United States
Department of
Agriculture

Forest Service

Winter 1980-81
Volume 42, No. 1

Fire Management Notes

Fire Management Notes

United States
Department of
Agriculture

Forest Service

Winter 1980-81
Volume 42, No. 1

An international quarterly periodical devoted to forest fire management

Contents

Fire Management Notes is published by the Forest Service of the United States Department of Agriculture, Washington, D.C. The Secretary of Agriculture has determined that the publication of this periodical is necessary in the transaction of the public business required by law of this Department. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through September 30, 1984.

Subscriptions may be obtained from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. The subscription rate is $5.00 per year domestic or $6.25 per year foreign. Single copy cost is $1.25 domestic and $1.60 foreign.

NOTE—The use of trade, firm, or corporation names in this publication is for the information and convenience of the reader. Such use does not constitute an official endorsement of any product or service by the U.S. Department of Agriculture.

Send suggestions and articles to Chief, Forest Service (Attn: Fire Management Notes), P.O. Box 2417, U.S. Department of Agriculture, Washington, D.C.20013.

Cover: Our lead story explains how three U.S. Department of the Interior agencies in Colorado cooperate to use one helicopter for forest fire management and other natural resource missions. The crew consists of: Front row—Glen Colonuts, Terry Lay, and Bill Pool; Back Row—Paul Broyles, Jim Tschetter, Mark Harvey, Charles Neumann, Don Whyte, Bill Collins, and Eric Eyetoo.

An Interagency Cooperative Effort

Paul Broyles

Interagency Helitack Coordinator

*Natural Resource Management,
Mesa Verde National Park, Colo.*

Three Federal agencies, one helicopter! That is the result of an innovative interagency approach to fire and resource management in southwestern Colorado. This interagency helitack program involves three Department of the Interior agencies: the Bureau of Indian Affairs (BIA) (Ute Mountain Ute Indian Agency), the Bureau of Land Management (BLM) (Montrose District Office), and the National Park Service (NPS) (Mesa Verde National Park).

How the Program Was Established

The idea for the cooperative helitack program was originated in 1978 by two Regional Fire Management Specialists—Jim Schneider of the BIA, Albuquerque, New Mexico, and Jim Olson from the NPS, Denver, Colorado. Both were aware of the mutual need to cooperate on fire and resource management activities on the Mesa Verde plateau. In the past, both agencies had regularly but independently used helicopters in fire suppression operations on the plateau. Why not consolidate and develop a centralized helitack program, sharing costs and benefits?

With approval from the Regional and Area offices, cooperative agreements were drafted and signed in the fall of 1978. These agreements outlined dispatch priorities, daily management guidelines, and fiscal responsibilities.

After the 1979 season, the BLM, Montrose, Colo., expressed strong interest in joining the program, as many of its lands adjoin those of Mesa Verde National Park and Ute Mountain Ute Indian Agency. After receiving State Office approval and after redrafting and signing updated agreements, the BLM became the third party to this Interagency Helitack program in early 1980.

How the Program Works

This program is unique in the area of Federal interagency cooperative efforts because not only are aircraft and equipment costs shared, but each agency contributes personnel to the program on a nonreimbursable basis, which eliminates cross-billing for personnel costs. Radio frequencies are shared as needed, as are portable radios and other helicopter and fire equipment.

While the primary use of the helicopter is for fire suppression, it also is used extensively in natural resource work, making the best use of a resource each agency would not otherwise be able to afford. Thus, coordinating resource activities around suppression activities is an important phase of the program.

Natural resource activities involving the helicopter have included roundup of trespass cattle and stray horses, boundary fencing, forest insect and disease surveys, archeological site surveillance, search and rescue, law enforcement, wildlife surveys, and transport of archeology crews for site surveys.

The "protection zone" for which the interagency helitack crew is responsible encompasses over 800,000 acres (BIA over 557,000 acres; BLM, over 161,000 acres; NPS, 52,000 acres) within a 50-mile radius of Mesa Verde National Park.

Most of this land is covered by sage, pinyon-juniper (fig. 1), and ponderosa forests. Also, the helicopter and crew are available to assist other neighboring agencies such as the U. S. Department of Agriculture Forest Service, Colorado State Forest Service, and the Montezuma County Sheriff's Office, in fire suppression and medevac activities.

The 1979 and 1980 seasons brought extensive development of facilities and training of personnel. The base heliport near the Mesa Verde National Park headquarters was constructed to Class II heliport specifications of USDI Office of Aircraft Services. National Park Service maintenance personnel constructed the helipad, and the helitack crew completed the heliport with a helihut and fuel shed. In the two seasons, 95 helispots were constructed, forming a network across the Mesa Verde plateau which allows ready helitack access to the mostly roadless mesas (fig. 2).

The helitack crew (comprised of four NPS employees—including the foreman, three BIA employees, and one BLM employee) received over 120 hours of training in such subjects as Interagency Helicopter

Training, Basic Firefighter and Fire Behavior, Power Saws, Standard First Aid and Cardio-Pulmonary Resuscitation, helitack operations specific to this program, Defensive Driving (a National Safety Council standard course), and technical evacuation/mountain rescue.

A working foundation has thus been established to build on in the years ahead. Looking ahead to next year, moderate expansion of the program will involve adding another BLM employee to the crew, and contracting for a larger helicopter with better performance capabilities. Further training and crew depth will be developed to add to the continuity of the program.

Managers from all involved agencies have expressed great enthusiasm over the continued success of this program and in the interagency accomplishments made to date. These managers realize that, with shrinking agency dollars and increasing management problems, this type of cooperative program sets an example that will be repeated with greater frequency throughout the field of Federal resource management.■

Figure 1.—*Typical pinyon-juniper forest on the Mesa Verde plateau.*

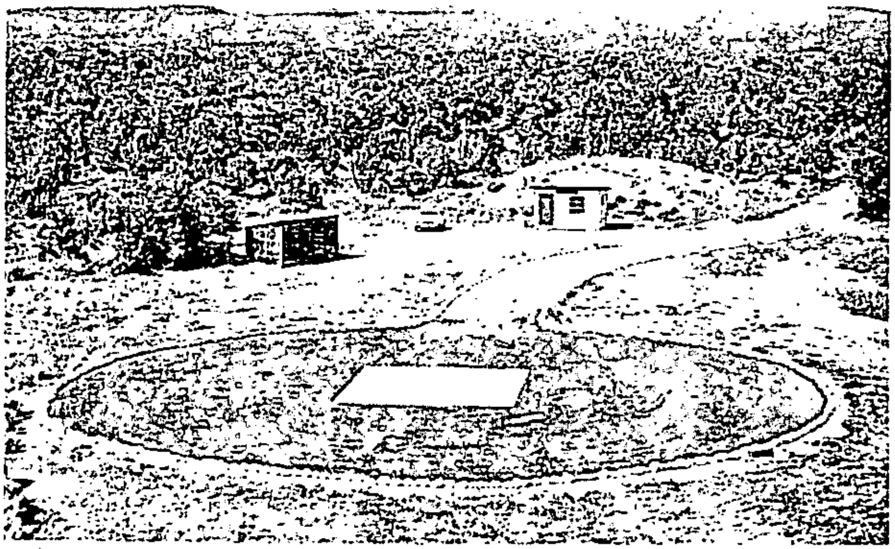


Figure 2.—*Aerial view of the Chapin Mesa Heliport.*

Gelled Fuel Saves Gasoline in Slash Burning

Robert R. McKee and Richard Ramberg

Fire Management Officer, Darby Ranger District, Bitterroot National Forest, USDA Forest Service, Darby, Mont.; Equipment Specialist, Equipment Development Center, USDA Forest Service, Missoula, Mont.

Gelled fuel appears to be an effective way to save fuel in hand-firing tasks. During the fall of 1979, crews on the Darby Ranger District of the Bitterroot National Forest began igniting slash piles with gelled gasoline to reduce consumption of gasoline and diesel fuel in drip torches.

Crews were hand-piling brush from roadside cleanup, precommercial thinning, and other fuel management projects. The material was bucked with chainsaws, piled away from standing trees, and burned after enough moisture had fallen to reduce the fire danger. At times this required using much drip-torch fuel to generate a hot fire that would burn the material cleanly. Burning the piles in drier weather would have risked damage to the stand and increased costs because of the extra personnel needed for control.

Personnel on the Darby District asked the Missoula Equipment Development Center (MEDC) for information on hand-firing devices to replace expensive drip-torch fuel (mixed diesel and gasoline). The center suggested gelled gasoline and supplied the Darby District with military M-4 fuel thickener.

Fuel was mixed in a plastic pail by adding 1 pound of the M-4 to 5 gallons of regular gasoline. The fuel was easily transported and was fully gelled when crews arrived at the worksite. A cup or less of gelled fuel was placed on top of each pile and ignited (fig. 1). This amount

Figure 1.—*This pile of wood will be ignited by lighting the gelled fuel being placed on top of the pile.*

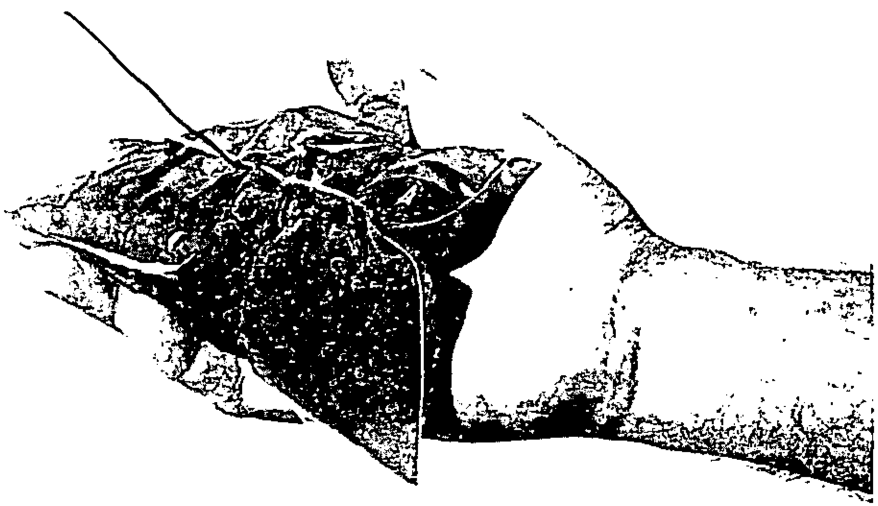


Figure 2.—*Gelled gasoline placed in a plastic sandwich bag makes a simple hand-thrown device.*

burned for about 20 minutes and gradually melted and ran down into the pile.

For large piles and inaccessible areas, a simple hand-thrown device was made by putting a small amount of gelled gasoline into a plastic sandwich bag (fig. 2).

A short length of ignitor cord was used to ignite the fuel. Ignitor cord is an external burning fuse that can be obtained from explosives dealers. Medium speed, Type A cord that burns at the rate of 8 seconds per foot was used. The bags were filled just before use so that fumes could not accumulate. Crews were careful not to touch the burning fuse or to spill any of the gelled fuel on their hands or clothing.

Based on the results of this project, gelled gasoline appears to be a safe, inexpensive, energy-efficient way to accomplish hand-firing tasks. The Darby District estimated that gelled fuel used 80 percent less fuel than regular gasoline or diesel fuel and allowed crews to accomplish the burning in a much shorter time. Gelled fuel has already proved valuable in aerial ignition (see Gelled Fuel Helitorch Operating Guides, 8051 2605, MEDC, Bldg. 1, Fort Missoula, Missoula, MT 59801). ■

New Fire Hose Dryer Developed

During the 1979 fire season, the U.S. Department of Agriculture Forest Service's Northern Region used over ¾-million feet, or nearly 150 miles, of 1-inch and 1.5-inch fire hose. Upon return, each length had to be tested, sometimes reconditioned, washed, dried and reassembled for future dispatch. The drying process eventually posed a serious bottleneck in accomplishing this job.

Historically, the Region has dried fire hose by stretching it out on an asphalt or concrete surface and letting the sun do the job. The fall of 1979, however, was marked by more than normal precipitation and eventually freezing temperatures. The hose continued to pile up until Tony Jinotti, Northern Region Fire Equipment Specialist, converted an excess military shop van into a hose dryer (fig. 1).

Loosely rolled hose is placed on three specially built shelves. The center shelf is mounted on wheels and is removed from the dryer to gain access. An externally mounted diesel oil powered space heater vents into the trailer producing internal temperatures of 100°–140°F, depending upon ambient temperatures. About 11,000 feet of hose can be dried in 3–6 hours. An internally mounted furnace fan helps circulate hot air within the dryer. Two louvered, self-rotating, top mounted, venting fans remove the high humidity moisture laden air. The exterior of the van was painted black to enhance sunlight absorption to raise internal temperatures.

Lloyd Mogan, then working in the Region's Engineering shop, and Larry Peltier, Missoula Ranger District, assisted Jinotti in constructing this dryer.

Additional information is available from Aviation and Fire Management, P. O. Box 7669, Missoula, MT 59807. ■

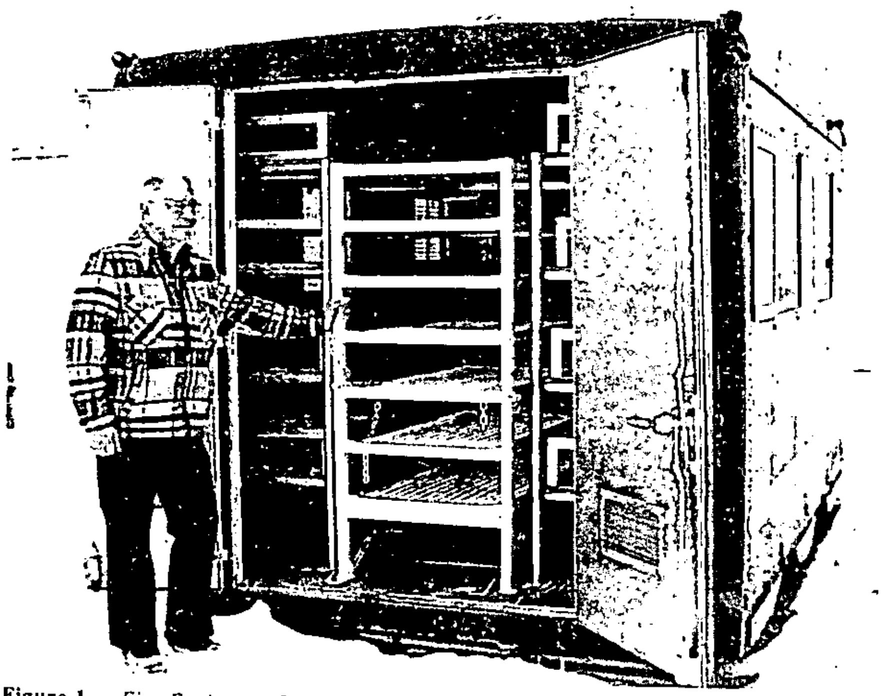


Figure 1.—*Fire Equipment Specialist Tony Jinotti stands beside the fire hose dryer he created from an excess military shop van.*

A Rational Approach to Evaluating Fire Control Effectiveness

Jim Davis and Ben Lyon

Research Forester, Fire Planning and Economics; Forester, Fire Control Technology, Forest Fire and Atmospheric Sciences Research Staff, USDA Forest Service, Washington, D.C.

Some years ago a typhoid fever epidemic struck a small Mexican town. A medical team from the capital was dispatched to the town and, at a cost of about $1,000, inoculated all of the residents. Ten people died from typhoid fever. An American economist heard the story and concluded that the inoculation program had been carried out at an average cost of $100 per *victim*. He further calculated that, had 100 people died, instead of just the ten, the average cost per victim would have been only $10—clearly a much more cost effective program.

The economist's error in logic is easy to spot: he related the program's cost to its failure, rather than to its success. He should have calculated cost per *survivor*.

But that's obvious. Right? Wrong! Some foresters and economists have for years been using "average suppression cost per acre burned" as a measure of fire suppression effectiveness, as a measure of the difficulty of control, or both. In reality, it provides no usable information about either. There are two kinds of errors in evaluating suppression effectiveness this way. The first, made only by junior accountants on their first day on the job, relates *total fire management program costs* to acres burned. This is identical to the public health problem and makes just as much sense.

A successful agency that prevents most of its fires and keeps the rest small will have a high cost per acre and thus superficially look like a failure compared to an agency with the same budget that burns many acres.

A second and more subtle error, made by lots of people who should know better, is to use *average suppression costs* per acre burned as a measure of efficiency. The problem is that acres burned may have little relation to the suppression cost. There are several reasons:

1. The cost of line built and held tends to increase with fire size. Data from northern California for example, show that costs increase on the average from less than $50 per chain to build and hold line on a 1-acre fire to more than $2,000 per chain on a 100,000-acre fire (fig. 1). Since big fires are usually hot and fast moving, and generally require much indirect attack, average line is wider and thus costlier. Also, large fires usually call for fire camps, large overhead organizations, long distance transportation costs, and contract equipment costs.
2. Fire *shape* has much to do with suppression costs. In theory, the minimum length of line needed occurs with a circular fire—probably an "easy" fire anyway. But as wind and slope become factors in spread, the fire tends to get long and skinny. Then, both the amount of line needed per acre burned and the cost increase rapidly (fig. 2). Most difficult fires resemble neither circles nor ellipses, but rather amoebas, with even greater requirements for line per acre burned.
3. On the other hand, *per acre* costs tend to *decrease* with fire size because most of the work is applied on the edge of the fire—not over its total surface. While mop-up may involve time and effort,

Figure 1

Suppression Cost Related to Fire Size

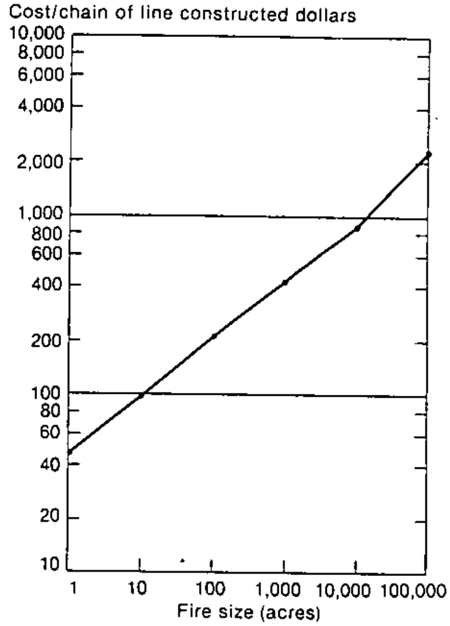


Figure 2

Dimension of Typical 10 Acre Ellipses

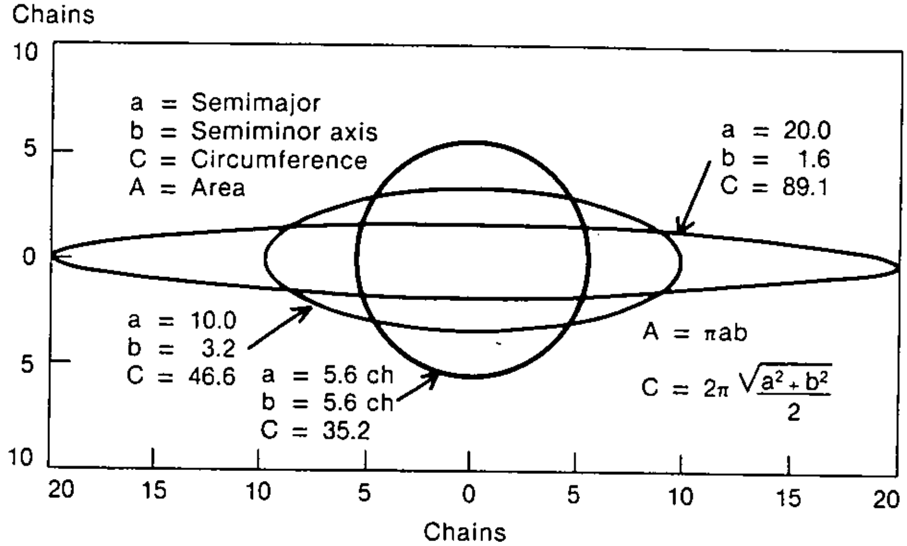
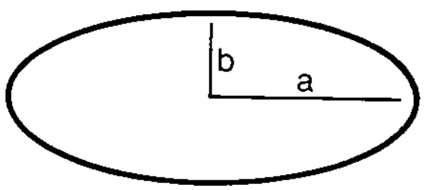


Figure 3

Typical Ellipse With Semimajor Axis (a) Equal to Twice Its Semiminor Axis (b)



most of the big-expense items such as air tankers, tractors, hotshot crews, and pumpers are mainly devoted to constructing and holding line at the fire edge. Since large fires have smaller perimeter/area ratios than small fires, "per acre" costs tend to be lower.

To illustrate the point, consider a number of different size fires all shaped like an ellipse in which a = 25 (see fig. 3). Using the line construction costs cited earlier (from fig. 1), it is noted that even with the increasing costs on bigger fires for building and holding line, cost per acre burned decreases dramatically (table 1).

4. Natural barriers, when used as final control line, can cut cost per acre remarkably. The Pacific Ocean and the Mojave Desert are frequently employed with excellent economic results by western fire tacticians.

5. Finally, changing weather conditions play their part. Even a 10-percent humidity rise in the mountains of southern California can produce hundreds of chains of "poop out" line that no longer require full line construction. This results in a greatly reduced cost per acre for that fire. Obviously, if managers want to minimize average cost per acre burned they should let the easy fires get big. Right? Right! (But this may not be good management).

For the foregoing reasons, average suppression *cost per acre burned* has no significance in a wildfire context. As in the typhoid fever episode, what *does* have significance is the cost per acre *saved*.

A manager wishing to *save* acres from burning (seems like a reasonable objective) will be interested in the unit cost of doing this. Take for example a protection unit in which 200,000 acres could be burned over by a fire under a given set of en-

Table 1—*Relation of fire size to suppression cost per acre*

Fire size (acres)	Circumference (chains)	Total cost (dollars)	Suppression cost per acre burned (dollars)
1	12	540	540
10	40	3,880	388
100	125	26,750	268
1,000	396	173,844	174
10,000	1,253	1,120,000	112
100,000	3,963	9,200,000	92

Table 2—*Relation of fire size to suppression cost per acre saved*

Fire size (acres)	Acres saved	Acres saved/dollar of suppression cost	Suppression cost/ acre saved (dollars)
1	199,999	370.0	Nil
10	199,990	52.0	.02
100	199,900	7.5	.13
1,000	199,000	1.1	.87
10,000	190,000	0.2	5.89
100,000	100,000	0.01	92.00

vironmental conditions. Table 2 shows that for elliptical-shaped fires (in which a=2b) the *acres saved* per chain of line constructed (hence cost of suppression) is maximized when fire size is minimized.

By keeping fires small (if this is possible) the manager both saves resources and minimizes suppression cost per chain of fireline.

Of course, keeping fires small may involve a substantial fixed and presuppression cost.

Operating on the basis of "acres saved" the fire economist can apply the criterion of "total cost plus net value change" to a given protection unit and determine the optimum-size fire and then plan protection accordingly for that unit. (At one time, 10 acres was the established "optimum" for planning purposes. How does that fit most units today?).

"Average cost per acre saved" may also be useful in conducting an Escaped Fire Situation Analysis (EFSA). Various control opportunities might be compared by weighing suppression investment against resource *savings*.

Where do the values come from for calculating "cost per acre saved"? They should be derived from typical fireline construction costs, rates of spread, and fire shapes experienced in that protection unit.

Is it possible to predict acres that might have burned? Yes. Fire managers are doing this now as part of the decision models being used to determine various fuel management strategies.

Is keeping wildfires small a reasonable goal? We hope so! While this hypothesis avoids dealing with the many complexities and variables associated with fire suppression costs, it demonstrates a definite relationship between smaller fires and greater savings—which is something we suspected all along. ■

Wilderness Fire Management at Pinnacles National Monument

James K. Agee, L. Dean Clark, Rothwell P. Broyles, and Larry Rose

Research biologist, National Park Service Cooperative Park Studies Unit, College of Forest Resources, University of Washington, Seattle, Wash.; Forestry Technician; Superintendent; Chief Ranger, Pinnacles National Monument, Paicines, Calif.

Pinnacles National Monument, in the central Coast Range of California (fig. 1), is a 15,000-acre area managed for perpetuation of its natural values. Over 90 percent of this chaparral environment is legally classified as wilderness. This designation creates several problems for fire managers. The monument (which is surrounded by private, State, and Bureau of Land Management land) is so small that fire suppression outside will continue to reduce the incidence of outside natural ignitions that once would have burned into the area. Conversely, managers must be sure that any natural ignitions inside the monument are contained and do not burn across the boundary. These problems are resolved in the fire management plan by using a prescribed fire strategy that is meeting multiple objectives.

Plan Objectives

The plan has evolved over several years with these objectives:

(1) Restore the natural role of fire to the monument.

(2) Minimize smoke problems.

(3) Use fire containment techniques consistent with wilderness values.

(4) Operate the program at low cost.

Figure 1.—*Pinnacles National Monument lies east of the Salinas Valley in central California.*

Site Characteristics

The mediterranean climate of the area is characterized by cool, wet winters and hot, dry summers. Annual precipitation is about 16 inches, and most of it falls between November and March.

Fuel types at Pinnacles can be divided into three types: Foothill-woodland grass (NFDRS Model A); chamise (*Adenocaulon fasciculatum*) chaparral (NFDRS Model B); and mixed-chaparral dominated by buckbrush (*Ceanothus cuneatus*), hollyleaf cherry (*Prunus illicifolia*), and manzanita (*Arctostaphylos pungens*, *A. glauca*) (NFDRS Model F). Much of the fire-adapted chaparral has not burned in the last 40–50 years, and fuel loads over 30 tons per acre (more than 50 percent dead) are present on northfacing slopes.

Topography of the area is relatively rugged, reflecting the volcanic geology which helped lead to the site's being designated as a national monument. Abundant rock outcrops, shallow soils, and environmental differences due to aspect have created an intricate mosaic of the three generalized plant communities.

Development of the Fire Program

Several problems surfaced in the development of the plan. Surrounding lands are managed for other objectives, dictating control of all monument fires within the boundaries and insuring an abnormally low frequency of natural fires that are ignited outside the monument but burn into it. Natural fire frequency is only generally known, because the life expectancy of the vegetation is short and people have long influenced the surrounding area. Smoke is likely to be a problem if fires are not closely coordinated with air pollution agencies. Maintenance of the wilderness character of the monument requires low-impact fire containment techniques; bulldozer trails in these shallow, droughty soils are apparent for decades (fig. 2). Unusual fire weather, such as afternoon down-canyon winds, is likely caused by the proximity of sea breezes (Schroeder 1961).

Figure 2.—*Bulldozer-created firebreaks can leave scars for decades in the nutrient-poor soils of the area. Natural fuelbreaks are chosen whenever possible in laying out burn unit boundaries.*

Along with these constraints are several advantages. Fuels are not always continuous and are broken up by cliffs and relatively barren ridges. Slope aspect can be used as a fire boundary during spring and fall, when south slope fires stop at north and east aspects where fuel moisture is higher. Grassy areas are also effective fuelbreaks before the annual grasses cure.

The fire management plan proposed use of prescription burning with minimal fireline construction on a rotation of about 30 years (Biswell 1976). Prescribed fire allowed control on fire behavior, and the planned nature of ignition was consistent with smoke management "burn day" requirements. Prescribed fire could more closely mimic natural fire frequency than could reliance on a significantly reduced natural fire incidence in this wilderness "island." The fairly diverse plant community mosaic and topographic barriers could be used in place of wide, cleared firelines to keep fires from spreading outside of the monument.

In the heavily used nonwilderness core area of the monument, a small-scale mosaic is the objective of the plan. The units of 50 acres or less will provide landscape diversity to complement the physiographic diversity and minimize maintenance needs over large sections of the trail network at any one time. In the more remote areas of the monument, larger units are defined based on natural fuelbreaks and cooperative planning with adjacent landowners. Under a 30-year rotation, about 500 acres a year should be treated, although year to year variation due to unit size is expected.

Burning Techniques

The plan began in an experimental phase and has recently become operational. Four burning techniques have been used:

1. *Fall burning* after initial rains (0.3 inch minimum). From ridgetops, short upslope strip fires are ignited in chaparral on down the ridge. Backing fires are set in woodland-grass areas and allowed to burn downslope. Fire perimeters are extinguished by high evening humidity and increasing vegetation and soil moisture.
2. *Winter burning*. Upslope strip burning of south-facing slopes of chamise, sage, and buckwheat stands is done between 10 A.M. and 3 P.M. Grassy areas are green and will not burn.
3. *Spring burning*. After grasses cure (about May), techniques similar to fall burning are used. Black-lined ridges (fig. 3) and north-facing draws act as fire barriers.
4. *Pile burning*. Localized hazard reduction is accomplished near developed areas in woodland vegetation. Debris is piled and burned under wet conditions in high-value areas.

Fire behavior forecasts are obtained by evaluating National Fire-Danger Rating System components and indices obtained from the fire weather station in the headquarters area. Site-specific predictions are made from weather observations from a remote, automatic weather station at proposed burn sites. Because the live crowns of chaparral plants have so much influence on fire behavior, acting one day as a heat sink and on another as a heat source, live fuel moisture is monitored weekly. Live fuel moistures for chamise and buckbrush are measured near the headquarters and on selected fire sites.

Most burns are small, and each is staffed by two or more people who coordinate the fire behavior observations and firing pattern. Although an area plan is prepared for each fire, the firing pattern (for instance, length of upslope strips) may change during the burning if site-specific information indicates a change is needed. All burns are conducted on days defined by the local air pollution control agency as burn days. Smoke rarely carries over to the next day because of the large quantity of 10-hour-timelag and smaller fuels and shallow litter layers.

Program Results

Between 1977 and the end of 1979, roughly 700 acres were burned. Most of the area burned has been on relatively xeric slopes of annual grass-buckwheat and pure chamise on south aspects. A range of burning conditions has been tested and the best range for the south aspect chamise is shown (table 1). However, consistently choosing the high range of relative humidity, windspeed, and other weather conditions will result in component and index values exceeding those shown in the table.

Costs have averaged about $15 per acre, depending on the size of the burn; larger units burned have

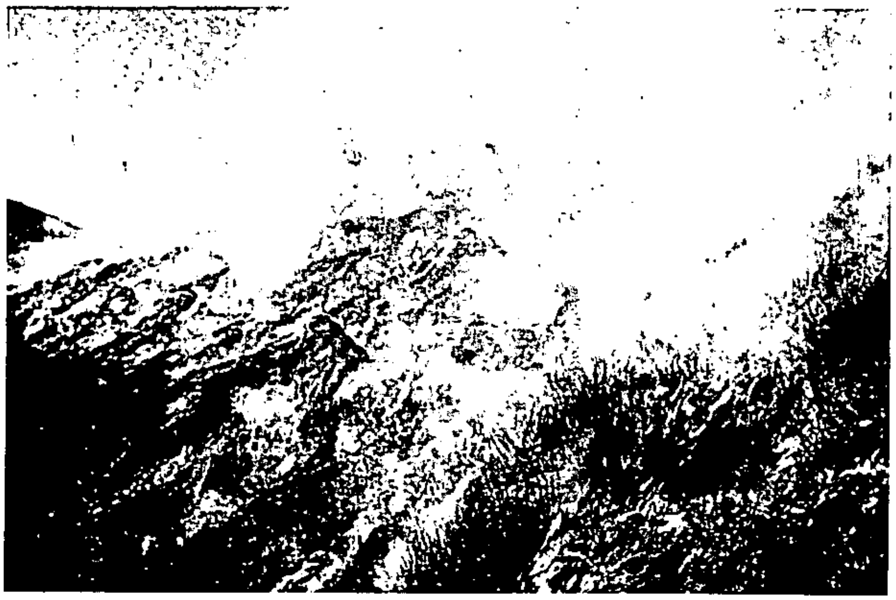


Figure 3.—*Blacklining a grassy ridgetop provides necessary fuel discontinuity for prescribed burns in other seasons.*

Table 1.—*Burning conditions for chaparral fires at the Pinnacles*

Burning condition	Range tested	Optimum range (NFDRS Model B)
Temperature (°F)	25–94	45–84
Relative humidity (%)	8–100	18–44
Windspeed (mph)	0–30	below 15
Live fuel moisture (%)	47–330	50–120
10-hour timelag moisture (%)	4–30	below 10
Spread component	0–14	4–14
Energy release component	0–44	15–44
Burning index	0–56	25–55

been cheaper per unit area. This relatively low cost is the result of small crew size, absence of pretreatment such as crushing or spraying, and limited use of containment firelines. Also, because of the wilderness location, pumpers and other vehicle support are not required.

The program has been well-coordinated with local air pollution agencies, and fires are restricted to days of good smoke dispersal. These restrictions have not caused delays exceeding those due to the monument's internal limitations. These include too dry or too wet weather and avoidance of heavy visitor use days.

An interpretive display on the role of fire in chaparral is showcased at the visitor center so that visitors can learn about this natural disturbance factor and have *previous burns* pointed out on the monument trail maps.

In 1979, the first burn coordinated with outside landowners was conducted. On the southeast corner of the monument, a unit was defined to blend in with the burning plans of the Bureau of Land Management, which was prescribing a burn for wildlife habitat improvement. Although the objectives of the two agencies for the burn differed slightly, the application of fire to the area was very complementary.

Monument staff blacklined a firebreak within the monument using small spot burns, and then the unit firing both inside and outside of the monument was done with a helitorch.

Future of the Program

Refinement of information on natural fire frequency is needed to predict the rotation cycle for burning. Fire-scar information from the few areas of older digger pines (*Pinus sabiniana*) is being collected now. Recent discovery of light charcoal layers in ravine alluvium will allow radiocarbon dating of these events, which should shed more light on natural fire frequency at the Pinnacles. If these data suggest a rotation significantly different from 30 years, then the acreage burned per year will be increased or decreased.

Most of the burning to date has been in the drier chamise and grass types. More of the mixed chaparral on north-facing slopes will be burned under dry conditions after the adjoining more xeric vegetation units are burned. Refinement of prescriptions will continue, as will the coordination of burns near the boundary with adjacent landowners.

The approach that has worked well here is not applicable everywhere in the California chaparral. Large areas of continuous fuel, and ownership patterns with numerous inholdings may pose constraints not present at the Pinnacles. The unique conditions at the Pinnacles combined with innovative fire management have resulted in the success of this small-scale operation.

Literature Cited

Biswell, H.H. 1976. A management plan for restoring fire in chaparral at the Pinnacles National Monument. Final report, contract PX8450-6-0378, U.S. Dep. Int., National Park Service, San Francisco. 32 p.

Schroeder, M.J. 1961. Down-canyon afternoon winds. Bull. Amer. Meteor. Soc. 42(8):527–542. ■

A Taxonomy for Fire Prevention Programs

G. Richard Wetherill

Sociologist, USDA Forest Service, Southern Forest Experiment Station, Forestry Sciences Laboratory, Starkville, Miss.

When I began working for the Forest Service, the first step in my education on fire prevention was to read all the prevention articles ever published in *Fire Management Notes* (formerly *Fire Control Notes*). Over 40 years of published prevention articles led me to a listing of types of prevention programs and provided a background for a regional inventory of forest fire prevention programs. In the published prevention articles, I discerned a broad classification framework. Two later inventories (both in the 13 Southern States) of existing prevention programs refined the classification scheme further till I now have a useful format for identifying forest fire prevention programs by type.

From its beginning in 1936 through Volume 39 in 1978, *Fire Management Notes* has printed 130 articles dealing with fire prevention—about 6 percent of all articles (2016) published. Of these 130 articles, 42 (32%) dealt with mass media programs, 19 (15%) dealt with personal contact, and 6 (5%) had to do with law enforcement approaches. Also, 24 (18%) articles concerned what I call "mid-range approaches," those educational approaches that fall along the public involvement continuum between personal contact and mass media. Two further groupings of articles included 6 (5%) that were various combinational approaches from among the first four and 33 (25%) articles classified as "other," which included positional papers, surveys of the field, state-of-the-art, etc.

Using the *Fire Management Notes* articles as an historical base for classification, I further refined the typology by conducting two prevention programs inventories within the Forest Services Southern region (Region 8). These existing programs gave the necessary information to accurately describe several types of programs, which I grouped under four major headings. A working taxonomy for forest fire prevention programs is as follows:

A Prevention Program Taxonomy

I. *MASS MEDIA PROGRAMS*

- A. Television
- B. Radio
- C. Signs
- D. Print Media
- E. Posters

II. *MID-RANGE PROGRAMS*

- A. Gimmicks and Displays—exhibits at fairs, shopping malls or public meeting places, parade floats, contests, birthday cards, reading programs, etc.
- B. School Programs—school assembly and classroom approaches to teaching fire prevention, grades K–12.
- C. Community Group Programs—programs in which prevention personnel organize or assist in organizing community-level groups to do the business of fire prevention.
- D. Demonstrations—programs in which participants can see or touch objects directly related to the concept being taught.
- E. Public Information Contactor Approaches—this category closely approximates the personal contact approach. It was, however, different enough from personal contact to warrant inclusion in the mid-range category because the programs operated in field settings such as visitor centers and combined some elements of classroom teaching, demonstrations, exhibits, and open forums with individual contact.
- F. Open Forums, Workshops, and Training Programs—this subtype accommodates such programs as fire training, summer camps, teachers' workshops, and environmental workshops. These are more difficult to organize and operate than most of the other approaches, but they have many potential benefits.

III. *PERSONAL CONTACT PROGRAMS*

A. Agency Personnel—uses agency personnel for direct contact work.
B. Local Voluntary—uses voluntary local citizenry, especially local opinion leaders.
C. Created Opinion Leader—involves the recruitment, training, and subsequent use of an opinion leader in the target locality.

IV. *LAW ENFORCEMENT PROGRAMS*

A. Overt Operations

B. Covert Operations

From designing experimental programs to evaluating existing ones, I have found this classification very useful as a shortcut to describing whatever program I happen to be working with. The major usefulness of this system (or any classification scheme for that matter) is its ability to insure that we are all speaking the same language. It seems to make more sense to speak of a particular *type* of program rather than saying, "Well, it's a prevention program where we go out and talk to the people and hand out rulers and balloons and give a slide show and bring in Smokey and Woodsy. . . ." ■

New General Manager

With this issue, Fran Russ, Cooperative Fire Protection, became General Manager of *Fire Management Notes*. Please continue to support *Fire Management Notes* by submitting your articles for publication and sending your letters and comments. Fran follows Dave Dahl, who transferred to the Wasatch National Forest in Utah. ■

New Slide-Tape Helps Drivers

Driving For the Fire Service is a slide-tape training program for fire personnel who have the responsibility for driving under varying road and off-road conditions. The training takes about 40 hours and is self-contained. Developed by Jim Moore and Arch Wirth of the U.S. Department of Agriculture Forest Service's office in Ogden, Utah, the package has been well-received in the wildland fire community. An effort is being made to locate a source to reproduce and distribute the slides, cassette tapes, and workbooks. For now, you can either contact Cooperative Fire Protection units in the Forest Service's Regional or Area State and Private Forestry offices or write this publication. The training is also available at some Bureau of Land Management State offices. ■

Fire Film Available

Standards for Survival, a 16-mm color and sound film dealing with wildland firefighting, is now available for purchase or rental. The film covers two sets of guidelines for firefighting safety: the "Ten Standard Firefighting Orders" and the "Thirteen Situations That Shout Watch Out."

It was funded by the Cooperative Forest Fire Management Staff, USDA Forest Service, Washington, D.C. Technical direction was provided by the Northeastern Forest Fire Supervisors and the USDA Forest Service.

Produced by Film Communicators of North Hollywood, Calif., the 18-minute film may be purchased for $245 plus $3.50 for handling and shipping, or it can be rented for $50.00 per week. It is available from Film Communicators, 11136 Weddington Street, North Hollywood, CA 91601. ■

National Interagency Fire Qualification System

The Qualification and Certification Working Team
of the National Wildfire Coordinating Group.

The Team chairman is Clint Phillips, California Department of Forestry, Sacramento, Calif.

Individual wildland fire protection agencies are organized to handle normally expected fire control problems. When those problems go beyond what is considered "normal," the agencies often require additional suppression forces. Sharing of forces among various State, Federal, and local agencies during critical fire situations has therefore become commonplace. This sharing process has resulted in the need to develop standards of firefighter qualifications common to all agencies.

For many years it was difficult to mix personnel and equipment from different agencies on the same fire. Training, experience, and terminology varied considerably among organizations. Requests for assistance didn't always result in the Fire Boss's receiving what he thought he ordered. A "tanker," for example, might arrive at a fire on wheels or with wings.

Something had to be done. It wasn't until the National Wildfire Coordinating Group (NWCG) was organized in 1974 that an effective means was developed for solving wildfire management problems between agencies. One of the problems was to make interagency use of firefighters more effective.

National Qualification System

One of the early products of NWCG was the National Interagency Fire Qualification System (NIFQS). The system has been adopted by all Federal wildland fire control agencies and many State and local agencies.

The mission of NIFQS is to provide a nationwide source of professional help to fire managers. Its purpose is to assure that firefighters sent to any fire have satisfactorily completed proper training courses, have attained specified physical fitness levels, have performed satisfactorily on previous fires, and have the currency of experience to maintain proficiency in job assignments. Certification of an individual's qualifications is displayed on SF-228, the Interagency Fire Job Qualification Card, better known as the "Red Card."

NIFQS became at least partially operational about 1976 when the Forest Service and some other agencies started using a preliminary system. Full implementation by all Federal agencies came about in 1978. Several States and at least one interstate fire compact have declared their intention to use the system.

Development of NIFQS

Responsibility for the development of NIFQS has been primarily that of two NWCG working teams—the Qualification and Certification Working Team and the Training Working Team. Jointly the two teams have pulled together the qualification and training requirements needed by the partner agencies.

The Qualification and Certification (Q&C) Working Team identifies the common interagency fire positions that are included in NIFQS's fire organization. Then it establishes the acceptable job performance requirements for each position. Finally, the Team determines the experience, training, physical fitness, performance level, and other qualifications essential to certify individuals to each fire position.

After NWCG approves the job performance requirements and other qualifications, the Training Working Team then coordinates the development of training packages. These packages are designed to provide firefighters with the skills and knowledge needed to perform satisfactorily in particular fire positions. The team maintains quality control through course development guidelines and certification. It also provides for publication, delivery, and maintenance of training packages.

The standard courses increase training efficiency through the sharing of instructors and facilities and the interagency mixing of trainees in classes. They make possible local, regional, and national interagency fire training programs. And they lead toward making a reality of the "closest forces" concept of total mobility.

The Q&C Working Team has developed and recently published a *NIFQS Handbook* for use by participating agencies. Purposes of the handbook are to describe:

1. How NIFQS and the interagency fire organizations work.
2. How an agency can participate in NIFQS.
3. How the professional firefighter can qualify and be certified in NIFQS.
4. How the records of certified firefighters can be kept up to date.

Qualification Requirements

Before people can be dispatched for interagency or interstate use, whether as a General Headquarters Fire Boss or a firefighter crew member, they must be qualified according to the NIFQS standards and possess an interagency "Red Card". Lack of qualification does not keep a firefighter from being on intra-agency fires as long as that agency's own standards are met. Nor does it preclude the use of pick-up labor and equipment on a local fire under an individual agency's requirements.

Some Problems

NIFQS has generally worked well but still requires time to iron out some kinks. The most urgent needs are related to fire training courses and to the "Red Card."

The development of training courses is a continuing project and requires constant changes. Courses seemingly can't be cranked out fast enough to satisfy the field's demands. Some 35 subject courses should be available within the next year. But as job performance requirements are introduced by the Q&C Working Team, additions, deletions, or changes in training courses may be required to support them.

National training courses sometimes receive field criticism because they do not always address regional or local conditions. Changes to fit local situations can be made but only if national interests remain protected. Credit for such training should be coordinated with NWCG so as not to compromise the integrity of interagency objectives.

Preparation of the "Red Card" has also caused the field some problems. The card can be produced by a computer printer or can be manually prepared. Information on the card is based upon the Fire Job Qualification Experience and Training Record, SF-227, which identifies an individual's best functional assignments. Data entered on the SF-227 are processed by computer, and a master file is assembled. The field has had some problems in using the original computer program, a common occurrence in any pilot model, be it a computer program or a fire engine. The computer program is being overhauled currently, and the revised program should answer most of the field's criticisms.

Looking Ahead

If NIFQS is to continue as a viable and dependable system, it must have strong support of management at all administrative levels. Certification of firefighters must reflect true performance capability. Waivers from the NIFQS system, except for purposes of downgrading "Red Card" qualifications, are not acceptable.

Also, NIFQS must have the support of the field user. If a user feels any part of NIFQS is incorrect or not working well, that person should communicate the concern and include recommendations for solving detected problems. Those recommendations should be transmitted to the National Wildfire Coordinating Group. That body will then take appropriate corrective action.

With proper management and dedication by its users, NIFQS should make easier the use of the concepts of "closest forces" and "total mobility"—locally, regionally, and nationally. The bottom line should then be significant reductions both in damages by fire to natural resources and in the cost of firefighting. ■

Community Involvement in Fire Prevention—An Effective Tool for Today's Land Manager

Mel Parker and Dan Bailey

Area Forester, St. Regis Paper Company, Libby, Mont., and Assistant Director, Southwest Lincoln County Fire Prevention Cooperative; District Fire Management Officer, Troy Ranger District, Kootenai National Forest, USDA Forest Service, Troy, Mont., and Director of the Cooperative.

Fire prevention! If you ask someone to define it, you can get numerous answers, from the "Smokey Bear" campaign to people patrolling the Forest, posting signs, inspecting equipment for proper fire safety, or talking to recreationists about fire prevention tips. These are indeed a part of today's fire prevention programs, but there is more . . .

On the Troy Ranger District of the Kootenai National Forest, fire prevention programs reflect a unique approach. The Troy Ranger District protects over 400,000 acres including State and private lands in the northwest corner of Montana and northern Idaho. Since the mid-1960's, person-caused fires on the Troy District increased almost 70 percent because of increased population, more outlying subdevelopments, and increased home construction in forested areas.

The local area fire-related problems are: population increases (especially in outlying areas); lack of structural fire protection in outlying areas; no specific local news media (closest newspaper and radio stations are 20 miles away); duplicate efforts between local agencies in fire prevention, structure and wildfire prevention; increased person-caused fires; and limited Forest Service budget for prevention.

In 1978 these problems were analyzed to develop a better fire prevention program in the community. The program analysis stratified problems by importance, such as dollar losses, number of person-caused fires, and duplicated agency efforts. The analysis showed that the local problems were too large for one agency, the landowner, or fire district to handle.

After the major problems and their scope were identified, an action plan was developed and set into motion. In late 1978, a 1-day session was held to review fire problems within the Troy area. This session was attended by community leaders, State and Federal agency representatives, and local area residents and businessmen. The group reviewed slash disposal problems on private lands and patterns of home construction. The consensus of the group was that there indeed was more of a problem than most participants had realized.

A Cooperative Effort Formed

In January of 1979, as a result of the review group's recommendations, the Southwest Lincoln County Fire Prevention Cooperative was formed. The charter of the group was simple: make people more aware of fire prevention and home fire safety techniques, and get more involvement from the community. Membership in the cooperative was an important factor—a cross section from the local area community was a must, and each individual had to be interested and willing to participate.

Members in the Cooperative, which meets monthly, include: a Lincoln County Commissioner, the Lincoln County Extension Agent, a representative from the USDA Forest Service (Fire Management Officer and Prevention Specialist), three local landowners, a representative from ASARCO (local mining company), a representative from Burlington Northern Railroad, St. Regis Paper Company area forester, a media representative, a representative from the State of Montana Division of Forestry, a local teacher, three local volunteer fire department chiefs, and the superintendent of schools.

The Cooperative at Work

Since 1979, the success of the Southwest Lincoln County Fire Prevention Cooperative has been overwhelming. It has improved interagency cooperation and coordination, has increased the effectiveness of the local fire prevention programs, and has made local area residents become much more involved in prevention programs. Success has even spread in that many other areas have built similar cooperatives based on the Southwest Lincoln County Fire Prevention Cooperative.

Among the things the Cooperative has undertaken are:

- Sponsored jointly with the Kootenai NF and local schools a Wildfire Prevention Poster and Essay Contest. The contest has attracted over 1,000 fourth-,fifth-,and sixth-graders since 1978. Winning posters are published in the local newspaper and used as restaurant placemats. Essays are recorded for use on the area radio stations as fire prevention messages.

• Printed and distributed 5,000 restaurant placemats on home fire safety (paid for by local businesses).

• Prepared, printed, and distributed local area mailers on home fire safety awareness.

• Conducted, in conjunction with the State of Montana, a workshop on how to establish rural fire districts.

• Conducted workshops on woodstove installation and safety.

• Prepared, printed, and distributed over 10,000 copies (three editions) of a special fire prevention newspaper, *The Troy Herald*. This was an original newspaper of the Troy area during 1900–1930. It is now printed four times per year and is basically a fire prevention newspaper, paid for through local business ads.

• Conducted an evening series of four 12-hour workshops on wildland fire suppression. These sessions trained local volunteer firemen in wildland fire suppression techniques. Over 100 persons participated.

• Conducted an evening program for local residents on "Safeguarding Your Forest Home from Fire."

• Conducted community school programs on fire protection, fire prevention, and fire awareness.

• Assisted in the development of two rural fire departments.

The future looks bright for the Cooperative. It has gotten off to a very productive start and continues to develop community and rural fire awareness programs. The Cooperative's efforts have shown a definite reduction in person-caused fires within the local area over the past 2 years. In these days when cutbacks in county, State and Federal programs are occurring, this approach to community fire problems seems to be an innovative and effective way to involve the community in National Forest land management programs. ■

Recent Fire Publications

Albini, Frank A., and C. H. Chase. 1980. Fire containment for pocket calculators. U.S. Dep. Agric. For. Serv. Res. Note INT-268, 17 p.

Arno, Stephen, F. 1980. Forest fire history in the northern Rockies. J. For. 78:460–465. J. For.

California Dept. of Forestry. 1980. Fire safe guides for residential development in Calif. 34 p. Calif. Dept. For., Sacramento, Calif.

Chase, Richard A. 1980. FIRESCOPE: a new concept in multiagency fire suppression coordination. U.S. Dep. Agric. For. Serv. Gen. Tech. Rep. PSW-40. 18 p.

Dieterich, John H. 1980. Chimney spring forest fire history. U.S. Dep. Agric. For. Serv. Res. Pap. RM-220. 8 p.

Feldman, Danah. 1980. Wildland fire fighting. International Fire Chief. 46(8):16–17.

Fischer, William C. 1980. Index to the proceedings of the tall timbers fire ecology conferences: nos. 1–15, 1962–1976. U.S. Dep. Agric. For. Serv. Gen. Tech. Rep. INT-87. 140 p.

Fuquay, D.M. 1980. Forecasting lightning activity level and associated weather. U.S. Dep. Agric. For. Serv. Res. Pap. INT-244. 30 p.

Greenlee, J., and C. Wilson. 1980. Cost-effective fire management: a pilot study. 276 p. Fire and Land Management Enterprises, Boulder Creek, Calif.

Lucht, David A. 1980. Fire prevention planning and leadership for small communities. NFPA No. FSP-54. 73 p. Nat. Fire Prot. Assoc., Boston, Mass.

NWCG Fire Equipment Working Team. 1980. Air Tanker Base Planning guide. 30 p. National Wildfire Coordinating Group. Contact Paul Hill, U.S. Dep. Agric. For. Serv. Equip. Dev. Cent., San Dimas, Calif.

Nelson, Ralph M., and Darold E. Ward. 1980. Backfire particulate emissions and Byram's fire intensity. U.S. Dep. Agric. For. Serv. Res. Note SE-290. 6 p.

Noble, Delpha. 1980. Honing fire to a precision tool. U.S. Dep. Agric. For. Serv., Forestry Research West, Aug. 1980. Fort Collins, CO. p. 12–15.

Rea, James A., and Chris E. Fontana. 1980. An automatic lightning detection system in northern California. U.S. Dep. Comm. NOAA Nat. Weather Serv., NOAA Tech. Mem. NWS WR-153. 15 p.

Rothermel, Richard C., and John E. Deeming. 1980. Measuring and interpreting fire behavior for correlation with fire effects. U.S. Dep. Agric. For. Serv. Gen. Tech. Rep. INT-93. 12 p.

Roussopoulos, Peter J. 1980. Improving wildland fuel information decisionmaking. *In* Proc. Soc. Amer. For. Nat. Conv. Boston, MA., October 14–17, 1979. p. 138–142.

Sackett, Stephen S. 1980. Reducing natural Ponderosa pine fuels using prescribed fire; two case studies. U.S. Dep. Agric. For. Serv. Res. Note RM-392. 6 p.

Sandberg, David. 1980. Duff reduction by prescribed underburning in Douglas-fir. U.S. Dep. Agric. For. Serv. Res. Pap. PNW-272. 18 p.

Stickney, Peter F. 1980. Data base for post-fire succession, first 6 to 9 years in Montana larch-fir forests. U.S. Dep. Agric. For. Serv. Gen. Tech. Rep. INT-62. 12 p.

U.S DEPARTMENT OF AGRICULTURE
WASHINGTON, D.C. 20250

OFFICIAL BUSINESS

POSTAGE & FEES PAID U.S. DEPT. OF AGRICULTURE AGR 101

U.S. MAIL

Susott, Ronald A. 1980. Effect of heating rate on char yield from forest fuels. U.S. Dep. Agric. For. Serv. Res. Note INT-295. 9 p.

Taylor, Dale L., and William J. Barmore, Jr. 1980. Post-fire succession of avifauna in coniferous forests of Yellowstone and Grand Teton national parks, Wyoming. *In* Workshop proc.: Management of western forests and grasslands for nongame birds. Salt Lake City, Utah. Feb. 11–14, 1980. U.S. Dep. Agric. For. Serv. Gen. Tech. Rep. INT-86. p. 130–145.

Wilson, Carl C., and J.C. Sorenson. 1980. Some common denominators of fire behavior on tragedy and near-miss forest fires. (English or Spanish) U.S. Dep. Agric. For. Serv., Broomall, PA. 31 p.

Wilson, Ralph. 1980. Reformulation of forest fire spread equation in SI units. U.S. Dep. Agric. For. Serv. Res. Note INT-292. 5 p.

Wright, Henry A. 1980. The role and use of fire in the semidesert grass-shrub type. U.S. Dep. Agric. For. Serv. Gen. Tech. Rep. INT-85. 24 p.

U.S. Department of Agriculture, Forest Service 1980. Ignition characteristics of internal combustion engine exhaust products. ED&T Project 2021. U.S. Dep. Agric. For. Serv., San Dimas Equip. Dev. Center. San Dimas, Calif. 51 p.

U.S. Department of Agriculture, Forest Service 1980. Northern forest fire laboratory, Missoula, Montana. U.S. Dep. Agric. For. Serv. 4 p.

U.S. Fire Administration. 1980. Highlights of progress for volunteer fire service. Federal Emergency Management Agency, Washington, D.C. 8 p.■