# FIRE CONTROL NOTES

***A quarterly periodical devoted to forest fire control***

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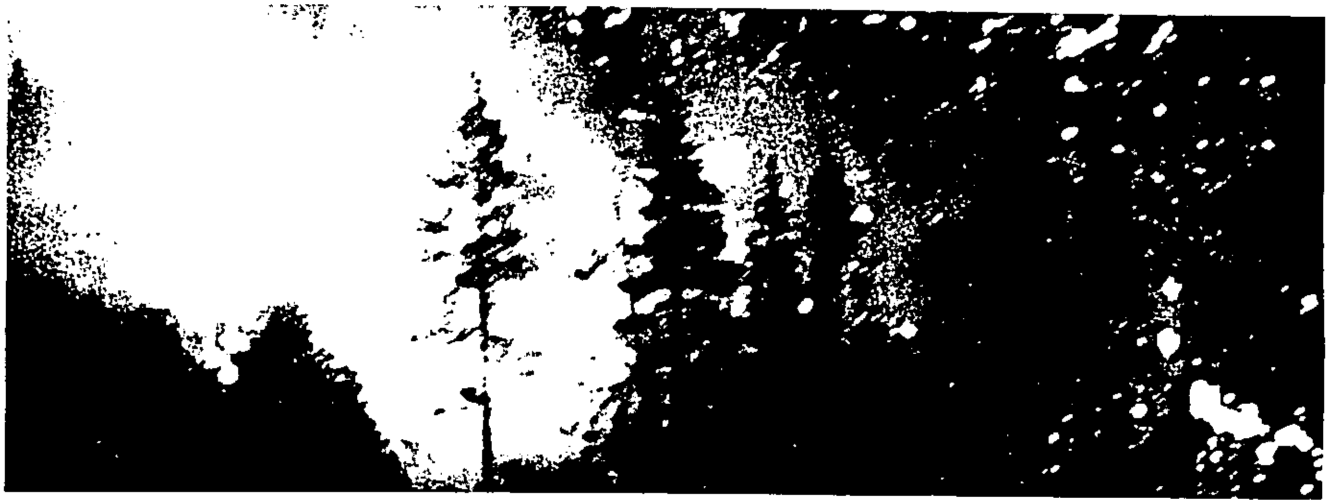

# 1970 Fire Season Statistics : November 30

The number of man-caused fires in National Forests in 1970 was the highest in 18 years. This year, 6,770 fires were man-caused; in 1952, the next highest year, 7,021 fires were man-caused.

Burned acreage, 552,836 acres, was the highest since 1934, or in the last 36 years. The last 5-year average was 182,000 acres/year.

The November 23, 1970, issue of the *National Geographic School Bulletin,* number 11, had a six-page article on fire fighting and the 1970 fire season. The article includes mention of a successful raindance performed last summer by Hopi Indians in California.

On November 25, 1970, as *Fire Control Notes* went to press, two class E fires were burning in California:

Meyers Fire, on the Angeles and San Bernadino National Forests, a reburn, started on November 13th. As of the 18th, 26,000 acres had burned.

Bear Fire, on the San Bernadino National Forest, a new fire also began November 13th. As of the 18th, 54,400 acres had burned, and the fire was contained.

FIRE STATISTICS

| Location | Number Fires | | Acres Burned | | | Fatalities | |
|---|---|---|---|---|---|---|---|
| (Region) | Lightning | Man-caused | NF | Other inside | Total | Number | Cause |
| 1 | 1,418 | 400 | 16,488 | 1,769 | 18,257 | 1 | Snag |
| 2 | 317 | 208 | 7,196 | 672 | 7,868 | | |
| 3 | 2,213 | 470 | 25,704 | 5,442 | 31,146 | | |
| 4 | 788 | 231 | 3,460 | 234 | 3,694 | 0 | |
| 5 | 856 | 1,527 | 249,364 | 52,495 | 301,859 | 5 | Helicopter |
| | | | | | | 1 | Smoke-jumper |
| 6 | 2,015 | 1,370 | 150,929 | 9,479 | 160,408 | 1 | Snag |
| 8 | 145 | 1,783 | 15,359 | 9,671 | 25,030 | 0 | |
| 9 | 74 | 752 | 1,966 | 2,605 | 4,571 | 0 | |
| 10 | | 29 | 2 | 1 | 3 | 0 | |
| Regional total | 7,826 | 6,770 | 486,956 | 82,368 | 552,836 | 8 | |
| | (Total number Fires) 14,596 | | | | | | |
| BLM | (Total number of Fires) 1,805 | | | | 213,852 | | |
| | Acres Burned as of (month) | | | | | | |
| S. Cal. State & County | Sept. | | | | 324,200 | | |
| Washington State | Nov. | | | | 61,524 | | |

(figures updated December 1970)

A fireline strategy session on the Mitchell Creek Fire on the Wenatchee National Forest in the Washington State.

# THINNING SLASH CONTRIBUTES TO EASTSIDE CASCADE WILDFIRES

JOHN D. DELL[1] AND DON E. FRANKS[2]

*Silvicultural practices, such as thinning, can affect the forest microclimate and arrangement of fuels. And any changes in air mass and fuels will affect the start, growth, and behavior of a fire.[3] One result is that fires can flare up more easily, will burn hotter, and can become difficult or even impossible to control. To illustrate the importance of thinning slash, two wildfires that broke out on the same National Forest in eastern Oregon less than a year apart are described.*

### THE WEIGH STATION FIRE—JUNE 1968

June 11, 1968, was not the kind of day on which you would expect to see a violent wildfire on the pine-covered, relatively flat plateau south of Bend. Minimum humidity for the day was about 40 percent, the maximum temperature, only 65°F; and there was a trace of rain. The fire season can start early here, but it still seemed weeks away. Other events—perhaps a careless traveler discarding a cigarette into dry thinning slash, and less-than-usual winter and spring precipitation, however, collapsed weeks into minutes.

Sometime after 1400, a small fire started in dry grass and needles adjacent to ponderosa pine thinning slash alongside a seldom used dirt road. At 1500, westerly winds accelerated to about 20 miles per hour, and the fire picked up. By 1830, the wind speed had dropped and the tractors were able to complete a line around the fire. By about 2000 all firelines were burned out and the fire was contained.

Despite an all-out air and ground attack effort, the Weigh Station Fire had killed more than 180 acres of thinned, pole-sized ponderosa pine on the Fort Rock District, Deschutes National Forest. Fire suppression costs totaled $20,000. Forest personnel estimated timber resource damage at $15,000.

### THE BULL SPRINGS FIRE—APRIL 1969

Less than a year later, on April 16, 1969, another thinning slash fire occurred within the Sisters District on the same national forest where the Weigh Station fire had broken out. The 5-acre Bull Springs fire is believed to have started from a warming fire in an old stump next to a plot that had been thinned in late February—only 8 weeks earlier.

At 1330 the fire was discovered by a forest industry crew. It was spreading through heavy ponderosa pine thinning slash on a 10-20 percent southeasterly-facing slope. Dry bulb temperature at 1430 was 69°F. Relative humidity was 30 percent. Wind speed was 5-7 miles per hour from the northeast. The fire burned uphill with some intensity, but at only a moderate rate of spread. Here again, however, resistance to control was extreme because of the volume and arrangement of slash on the ground.

Figure 1.—Untreated slash from precommercial thinning is ready-made fuel for the ignition and spread of wildfire. Resistance to line construction and potential rate of spread in these heavy fuel accumulations are considered extreme (E.E.)

Hand crews could not work their way through the heavy slash, and tractors were re-

[1]Forester, formerly with the Pacific Southwest Forest and Range Experiment Station, Berkeley, California; now with PNW Forest and Range Exp. Sta., Portland, Oreg.

[2]Fire dispatcher, Deschutes National Forest, Bend, Oreg.

[3]Countryman, Clive M., and Mark J. Schroeder. Fire environment—the key to fire behavior. Proc., Forest Prot. Div., Fifth World Forest. Congr. 4 p., illus. 1960.

quired. The fire spotted across a road at the top of the slope, where there was no thinning slash—only scattered manzanita. Ground tankers extinguished this slopover with little difficulty. The fire was finally contained at 1600 by Forest Service and Oregon State Forestry Department crews. About 80 percent of all trees in the thinned stand were killed by the fire.

## OTHER FIRES

Later in the summer of 1968, portions of several large wildfires in eastern Oregon and Washington burned through similar pine thinning slash areas. The Marks Creek fire (Ochoco National Forest, July 5-8) and the 4th-of-July Mountain fire (Wenatchee National Forest, August 4-10) received much of their impetus in this fuel type.

## DISCUSSION

When dense, young conifer stands are thinned their effect on fire control is still debatable: For example, Fahnestock[4] concludes that precommercial thinning in ponderosa pine stands seriously increases fire hazard for at least 5 years. He pointed out, however, that in the long run thinning greatly reduces the vulnerability of stands to fire. Cron[5] cites three cases in which thinned stands, with thinning slash on the ground, aided in controlling fast-spreading fires under extreme burning conditions (these conditions were not described). Appleby[6] maintains that it is not possible to generalize about fires in thinning slash. Weather, fuels, and topographic conditions in each fire must be considered to make valid comparisons of fire control in thinned and unthinned stands.

### Contributing Factors

Several factors contributed to the origin of the two principal fires described here. Lack of precipitation was one. Between September 1967 and June 1968, only 5.63 inches of rainfall and 15 inches of snowfall were recorded at Bend, Oreg.—about half of what is normal for this period. Between February and June, only 1.5 inches of rain fell, with only a trace of snow.

In the months before April 16, 1969, about 10 inches of rain and 75 inches of snowfall were recorded in nearby Bend. Although total precipitation was normal for this area, snowfall was more than twice the average for the period. But in the 30-day period before the Bull Springs fire started, only a trace of snow or rain was recorded.

The second factor was the presence of thinning slash. For instance, almost all area burned by the Weigh Station Fire—except at the actual point of origin—had been covered by dense 3-year-old thinning slash with needles still intact on the branches (fig. 1). Trees had been thinned to a 16- by 16-foot spacing. Using Fahnestock's method[4], we estimated 35 tons of slash per acre, or 6,300 tons for the 180 acres burned.

The third factor was the moisture content of needles, branches, and twigs. It was estimated to be less than 30 percent in the Weigh Station Fire, making these materials highly susceptible to burning. Rate of spread and resistance to control in this fuel was rated extreme (E.E.).[7]

Fuel moisture samples were collected a few weeks after the Bull Springs Fire from thinning slash in a nearby stand that had been thinned at the

Figure 2. — A wildfire in dense ponderosa pine thinning slash has consumed the ground fuels and killed the standing trees. The fire was so hot, a coating of ash was left on the ground. Note silver hard-hat on stump, left center.

[4]Fahnestock, George R. Fire hazard from precommercial thinning of ponderosa pine. USDA Forest Serv. Res. Pap. PNW-57, PNW Forest & Range Exp. Sta., Portland, Oreg., 16 p., illus. 1968.

[5]Cron, Robert H. Thinning as an aid to fire control. Fire Contr. Notes 30(1): 1. 1969.

[6]Appleby, Robert W. Thinning slash and fire control. Fire Contr. Notes 31(1): 8-10. 1970.

[7]Based on Guide for Fuel Type Identification—R-6 (1968). U.S. Forest Serv., Portland, Oreg., 48 p., illus. 1968.

same time. Moisture content in the finer fuel components was 50 percent. This and the intensity of the fire suggest that green thinning slash had cured rapidly to a low moisture content and a highly flammable state, even though it was spring.

#### Fire Spread and Resistance to Control

Shortly after it started, the Weigh Station Fire—influenced by the fresh westerly wind—began spotting into thinning slash. The spot fires rapidly burned together, and the fire then pushed easterly in an intense front. It burned mostly on the ground in the slash, but occasionally crowned through the spaced trees in the thinned stand.

The dense thinning slash was almost impenetrable to hand crews with cutting tools. Direct attack on the fire was impossible. Handline construction on the flanks was too slow and difficult to keep up with the rapid spread of the fire. The dense slash also hampered the ground tanker attack. When tractors arrived on the scene during the Weigh Station Fire, the ground crews were used for line holding.

In a wildfire of such intensity, almost no ground fuels are left, and most of the standing trees are killed (fig. 2).

### CONCLUSIONS

As we see it, most of the emphasis in these differences in viewpoints has been on the ease or difficulty of *controlling* a moving wildfire in thinned stands. Equal consideration should be given to the *ignition and spread potential* that exist in heavy accumulations of dry thinning slash. One goal of good forest management is to prevent wildfires from starting at all, but if they do start, management should be able to control them at a minimal size.

The two fires described in this paper are graphic examples of the ease with which a fire can *ignite* and *spread* in ponderosa pine thinning slash. If weather and fuel conditions are the least bit critical when a fire occurs, the investment in having thinned the stand—and the stand itself—may be lost entirely. Foresters must recognize this possibility, and plan counter-measures as precommercial thinning progresses. Such measures might, where feasible and economical, include treating thinning slash by mechanical crushing or chipping.

In some areas, extra fire patrol or protection may be necessary. Forest managers should consider topography, cleaned buffer zones, use of natural barriers, and adjacent fuel types when they plan for thinning. △

## Fire Occurrence Mapped by Computer

A. T. ALTOBELLIS,

C. L. SHILLING, AND

M. M. PICKARD [1]

Maps showing fire occurrence patterns are used extensively by prevention administrators and researchers, but preparation and updating are tedious and time consuming. A computer program is now available that prepares fire occurrence maps for areas in which fire locations are based on the U.S. public land survey system. From cards prepared for individual fires, the computer totals the number of fires per 40-acre block and prints the totals on a township overlay with a scale of 1 inch per mile.

For each fire, county name and code number, township, range, section, and code number for the forty-acre legal subdivision within the section must be punched on a card. The cards may be filed by township, county, or larger area. The program, written in FORTRAN IV, G LEVEL, scans the card deck for fires in the township(s) of interest and prints an overlay of the number of fires up to nine that have occurred in each "forty" in the township. An X is printed to indicate more than nine fires. Unless data are being plotted for a long period of time, e.g., more than 5 years, the limit of nine fires per "forty" is seldom reached. For most purposes, this limit does not detract appreciably from the usefulness of the overlays.

#### States Not Under Survey

In many States that are not under the public land survey system, fire control organizations have a grid system for locating fires. With some alterations in coding, the program can be adapted for use in these States.

Program source decks and test data are available on request from the Fire Prevention Project, Southern Forest Experiment Station, P.O. Box FX, State College, Miss. 39762.

△

[1] Altobellis and Shilling are research foresters, Southern Forest Exp. Sta., USDA Forest Service; Shilling is currently enrolled in the Dep. of Recreation and Parks, Texas A & M Univ., College Station, Texas. Pickard is a graduate assistant in the Computer Sci. Dep., Miss. State Univ., State College, Miss.

# DIAMMONIUM PHOSPHATE PREVENTS ROADSIDE FIRES

JAMES B. DAVIS [1]

*Application of DAP retardant resulted in reduction of average fire occurrence along the Ridge Route on the Angeles National Forest. Evidence is being found that reduced flammability in treated grass areas is significant.*

Mix high-risk, flashy fuels along a highway with a long, hot, dry summer and you have an explosive combination: This is the situation where U.S. Interstate Highway 5 crosses the Angeles National Forest in southern California. In 1964 more than 6 million vehicles sped over this 9-mile stretch of highway known as the Ridge Route (fig. 1).

And where you have people, you usually have fires. In fact, the Angeles National Forest used to record annually as many as one fire per mile for this route, or about one-fourth of all the wildland fires on the Forest. This is not so today. The traffic has increased to nearly 9 million vehicles, but during the past 5 years the number of fires has averaged less than two per year for the entire stretch of highway (table). What makes the big difference? The roadside application of chemical fire retardants may be the answer.

#### Hazard reduction is not new

Hazard reduction has been practiced on the Ridge Route for many years. Since 1955 hand crews removed all vegetation for 6 to 10 feet on each side of the highway. Yet, fire starts continued—the usual methods of hazard reduction just weren't enough.

#### DAP Use is new

William Beaty, Angeles fire control officer, wondered if it was possible to deal with the problem by fireproofing the fuel just beyond the cleared area. Then fires that did start would burn slower, allowing fire control personnel to restrict fires to the **A** or **B** size class. He knew from studies conducted by the Pacific Southwest Forest and Range Experiment Station that diammonium phosphate (DAP) solutions—used in many cases by airtankers—sprayed on roadside vegetation could make it fireproof.[2]

Station researchers found that grasses treated with DAP at the rate of about 2 pounds per gallon of water applied at the rate of 2 gallons for each 100 sq. ft. would burn slowly. And in some cases, grasses would not burn at all.

[1]PSW Forest and Range Exp. Sta., USDA Forest Service, Berkeley, Calif.

[2]Dibble, Dean L. Roadside hazard reduction with fire retardant chemicals. U.S. Forest Serv. Res. Note PSW-N21, Pacific SW. Forest & Range Exp. Sta., Berkeley, Calif. 9 p. 1963.

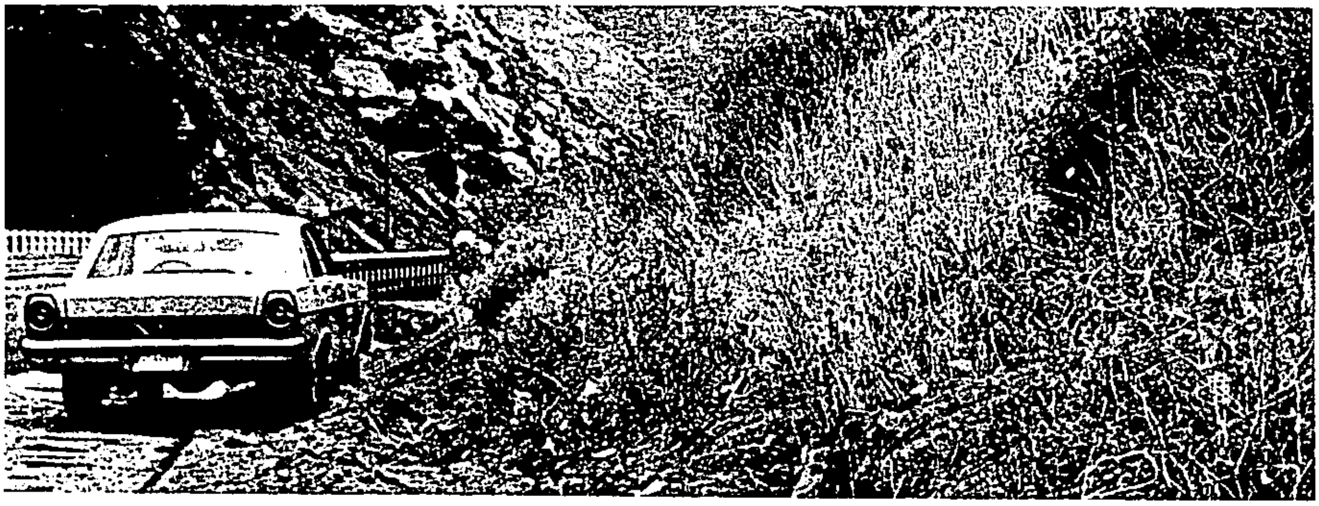

Figure 1.—Rough topography, flashy fuels, and heavy traffic combine to create a serious fire problem on the Ridge Route of the Angeles National Forest in southern California.

A big drawback is that DAP is soluble and can be washed off by as little as ¼-inch of rainfall. However, the Ridge Route receives only 8 to 12 inches of rainfall annually and almost none of it during the summer fire season. Therefore, the lack of summer rainfall—so important to the fire problem—made feasible the use of fire retardants.

Before treatment, the area was averaging 4.7 fires per year (9 fires in 1964) at a suppression cost of at least $10,000 annually. Beaty estimated that spraying both sides of the 9-mile strip would cost about $1,000. If the number of fires could be reduced by 10 percent, then suppression costs would be offset, and the subsequent reduction in damages would be a bonus.

#### 5-year try

Beaty decided to treat the fuels along this stretch of highway for 5 years and then evaluate the results. For the years 1965-1969 the fuel removal continued, but in addition, crews sprayed the adjacent grass fuels with a DAP mixture for 15 to 30 feet beyond the cleared area as topography and plant cover required.

#### Results? Yes!

The results were far better than Beaty had hoped. Fire occurrence was reduced from 4.7 to an average of 1.6 per year. A simple test showed that this was a statistically significant reduction in fire occurrence.[3]

More important—no fire escaped. Previous to treatment, the Ridge Route had been an area where destructive fires often got started on the Angeles National Forest. After the treatment, the Ridge Route had no fires larger than 1 acre—chiefly because fires that did start burned slowly. In one case, the fire crew arrived to find the fire barely creeping, and several bystanders wondering why the dry grass was not burning well in such hot dry weather.

#### Frankenstein monster?

DAP is an effective fertilizer. Anybody who has had experience with range fertilization might well ask: "What effect is all this DAP going to have on the volume of grass growth? Aren't you going to create a Frankenstein monster by increasing the fuel volume?" While there has been some growth increase on some of the test plots set up elsewhere in California by the Pacific Southwest Station, it has not been a problem on the Ridge Route. Probably other factors, such as low rainfall or the shortage of other grass nutrients, are limiting.

An interesting speculation is that the Angeles National Forest may be favoring slow-burning grass. A chemical analysis of green grass growing on an area treated for the past 4 or 5 years but not treated immediately prior to analysis shows a significantly higher phosphate and total ash content than grass growing outside of the treated area. This indicates the retardant is being absorbed by the roots. Total ash content for six sample areas that were treated averaged 10.7 percent of dry weight. Shadscale, saltbush, and fourwing saltbush are species considered to be slow-burners because of their high ash contents (10 to 20 percent). On the other hand, ceanothus, big sage brush, and chamise—species considered flashy fuel—have low ash contents ranging from about 3 to 6 percent.

#### Questions

Some questions that need to be answered are:

1. Under what soil and rainfall conditions will DAP applications produce more fuel because of fertilization?
2. Will the persistence of DAP in the topsoil consistently increase the phosphate and total ash content of the new grass crop and result in reducing its flammability? This growth could contribute to the development of slow-burning vegetation. The value of such a characteristic in vegetation is obvious.
3. What will be the effect on vegetation compositon? California's annual herbaceous vegetation varies from year to year and site to site. Selective range fertilization can change the composition greatly. Range fertilization programs using phosphates have produced increases in broad-leaved plants, such as clovers, that tend to be much less a fire problem than the more flashy annual grass fuels.
4. What other treatments might yield greater results or cost less? The Angeles National Forest is getting equipment which will enable its fire crews to apply the DAP mixture more economically at a variety of sites. The unit was developed by the Forest Service's Equipment Development Center, Missoula, Mont. The

Table.—*Number of fires on Ridge Route, Angeles National Forest, California, by years and size-class, 1960-69*

| | SIZE-CLASS | | | | | |
|---|---|---|---|---|---|---|
| Years | A | B | C | D | E | Total |
| 1960-64 | 23 | 6 | 3 | 0 | 1 | 33 |
| 1965-69 | 6 | 2 | 0 | 0 | 0 | 8[1] |

[1]Fire retardants used in 1965-69.

[3]The $t$ test of the difference between two means was significant to the 5 percent level (18 degrees of freedom).

unit resembles an orchard sprayer and should be a major improvement over the tank trucks previously used.[4]

The Angeles National Forest is now using DAP as an operational treatment for drier parts of the Forest if the principal fuel is dry grass. The retardant should be effective on campgrounds, where fuel removal can cause a problem of dust; in work areas, such as construction projects, where work will be able to be continued even during periods of high fire danger; and on fire lines, where retardants will be used to widen or supplement other forms of line construction.

#### Are retardants for you?

But whether retardants would be effective in these other places will depend on fire incidence, values threatened, length of treatment, and rainfall pattern. Frequent summer rainfall would probably require repeated treatment. Repeated treatments can be justified when values are high enough. For example, the U.S. Army has repeated treatments of diammonium phosphate on a missile test range near Monterey, Calif. The purpose of the treatment is to keep the vegetation in its natural conditions yet prevent fires from destroying expensive instrumentation located throughout an impact area.

On the basis of 5 years' results at Ridge Route, I suggest that if you have an area where values are high, fire incidence great, and rainstorms few and far between, perhaps you ought to consider chemical retardants as a means of preventing fires. △

[4] Jukkala, Arthur H. High volume retardant sprayer. Fire Contr. Notes 30(1):4&11. 1969.

## Air Horn Helpful in Fire Emergencies

ALBERT G. BELL [1]

*The lookout posted on a vantage point observing the fire's behavior is the eye of safety of his crew. Because of the shortage of fireline radios, the lookout has only hand signals and word of mouth to alert his crew of danger. But we felt we needed to provide the lookout with another means of communication.*

The Southwest Forest Fire Fighters Interagency Council (SWFFF) discussed this safety problem at their annual meeting in Santa Fe, N. Mex. This council consists of one representative from each of the following agencies: National Park Service, Region 3; Bureau of Land Management; State of New Mexico; USDA Forest Service, Region 3; Bureau of Indian Affairs, Albuquerque Area; and New Mexico Department of State Forestry.

The SWFFF Interagency Council has the responsibility of establishing policies and procedures for the performance, training, safety, and equipment as related to organized Southwest Forest Fire Fighting crews.

#### Air horn suggested

The National Park Service representative, Tom Ela, recommended that all SWFFF Crew Liaison Officers should be issued a manual type air horn when dispatched on a fire detail. This suggestion was adopted and implemented for the 1970 Fire Season.

Several models and types of air horns were reviewed and tested. The Falcon, model no. U-4, was selected because of its size and audibility (fig. 1). This particular model weighs two pounds. Cost of this model is $15.25, complete with horn, valve, gas supply, and belt clip. Replacement gas supply cans are available for $1.95 each.

Special instruction labels are attached to each horn (fig. 2) and specific operating procedures are also included with the crew liaison officers' instructions. It is our intent the air horn will only be used to notify the crew to evacuate to a safe area via a pre-planned escape route. It is very important that the horn is not used for any other purpose. If coded signals were used for other purposes, the horn would soon become inadequate for evacuating crews under blow up conditions.

Gary E. Cargill reports the see AIR HORN, p. 15.

[1] Fire dispatcher, Region 3, USDA Forest Service.

Figure 1.—Falcon model no. U–4 air horn.

# ℞ for Burning On Apache National Forest

BILL BUCK [1]

*The Apache National Forest in the Southwest is zeroing in on prescriptions for successful prescribed burns. Manpower, timing and physical layout are important considerations in planning a prescribed burn.*

Logging and pulp slash. This hottest burn had a convection column well developed to 10,000 ft. above ground surface.

The Apache National Forest, like many southwestern forests situated on the Colorado Plateau, has significant fuel hazard problems. The extensive fuel accumulations in these coniferous forests are the product of several factors: the climate of the Southwest; the history of forest use by stockmen and loggers, creating an environment favorable to the establishment of extensive "doghair" (Black Jack) thickets; and the steadily increasing logging operations, for which the needed slash cleanup has not been adequately financed.

#### How much in a year?!

The Apache acquires 40,000 acres of new slash fuels each year, with an average of 45 tons of dead fuels per acre. Vast acreages on the Apache actually have two or more deposits of slash—resulting from successive cuttings since the early 1950's. If we are to correct this excess, we must make successful use of prescribed fire.

The Apache initiated its prescribed burning administrative studies in 1967. Under the direction of Harry Nickless, District FCO, 400 acres of the Iris Springs project were burned on the Springerville Ranger District in November.

#### Prescriptions for Fires

In 1968, we modified the Iris Springs prescription and burned additional acres. The results of these prescribed burns were successful enough to be helpful to other foresters with similar problems. We burned 800 acres at a cost of $2.50 per acre and stayed within justifiable mortality limits.

The table, on the next page, compares the statistics of three block burns in the Iris Springs Burn. Comments on the burn are included, and indicated optimum prescriptions are given.

The following tabulation indicates the prescription that will work in our situation:

| | |
|---|---|
| Temperature | - Maximum 50°F. |
| | - Minimum 40°F. |
| Relative humidity | - 30-40% |
| Fuel moisture sticks | - 20% |
| Wind | - 10-15 m.p.h. (steady) |

To some degree, trade offs can be made between prescription elements; lower temperatures and higher relative humidity than those prescribed could be satisfactorily offset by strong, steady winds or by using slope and firing techniques in your favor.

#### Mortality Strips

In the most severe scorch area, mortality strips one year after the Iris Springs burn revealed these losses:

1½% of the stems over 6 in. d.b.h.

16½% of the stems 3 in. to 6 in. d.b.h.

18% of the stems under 3 in. d.b.h.

36% was the total loss (30% of this 36% was in the suppressed or intermediate trees).

The loss represented 15½

[1] Fire control officer, Apache NF.

percent of the basal area, 10 percent of the 15½ being in the suppressed, intermediate class.

Another sample taken in an unthinned site (Loop Burn) revealed 45 percent of the total stems were lost—41 percent of which were under 3 in. d.b.h. and which had been suppressed to a basal area of 99 sq. ft. On a high Class II site index, 74 percent of the total trees were left.

**Our Objective**

Our objective is to compile a catalog of proven prescrip-

Canyon Bottom thinning slash: *Above;* Before [illegible] thinning stem, 3 in.; fuel moisture, [illegible] temperature 40°F.; relative humidity, [illegible] *below;* after burn, same location; note end of log in both pictures.

***Table. — Statistics of the 1968 Iris Springs Burn***

| CONDITIONS | BLOCK NUMBER 6 | 10 | 4 |
|---|---|---|---|
| I. Record of actual burn | | | |
| Acres in block | 30 | 60 | 30 |
| Fuel type | Ponderosa Pine with 3 & 4-year-old logging slash | same with 3-year-old logging slash | same with 3-year-old logging slash |
| Fuel loading | Heavy Over 30 tons | Heavy Over 30 tons | Average 30 tons/acre |
| Aspect | SE | E | SE |
| Slope | 20% | 30% | 15% |
| Observed weather | | | |
| Temp. | 40°-43°F. | 38°-46°F. | 32°-41°F. |
| Relative Humidity | 38%-44% | 20%-40% | 28%-32% |
| Wind | 15-25 m.p.h. | 5-10 m.p.h. | 0-5 m.p.h. |
| Fuel moisture (½-in. Stick) | 30% | 20% | 15% |
| Firing method | We utilize strip head firing primarily, working down slope on the contour. This technique gives us optimum control and flexibility. | | |
| Fire behavior observed | Hot, parallel to wind cool, against wind | Ideal burn, little too hot at 1400 | Too hot in places, scorch and crowning |
| Fuel Consumption by percent | | | |
| Light | 70 | 90 | 80 |
| Medium | 40 | 60 | 60 |
| Heavy | 30 | 30 | 20 |
| Duff | Average depth in all three blocks—3 in. Consumption averaged 1 in. in depth with complete consumption beneath and adjacent to fuel concentrations. | | |
| Comments | The gusts rather than the high winds seemed to do the only damage. The high winds would fan the fires in the pulp tops to high temperatures; then the wind would quit, allowing vertical dissemination of heat into the tops of the pole stand. | Ideal burning conditions. Very little scorch or kill. | Fuel moisture may have gotten a little too low. Also lack of wind contributes to "baking" the crowns. The aspect seemed to have considerable affect. |
| II. Indicated Optimum Prescription | | | |
| Temp | 43°F. | 40°F. | 35°F. |
| Relative Humidity | 38% | 30% | 30% |
| Wind | 15 m.p.h. | 10 m.p.h. | 10-15 m.p.h. |
| Fuel moisture (½-in. stick) | 20% | 20% | 20% |

tions to burn any given site in the pine type. Each prescription will vary, dependent upon the basic ingredients of slope, aspect, weather, fuel arrangements, fuel densities, character of residual stand, and the desired density and composition of the residual stand when completed. And, in order to reach our objective, several factors have to be considered.

#### *Men are important, too*

The prescription alone doesn't get the job done. Of first importance is men. The men selected as your torch men must develop a "feel" for the job. They must know when to slow or accelerate the ignition rate; how much heat they've got going and if it is for or against them; and when they need more fire momentum, how to get it, and how to break it (firing techniques).

#### *What does it look like?*

Another important factor is the negative aspect of a scorched stand. We must realize we can't burn on a production basis without some degree of mortality. We are not going to get 100 percent consumption of ground fuels with a cool burn.

### *Money Matters*

Financing has to be programmed. To plan a burn relying on contributed labor is wishful thinking. You must be guaranteed ahead of time the right manpower will be on hand when you need it—and on short notice. This requires approved financing.

### *When to Burn*

It is important to recognize when you can safely burn. For the Apache, the time is late October and November. This puts us just past the fall drying trend and into the cooler temperatures and shorter days before our first winter storms. This is the time of year when the perennial grasses are cured, offering the flash fuels necessary to carry the fire. We begin our burns 1 to 4 days following light precipitation, which allows the light fuels to pick up then lose the necessary fuel moisture for a medium spread factor.

#### *Logical layout*

The physical layout of your project must be logical. Individual blocks must be laid out so that they can be totally ignited and held, within 4 hour periods. Generally this means about an 80-150 acre block for a four to six man crew. Fuel arrangement, density, and moisture content; topography; cultural features; and aspect of slopes will all effect block layout.

### Conclusion

Prescription burning can be a successful and practical solution to much of the fuel hazard on the Apache. Our work so far indicates we are nearing the desired prescriptions, while within justifiable losses of the residual stand and within economic limits. △

Logging tops: *Above*, Intermingled with reproduction; *below*, torching out, reducing residual stand. This is the most difficult situation to cope with because such fuel arrangements invariably mean loss of patches of trees.

# Flexible Plates For Simulators Found Feasible

H. P. GIBSON [1]

The standard method of producing the flame and smoke patterns in the fire simulator is through the use of painted glass plates. The paint is scraped off the plate in a pattern which will produce the desired outline on the background scene on the screen.

While the flame and smoke patterns are satisfactory, the plates themselves have a number of disadvantages. They are subject to breakage. They will damage the simulator if accidentally dropped through the plate opening. They must be cleaned and repainted. Their bulk and brittle nature makes it impractical to store simulator exercises with prescribed plates. For this reason, it is impractical for a headquarters unit to supply prescribed plates with exercises to be used on simulators in field locations.

### What's needed?

Some criteria for selecting an alternate material for simulator plates are:

1. It should be a transparent material precoated with a durable, scribable coating.
2. It should be flexible enough to withstand handling in the mail.
3. It should be thin enough to make storage in file folders practical.
4. It should lend itself to photographic reproduction.
5. It should be soft enough to cut with scissors.

### This may be the answer

There a number of products which fit these criteria. One of them is a drafting supply film made by Keuffel & Esser Co. It is their Stabilene Film© called Scribe Coat©, #443207. This is a coated flexible film obtainable in either .005 in. or .0075 in. thickness. The white coating readily accepts ordinary pencil and is easily scribed with a sharp knife blade (fig. 1).

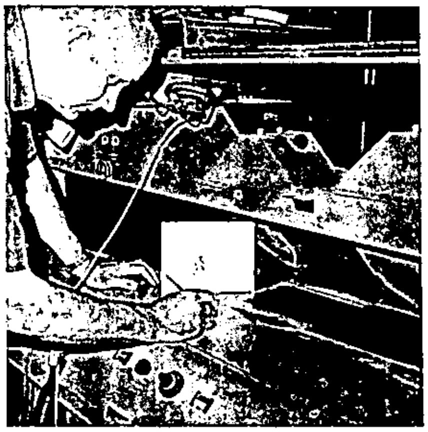

Figure 1. — Scribe Coat© plate, standing on edge, shows etched pattern. In position on the command simulator is a photo reproduction of the Scribe Coat© plate.

When the film is used, all glass simulator plates are thoroughly cleaned and left in place in the simulator. The film is cut to the exact size of the glass plates and taped over them with masking tape. Masking tape will not pull the coating from the film.

The film may be etched with a sharp knife blade while the exercise is in progress. This method is suitable for producing fire, smoke, and symbol. K&E produces a touch-up fluid which may be used to cover etched areas. It is applied with a small brush. This is their catalog item #582100. Their clear, uncoated .0075 in. Stabilene Film© may be used with the touch-up fluid to produce char.

### Uses

The use of this coated film will make it practical for the Fire Control Training Officer to design simulator exercises, scribe the plates for each exercise, and store them in ordinary file folders for immediate use. Pre-scribed plates are masked with constuction paper at the beginning of the exercise, and the masks are withdrawn as the fire spreads.

With the general use of the new COMPACT Fire Simulator and flexible plates, standardization of hardware in the simulation field will be possible for the first time.

### Duplicate Plates

The Fire Training Officer may now produce simulator exercises with prescribed plates for distribution to field stations. The scribed film plates may be copied on a light table.

Quantities may be produced photographically by using the original as a negative and producing film positive prints in the darkroom. A clear edge may be left on the photographically duplicated plates to facilitate proper location on the simulator (figs. 1&2). Scribing on the reproductions may be covered with the touch-up fluid, but additional scribing cannot be done.

### How much will all this cost?

The film and touch-up fluid are described in K&E Catalog #3. The cost of the scribe coat plates would be approximately $.35 to $.70 each, depending on size. This is not excessive considering the cost of moving a glass plate to a suitable work area and cleaning and repainting it. △

[1] Director, National Fire Training Center, USDA Forest Service, Marana Air Park, Marana, Ariz.

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*Note: First figure is issue number; second is page.*



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# 1970 SUBJECT INDEX



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AIR HORN, from p. 9.

successful use of the air horn on the Soldier Fire, Tonto National Forest, July 6, 1970.

Planned escape routes and signals were thoroughly discussed before the crews were committed to the line. Thus, without radio communication, firefighters alerted by the air horn reached safety when their position was outflanked by the fire.

In this instance, the large canyon and Four Peaks acted as a huge amphitheater, amplifying the sound. However, the opinion of overhead was that the air horns would be loud enough to be heard, even under less favorable acoustics.

This was a good example of effective communications without radios. When planned in advance, lookouts, hand signals, and air horns can be combined to provide for safety first in aggressive firefighting. △

BLACK DAYS, from p. 16.

low relative humidities. When these conditions combined with an unstable atmosphere, all conditions were "go" for blowup fires. And blow-up fires did occur.

At 9 p.m. that Black Wednesday evening the Ouachita National Forest called to report one of their worst fires in 3 years had been burning out of control. Aerial tankers, as well as hand crews, had been ineffective against this fire. The Oklahoma Division of Forestry reported a total of 35 fires that burned 7,669 acres, while one fire roared over 2,080 acres. Arkansas (State and National Forests) had a total of 142 fires which burned 12,559 acres.

### Air Stability the Key

When fire weather conditions are conducive to many fires (i.e. large precipitation deficiency, and low relative humidities) the fire weather meteorologist gives special attention to the stability of the atmosphere. The key to identifying this situation is interpretation of the early morning radiosonde observation, including temperature, humidity, and wind from the ground upward, thousands of feet. The fire control agency, informed of dangerously unstable atmospheric conditions by the fire weather meteorologist, is warned to expect erratic fire behavior. △

# BLACK WEDNESDAY
## in Arkansas and Oklahoma

ROLLO T. DAVIS AND RICHARD M. OGDEN [1]

During the more critical fire seasons there always seems to be one or more days that stand out as "black days." On these days fires burn hotter and are harder to control than on other days. Fires blow up on "black days." Like Black Wednesday, April 8, 1970, in Arkansas and eastern Oklahoma.

### Fire Season

The fire season in both states usually ends in late April. Normally by this time, vegetation is turning green. Fire control agencies are shifting to other forestry operations, and seasonal fire control crews are leaving. But April 1970 was unusual.

Rain fell in above-normal amounts during the early spring months. Periods of rain were so spaced that all fuels, except the fine ones, remained wet. Temperatures remained well below the seasonal normal keeping the vegetation in the cured stage. Except for a few border stations, fire danger stations did not go into the transition stage until mid-April. Rainfall, that had been coming in substantial amounts, dropped off in late March to almost nothing. This dry spell continued into mid-April and temperatures started rising to more normal levels. This was just the type of weather the people were waiting for: to begin field clearing by burning, brush pile burning, and garden and household debris burning. During this period, a great number of fires roared out of control.

### Synoptic Situation and the Black Wednesday Forecast

The dry spell, begun in late March, stretched into April as dry, high pressure spread over Oklahoma and Arksansas. It blocked frontal systems from the area. By April 7, high pressure extended upward to 20,000 feet, but the surface high center had moved to the lower Mississippi Valley. Moderate-to-strong, southwesterly, low-level winds pumped even drier air over Arkansas and Oklahoma. Afternoon relative humidities dropped to the 20-percent level, and some places had humidity readings down in the 'teens. With fuels already bone-dry, an extremely dangerous fire situation was in the making. Fires by the hundreds were being reported in Arkansas and Oklahoma. But most of them were not too difficult to control.

Wednesday morning, April 8, another dangerous weather feature entered the weather picture. The 6 a.m. radiosonde observations at Oklahoma City and Little Rock showed the air to be conditionally unstable to about 15,000 feet. It would become absolutely unstable from the surface up to 4,000 feet by the middle of the afternoon. Widespread surface whirlwinds or dust devils resulted from the great instability in the lower 1,500 feet. Warnings were called to the State Fire Control Chiefs, as well as to the Ozark and Ouachita National Forests. The warnings were for potential blow-up conditions. Hard-to-control fire behavior such as rapid crowning, long-distance spotting, and large convection columns was expected.

### What Happened

All conditions were favorable for fires in Oklahoma and Arkansas. There was a significant deficiency in rainfall during the last half of March and the first half of April. There had been an extended period of extremely

see BLACK DAYS, p. 15.

[1]Forestry meteorologists, NOAA, National Weather Service, Oklahoma City, Okla., and Little Rock, Ark.