, the following facts are evident:

First, forecasting unusually strong surface winds, especially those that are associated with the jet stream or abrupt changes in pressure patterns, is perhaps the most important single activity for the fire weather forecaster. Forecasting units may currently be doing this operationally, but additional "red flag" emphasis should be given to these situations when they occur.

Second, when fires start under these severe wind conditions, or if fires that are burning come under the influence of winds over 30 mi/h, the chances are good that they will continue to spread until the weather changes, or until they run out of fuel.

Finally, by current fuel treatment standards, even our best efforts of fuel reduction do not appear to be adequate to provide much assistance in the control of high-intensity wind-driven fires such as the Dudley Lake and Willow Fires. If fuel treatment is the answer, it will need to be done on a level that is far more *extensive* (area) and *intensive* (fuel reduction) than we are now accomplishing—even on our best fuel breaks.

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Byram, George M.
1959. Combustion of forest fuels. *In* Forest fires: control and use. Kenneth P. Davis (ed.). McGraw-Hill, Inc. New York. p.61-89.

John H. Dieterich is a Research Forester at the Forest Hydrology Laboratory, Rocky Mountain Forest and Range Experiment Station, Tempe, Ariz.

Strategies for Reducing Incendiary Fire Occurrence in the South

For the past 10 years, the South has had the worst incendiary fire record in the nation. More than 80 percent of all forest fires intentionally set in the United States happened in the South. Obviously, if such fires can be eliminated or drastically reduced, immense savings will be made in the cost of fighting fires—and in reduced damage to forest resources.

To find out more about the South's incendiary fire problem, the fire prevention research unit of the Forest Service's Southern Forest Experiment Station conducted 15 field studies in Louisana and Mississippi from 1964 to 1973. The areas studied had a long history of high incendiary fire incidence and, although limited to a two-state area, were deemed to be fairly typical of incendiary areas in the South.

An eight-page booklet based on these studies was prepared by Larry Doolittle, Southern Forest Experiment Station; Ernie Eller, Southern Region of the Forest Service; and Bob Jackson, Southeastern Area of the Forest Service. The booklet can be used by the field organizations of the various agencies involved in wildland fire prevention. It presents procedures for developing an incendiary fire prevention program.

Copies can be obtained from the Southeastern Area, Forest Service, U.S. Department of Agriculture, 1720 Peachtree Road, NW, Atlanta, Ga. 30309.

EVALUATION OF FIRE—
CAUSE STATISTICS

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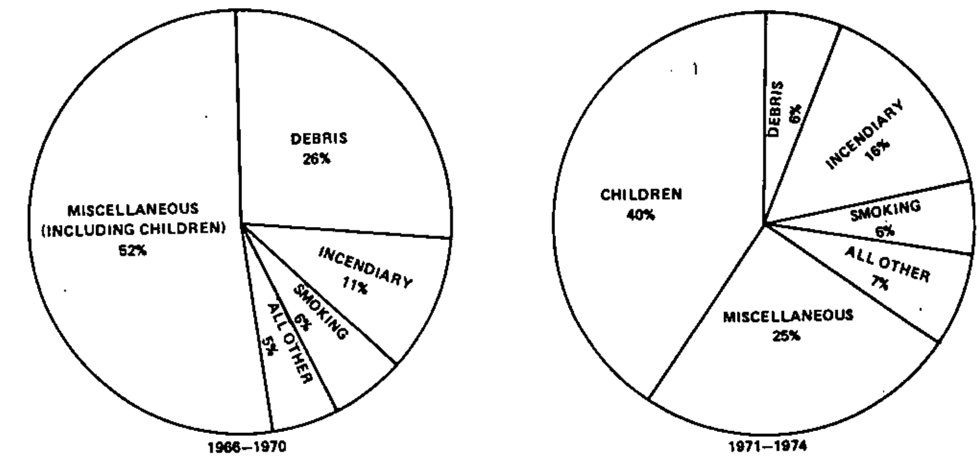


Figure 2.—Man-caused fires in Massachusetts (in percentages).

Leading Problem

Children-caused fires surfaced as the number one wildfire problem in Massachusetts during the 1970's (fig. 2). One reason for the percentage increase in this category is the corresponding reduction of debris fires. Another important factor in better reporting procedures instituted by the State of Massachusetts as a result of the Clark-McNary requirements. Before the 1970's, children-caused fires were reported under the miscellaneous category. This made it difficult to assess the magnitude of this problem. Nevertheless, it appears that more children are setting fires now than they did in the past. Although we lack supportive data, the Massachusetts Department of Natural Resources indicates that urban children, unaware of fire's damaging effects, are responsible for a large portion of these fires.

The State of Massachusetts has since redirected its prevention messages from the debris-burning public to grade school children. The State is attempting to educate these children at an early age.

Through proper data evaluation, a fire protection agency can adjust fire prevention programs to meet the problem. Once the problem has been properly identified, fire prevention personnel can use regulations and enforcement, as in the case of debris fires in Massachusetts, or other means, such as education in the case of children, to reduce the incidence of man-caused fires.

Fire-Weather Observer's Handbook Reissued

The Fire Weather Observer's Handbook, which was previously an Intermountain Station Paper, has now been revised and reissued as U.S. Department of Agriculture, Agriculture Handbook 494.

The current edition differs from the previous version in the arrangement of the humidity tables. These tables now appear as tear-out sheets in the back of the Handbook. The Handbook has a new cover, and all errors which appeared in the first edition have been corrected.

The publication has been reissued in a Department series to increase its availability to the ever-widening group of potential users. It is being sold by the Superintendent of Documents under stock number 001–000–03510–0 at $2.65 per copy.

Automatic distribution has already been made through Forest Service channels; however, if additional copies are required they can be obtained through Forest Service channels or by ordering copies direct from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

The Computation of Fuel and Fire Danger Parameters Using a Pocket Calculator

Charles F. Roberts

One of the major obstacles to the use of the new National Fire Danger Rating System (NFDRS) has been the extensive arithmetic required to determine the components and indexes. The System requires 11 time-dependent variables as input data in order to compute the values for the 3 components and 3 indexes. The original description of the system provided by Deeming et al. (1974) reduced the calculations to table look-up operations. Subsequent publications have provided graphical solutions to the equations through the use of nomograms.

For those offices having access to a computer terminal, an interactive computer program is available through the Automated Forest Fire Information Retreival System Program (AFFIRMS) (Helfman and Deeming 1975). AFFIRMS is now operational in the GE Time-Share System and is widely used by various fire protection organizations.

There are, however, a number of users or potential users of NFDRS who neither own nor plan to buy computer terminals. Many of these find the manual application of the system too awkward for application in their fire program. Moreover, the use of tabulated values of fire danger parameters produces undesirable gaps which can cause important decisions to be made on differences in index values which may be entirely false. Graphic solutions also pose problems in terms of the consistency of the answers.

Program Development

Situations give rise to a need for a convenient, inexpensive method for calculating fire danger for those activities not having access to AFFIRMS. To meet this need, I have attempted to develop a program to calculate fire danger through the use of a small hand-held, programmable, electronic calculator. I used a model HP-65 Hewlett-Packard calculator. The HP-65 has 100 stored program steps which can be recorded on a single magnetic card. By using several cards in sequence a large program can be built up to run on the HP-65. There are nine addressable storage registers and three "stack" registers for performing arithmetic operations. In spite of this rather respectable capability, handling the fire weather and fuels input data and solving the fire behavior equations proved to be a formidable undertaking.

The first requirement consisted of reducing the NFDRS equations to their simplest form for efficient calculation of the governing variables. This was achieved in some instances by developing simpler forms of the equations through approximation techniques. The Rothermel fire behavior equations (Rothermel 1972) were simplified by precalculating some of the terms and treating them as constant coefficients in the resulting relationships. Where relationships existed only in tabular or empirical form new best-fit expressions were derived. A description of the program and operating instructions are available from the Director of Forest Fire and Atomoshperic Sciences Research, Forest Service, U.S. Department of Agriculture, Washington, D.C. 20250.

Charles F. Roberts is the Principal Research Meteorologist, Forest Fire and Atmospheric Sciences Research Staff, Forest Service, U.S. Department of Agriculture, Washington, D.C.

Equilibrium Moisture Content

For the calculation of equilibrium moisture content (EMC), I used the Simard equations (Simard 1968) much as they are used in the AFFIRMS program except that I omitted the Simard equation for relative humidities less than 10 percent. EMC values for these low humidities are estimated by extrapolation from the equation for the 10- to 50-percent range. Errors become large only for humidities of less than 5 percent.

Fine Fuel Moisture

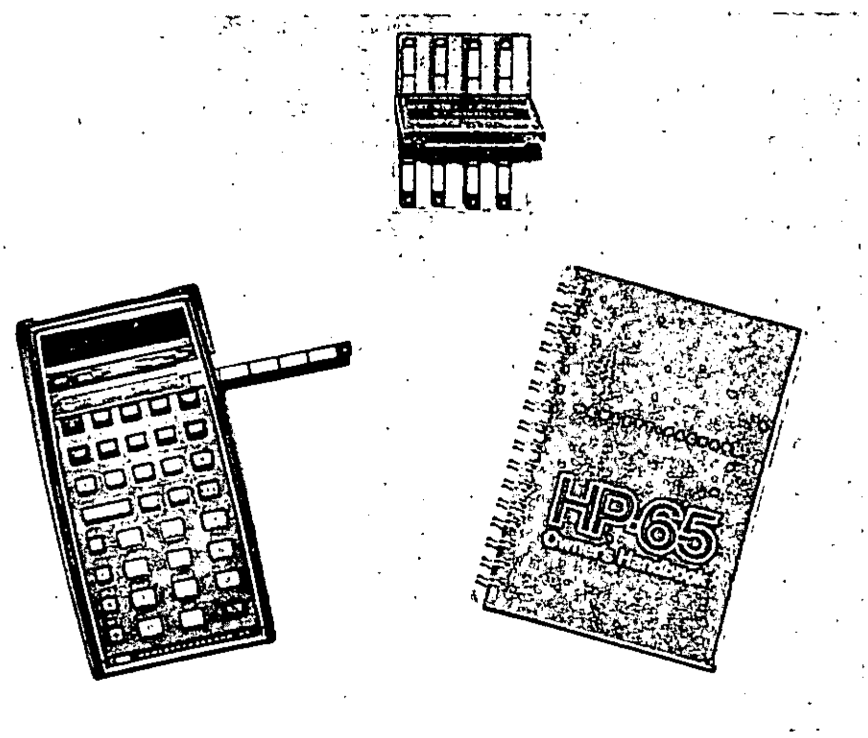
Fosberg's transcendental equation (Fosberg and Schroeder 1971) for calculating fine fuel moisture (FFM) could not be solved with the HP-65. Hence, linear approximations to the tabulated solutions are used to calculate FFM.

The same equations used in AFFIRMS for the calculation of 100-hour timelag fuel moisture are used in the HP-65 program.

The rate-of-spread equation is simplified by precalculating as many of the terms as can be treated as constants. Generally, these calculations involve factors that do not depend on fuel moisture or wind; however, most of the constants are fuel model dependent. I have developed a separate program to compute these factors from basic fuel model characteristics. This latter program actually provides a capability for one to develop his own fuel model from basic fuel inventory methods; however, the validity of these arbitrary fuel models has not been tested.

The energy component calculations are handled in a manner similar to that used in rate-of-spread determinations.

The final version of the program requires eight magnetic cards for execution. While this seems like an inordinately large number of cards, tests suggest that the time required to run the program, including data input, is not substantially different from that required for the full AFFIRMS operation. This program can not replace the AFFIRMS operation though.



For those users who neither own nor plan to buy computer terminals, the small hand-held, programmable, electronic calculator offers a relatively inexpensive means of calculating fire danger.

Advantages and Disadvantages

At this point it is perhaps worthwhile to consider the advantages and disadvantages of this method of calculating fire danger as compared to AFFIRMS.

The principal advantages arise from its flexibility, mobility, and potential cost savings. The program can be executed under a wide range of field conditions, and, to the extent that present fire danger rating calculations are valid for specific conditions, the HP-65 program can be used to guide on-the-ground decisionmaking for prescribed burning or fire suppression operations. For the latter applications one needs to be aware of the severe constraints which the assumptions used in constructing the fire behavior equations place on the applicability of these factors to specific fire situations.

Some of the shortcomings of this program are fairly serious. Perhaps its major drawback lies in its inability to file the fire danger data or to use automatically the fire weather forecasts. Data must be recorded and filed by hand. A further difficulty arises from the approximation which the HP-65 program employs in determining fine fuel moisture. This approximation can result in difference of up to 1 ½ percent of fuel moisture in calculated FFM in the range of 15 to 20 percent. Differences of this magnitude—7 ½ to 10 percent—have a major effect on the ignition component. The ignition component varies significantly with FFM differences of only a few tenths of a percent especially at low FFM values. There are major reservations regarding the current resolution which the fire danger rating calculations provide for moisture determination. Tests indicate that it is virtually impossible to determine atmospheric humidity under field conditions to an accuracy greater than ± 4 percent. Errors of this magnitude result in EMC errors of 1 percent moisture content, and these in turn translate into as much as 3 percent FFM error. Clearly, errors of 3 percent FFM have devastating effects on the accuracy of ignition and spread calculations.

While the hand-held calculator program for the fire behavior components may at times produce differences from the AFFIRMS-computed components that are unacceptable for comparison purposes, it is not correct to conclude that the HP-65 computations are less valid for a specific fire situation than the more elaborate AFFIRMS solution.

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FOCUS: How It Can Be Used by Fire Managers?

W. B. Phoenix

As the individual responsible for forest fire protection in a State forestry organization, I always have certain concerns when a new program is urged upon Fire Management.

Concerns

Among these concerns are:

1. How much will it cost my organization in terms of manpower commitment and in actual dollars?
2. If it is a computer related program, will it "bomb out" or will it actually give us more information with less time and effort expended to obtain the same results?
3. Is this a National Forest System program that does not necessarily apply to State organizations?
4. Does this program fit in with State operations, or will it require budget bureau or legislative action?
5. How will this program benefit my organization?

This article is an attempt to provide information that may serve to answer these common concerns.

W. B. Phoenix is the Chief Fire Warden, New Jersey Forest Service, Trenton, N.J. At the time he wrote this article, Mr. Phoenix was serving as State and Private Liaison Officer assigned to the FOCUS Project at Riverside, Calif., under the auspices of the Intergovernmental Personnel Act.

FOCUS

FOCUS (Fire Operational Characteristics Using Simulation) is a system which uses modern analytical techniques, without human bias, to provide objective evaluations of fire management alternatives suggested by the fire manager. The fire manager may then use these evaluations in making decisions concerning his ultimate fire plan or plan revisions.

The need for a simulation system like FOCUS was initially expressed by fire managers. The Fire Management Systems Project of the Riverside Fire Laboratory, Pacific Southwest Forest and Range Experiment Station developed and tested FOCUS. A steering committee with representation from the Bureau of Land Management, California Division of Forestry, and Forest Service Research, State and Private Forestry, and the National Forest System set guidelines and insured that FOCUS would meet the needs of all agencies.

Frequently, forest fire managers ask the question, "What can FOCUS do for me" Let me emphasize that FOCUS is not a fire fighting tool, but is used in long-range wildland fire planning. The fire manager can save untold manpower and drudgery by using FOCUS to test alternative concepts in his fire planning.

Simulation

Simulation is a technique that has been used successfully to solve a number of large and complex problems. FOCUS is one of the largest and most sophisticated computer simulation models developed for other than defense or aerospace use. In order to simulate successfully the fire load on a management unit, a "real world" data base must be entered into the system. The information gathered for this data base must be at least as accurate as the desired results. Where reports do not provide needed information, "educated guesses" by competent, experienced fire managers are perfectly acceptable as inputs.

For the initial data base, a management unit must expect to devote approximately 68 to 77 mandays gathering and entering information, such as "road network," value class, evaluation, fuel type, fire occurrence, weather occurrence, dispatching procedure, and resources available. These resources should include firefighters and equipment with associated production rates, wages, and other costs. Computer expense for entering this data base might run from $100 to $2,000, depending on the available computer facilities.

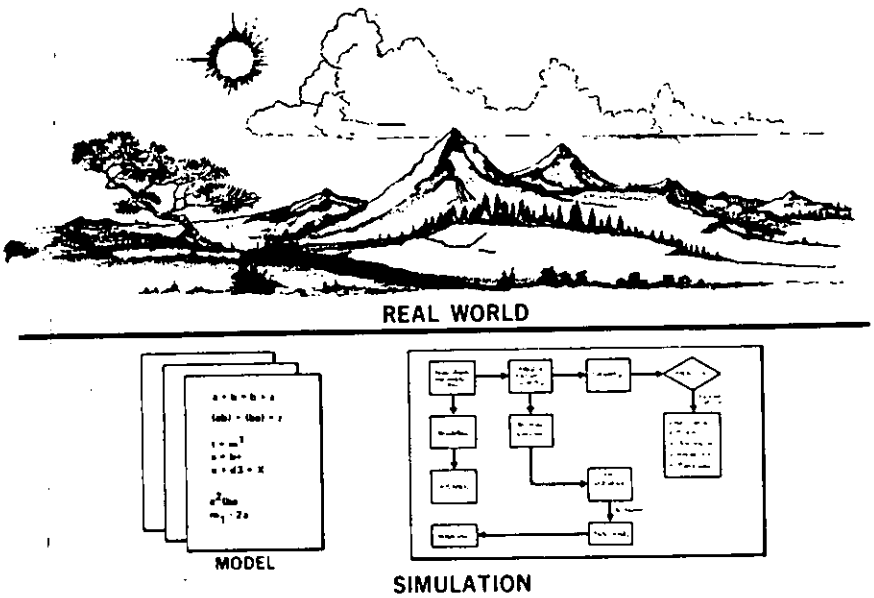

Figure 1.—A data base consisting of "real world" information must be entered into the computer to simulate the fireload on a management unit.

Evaluation of Alternatives

Using the simulation approach, it is possible to evaluate many alternative plans against the same set of conditions, and each plan can be evaluated from an entirely objective cost-benefit standpoint.

FOCUS can test one of these plans on the computer in seconds. In an on-the-ground test, many years might be required for the same comparative results. This simulation approach has been termed, "What If Planning." A fire manager might ask, "What if I changed the location of an air attack base? What if I changed the type of aircraft used in a protection unit? What if I initiated a hazard reduction program? What if my budget is cut by 10 percent?" Any of thousands of possible plan alternatives can be tested in a matter of minutes.

It must be emphasized that with these results the computer will not tell the fire manager what to do, but will give him the quantitative, objective information on which to base his decisions. What a tool to use in justifying a budget request! Most budget analysts look favorably upon this type of planning, particularly when presented along with a computer summary justifying a change.

Rigorous statistical tests for validity have not been applied; however, results from the use of FOCUS look surprisingly good. To date, two National Forests and one California Division of Forestry Ranger unit have been tested. Comparisons of the percent of fires by size class generated by FOCUS and those taken from actual 5-year averages compare closely for all units in which comparisions have been made.

The ultimate FOCUS model should include not only the suppression and cost modules, as it does now, but an economic evaluation module, a complete prevention module, a test detection module, a large fire module, and a stochastic fire location module (at present a sample of historical fires is used). The system is designed with enough flexibility so that each module is relatively independent, but each along with other new inventory systems, can become an integral part of FOCUS. This overcomes the fire manager's objection of having to continually recollect data for a new system, when it could have been collected initially at a much lower cost.

FOCUS Helps Meet Need

FOCUS helps to meet the fire manager's needs to:

1. Evaluate hazard reduction measures, such as mechanical slash reduction or prescribed burning.

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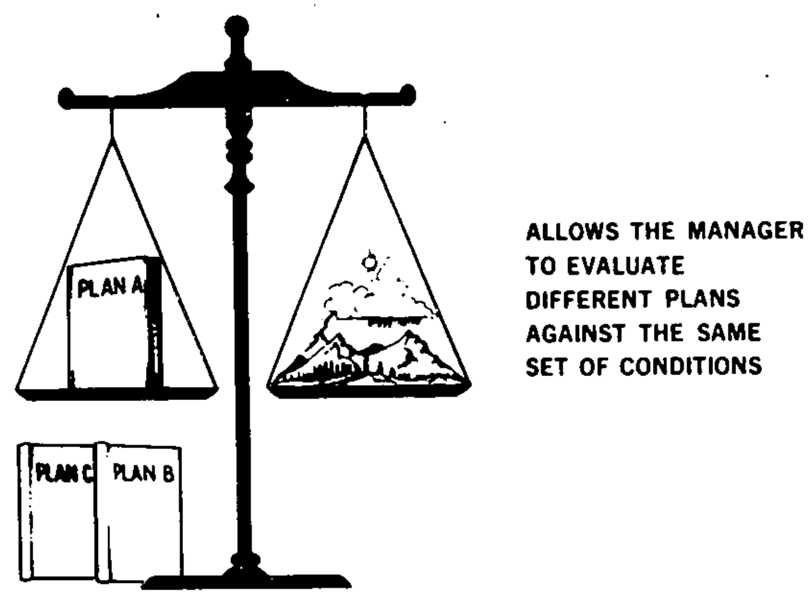

Figure 2.—A manager may weigh several plans against the data base in a matter of seconds.

FOCUS

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CLEARWATER ALTERNATIVES

0. 1972 FIRE PLAN; PRIMARY AND SECONDARY FORCES

1. INCREASE 1972 PLAN WITH ONE LARGE HELICOPTER
2. INCREASE 1972 PLAN WITH TWO LARGE HELICOPTERS
3. REDUCE SMOKE JUMPERS IN 1972 PLAN
4. REDUCE DISTRICT MANNING
5. REMOVE HELICOPTERS, INCREASE SMOKE JUMPERS
6. INCREASE SMOKE JUMPERS, REDUCE DISTRICT MANNING

RANKING OF ALTERNATIVES

ALTERNATIVE	RANKING	NUMBER OF FIRES BY SIZE CLASS A	B	C	FIRES OVER 100 ACRES	NO DISPATCH FIRES	ABC VALUE INDEX
0	....	377	55	7	5	4	1127
1	SECOND	383	50	7	3	5	1198
2	FIRST	385	52	5	3	3	1107
3	FIFTH	385	50	5	5	3	999
4	FOURTH	386	49	5	5	3	976
5	SIXTH	373	57	6	6	6	1190
6	THIRD	378	56	7	4	3	1313

Figure 3.—These alternatives were tested against the base plan on the Clearwater National Forest.

2. Evaluate the best deployment of forces to meet the established protection standards.

3. Evaluate the location and value of fuelbreaks and firebreaks.

4. Evaluate fuel modification programs.

5. Evaluate strategies for dealing with special fire problems created by changes in hazard, such as those caused by frost, ice, hurricanes, insect, or disease damage to vegetation.

6. Bridge the gap between land-use planning and fire planning.

It is important to remember that it is the fire manager who suggests alternatives to be run by means of FOCUS. It is his experience that provides the necessary input, and his judgment that will make the decision from the output provided by FOCUS.

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Working with the Neighbors

Marvin E. Newell

Each spring the Forest Service, Bureau of Land Management (BLM), Bureau of Indian Affairs (BIA), National Park Service (Dinosaur National Monument), and the Utah State Department of Natural Resources (Forestry and Fire Control) in northeastern Utah dutifully observe the ritual of revising the cooperative fire suppression plans. Occasionally during the fire season, we lend each other a hand. Mostly, we each go our own way like the extinct reptiles that once roamed the Uinta Basin in northeast Utah.

Two Plans

Until recently, the Forest Service had an annual operating plan with the BIA and another with the BLM and the State of Utah. Because of common boundaries, these were the primary agencies we worked with; however, we had never come together under one operating plan.

The operating plan between the National Park Service and the Forest Service had not been maintained for some years. Cooperation with the National Park Service was on a verbal basis, mainly an exchange of data, with little active cooperation in actual fire suppression.

Most of us sensed the need for closer, more meaningful cooperation; however, we each hung back, lacking an incentive or common need. As far as the Ashley National Forest is concerned, that incentive came through the 1972 National Fire Planning analysis.

National Fire Planning

The analysis of resource values, fuel types, fire size goals, and access to problem areas demonstrated that we could not meet required initial attack times for some areas on the Ashley National Forest with existing manpower and equipment. The main area of concern was the southern portion of the Flaming Gorge National Recreation Area. Lightning- and man-caused fire occurrences, high recreation values, fuel types, severity of fire season, and difficult access all added up to a nightmare in fire prevention, detection, and initial attack.

Given the rugged topography, how could we meet national fire planning initial-attack objectives? We considered increased manning of crews and pumper units, trail bike initial-attack crews, an air tanker from Salt Lake City, and even an unacceptable writeoff of resource values.

Helitack

Helicopter initial attack appeared to be the best way of meeting initial-attack times. By stationing a helicopter and helitack crew at the Dutch John Airport, which is a couple of miles from Flaming Gorge Dam, the critical areas could be reached within 30 minutes. Bucket operations could also be used with

Continued on next page

Three-man helitack crew, pilot, and mechanic at the Dutch John Heliport, Ashley National Forest, Utah.

WORKING WITH NEIGHBORS

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water from the Flaming Gorge Reservoir or the Green River.

Although the fire planning justified helicopter operations, past occurrence and severity showed the operations would be marginal when based on National Forest use alone. Fortunately, we were aware of nearby problem areas managed by other Federal and State agencies.

We met with representatives of these agencies in March 1973. After reviewing the fire planning maps, statistics, problem areas, and our helicopter proposal, the agencies decided to share in the operations. They saw it as an answer to initial attack in areas with high fire occurrence and difficult access. Last-minute financial arrangements could not be worked out; however, because it was too close to the beginning of the new fiscal year and the new field season, we agreed the helicopter would be available to cooperating agencies on a "trip" basis.

We were not prepared for full season operations in 1973 and did not get an aircraft until the middle of the fire season. Then, because of fire emergencies in other areas, the aircraft was detailed to those areas for the balance of the season. It was not replaced because of lower-than-average local fire condition classes, and aircraft availability from local sources was adequate.

Additional Planning

Additional planning was done during the winter of 1973–74, and the BIA agreed to cooperate in financing the operation. For instance, during 1975 the BIA financed 2 weeks of helicopter time on a contract which guaranteed 2 hours per day. After the agreement was made, the BIA found that helicopter initial attack provided the answer they needed for a remote, high occurrence area. In the future, the other cooperators may also participate in the base financing, but for now they use the helicopter on a trip basis.

During 1974, no aircraft were contracted for due to extremely high bids; however, other helicopters were detailed to the Forest during a critical fire season which set all-time records for both the Ashley National Forest and the State of Utah. The helicopters were used cooperatively on other agencies' fires.

Single Interagency Plan

We now have operation plans negotiated for financing, managing, and dispatching the helicopter. The Ashley National Forest dispatcher is responsible for dispatching and will base his decisions on overall interagency priorities. A helitack crew will be dispatched with the helicopter when it goes to a fire. The crew can be relieved later by the responsible agency if the agency decides to do this.

The helicopter can be used for administrative purposes when fire conditions permit and when finances are available. Efforts will be made to keep the operations as flexible as possible and to promote rather than restrict, use.

One immediate result has been the development of a single interagency annual operating plan, rather than the two plans described. This is a "first" for our areas and provides a sound basis for continued joint problem solving.

Meeting this management challenge has certainly provided us with a better understanding of the other fellow's needs and problems. Open and frequent communication is a new way of life. For instance, in a recent meeting we discussed joint fire caches and dispatching to reduce investment and duplication.

We have used each others' local firefighting forces more, rather than calling for outside assistance within the agency. This eliminates some travel along with the resulting delays and expenses.

Cooperation is becoming a fact rather than just a byword. We welcome its benefits and challenges.

This interagency management challenge has provided a better understanding of the needs of others. Open and frequent communication has a new way of life.

Marvin E. Newell is the Fire Management Staff Officer, Ashley National Forest, Forest Service, U.S. Department of Agriculture, Vernal, Utah.

Forestry and Forest Fire in Turkey

Ali Ozyigit
and Carl C. Wilson

Although it is on the opposite side of the globe from the United States, Turkey has forestry and fire problems similar to those in America.

Turkey has been a republic since 1923. It is almost twice the size of California, and in 1973 had almost twice the population of that State. Central Turkey has wide plateaus, with hot, dry summers and cold, wet winters. High mountains encircle the interior on all but the western side of the country. There are 20 peaks which exceed 10,000 feet.

Fires in Turkey

As in the United States, forests of Turkey generally are harvested on a sustained-yield basis. In Turkey's national forests, multiple use management is practiced. Most of the forest fires are started by people—either intentionally or accidentally.

Turkey's fire prevention mascot, "Smokey Deer," is very popular (fig. 1). Children in primary schools in Turkey are taught about Smokey Deer and how to be careful with fires in the forest.

Figure 1.—Smokey Deer

Most of the forest fires (almost three-fourths) occur during July, August, and September. Some fires may occur during the winter months when the hot, dry foehn winds may reach velocities of 15 mi/h, and temperatures may be as high as 80°F. These conditions are similar to those in the Santa Anas in southern California and to the dry east winds in Oregon and Washington.

There are two major differences between the forestry and fire problems of the two countries. The first is that since 1937, under terms of a Turkish forest law passed in that year, the State has had control of all forests—about 45 million acres—including those in private ownership. This, of course, is not the case in the United States, where about one-half of the 1.5 billion acres of forested land is in private ownership and control.

The second major difference is that citizens of Turkey are required by law to fight any forest fires that break out near their homes.

Turkish Forestry

Forests have been harvested on a sustained-yield basis in Turkey since 1936. However, most of Turkey's commercial forests are overmature, because until recently, they have been inaccessible. The Turkish Forest Service estimates that it will take 50 years to cut over these forests and to place them in the best growing condition.

The Turkish Forest Service's policy of multiple use management applies to the renewable surface resources of the national forests. Management is aimed at providing optimum quantities of water, forage, recreation, and wildlife for the people.

Forestry has a profound influence on Turkey's population. Forests cover 20.2 million hectares (50.5 million acres), or more than one-quarter of the surface of the country. Almost 24 percent of Turkey's population (4.5 million people) in 6,725 villages live within or close to the forests. Existing agricultural lands and other resources of these villages are limited. A national agency, the General Directorate of Forests and Village Relations, is responsible for helping with the development of the forest-dependent communities.

There are 6.7 million hectares (16.7 million acres) of burned and over-used forests which need to be rehabilitated in order to produce commercial fores products. The three major rehabilitation methods being used are:

- Regeneration measures, such as clear cutting of degraded coppice stands, to convert them into productive and high forest.
- Selective thinning of young trees to increase growth.

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FORESTRY AND FOREST FIRE IN TURKEY
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• Planting of seedlings in degraded areas where natural regeneration is not possible.

Use of fast-growing species, such as poplars and pines, is increasing. New plantations of these species represent a large government investment in rehabilitation, and these new stands are being intensively protected from unlawful cutting, overgrazing, and fire.

The rough topography, low rainfall, and long history of overgrazing and destructive fires, as well as other population pressures, have been the main causes of deterioration of the Turkish forests. Landslides, heavy surface runoff, erosion, and floods are common. Reforestation measures heal the damaged watersheds as well as providing forest products.

Fire Control

Because so many people live in or adjacent to Turkey's national forests, most fires are caused by people. About 99 percent of the blazes are started either by careless or "intentionally careless" people. (fig. 2).

Forest fire prevention, detection, and control are the responsibility of the Division of Fire Control in the General Directorate of Forests in Ankara.

Turkish radio, TV, and newspapers advise citizens to be careful when using fire in forests during the summertime.

There are more than 1,000 lookout towers for detecting fires. In addition, 59,028 km (35,417 mi) of telephone lines are used by the protection organization. Radio systems also cover most of the forested regions.

In general, there are more forests fires along the Mediterranean and Aegean coasts than elsewhere in Turkey—primarily because the temperatures there are higher, the humidities lower, and the winds stronger. In his description of the climate of Turkey, Ernic (1961) reports that for the 20-year period between 1940 and 1960, there were from 2 to 24 foehn days each year—an average of 12 foehn days per year. These winds account for the abnormally high winter temperatures along the coast.

The number of forest fires in the national forest regions from 1960 to 1972 are shown in figure 3.

One of the most destructive fires occured in a forest of Austrian pine *(Pinus nigra)* in the Gordes-Sigirova National Forest in 1962. (See "before" and "after" photos; figs. 4 and 5).

Despite the progress made in preventing fires and in speeding up attack, damages continue to be high. The highest damages during the past 14 years occurred in 1973 when T£ 113,534,191 (about $8.1 million) in damages resulted.

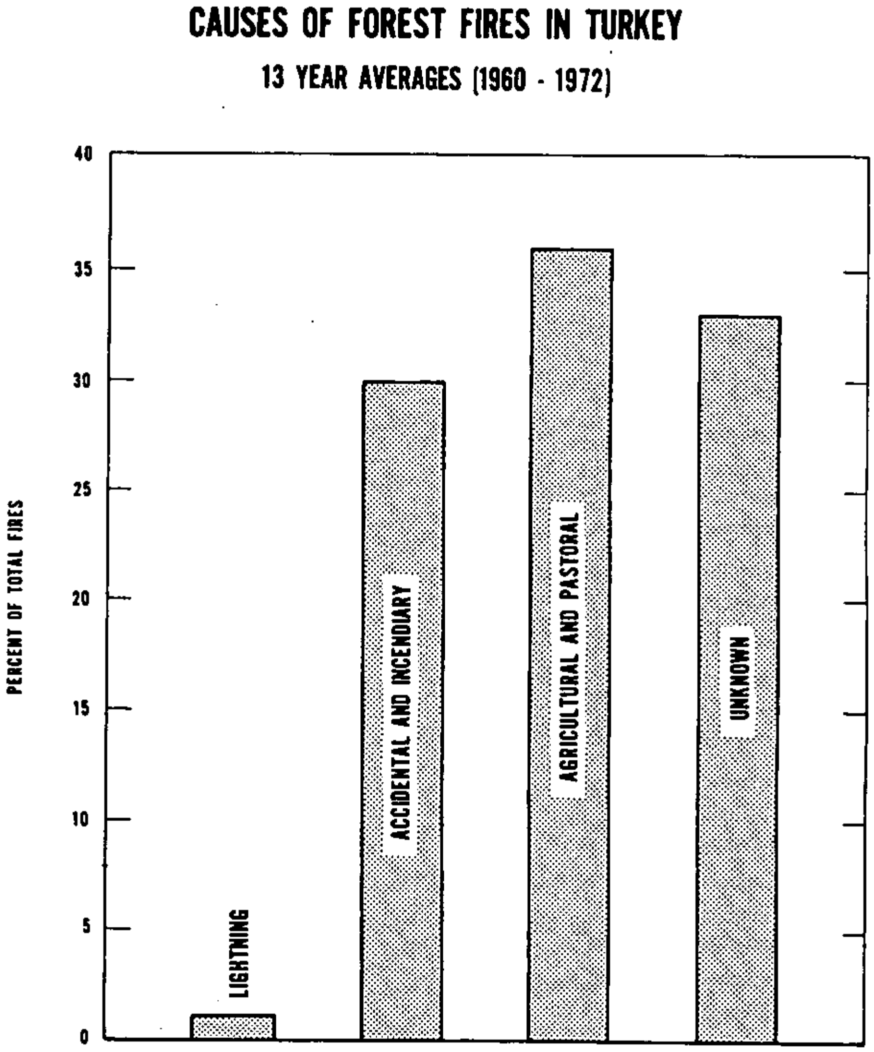

Figure 2.—Forest fire causes in Turkey. Figures represent 13-year averages (1960-1972).

Ali Ozygit is with the Directorate General of Forests, Ormad Bolge Basmundura, Ismir, Turkey. Carl Wilson is a Forester with the Cooperative Fire Protection Staff, Forest Service, U.S. Department of Agriculture, Washington, D.C. Carl is stationed at Berkeley, Calif.

Forest Fire Laws

Although the number of forest fires and resulting damage appears to be increasing in the Turkish national forests, there are several reasons for optimism. First, the Turkish Forest Service actively encourages villagers to extinguish forest fires. Article 68 of the Turkish Forest Law states, "Those who notice any sign of fire or burning in nearby forests are compelled to advise, in the shortest delay of time, the Forestry Administration or the town hall of the nearest village, the police, or the persons responsible for civil administration. All means of communication, civil or military, can be used free of charge for the announcement of a forest fire."

Article 69 continues, "In case of forest fires, *all the male population* between 18-50 of the neighboring villages and boroughs *is constrained to run on the spot of the sinister with all tools for that purpose,* such as hatchets, shovels, axes, saws, *to help to suppress the fire*" (emphasis added).

Article 69 also requires that if the number of persons present is not enough, more of the male population of surrounding villages and boroughs will be sent to the fire. Article 70 permits those who have to buy tickets at a fixed price in order to go to the fire site, or who take other means of transportation, will be reimbursed for all their travel expenses by the Forestry Administration.

MONTHLY OCCURRENCE OF FOREST FIRES IN TURKEY

13 YEAR AVERAGES (1960 - 1972)

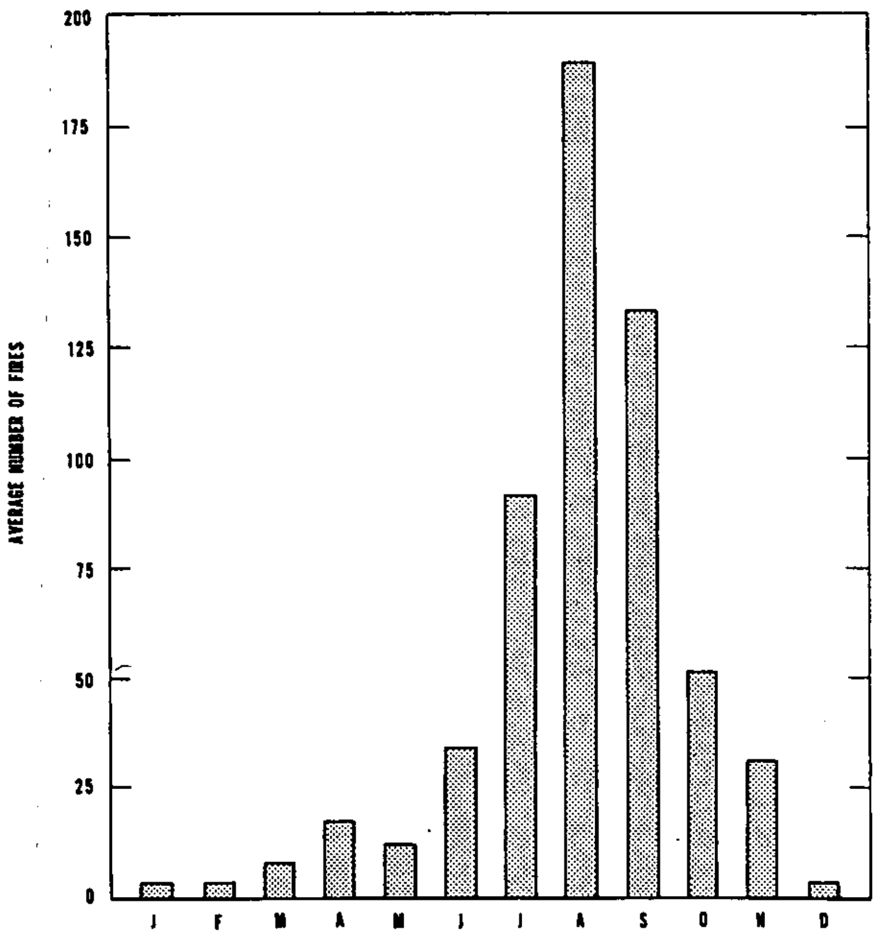

Figure 3.—Forest fire occurrence, by months, in Turkey reveals a fire season similar to those in the westen United States (based on a 13-year average).

Forest Education

A second reason for optimism about forestry and fire management in Turkey is that education programs are being expanded and upgraded. A 4-year program in professional training, leading to a forest engineer degree, has been offered at Istanbul University since 1857—almost 50 years before the Forest Service was created in the United States. Trabzon Technical University, organized in 1970, offers a degree in general forestry and forest products. There are numerous schools for fire guards and technicians, as well as training camps for forest workers.

The Forest Research Institute in Ankara is conducting research on forest fires. One of the Institute's recent studies was an evaluation of a native shrub, *Nerium oleander,* for fuel-break plantings. Ozyigit (1973)' reported that leaves of *N. oleander* required 10 times as long to ignite as did another common native shrub, *Juniperus oxycedrus.*

Progress and Cooperation

In spite of the relative inaccessibility of some forest areas, initial attack on fires is quite rapid. Furthermore, there seems to be a decrease in travel time. In 1968, for example, only 66 percent of the fires were attacked within 1 hour. In comparison, 92 percent were reached within the same period in 1972. Some of the decrease resulted from having new forest roads which improved accessibility.

There is a continuing need for Turkish and American fire specialists to share information on forestry and fire management problems. Such an exchange may improve the forestry practices and help reduce the fire losses of both nations. **Continued on next page**

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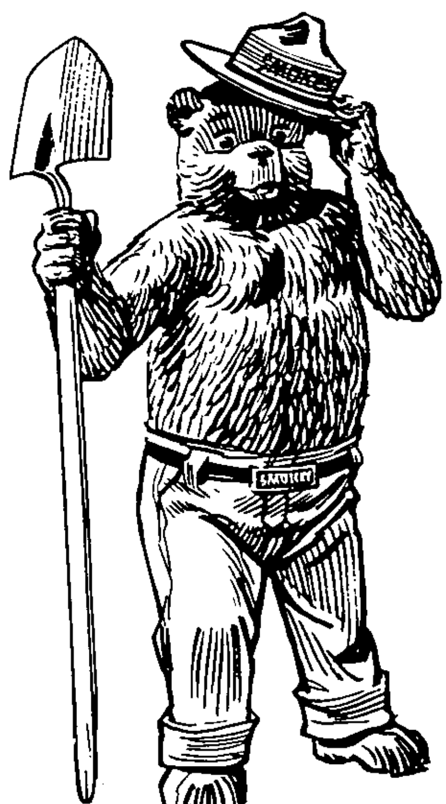
FIRE PREVENTION—ITS FUTURE

from page 4

tion efforts on the problem determination have begun in many sections of the country with reports of good results.

The Team will call attention to other efforts in fire prevention from time to time. As an example, see the brief report on a new publication, *Strategies for Reducing Incendiary Fire Occurence in the South,* in this issue.

Historically, fire prevention is very much a part of our tradition. In the future it will continue to be a vital part of our total protection and management effort.



POCKET CALCULATOR

from page 11

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