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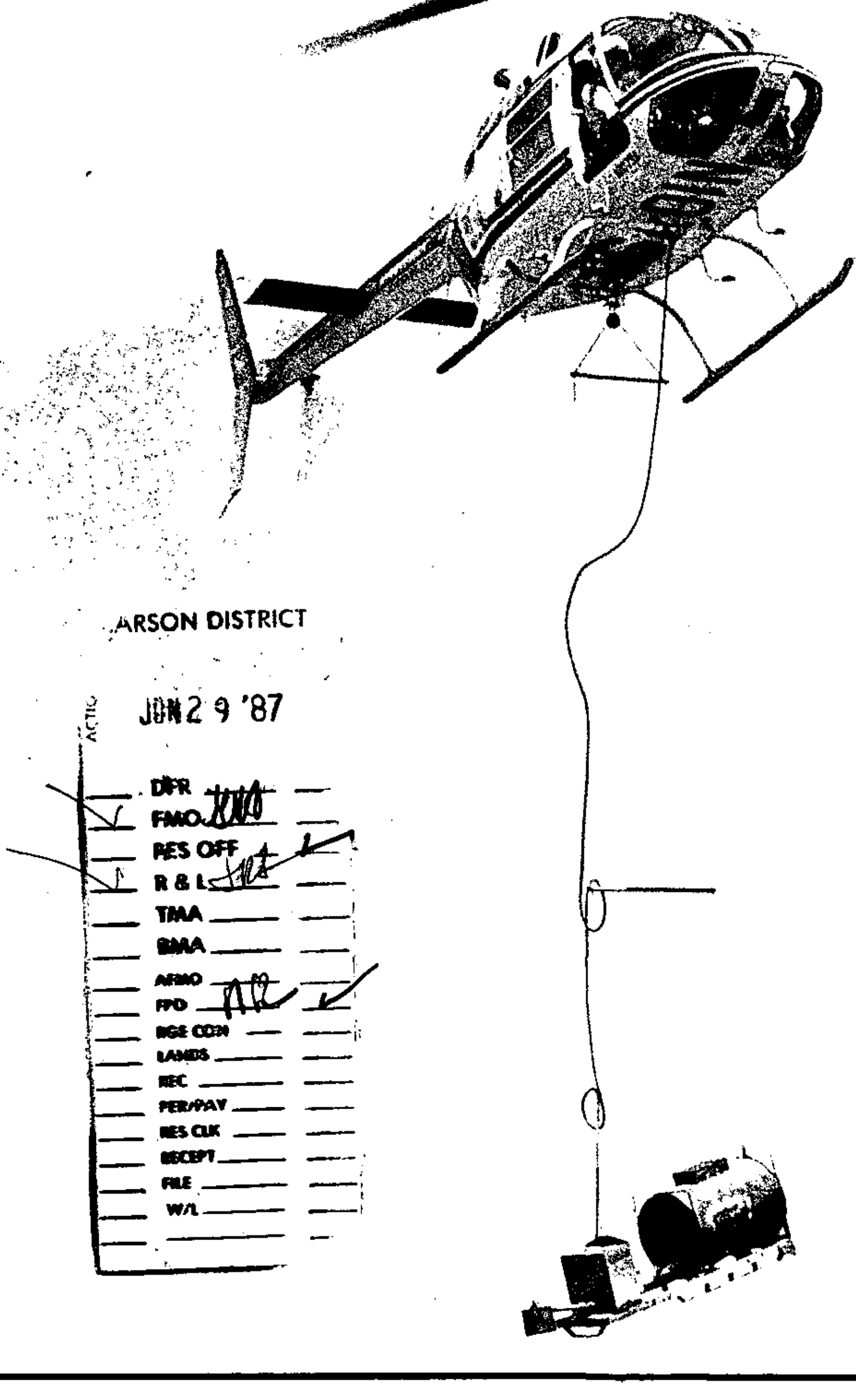
Fire Management Notes



Fire Management Notes

An international quarterly periodical devoted to forest fire management.

United States Department of Agriculture

Forest Service

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Contents

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Fire Planning in Alaska

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Wildland fire suppression in Alaska has been predominately conducted by the Bureau of Land Management. The Bureau began organized efforts of suppression in 1946 after several years of sporadic attempts along the railbelt and road network. A policy of total suppression was followed since that time. As a more sophisticated suppression force was developed the efforts became more successful. Since 1969 the number of acres burned annually has been reduced significantly to the level of 375,000 to 600,000 acres. A recent study in the Tanana Valley indicates a 2.7-fold increase in the length of the fire cycle since the period prior to active suppression. This lengthened fire cycle will result in predicted loss of nonforest, hardwood, and mixed forest vegetation types. A long-term loss of net productivity will result. Other studies have substantiated that more damage is done as a result of suppression techniques than would be caused by the fire itself.

Recent historic events have caused a change in the way fire is managed in Alaska. The Alaska Statehood Act of 1959, the Alaska Native Claims Settlement Act of 1971, and the Alaska National Interest Conservation Act of 1980 transferred 104 million acres to the State, 44 million acres to the Native Corporations, 54 million acres to the National Park Service, and 78 million acres to the Fish and Wildlife Service. These new land managers arrived with their own goals and philosophies toward land management. In 1980 a fire working group was formed to develop interagency protection goals and objectives, categories of protection, and complementary suppression strategies. The effort resulted in the Alaska Interagency Fire Management Plan. In 1982 the Alaska Interagency Fire Management Council was established by memorandum of agreement. The Council was to facilitate the task of statewide fire planning.

The Council divided the State into 13 planning areas and established a schedule to complete the plans. The areas ranged in size from 5 million to 47 million acres. Representatives on the area planning teams included National Park Service, Bureau of Land Management, Fish and Wildlife Service, Bureau of Indian Affairs, Forest Service, Alaska Division of Forestry, and Alaska Department of Fish and Game. Twelve Regional Native Corporations, 10 boroughs, and over 200 villages also provided input to the plans. To date 341 million acres of Alaska have fire management plans completed and implemented. Only the 29 million-acre Southeast Panhandle remains to be completed.

Due to the highly mobile nature of the smokejumper force and the fact that a jumper may work on several different agencies' lands in a week, common terminology and common tactics had to be agreed to. People have enough to think about when they jump out of a perfectly good airplane; they shouldn't have to carry a library of different agency fire plans to know what is expected of them when they get to the ground. Consequently, none of the terminology fits any one agency's manuals. It may sound silly, but deciding on common terminology was the greatest hurdle we had to overcome in fire-planning 370 million acres.

The fire plan identifies four categories of suppression:

A. *Critical protection* is a site-specific category that identifies human habitation and/or development. When threatened, these sites receive the greatest effort toward protection.

B. *Full protection* identifies areas of high natural resource value. Wildfires are controlled with immediate and aggressive action to minimize acres burned. Only critical sites receive higher priority for suppression forces.

C. *Limited action* is available for application on acres where fire is desirable or resource values do not warrant suppression expenditures. Suppression activity is limited to the prevention of escape from the designated area. Monitoring of fire behavior and spread is essential to allow time for development and implementation of contingency plans if necessary.

D. *Modified action* areas provide for initial attack on all new fire starts during the severe burning portion of the fire season. Those fires that escape initial attack are evaluated by the land manager and suppression organization to determine the appropriate containment strategy. On a predetermined date modified areas convert to the limited category. The modified option is designed to provide opportunities, during the low risk period, for fire to complement management objectives.

Land managers in Alaska have collectively selected approximately 60 percent of the State for limited protection, 20 percent for full protection, and 20 percent for modified protection. About one-half of the limited acreage is unburnable ice, rock, and water. Because the critical option is available only for specific sites, the total acreage has not been computed. A significant benefit being derived from the planning decisions is the ability for suppression organizations to quickly prioritize intial attack actions during multiple fire occurrences. Available suppression forces are now used in the most important areas as designated by land managers. The National Park Service has seized this planning opportunity to return the natural role of fire to most of its 54 million acres in Alaska.

The interagency approach has offered an important opportunity for land managers to exchange personal and agency philosophies. These exchanges have resulted in a cooperative spirit and better communications. The greatest benefit of fire planning on an interagency basis is that option boundaries are negotiated between neighboring landowners. Because of these negotiations we were able to fire-plan fuels rather than being locked into trying to plan individual ownerships, which may have boundaries running through continuous fuels. The result is a fire plan with a large measure of integrity. ■

Guidelines for Preventing Fire Retardant Corrosion

The USDA Forest Service recently published guidelines to help those who operate and maintain air tankers and ground support equipment to fight corrosion. The guidelines describe the corrosive action of fire retardants and tell how to control or minimize corrosion of air tankers and ground support equipment.

Fire control agencies in the United States use millions of gallons of fire retardant annually in the suppression of wildfires. Most of the fire retardants now in use are chemical salt solutions (usually 10 to 15 percent) containing monammonium phosphate, diammonium phosphate, ammonium polyphosphate, or ammonium sulfate. The chemical salt solutions used as fire retardants corrode metal. This corrosion can destroy the equipment used for mixing, storing, and applying fire retardants, resulting in a loss of hundreds of thousands of dollars of equipment every fire season. In addition to economic loss, corrosion of equipment, particularly aircraft, can create safety hazards.

The publication "Guidelines for Preventing Fire Retardant Corrosion," General Technical Report INT-210, was written by George A. Gehring Jr., and Charles W. George. This publication is available in limited quantities from:

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Very Portable Remote Automatic Weather Stations

John R. Warren

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Portable remote automatic weather stations (RAWS) are now available in a single fiberglass carrying case (fig. 1). The case also serves as the base of the mast structure that supports the wind instruments and other sensors. The stations are helicopter transportable and may be carried by two people over distances of a quarter mile or so of relatively rough terrain. The unit weighs about 120 pounds. These portable units are especially useful for temporary operations in remote areas. They are usually used in the voice-synthesized mode, where a voice tells you what the weather at the station is over your own radio link any time you interrogate it. The RAWS units can also transmit the weather data via a geostationary operational environmental satellite (GOES), as is done with their big brothers, the semipermanent RAWS installations, or they could have both types of transmissions available. Portable RAWS units are especially applicable for monitoring weather at a planned prescribed burn site to determine from the comfort of an office when conditions are just right to initiate burning. Portable RAWS units can be used in conjunction with repeaters to extend the transmission range. They can also be used during wildfires to permit weather data gathered from one or more pertinent sites to be transmitted via radio. They are also advantageous as replacements for the standard stations typically located near ranger stations, because they can be placed (within radio range) where you really want to know the weather as opposed to where it is most convenient for an observer to gather the data daily. In this application the weather is also as near as your radio even when all the employees are away from the ranger station for fire activities or other reasons.

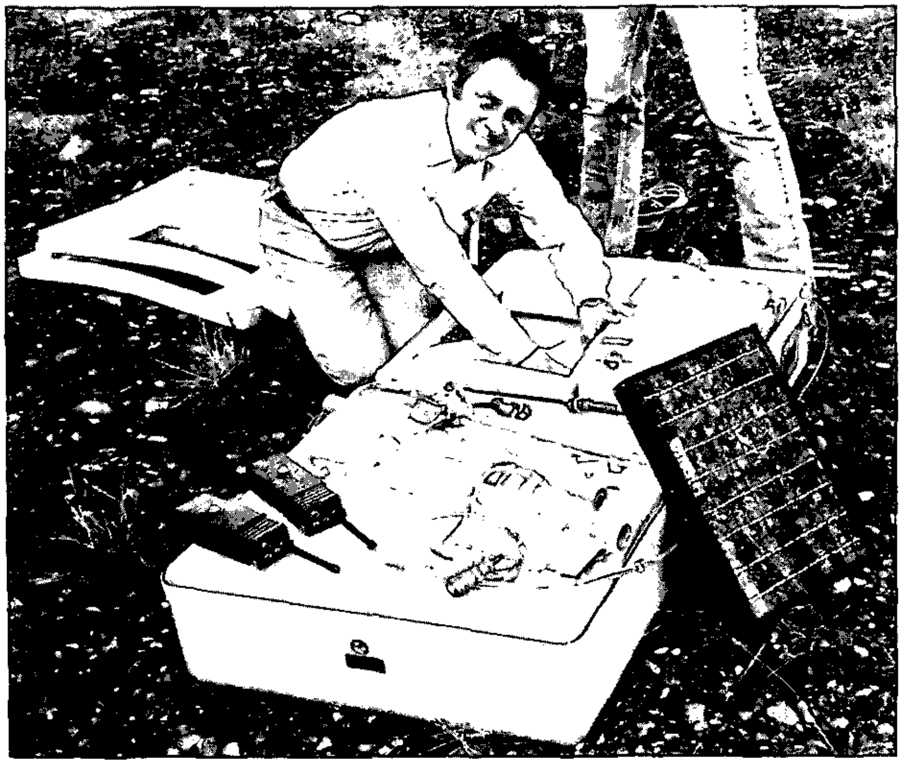

Figure 1—*The very portable RAWS fits in a single carrying case.*

Background

Remote automatic weather stations were introduced to USDA Forest Service and USDI Bureau of Land Management field units in 1978 following development, testing, and evaluation conducted jointly by the two agencies (1). Subsequently a need for a more portable RAWS unit was expressed. The original configuration was designed for semipermanent installations—that is they were not cast in concrete and could be moved, but that involved essentially dismantling and reassembling the stations following transport to the new site. The more portable RAWS was developed by adapting a tripod-based mast support structure that could be folded umbrella style for transporting. It was fairly easy to move and quicker to set up than the original triangle-based, bolted-together support structure.

At about the same time, the need for a radio line was recognized, so that remotely located incident command posts without access to the Automatic Forest Fire Information Retrieval and Management System (AFFIRMS) or a GOES ground station could obtain weather data locally. Voice synthesizers were now a usable technology and these were incorporated as an optional feature into the electronic package of the RAWS. This feature permits anyone with a radio equipped with a telephone-type touch-tone pad to acquire weather information simply by interrogating the RAWS. No sophisticated satellite ground receiving station with computer processing was necessary, not even a data terminal. Additionally, the weather information is available as often as needed and updated every 5 minutes or other time interval programmed. This eliminates the 3-hour wait of the self-timed RAWS, which are scheduled and preset to a specific transmission window. These can be useful features for temporary setups and dynamic situations, but for the usual routine data gathering and AFFIRMS entry, the GOES link to a computerized ground station has many advantages.

Making a Very Portable Package

Although the transportable RAWS were put into use and seemed quite acceptable, there was another step in the process. USDA Forest Service Region 10 had some other ideas on "transportable" and "portable." The transportable configuration included a couple of carrying cases and a long (about 8-foot) box for the mast and support structure. While they seemed reasonable enough to those of us who roam around in pickup trucks over forest roads, it presented quite a logistics headache to our friends up north in Alaska who measure distances and accessibility in a totally different light. They suggested that the unit should be redesigned and repackaged to eliminate the long box entirely. They also proposed that a 6-foot wind instrument height would be satisfactory since that is about the height that hand-held instruments are used and besides the standard 20-foot wind instrument height was often used to calculate or estimate the wind closer to the surface where fires tend to move anyway. After consulting the meteorologists and fire weather experts who basically agreed with that rationale, some reluctantly, the idea was pursued. Region 10 also had several other good ideas following their operational use in the field and these also were considered and many incorporated into the new portable conceptual design.

The first of the new portables was packaged into two carrying cases, which seemed about as good as could be done, considering the size and shape of the standard wind instruments, other sensors, and electronics package. But through some rather ingenious efforts, eventually the entire station was incorporated into a single carrying case. All, that is, except the tipping bucket rain gauge, which is not part of the "normal" portable station, and not including the GOES antenna, if that capability is wanted, although it usually is not needed for the temporary portable station. When the station is set up and operating it does not appear that it could possibly have all come out of that one carrying case, and certainly it could never go back in there—but it really does.

One of the suppliers of all the configurations of RAWS, Handar, Inc., now has a commercially available version of the portable RAWS, which they go so far as to call a MICRO-RAWS. That may seem a bit of an exaggeration, but it surely is as micro as possible while still using the regular RAWS sensors and electronics package, so that it is interchangeable with the other RAWS configurations. Of course, this capacity offers many advantages with respect to compatibility, maintenance and spare parts considerations, accepted instruments, lower costs, and so forth.

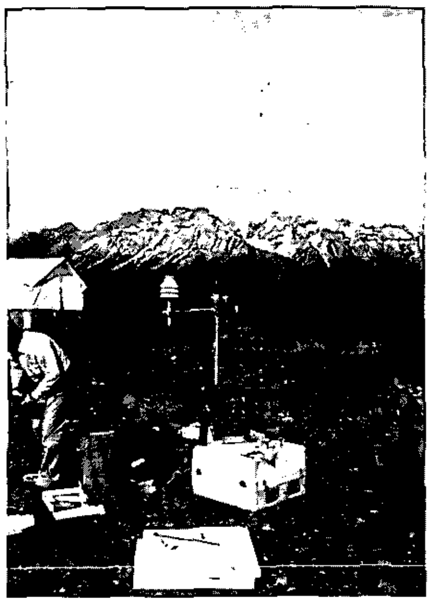

Figure 2—*Portable RAWS being set up in May Creek, AK.*

One other comment about the portable or MICRO-RAWS; it can be set up in about 20 to 30 minutes, depending on the experience of the person, the weather, and other conditions (fig. 2). The electronics package is programmable with the standard programming set used for the full-size RAWS electronics package, but the system can be shipped preprogrammed, so that a programming set and trained person to activate and program the electronics is not necessary at the field site. ■

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The 1986 Fire Season

The 1986 fire season, although not as extensive as that of 1985, required record-setting mobilization of personnel and equipment, for a short period in late summer.

Fire activity began early in January in the Southeast, where the high incidence of person-caused fire starts was aggravated by the continued drought experienced in the area. Through cooperative agreements, the Forest Service provided fire suppression resource assistance to the States and vice versa. By April areas of the Southeast were showing as much as a 15-inch deficit in precipitation; 59,134 wildfires had burned over 955,463 acres. Major support activities from the West included the mobilization of 24 organized firefighting crews, 2 National Interagency Incident Management Teams, 3 large contract aircraft, and 3 large military aircraft.

Little fire activity occurred on National Forest System lands during the months of May and June. However, the Forest Service provided resource support during this period to Alaska. The Department of Interior and the Alaska Division of Forestry were experiencing high fire occurrence due to deficits in precipitation and record-breaking high temperatures. The National Interagency Fire Coordination Center (NIFCC) mobilized 6 organized firefighting crews, 181 smokejumpers, 406 miscellaneous overhead personnel, 6 air tankers, and 3 incident management teams to Alaska. In July, precipitation moderated the fire situation in Alaska. Fire conditions in the West became more severe during the last 2 weeks of the month. An increase in fire activity in southern California necessitated the mobilization of air tankers and organized firefighting crews to that area.

August brought the peak fire activity for the 1986 fire season. During the first 2 weeks of the month intense dry lightning storms moved across Oregon and western Idaho, starting multiple fires. The Malheur, Umatilla, and Wallowa-Whitman National Forests in northeastern Oregon had over 800 fires, of which 40 became major fires of more than 1,000 acres each in size. The Boise and Payette National Forests in eastern Idaho had 157 fires, of which 9 became major fires. Eight National Interagency Incident Management Teams and numerous local area teams were mobilized to manage fires in the two States. A state of emergency was declared in both Oregon and Idaho as a result of the critical fire situation. Hot dry weather continued throughout the month. Although the total number of resources mobilized was less than in 1985, a record number of resources were mobilized in a shorter period of time. During August 659 fire crews, 396 smokejumpers, and 1,205 miscellaneous overhead personnel were mobilized. Smokejumpers became a critical resource and were continually moved between the smokejumper bases in northern California, Oregon, Idaho, and Montana for initial attack.

In September fire activity was reduced dramatically as cooler and wetter weather settled in over most of the Northwest. Some activity continued in California, but this was short lived thanks to the weather conditions.

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Selecting NFDRS Fuel Models for the Northeastern United States

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Can you tell which of the 20 fuel models in the National Fire-Danger Rating System (NFDRS) *(2)* best describes your fuel complex? Does having an idea of the usual rates of spread and flame lengths in that fuel complex help you to decide which fuel model to choose?

Most managers select fuel models based on descriptions given in manuals. In a recent study based on 940 wildfires in Michigan, Pennsylvania, and Wisconsin, we found that observed rates of spread and flame lengths were sometimes quite different from potential fire behavior predicted by some NFDRS fuel models and, therefore, not in accord with the manual descriptions. We also found that some fuel models were good predictors of the potential rate of spread but poor predictors of potential flame lengths; other models were just the opposite.

In this study, we used standard weather station records from seven locations along with wildfire reports to statistically compare field observations with the NFDRS burning index and spread component. We evaluated the NFDRS as it is used operationally, rather than as a carefully controlled experiment.

The spread component was compared with observed rates of spread, and the burning index was compared with flame length. We also calculated heat per unit area by combining observed flame lengths and rates of spread. This allowed us to plot the data on a fire characteristics chart (fig. 1) *(1)*. The figure, in itself, allows managers in the Northeastern United States to gain a great deal of insight into possible fuel model selection for a given fuel complex. For example, if, under typical weather conditions, the rates of spread during previous fires in these fuels ranged from 5 to 10 feet per minute and flame lengths were about 3 feet, fuel models E, U, or P would appear to be good choices. On the other hand, fuel models A, L, N, O, and I might be poor choices.

In our study, fuel models A, C, L, R, and S were deleted from complete analysis because they did poorly in early tests. Models I, J, and P were also deleted because I and J were highly correlated with model K, and P with U. The remaining 12 models (B, D, E, F, G, H, K, N, O, Q, T, and U) were subjected to all tests.

Testing and Rating the Fuel Models

We used six tests to determine how well the fuel models satisfied six managerial needs:

1. *Means* are important for long-term planning. This test determined the difference between the average value predicted by the fuel model and the average fire-behavior value observed in the field.
2. *Sensitivity* is important to establish the range and level of resolution of each fuel model. This test determined

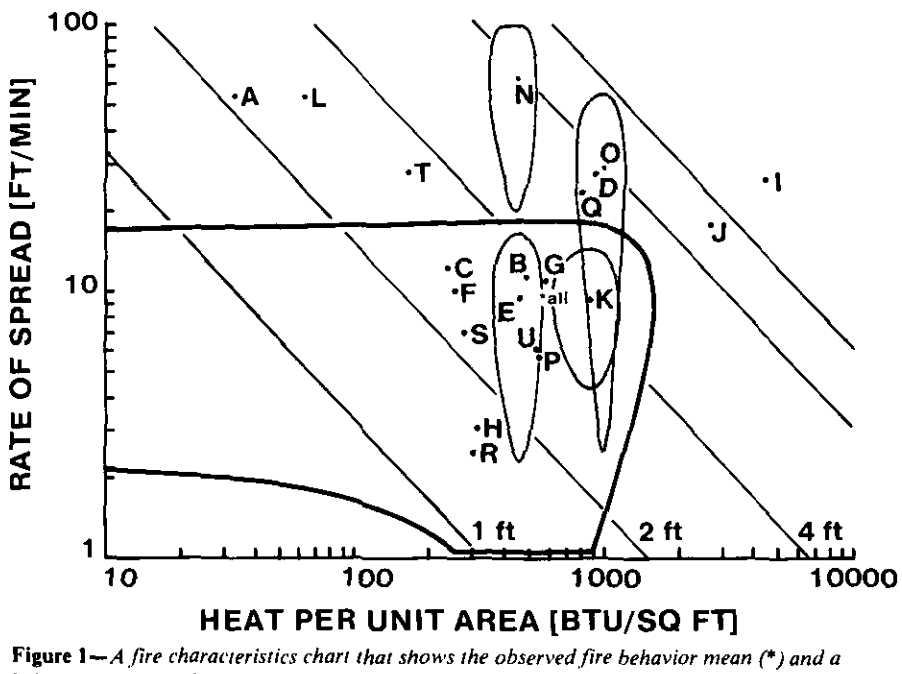

Figure 1—*A fire characteristics chart that shows the observed fire behavior mean (*) and a behavior envelope that outlines one standard deviation (heavy line). The graph also shows the means (•) of the predicted potential behavior for each of the 20 NFDRS fuel models, along with envelopes designating one standard deviation for fuel models N, O, E, and K. The diagonal lines show flame lengths. Because this is a logarithmic scale, the elliptical envelopes are distorted.*

the difference between the range of model predicted values and the range of fire-behavior observations.

3. *General Predictive Accuracy* is important for fuel complexes with multiple cover types. This test determined the variability (R^2) of fire-behavior observations in those complexes.
4. *Cover-Type Accuracy* is important in the management of fuel complexes that are predominately single cover types. This test determined the variability (R^2) of fire-behavior observations in four cover types: hardwoods, brush, grass, and upland conifer.
5. *Calibration* is important in determining if the fuel model can be used without "tuning." Because the fuel models in the NFDRS are "stylized," this problem is often overlooked.
6. *Robustness* is important if the fuel model is to be broadly applied. This test determined how well the fuel model performed for various seasons, cover types, and locations.

After completing all tests, we used four different methods to combine the results (pass/fail, rank sum, weighted, and unweighted). This ensured that the final results did not depend on the arbitrary choice of a particular combination scheme. We calibrated the results to a 100-point scale, ranked the models from best to worst, and classed them into five performance groups (table 1). Models within one group did better than models in lower groups, but differences between closely rated models were slight.

Table 1—*Relative overall rating of NFDRS models in the Northeastern United States*[1]

Fuel Model	Rating
E	79
K	67
N	64
U	62
B	54
Q	53
G	51
F	46
D	44
O	41
H	33
T	19

[1] Listed in order of estimated overall performance. Differences between models in a group are not considered significant. Ratings are on a 100-point scale.

The Results

Model E ranked as the best general purpose model for the Northeast; models K, N, and U ranked slightly lower. Other models, such as G, O, and N, performed well on some tests, but poorly on others. In selecting a model, a manager will have to decide which tests are most important and choose the fuel model on that basis. One very important point—our results confirmed the belief that no single fuel model is best for all purposes. For example, in a test for cover-type accuracy, fuel model E ranked highest in hardwood and grass, whereas K was highest in brush and upland conifer. Model G ranked second as a predictor of the potential rate of spread for all fires but was unacceptable as a predictor of flame length. In contrast, model O was the best predictor of potential flame length for all fires, but it ranked second worst for rate of spread.

For a complete analysis and detailed discussion of our study, see "Fire-Danger Rating and Observed Wildfire Behavior in the Northeastern United States," Research Paper NC-274, by Donald Haines, William Main, and Albert Simard. ■

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Wildland Fire Training in the Western Pacific

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This article explains some of the efforts being made to provide initial wildland fire training to the people of the Trust Territories of the Pacific Islands (TTPI). Cooperators were the USDI Trust Territories and International Affairs; Federal Emergency Management Agency-Fire Administration; and the USDA Forest Service. Training was conducted February 21 through March 29, 1986. The islands of Kosrae, Pohnpei, Truk, and Yap of the Federated States of Micronesia and Babelduap of the Republic of Belau were included in the training, which was developed specifically for these Western Pacific islands.

The islands of the Western Pacific are similiar to many locations in the United States with regard to the urbanization of the wildlands and the fire problems that are caused by this condition. Land area is very limited as is the amount of land base that can be burned over annually. Wildland fires damage not only the native vegetation, but more importantly damage the soil resource in general. Fire fighting agencies are fast becoming aware of the importance of watershed and soil protection. In the Western Pacific islands wildland fires are a fairly new problem. For example, the Island of Guam has one of the most serious fire problems within the United States. The last 5 years of fire statistics show that approximately 8 to 10 percent of the rural area of the island burns annually during their fire season. This causes not only a loss of possible improvements but a loss of the soil resource. Siltation from accelerated runoff causes the local lagoons and coral to suffer. Heavy impact to the coral causes the food chain to be impacted which affects the food resource of the islanders. The problem of soil resource loss is similar on all islands experiencing the fire problem. This realization has generated the need for the islanders to start an ambitious effort in reducing their wildland fire losses.

Some of the major pressures contributing to this increase in wildland fires are population increases, lack of knowledge of the harm that fires do, and local customs. Most people do not appreciate the value of the soil nor the damage a wildfire can do to it. Simple changes, such as building roads throughout the islands for transportation, are opening up areas to settlement that previously were wilderness. Most settlements on high islands were historically near water sources, which were on the windward side of the islands. With the development of artificial water systems, locating to the drier side of the island has become more appealing. It sounds all too familiar to the wildland fire protection planner—urbanization into the wildland. It may be slow but it is happening and is causing concern both politically and administratively.

William Patterson, fire representative of the Federal Emergency Management Agency (FEMA) Region IX, through his travels and contacts with the fire chiefs on the various islands developed a proposal to have "on-island" training conducted. This training needed to be something that would benefit the islands by being developed specifically to meet their particular needs. The USDA Forest Service agreed to cooperate in this venture and provided a cadre of experts to develop the proposed training. The first test course was conducted at Guam in June of 1985 in conjunction with the Third Pacific Foresters Short Course. With some minor modifications the fire course was presented to the five-island group in 1986.

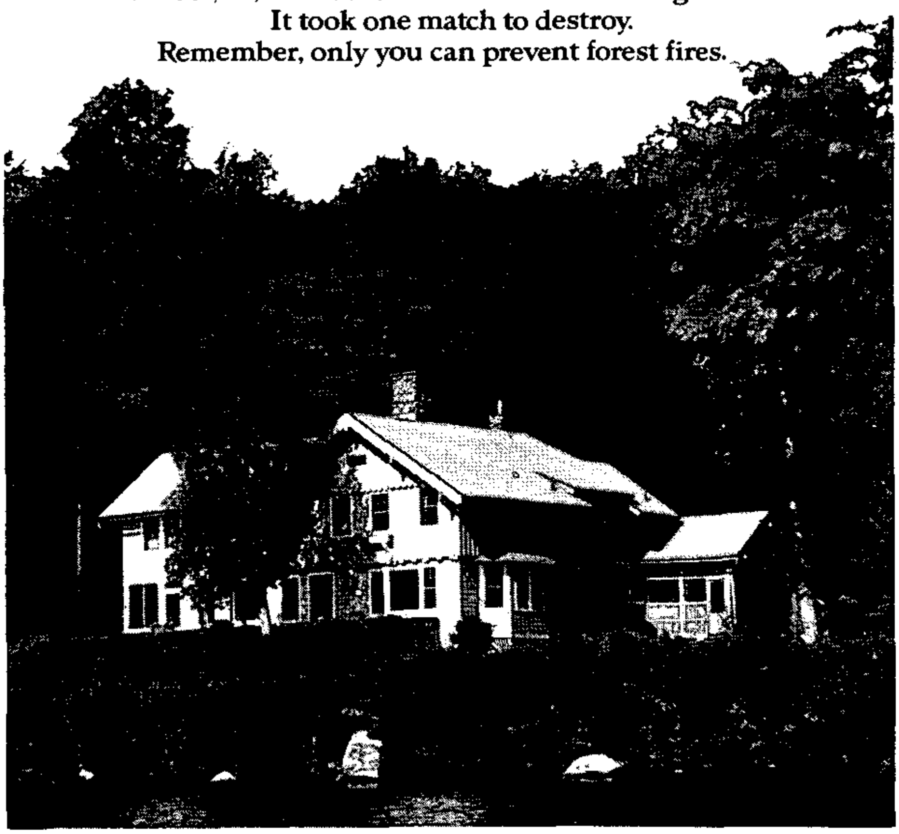
Funding for the 1985 sessions was provided by FEMA for the course development and travel. The training for the islands during the 1986 project was funded through the office of the Assistant Secretary of USDI Trust Territories and International Affairs. The Forest Service provided the instructors. This opportunity for intergovernmental cooperation was realized by these three agencies, which each have responsibilities to support the island governments and fire personnel.

Development of this course presented a few problems not encountered elsewhere. The Pacific Southwest Region Pacific Island Forester Leonard Newell assisted in providing the technical assistance needed to ensure that the trainers and the training packages were relevant to the islanders. Language was somewhat of a barrier, but with the use of interpreters was only a minor difficulty. Deciding on how to present the basic tenets of wildland fire training was the most difficult problem. Weather, topography, fuels, equipment, organization, and cultures combined to provide some unique challenges in course development. Mainland reference materials were gathered and analyzed and then adapted to meet the needs of the islanders.

The individual high islands are quite different culturally, less so as regards weather, topography, and fuels. Each one except Pohnpei and Kosrae goes through a drought period of varying severity or duration. Normally this drought period is not very long. However, several days of no rain will produce rapid burning conditions, especially in the lighter flashier fuels. This situation is really no different from that of most locations on the mainland. The "trades," the trade winds, can cause drying of the wildland fuels on a daily basis. The topography of the volcanic high islands also contributes to drying. During a normal day when cumulus clouds form and blow onto shore, then run up against the mountains, precipitation forms, usually only on the windward side of the mountain. And as the "trades" usually come consistently from the northeast, the leeward side, or south and west, of one island may become much drier and more flammable than the windward side.

The topographic conditions on each island are similiar to some extent. Coral reefs and lagoons dominate the shorelines, with some parts of some islands having large flat areas. The better land is usually covered with coconut trees and other cultivated food products. These areas can be flammable but usually are cultivated and not much of a fire problem. Where fire does become a problem is at those locations where the island vegetation dries out for long periods of time due to aspect, location, and weather. This drying coupled with topographic conditions of steep to gentle rolling hills produces the typical island fire hazard area.

To this time very little analysis of fuel conditions has been accomplished. There have been no fuel inventories to determine the quantity for each island, nor has there been much work to determine any fuel classification. Weather data are available from some of the airports and military bases in some areas. Considerable work yet needs to be done in developing fuel typing and fuel hazard analysis. At the present time, fire-danger rating methods consist of a judgment call made by the person with the most experience at the firehouse.



With these characteristics in mind the training cadre developed a course utilizing some of the basic tactics that have been developed over the years. Segments of the National Wildfire Coordinating Group (NWCG) basic firefighter course were combined with the guide and handbooks of Forest Service Regions 1 and 5. The slide and tape programs were developed almost exclusively from the National Wildfire Coordinating Group basic firefighter course. Field exercises were developed from the handbooks and guides. The course could have taken several varied approaches, but the one finally used was the old "Guard School" format. Classroom, lectures, visuals, demonstrations, and practical applications were the techniques used. The students were shown and taught to use the tools that are used normally in the Western United States, including the shovel, pulaski, mcleod, back pump, headlamp, and so forth. We had decided on this course of action so that the trainees would learn the basic precepts of the fire triangle. Whatever tools are commonly used on the islands can be used with the understanding of the components of the fire triangle.

One of the interesting aspects of the islands is the organization of the fire departments. There were very few problems in dealing with island politics and applying the fireline organization structures to the fire department work force. Each department is patterned after a fire department in the United States. There is usually a Minister of Public Safety, who supervises the police, and a fire chief. On most islands this could be the same individual, as the police and fire personnel are cross trained. Shifting of personnel between jobs seems to be common. Each class had several police officers in attendance learning the fire trade.

On most islands there are only two locations for the fire equipment, the airport for crash/rescue and the main headquarters unit for the fire station. The police officers are stationed at several locations and work in roaming patrol patterns. The use of police officers as trained firefighters helps to reduce travel time for responses on these islands. This use of public safety personnel, although not unique to the islands, is one adaptation that has worked well for them.

The course was developed and presented by David Conklin and Jeff Olle, both Forest Service employees. Dave is presently the Hot Shot superintendent of the Bear Divide Hot Shot Crew on the Angeles National Forest in California. Dave has had experience as a firefighter, engine foreman, and hot shot crew member. Jeff has worked on engines and is presently an engine foreman on the Sequoia National Forest, also in California. Both men brought several years of experience to the training project. Most importantly they were both very familiar with the NWCG basic firefighter training package and up to date with their instructor skills for this package. Their personal characteristics and skill levels enhanced the presentations and made them acceptable to the islanders.

The one common activity that occurred on all of the islands was the graduation ceremony and photo session during presentation of the certificates. On the Island of Yap Governor Mangefel came to the assembly along with members of the local public safety department. The presentations were made to the individuals who successfully completed the course, in this case private citizen volunteers as well as fire and police personnel. The recognition of these firefighters by the Governor was accompanied by an appreciation speech not only to the presenters but to those who have dedicated themselves to protecting the precious resources of the Island of Yap. The importance of this presentation was impressive to those attending.

Participants in the Pacific Islands wildfire training course and their Forest Service teachers.

This initial effort in providing wildland fire training to the Western Pacific has shown that a continued effort in recognition of the fire and urbanization problems of the islands is needed. Utilizing the various agencies with responsibilities to the islands in cooperative ways is a future target that needs to be remembered. This course was much appreciated by the islanders. The first step in learning how to organize, equip, and train for rural and wildland fire suppression will benefit the island firefighters as well as their islands. ■

Got an Idea?

We have a continuing need for articles for Fire Management Notes. Articles are due to the general manager by February 15, May 15, August 15, and November 15 annually. Articles must be typed double spaced.

We will consider articles of any length. Black and white photographs, line drawings, or tables, charts, and graphs to accompany articles are desired.

Moving?

Please advise us when you change addresses so that we can keep your copies of Fire Management Notes coming. Please return your mailing label with your new address. Thank you.

New Design for Compact Portable Pumping System

Rich Aldridge

Warehouse specialist, Umpqua National Forest, Roseburg, OR

Cottage Grove Ranger District fire management personnel have devised a completely portable firefighting system. The complete system weighs only 42 pounds. The system was developed using off-the-shelf components available from local small businesses and the General Services Administration (GSA) Federal Supply Service. The system is powered by a Japanese-made unit by Shindaiwa Industries. There are other comparable pumps available in terms of weight, size, cost, and performance. The pump, suction hose, and all the required accessories, including fuel for one and a half hours of engine operation, are carried on one packboard. All the accessories except the suction hose are packed in tool bags that are attached to the packboard. The items carried in these bags are listed in table 1 and shown in figures 1 and 2..

With a pressure output of 42.5 PSI at 5.25 gallons per minute, this pump is no Wajax Mark III, but what might appear to be lackluster performance is actually an advantage. The pump's advantages are many. Its light weight makes it possible for one person to pack the entire outfit. The low pumping rate allows use of small water sources or those with slow recovery rates, which would be rapidly exhausted by larger pumps. The low pumping rate thus opens up water sources that were considered unimportant or useless in the past. Modest amounts of continuously flowing water are now available when bladder bags or no water at all was the rule in the past.

Table 1—*Contents of compact portable pumping system*

Contents	GSA Stock Number
500-foot synthetic garden hose (⅝")	4210-01-167-1061
Adjustable garden hose mininozzles (2)	None
Garden hose gated wye	None
1" NPSH to garden hose reducer	4210-01-079-9286
Replacement spark plug	None
Reversible Phillips/straight screwdriver	5210-00-997-2857
Spark plug wrench	None
Hose lug spanner wrench	5120-00-596-1426
Roll of red surveyors flagging	9905-00-542-4505
Package of foam ear plugs	6515-00-139-0483
Safety goggles	4240-00-052-3776
Canvas tool bags (2)	5140-00-329-4306
Pint screw-top cans (to hold fuel - 3)	8110-00-178-8280

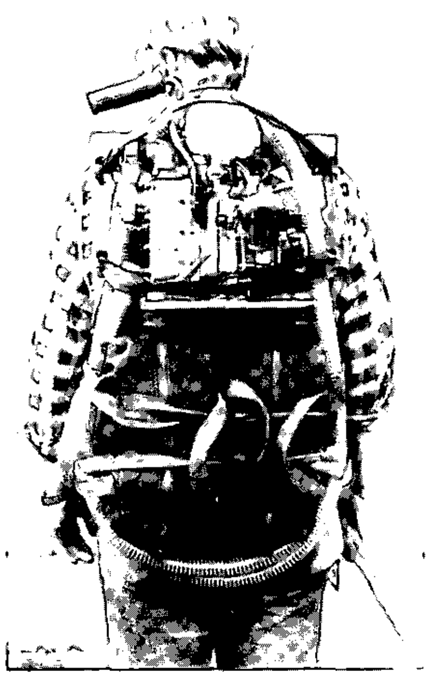


Figure 1—*Compact portable pumping system attached to packboard.*

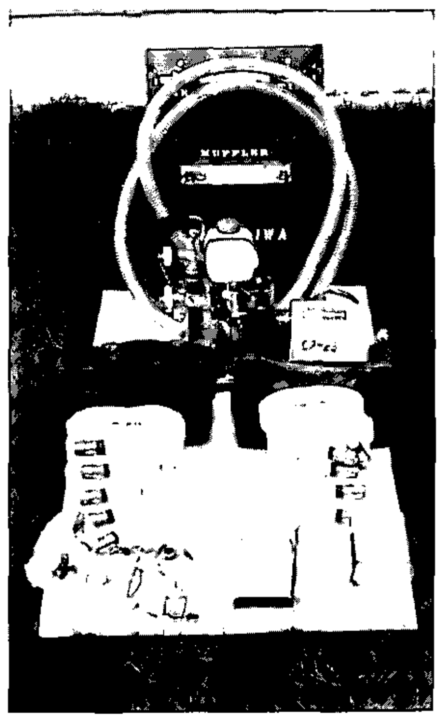
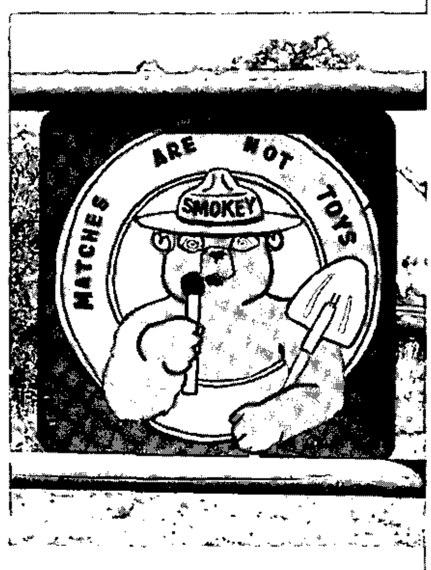


Figure 2—*Components of the portable pumping system.*

The flow rate is held to 10 gallons per minute or less by using the two nozzles, which each deliver 5 gallons per minute at 30 PSI and are found in the accessory bags. The pump head is limited by low engine power and the single stage centrifugal pump configuration.

Typical uses of the system include fire suppression work in hard to reach locations where modest amounts of water are available relatively close to the fire, mop-up operations, filling of bladder bags, and even as a volume pump to fill small (125-gallon) slip-on engines. The pump costs just over $200 and the entire system under $400. After the pump, the hose is the most expensive item.

For further information about this innovative system, contact Rich Aldridge, Umpqua National Forest, Roseburg, OR 97470. ■



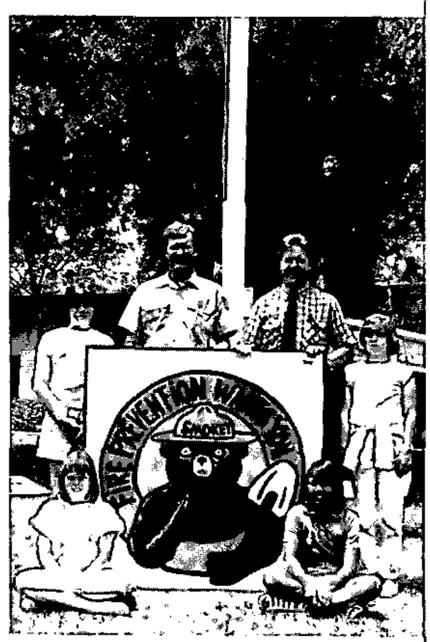
Original Fire Prevention Signs

Motorists driving the Angeles Crest Highway through the Angeles National Forest have been greeted by original hand painted fire prevention signs since 1983. These signs have been produced through the cooperation of the Forest Service and the Paradise Canyon (elementary) School in La Canada, CA.

William Shaw, Clear Creek Unit Ranger, had an idea to attract the public's attention to fire prevention through original signs. He found a willing teacher, Howard Leiwold, at the Paradise Canyon School to help him.

The signs were designed so the messages could be easily read by motorists. The designs were projected onto plywood boards that had been painted white. The designs were then carefully painted by the students.

The fire prevention signs remain in place all year, and the messages are changed as needed. Some signs contain a message in Spanish in order to reach that large Southern California community.



William Shaw and Howard Leiwold with the sixth-grade class at Paradise Canyon School show a finished fire prevention sign.

Fire-Weather Stations— Maintaining Accuracy

Donald A. Haines and John S. Frost

Principal research meteorologist and meteorological technician, respectively, USDA Forest Service, North Central Forest Experiment Station, East Lansing, MI

The quality of observations from fire-weather stations has been a source of serious discussion, if not an outright problem, for fire managers since the first stations were installed many years ago. The discussion is now centered on possible alternatives to the present system, e.g., automated versus manned stations; conversion to Forestry Weather Interpretations System (FWIS) *(5)*.

One of our major concerns as users of the observers' records was the apparent lack of concrete data upon which managers could make objective decisions. Most decisions appeared to be based on managers' personal experiences with fire-weather stations, and these experiences often centered on a small collection of examples.

Until recent budget cuts, the North Central Forest Experiment Station, National Forest System Region 9, and Northeastern Area State and Private Forestry cooperated in an inspection program of manned weather stations. This program provided a data base of station inspections from 80 locations in the Northeastern United States. It allowed us to evaluate fire-weather station maintenance *(1)* and anemometer performance in particular *(4)*. It also allowed us to estimate the accuracy and completeness of weather observations taken at manned stations and archived in the National Fire Weather Data Library *(2)*.

This summary of that evaluation gives managers quantitative information to use if faced with a decision to continue with observers or install automated equipment. Although the data base is from the Northeast, our discussions with fire managers as well as with involved computer and research personnel suggest that the findings can be applied over much of the United States.

Station Maintenance

This part of the study was reported previously in Fire Management Notes *(1)*; therefore, we will only summarize the findings. Using station inspection reports from 80 locations, we separated maintenance standards into seven categories: condition of the instrument shelter, psychrometer, maximum-minimum thermometers, rain gauge, anemometer, fuel moisture sticks, and stick weighing device.

Maintenance standards for the instrument shelter, psychrometer, maximum-minimum thermometer, and rain gauge were high, scoring 90 to 98 out of 100 possible points. Standards for anemometer maintenance were slightly lower, due primarily to a lack of regular instrument servicing. General maintenance standards for fuel moisture sticks and their weighing device were lower, scoring only 70 to 80 percent of possible points at infrequently inspected stations. Most infractions with fuel moisture sticks involved poor duff-bed maintenance or improper weighing methods.

Anemometer Performance

Wind speed measurements are critical to fire-danger rating and fire-behavior systems. For example, if we assume dead fine fuels and relative humidity of 25 percent, then at a wind speed of 10 miles per hour, a negative deviation of only 1 to 2 miles per hour from true wind speed will underpredict model E spread rates by 13 to 25 percent (National Fire-Danger Rating System). Even though maintenance of the anemometer at fire-weather stations was generally good, this did not necessarily mean that the wind speed observations were accurate. We found that periodic testing or calibration of anemometers was virtually nonexistent; consequently we attempted to improve the quality of wind speed observations by developing an instrument to test performance *(3)*.

The anemometer tester we designed and built is accurate, compact, portable (weight with case is less than 30 pounds), and low cost (about $200) (fig. 1). The design employs an industrial blower (minus the heat element) mounted on a wooden base. Major components include a 12-volt DC counter, a regulated 12-volt DC power supply, a line voltage monitor (a volt meter with an expanded scale), and a variable voltage controller. During tests, the operator continuously monitors the input voltage and adjusts it if voltage changes occur.

A survey of fire-weather stations throughout the Northeastern United States showed that the following types of anemometers were most often used:

Model	Percent of Use
M.C. Stewart aluminum-cup	55
Forester 9 x 145	25
Small Airways Model	16
Natural Power Model A75-104	4

We purchased a number of these model types and had them calibrated in a wind tunnel. These calibrated anemometers were then used as standards to periodically calibrate our portable tester.

After completing this background work, we tested 142 field anemometers. Analysis showed that 29 (about 20 percent) failed to respond with measurements within 10 percent of the wind-tunnel calibrated anemometers at one or more test speeds in the range of 5 to 20 miles per hour. These anemometers were either replaced or repaired. There was no significant failure difference among the anemometer types; all failed roughly in proportion to the number surveyed. An examination

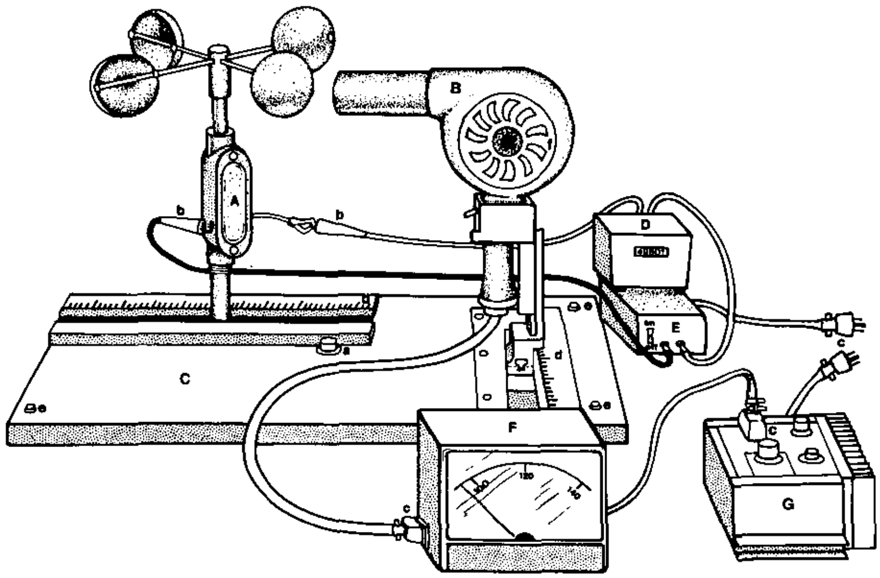


Figure 1—*The anemometer tester includes: (A) anemometer to be tested, (B) industrial blower, (C) 12- by 21-inch solid testing board, (D) 12-volt DC counter, (E) 12-volt regulated DC power supply, (F) line voltage monitor, (G) variable voltage controller, (H) bubble level, (I) connections to counter, (J) electrical plugs, (K) tracks with metal measures, (L) level adjustment screws, and (M) blower manifold. Track mountings for the blower and the test anemometer permit both horizontal and vertical movement. The operator can generate a range of wind speeds by varying the distance between the blower and the anemometer and/or changing the air intake controlled by the blower manifold.*

of anemometer failure rate as a function of time in service showed no discernible trend, but this may be related to a small sample size.

Observations and Records

The last phase of station evaluation centered on an investigation of weather observations and records. We did this in three parts:

- Documented missing station records in the files of the National Fire Weather Data Library (NFWDL) *(2)*. These data were separated into two categories—within the fire season and outside the fire season.
- Compared station records with corresponding library records to find obvious observation and transmittal errors.
- Compared maximum-minimum temperature records with corresponding records from nearby cooperative stations administrated by the National Oceanic and Atmospheric Administration (NOAA).

The NFWDL was designed to facilitate the cataloging and retrieval of large quantities of weather data, primarily from AFFIRMS (Automatic Forest Fire Information Retrieval and Management System). In conjunction with AFFIRMS, data arriving at the library are automatically edited. The library uses an editing technique that depends largely on determining if the element's value is outside a range of permissible values.

Missing records. A documentation of missing library records showed wide differences among the 64 stations examined. Although 40 percent of the stations averaged less than one missing day per month, 10 percent missed an average of 25 percent or more per month (fig. 2). A documentation of records for this time period, obtained from the files of fire-weather stations, showed that observations had been taken in most cases, but records of the observations were not filed in the library. Copies of 85 percent of the library's missing records were filed at regional network stations. Eighty-two percent of missing library records were filed at forest network stations, and 47 percent were filed within State networks. It's obvious that the major problem of missing records did not occur during observations but rather during data transmission and documentation.

We had anticipated that managers would be more concerned with weather events during the fire season, and, consequently, this concern would be reflected in a more complete library record during that period. However, this did not appear to be the case. Less than 10 percent of the stations filed complete records during the fire season, but almost 25 percent of stations filed complete records outside the fire season (fig. 2).

Obvious errors. Here we compared 36 station records with corresponding library records, looking for obvious errors uncovered through careful editing. For example, if a wet bulb temperature reading was higher than the dry bulb, this was an obvious observer error. When the library record differed from the station record and there was no good reason to doubt the observer's entry, we judged it a transmittal error.

Using 10 weather elements, we found 294 errors in the 2,067 observations examined in the daily records, an error in about 14 per-

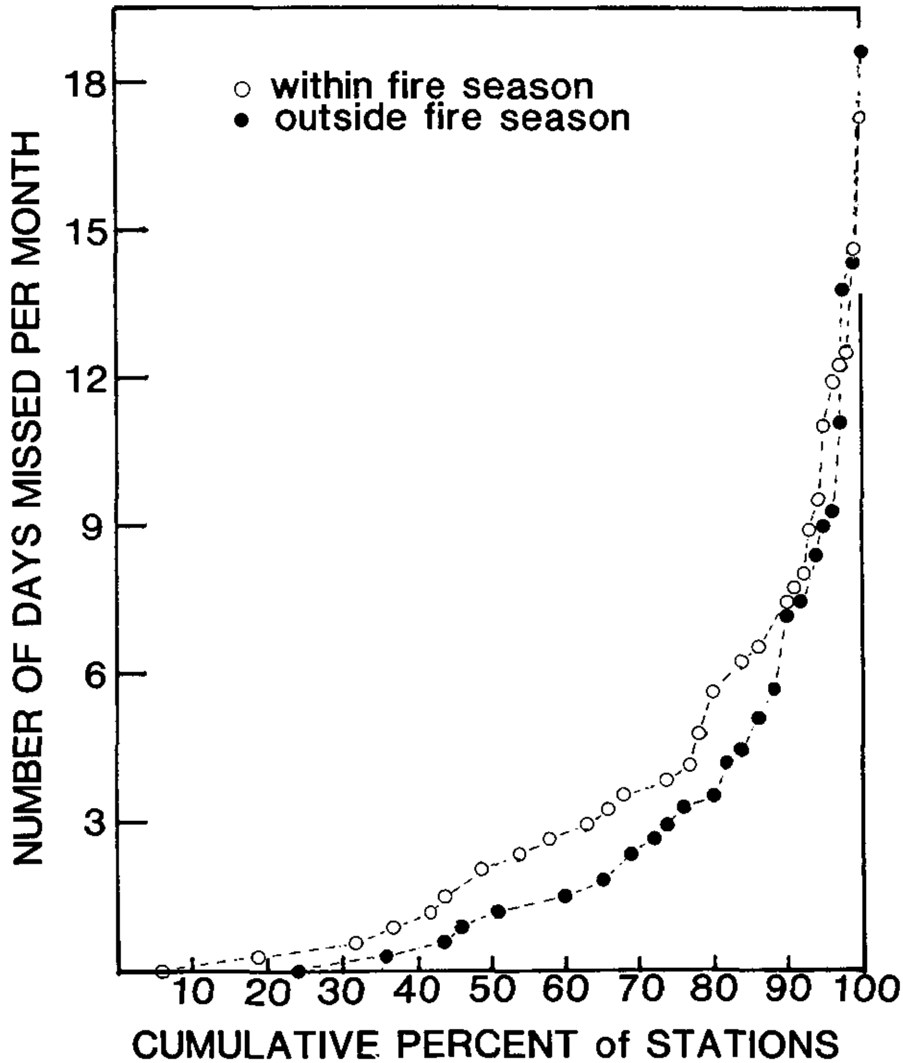


Figure 2—*Cumulative distribution of the average number of library records missing per month.*

cent of the observations. Roughly one-third of the errors were observational, and two-thirds occurred during transmission from the originating unit into the library.

Comparison errors. Here we compared the library records of 1,420 maximum/minimum temperatures at 24 fire-weather stations with those recorded at nearby NOAA cooperating stations. Analysis showed 18 maximum temperature errors and 9 minimum temperature errors within the sample, an error rate of about 1 percent per weather element—a bit less than the 1.4 percent observation/transmission error rate per weather element shown in the previous section.

Putting It All Together

Although there are problems within the networks of manned fire-weather stations, the system works. However, our analysis indicated that it would work even better if steps were taken to correct and improve specific features:

(1) Stations should be inspected regularly. The inspector should methodically go through a checklist of items *(1)*, explaining necessary changes to station personnel and following up to see that station personnel make needed changes.

(2) The anemometer should be tested periodically. Tests accomplish two objectives. They ensure that the anemometer is taken down from the mast and serviced and that the anemometer is mechanically sound.

(3) Rigorous transmittal and documentation procedures should be followed. Records from a majority of stations are nearly complete, but those from a significant percentage of stations are so incomplete as to be of questionable climatic value. This problem could be reduced dramatically. In the same vein, about one-third of the errors in the library records occurred during observations, and two-thirds occurred during transmission. Originating stations must check with the National Fire Weather Data Library to determine that records are complete and also that the library's records match the original station records.

Implementing these recommendations would go a long way toward ensuring quality weather data. It would also demonstrate to station observers that high station standards are both essential and expected. ■

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An Improved Helitorch Design

James Tour

Mechanical engineer, USDA Forest Service, Missoula Equipment Development Center, Missoula, MT

An improved single-point suspension system has been designed for the helitorch by the Missoula Equipment Development Center (MEDC). The new suspension system, bail, and a commercial hose swivel are included in a retrofit kit available from Simplex Co. (fig 1).

At the request of the Forest Service Washington Office Fire and Aviation Management Staff, MEDC reevaluated the design and operation of the Simplex Model 5400 helitorch suspension system with the goal of enhanced flight characteristics and improved safety. After interviewing users and assembling data, MEDC engineers determined that the spreader bar part of the suspension system could place excessive loads on the helicopter skid and thus affect stability and control. Fire managers also identified a number of other deficiencies in the original Model 5400 helitorch. The information from users and managers guided MEDC's redesign effort.

The improved design eliminates the spreader bar that caused the excessive loads on the helicopter skid. A pear ring connector adaptable to helicopters with all models of cargo hooks and all orientations under the helicopter has been added. The suspension cables have been lengthened and standardized to approximately 20 feet and are now plastic coated with permanent aircraft "forks" and "eyes." Clevis attachments have been eliminated, and the plastic suspension cable has much less tendency to tangle.

Two fiberglass separator bars have been installed in the suspension system to reduce torch movement in flight and stabilize cable movement during takeoff and landing. The separator bars also help maintain proper cable position and reduce the possibility of entanglement.

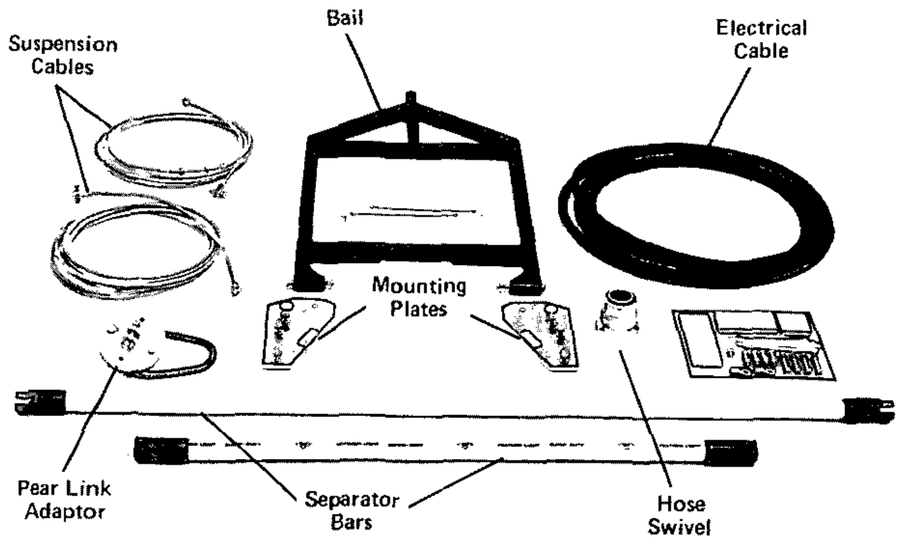

Figure 1—*Retrofit kit for helitorch eliminates some safety deficiencies in the original model.*

The improved bail has been reduced in size and relocated to the aft end of the helitorch so that it locks the barrel in place. This new location has eliminated "tip up" incidents. Quick-release pins replace the over-center latches and provide a more positive locking action that minimizes the problem of out-of-tolerance barrel retention rods.

The hose swivel, a 2-inch male-to-female wedgon (PN FO-200-MF) that is compatible with petroleum products, has been placed between the dry break valve and the pump head in the suction line. This allows the dry break valve to be easily rotated during connection to the barrel.

Helicopter specialists have found the new suspension system and bail easier to use. Only one connection is made to the helicopter cargo hook, and cables with "forks" and "eyes" have much less tendency to tangle. Flight tests have shown the new system to be both more efficient and safer. Pilots may experience some oscillation when first flying the new system; however, after several practice runs, they are able to control the helitorch as well as with the original system (fig. 2).

Each retrofit kit is supplied with the necessary hardware mounting plates and instructions to complete installation in the field with a minimum number of tools (wrenches, socket set, drills, tape measure, and pipe wrenches). No welding is required. Installation time varies from 1½ to 2½ hours. Retrofit kits are available from Simplex Co., 13340 NE Whitaker Way, Portland, OR 97230. [The kits cost approximately $750.] All new helitorches obtained from Simplex will incorporate the improvements.

For more information, contact James Tour, Mechanical Engineer, Missoula Equipment Development Center, Bldg. 1 Fort Missoula, Missoula, MT 59801. ■

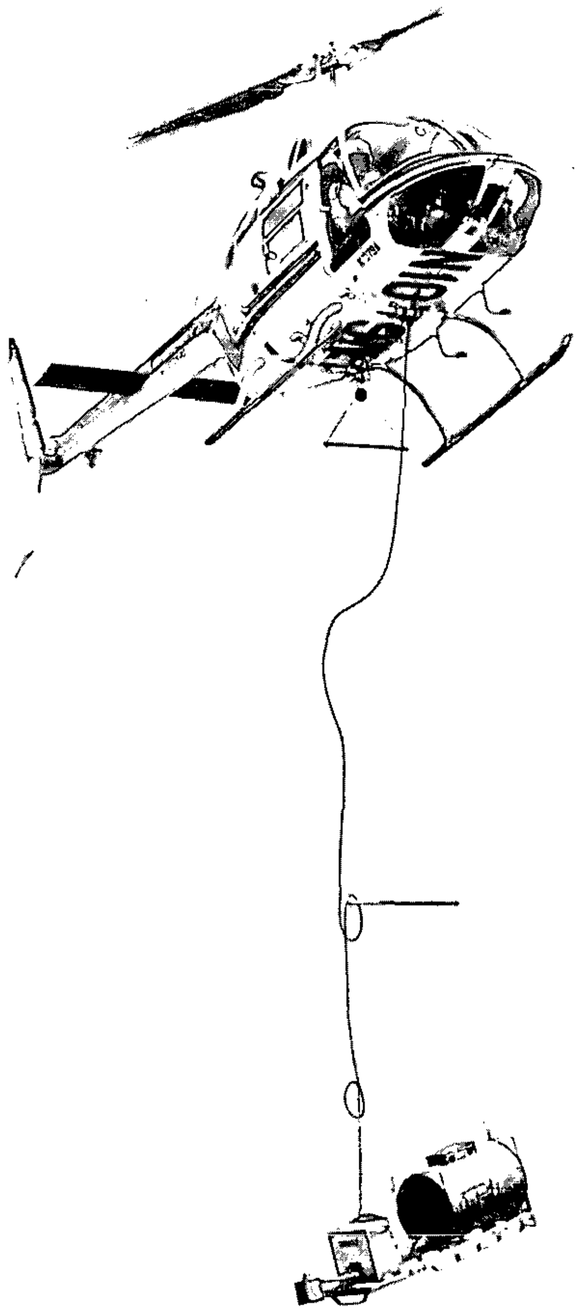

Figure 2—*Improved helitorch suspension system.*

Long-Term Fire Behavior Projections

Dave Lukens and John Krebs

Fire Management Officers, USDA Forest Service, Wallowa-Whitman National Forest, Baker, OR, and Clearwater National Forest, Orofino, ID, respectively

During the summer of 1985 a team of fire behavior analysts (FBA) was assembled with the goal of attempting to make some long-term forecasts on fires burning within the Selway-Bitterroot Wilderness. These fires were burning on the Moose Creek Ranger District of the Nezperce National Forest, located in north-central Idaho. The team was led by John Krebs and included Dave Lukens, Dave Sisk, John Lissoway, and Jim Saveland.

There were several wildfires burning in the same general area under a confinement strategy with little or no suppression effort being undertaken. The decisionmakers needed to know what final fire size could be expected given current conditions and expected weather patterns. A decision on any fire suppression effort would be strongly influenced by the projections that the team provided.

The initial effort was to concentrate on one fire and develop a process for long-term estimates if possible. After completing the process on one fire an evaluation would be made and a decision on whether to continue on the remaining five fires.

The Shasta Fire was selected as the fire to begin the effort on. This fire had started from a lightning strike on July 8, 1985 and was located approximately 8 air miles north of the Moose Creek Ranger Station. By July 30 when the team was first assembled the fire had grown to 1,075 acres and was burning in scattered brush and timber at elevations of 3,000 to 5,000 feet. The weather had been hot and dry during July and several large wildfires had been reported throughout northern Idaho. The 30-day weather forecast predicted above-normal temperatures and about average precipitation, and there was considerable uneasiness about the potential final fire size.

All of the FBA's were somewhat nervous about the project. Their training in Advanced Fire Behavior at the USDA Forest Service's National Advanced Resources Training Center at Marana, AZ, had cautioned against projecting more than 24 hours in advance. However, after establishing several assumptions as a framework the task was undertaken.

The final package was completed in 2½ days including time taken for gathering fuel samples, ground truthing the area, a flight over the surrounding area, and completion of all graphics. There was extensive use of the BEHAVE computer program for assistance in projections and for testing certain weather hypotheses. The final fire projections were unfortunately never put to the test. Unforecast rains during the projection period negated the potential for maximum spread.

Following is the procedure that we used to complete our projections:

1. We documented assumptions that would be used throughout the problem, such as, no suppression action would be undertaken.

2. We set a timeframe for the projection period of 30 days, or through the month of August.

3. We selected fire weather data from the nearest weather station for a month that was most similar to the conditions experienced in 1985 and fit the weather forecast made for the remainder of the season. August 1967 was selected. This month had virtually identical energy release component and burning index by the end of July and very little moisture during the entire month of August. (We were asuming a worst case situation for our analysis; however, another approach would be to select 3 past years' weather, with a dry and a wet situation, for comparison with the forecasted period.)

4. We allowed for the passage of a cold front during the projection period and the high winds associated with such a weather change. This type of weather system is not unusual during the late summer months in this part of the country and oftens results in substantially increased fire activity.

5. We used Intermountain Fire Science Laboratory fuel models 5 and 10 for the projection area and adjusted them when fuel beds became discontinuous. The fuel moistures were adjusted for elevation and aspect but were based on AFFIRMS data from our gamed month of August 1967. Because of the time limitations it was decided not to try to create any new fuel models using the NEWMDL subsystem of the BEHAVE program.

6. We researched local fire reports on similar fires in past years. One document that was particularly helpful was a report on the Independence Fire of 1979 by Larry Keown. We also found it very helpful to fly over the area and note the

old burn patterns from previous fires and the resultant vegetative patterns.

7. We made projections for a 3-hour period of each day from 1500-1800 hours when we felt fire spread would be most significant. For summarization, projection lines on the fire perimeter were drawn for 7-day periods with a brief narrative explaining how the fire advanced.

One very important item in the process was the role of the team of FBA's in the projections. The interplay of different backgrounds and experiences provided a valuable opportunity for sharing ideas and gaining instant feedback.

The completed projections, maps, and computer printouts were reviewed by the line officers, and their feedback was very positive on the effort. A followup presentation was made to an assembly of Forest Service Region 1 fire staff officers with again favorable feedback. The package has value not only as a tool for making decisions, but also as a summary of fire projection estimates for display to the public and other officials during times when questions may be asked concerning new fire management policies. ■

Development in the Pine Barrens: A Design for Disaster[1]

Joseph B. Hughes

Assistant state fire warden, Trenton, NJ

Fire has been a part of the New Jersey Pine Barrens ecosystem since prehistoric times. Repeated cutting and severe wildfire have played a primary role in the development of a forest cover that is considered to be one of the most hazardous wildland fuel types in the Nation. Many of the wildfires have been large and devastating; however, owing to the undeveloped nature of the area, the problem, except for an occasional news article, has gone largely unnoticed. But now the character of the Pine Barrens is changing rapidly—it is no longer uninhabited wilderness. Housing developments and retirement communities are converging on the region, and it is becoming more intensively used for recreation. As a result, risks to humans in the Pine Barrens have increased significantly along with the likelihood that future fires will involve large acreages often interspersed with structures or other improved property (fig. 1).

The potential for wildfire disaster in the Pine Barrens has already been dramatically illustrated. Large conflagrations occurred in 1930, 1954, 1963, 1971, and 1977. The most notable was in 1963, when damage to improved property exceeded $8.5 million. When this tragedy occurred, the region was still largely undeveloped. With the increased development of the last 17 years and the tremendous escalation of property values, the results of a similar series of fires today would be staggering, but this is the threat of disaster that residents of the Pine Barrens face. Two essential elements are already present—highly hazardous wildland fuels and numerous human ignition sources, with weather as the critical variable. Thus, conditions need only be similar to April 1963 for a fire disaster to occur.

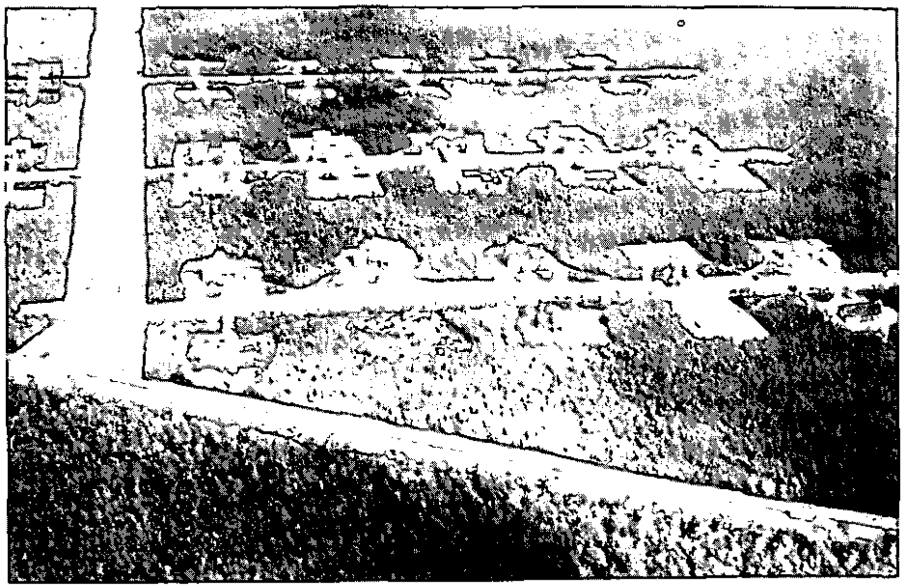

Figure 1—*Wildland/urban interface in the Pine Barrens of New Jersey. More and more houses are being built in what was formerly uninhabited wilderness.*

Fire has long been a factor in the Pine Barrens ecosystem. The Lenape Indians, residents of New Jersey for approximately 10,000 years, burned the woods deliberately in the spring and fall, and accidentally at other times. These burns were used to drive game, improve visibility, facilitate travel, drive away insects and snakes, increase the supply of grass seeds and berries, and for offense and defense in war. The predominance of pine in the early history of South Jersey has been attributed to these fires.

The large mature pine trees that greeted the early settlers were soon removed to support the early industries of the region. The combination of relentless cutting and increased frequency of fire resulted in less productive scrubby pine types that dominate the area today. These scrub pines now comprise one of the most hazardous wildland fuel types in the Nation.

The driest spring on record in New Jersey culminated on the weekend of April 20-21, 1963, when a series of wildfires burned 183,000 acres of woodland, consumed 186 homes and 197 outbuildings, and was responsible

[1]Reprinted from the magazine New Jersey Outdoors, Mercerville, NJ.

for the loss of seven lives. Thousands were forced to flee, and entire communities were evacuated. As already noted, more than $8.5 million in improved property was destroyed.

More recently, 15,000 acres, eight homes, and a number of outbuildings were destroyed in the South Jersey region on March 31, 1977. Later that year, four firemen were killed while fighting a 2,300-acre blaze on the Bass River State Forest.

However, developers continue to build in some of the region's most hazardous areas with little or no regard to the dangers of wildfire. The most dramatic example of this can be seen in the vicinity of Whiting in Ocean County, site of numerous residential and retirement developments.

In some cases, lot clearing amounts to no more than a swath cut by a bulldozer with little room for the structure. Forest fuels are dangerously close, and in certain instances, are in direct contact with buildings (fig. 2).

A number of dwellings are constructed of flammable building materials such as wood siding and cedar shakes, which can ignite readily in an intense wildfire. The problem is compounded because firefighters cannot use normal wildland fire suppression tactics when structures are involved. The immediate protection of life and improved property would become a primary concern and control of the wildfire would be delayed. As problem fires gain in size and build in momentum, overall damage to improved property would be greatly magnified. Firefighters may have to sacrifice some structures in order to reduce total damage, placing the fire boss in an unenviable position.

Figure 2—*Some houses are dangerously close to forest fuels.*

Furthermore, State Forest Fire Control initial attack vehicles are not designed to control structural fires nor are personnel properly trained in structural firefighting tactics. Many of the rural volunteer fire companies located in or adjacent to the Pine Barrens are poorly equipped and undertrained and would not be able to respond effectively to the multiple-dwelling fires involved in a wildland conflagration.

The combination of urban development and wildland fuels that has led to disastrous fires in California is similar to the situation that is developing in the Pine Barrens. Both areas are included in the same fuel classification (fuel model B) of the National Fire Danger Rating System, with terrain being the only major difference between the two areas. California is not the only State to experience a wildland fire disaster involving improved property; Wisconsin and Montana have recently experienced similar problems.

Considering the experience of other States, and the conflagrations that have already occurred in South Jersey, the question, "Is the Pine Barrens being primed for a major fire disaster?" must be asked. Statistics and past history support the premise that it is only a matter of time before such a calamity occurs.

How do we prepare for the inevitable?

First, a number of steps can be taken to reduce the impact of future wildfires in the Pine

Barrens. Several attempts have been made at the State and Federal levels to limit development in and preserve certain portions of the Pine Barrens.

The Pinelands Environmental Council, created by an act of the State Legislature in January 1972, represented the first coordinated effort to save and protect the resources of the Pine Barrens. The Council had the authority to review any project that would destroy or substantially impair significant historic or recreational resources or bring about a major change in the appearance of the region. One of the Council's primary tasks was to develop a comprehensive plan for preservation, enhancement, and development of the area's resources. Owing to a variety of problems both political and economic, its work was never completed.

A study was prepared by Rutgers University at the request of the National Park Service, purportedly to survey the New Jersey Pine Barrens as a possible candidate for incorporation into the National Park System. An outer protection zone and inner preserve are proposed and plans for both Federal and State control outlined.

In addition, former Governor Brendan T. Byrne created the Pinelands Review Committee by Executive Order 56 on May 28, 1977. The purpose of the committee was to develop a comprehensive land use plan for the Pine Barrens. The plan proposed an outer protection zone and an inner preserve similar to those of the Rutgers study.

Based on the recommendations of the Pinelands Review Committee and Federal legislation, the Governor issued Executive Order 71 on February 8, 1979, imposing a building moratorium on 1,500 square miles of Pine Barrens territory. This was done to allow sufficient time for the planning process without further degradation of the Pine Barrens ecosystem.

The Pinelands Protection Act became law on June 28, 1979. The Act established the Pinelands Commission and gave legal status to the building moratorium.

The Pinelands Commission will carry on the work begun by the Pinelands Review Committee and complete the land use plan for the Pine Barrens. The Commission will determine the type and amount of human development that the Pine Barrens can sustain while still maintaining its overall ecological values.

Land acquisition by the State or Federal Government is another method of controlling development in areas considered critical to saving the Pine Barrens. Both Federal and State initiatives have been made to purchase these areas.

In both the Rutgers study and Pinelands Review Committee Management Plan, the importance of fire in shaping and maintaining the Pine Barrens is emphasized. The need for prescribed burning and harvesting on a continuing basis is also stressed.

However, no reference is made to the danger that wildfire poses to current and future development.

In short, the dangers of wildfire have been generally overlooked by all but fire control personnel. There is, it seems, a tendency for people to forget, especially if it has been a few years since the last major fire season. Many individuals moving into the Pine Barrens region have never seen a wildfire, and planners and developers ignore the potential for wildfire when planning, locating, or building a development.

Better wildfire education programs are needed. Currently, a Wildfire Hazard Inspection Form has been prepared by the State Bureau of Forest Fire Management and distributed to residents as part of a contractor program. A brochure outlining fire danger to residents of wooded areas will be prepared and accompany the Hazard Inspection Form. Still, additional programs are needed to reach planners and developers.

Until recently fire standards could be enforced only through the enactment of ordinances and codes by local authorities. Unfortunately, very little was done in regard to wildfire protection.

The Pinelands Environmental Council made the first positive effort to incorporate fire features into subdivisions and developments. Plans were submitted to the State Bureau of Forest Fire Management for review and fire safety recommendations. Some recommendations were adhered to, but many were ignored.

Presently the Pinelands Commission has requested the Bureau of Forest Fire Management to develop a Fire Management Plan for the Pine Barrens. This plan outlines fire management policy and practices to be applied to Pinelands management. Wildfire hazard areas have been designated. A section of the plan outlines fire safety standards for subdivisions and developments. Specific recommendations for standards are made in the following areas: project planning, access roads, water supply, vegetative manipulation, and structural considerations.

The standards are based on a wildland hazard classification system that is tied to the rate of spread and resistance to control of native vegetation. There is a progressive scale for increasing the standards as the hazard becomes more severe. The standards will provide guidelines to municipalities for the enactment of ordinances and building codes necessary to make wildland subdivisions and developments as firesafe as possible.

The highly acid soils of the Pine Barrens lack earthworms and other organisms that would normally incorporate leaves and pine needles into the soil. Consequently, there is a rapid buildup of litter. Unless this fuel accumulation is periodically reduced, under controlled conditions, intense fire results, which can kill or severely damage the overstory (fig. 3). The vertical continuity of fuels enables flames to spread from the ground into treetops, resulting in dangerous and destructive crown fires. Prescribed burning has the greatest potential for large-scale fuel modification and hazard reduction in the Pine Barrens. Through periodic use of fire at 3- to 5-year intervals, horizonal and lateral fuel continuity can be broken and its accumulation reduced.

Prescribed burning has been used to some extent as a means of establishing and maintaining firebreaks around selected developments and other high-value areas. This practice should be expanded to other developments to increase fire safety.

Because of the vegetative composition and fire history of the Pine Barrens, the use of prescribed fire remains the most valuable and environmentally sound fuel management tool available. It will be an important element of the State's Fire Management Plan.

So, now you know the problem and some of the possible solutions. Unless we adhere to a prescribed set of strategic plans in this impending war (and yes, it will be a war of sorts), then we may possibly have a future holocaust in the Pine Barrens far surpassing the fires of California. ■

Figure 3—*Fire in the Pine Barrens.*

National Wildland/Urban Fire Protection Conference

In September 1986, 130 people representing a wide cross section of interests spent 3 days in Denver working to improve fire protection in wildland areas impacted by residential and commercial growth. At the end of the conference, a 97-page report had been prepared that clarified fire protection issues and recommended strategies for problem solving. This information will form the basis for a national report called "Wildfire Strikes Home!" that will launch a major United States fire protection initiative.

The Denver Conference culminated an 8-month effort by the National Fire Protection Association (NFPA), U.S. Fire Administration, and USDA Forest Service to gather information and identify interest groups that could help develop programs to reduce fire losses in what is referred to as the wildland/urban interface area.

The fire protection problems of interface areas have been recognized by wildfire and some urban fire organizations for a number of years. However, in 1985 the seriousness of the situation was dramatically demonstrated by wildfire incidents from coast to coast that damaged or destroyed 1,400 structures, resulted in 44 deaths, burned more than 3 million acres, and cost taxpayers more than 600 million dollars in losses and firefighting expenses.

The three sponsoring organizations agreed that steps had to be taken to reverse the trend of increasing fire losses in interface areas. They also recognized that the protection issues went beyond the fire community and needed to be addressed by interface communities as a whole. This concept was strengthened by a task force of 30 people representing interface community interests that met NFPA's headquarters in May to lay the ground work for the Denver Conference.

As the "Wildfire Strikes Home!" initiative moves from the information gathering phase to program development the sponsors have established a guiding management principle that local fire problems have to be solved by local people. The national support of the initiative will be to generate awareness of the issue, exchange information, encourage sharing of technology and other and similar activities supporting local efforts.

The report "Wildfire Strikes Home!" was released in January 1987. The video version of the report was broadcast by the NFPA satellite system to the Nation's wildfire and urban fire communities on March 3, 1987. The video programs will also be available for local use and to the general public after the satellite broadcast briefing to the fire community.

A series of regional conferences cosponsored by State and regional fire associations is being planned to take place between April 1 and September 1, 1987. The conference objectives will be to identify local and regional interface fire problems and to develop action plans and opportunities for the national initiative effort to support regional and local efforts.

By the end of 1987, it is hoped that the importance of fire issues will be recognized by the public and the fire community and positive programs will be under way to keep wildfire from striking home.

For information on how to obtain copies of the "Wildfire Strikes Home!" video or report, contact Public Protection Section, National Fire Protection Association, Batterymarch Park, Quincy, MA 02269 (telephone (617) 770-3000) or Fire and Aviation Management, USDA Forest Service, P.O. Box 96096, Washington, DC 20090-6090 (telephone (703) 235-8666).

Use of Rotor-Wing Aircraft for Air Attack

Ray S. Page and Tom Beddow

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From August 15 through September 2, 1986, the Anderson Fire Complex on the Boise National Forest was managed by a Southwest Area Class I Incident Management Team with an air operations branch at the height of activity consisting of 11 helicopters, 2 fixed-wing air tankers, and a support organization of up to 112 persons. At the time the Southwest Area Incident Management Team was assigned the Anderson Complex, the air operations branch was supporting not only the Anderson Complex, but also the Garden Valley and Mineral Mountain Fire Complexes. Because of the large number of fires on the Boise National Forest at that time, an been set up in Boise. In these early stages the area command was providing air attack support to all fires on the forest, and therefore, all requests for air tankers and air attack supervisors went through that organization, which then set priorities for fixed-wing retardant delivery. Due to extremely smokey conditions, little use could be made of air tankers, and in fact, on several days it was well into the afternoon before even helicopters could be used.

After several days of this type of operation, those of us at the Anderson Complex determined that it would be more effective to do our own air attack, utilizing rotor-wing aircraft, a concept that several of the team members had been interested in pursuing for some time. After reaching agreement with the area command, the team proceeded with this mode of air attack. At that time the following helicopters were assigned to the Anderson Complex:

Type I:
- 1 Boeing Vertol 107

Type II:
- 1 Bell 212
- 1 Sikorsky S55T
- 2 Bell 205

Type III:
- 1 Long Ranger L-3
- 1 Hughes 500D
- 2 Jet Ranger III

Type IV:
- 2 Soloy/Hiller 12-E

These 11 helicopters were used in the following configuration: the type I helicopter, having an onboard mixing system, was used for retardant and foam delivery; the type II's were used for bucket work (one of the 205's also had on-board retardant mixing capability and was also used for retardant purposes), cargo, and personnel movement; the type III's were used for bucket work, cargo, personnel movement, reconnaissance, air attack, and helicopter coordinator (fig. 1); and the type IV's were used for reconnaissance and air attack.

Two air attack supervisors were available, alternating flight shifts between the two, as is the normal operation for our Southwest Area class I teams. A helicopter for primary air attack use was assigned to each of them with the understanding that when the helicopter was not being used for air attack it could be used for other short-duration missions. However, priority use was for air attack. Because of the number of helicopters available and the close proximity to water sources, we relied almost entirely on helicopters with buckets rather than fixed-wing air tankers for air tactical missions (fig. 2).

When ground personnel called for an air strike the air attack supervisor evaluated the situation and determined whether to utilize

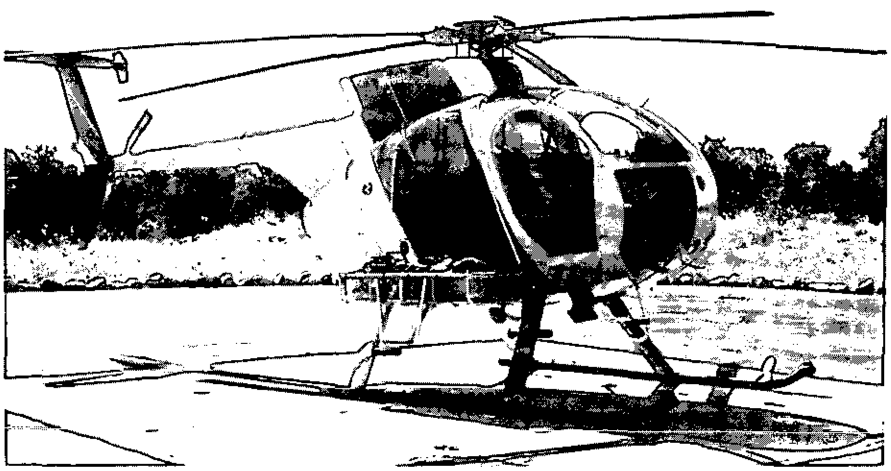


Figure 1—*Hughes 500D helicopter can be used for bucket work, movement of cargo and personnel, and air attack.*

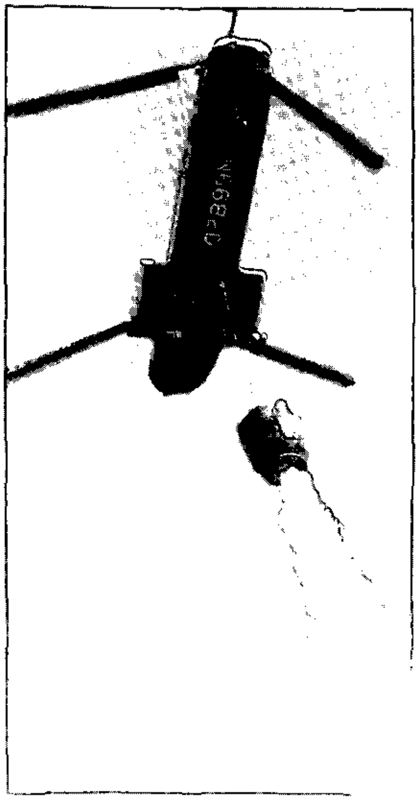


Figure 2—*Water drop from Vertol 107 helicopter.*

helicopters and/or fixed-wing retardant aircraft for the mission. If the target warranted a sustained operation with several helicopters, a helicopter coordinator was assigned, shown the target by the air attack supervisor, and then given control of the helicopters working that particular target until the mission was completed. Meanwhile, the air attack supervisor continued supervising the rest of the fire. In the event that air tankers were called in from Boise, the air tanker coordinator who came with them contacted the air attack supervisor for the target assignment and then continued to work the air tankers as directed by the air attack supervisor.

During the period from August 15 to September 1, only eight retardant loads from air tankers were used on the Anderson Complex. Four of these were to knock down hot spots threatening the line and four to pretreat the line in preparation for a burnout operation. During that same time, approximately 591,940 gallons of short-term retardant and foam were delivered with the Boeing Vertol with a total flight time of 94.8 hours. Due to the interest by Columbia Helicopters as well as the incident management team in the concept of using a heavy helicopter in this configuration, accurate records were kept on the amount of delivery provided by the Boeing Vertol. At a flight rate of $2,600 per hour, delivery cost of retardant was just under $0.42 per gallon. Total cost was slightly higher than this due to guaranteed availability for one day that the ship was not flown and move-in and move-out cost. With good dipping sites and short turnaround time this helicopter could deliver up to 10,000 gallons of retardant and/or foam per hour. The greatest delivery in one day on the Anderson Fire was 54,000 gallons.

Due to the limited radio communications in helicopters, one FM and one VHF radio, an adjustment had to be made in the communications configuration versus what would normally be possible in a fixed-wing air attack ship. The primary ground-to-air frequency utilized was the command frequency on which initial contact with air attack was made. The individual tactical frequencies for each division were also programmed into the 9600-channel radio, and tactical discussion was moved to the appropriate frequency after initial contact. With only one VHF radio in the helicopter, primary air-to-air and flight following was done on 122.925. Frequency 118.950 was used for TOLC (take-off and landing control), and when the helicopter coordinator was coordinating a number of helicopters on one target, that operation was moved to 119.950. A fourth VHF frequency, 127.925, was assigned for air tanker coordination, and was used by the air tanker coordinator for communications with the air tankers.

Advantages we found by using rotor-wing aircraft for air attack greatly outweighed the disadvantages. Probably the greatest overall advantage to this type of operation is having the air attack supervisor and aircraft at, or immediately adjacent to, the incident base. If air attack supervisors cannot be, or are not needed, over the incident from daylight to dusk, they are still in close proximity, so that when they are needed or visibility improves so that they can be over the incident, they are there immediately, and there is no delay caused by the flight time necessary to get to the incident. The air attack supervisors can therefore be much more responsive to the needs of the rest of the incident management team. They can establish on a vantage point from which the entire incident, or critical portions of the incident, can be viewed, and are in a position to be airborne when a problem develops or services are requested.

Another advantage of being in a helicopter is that the air attack supervisor can fly slower, get down low enough to better identify targets for air strikes, and thus preclude much of the confusion and missed targets that sometimes result when targets are described from a fixed-wing aircraft. If there is still a question about the target, it is possible that the air attack can land, pick up the operations chief or division supervisor to help clarify the specific target or simply to conduct a reconnaissance of the area of concern and discuss face-to-face the immediate tactical mission.

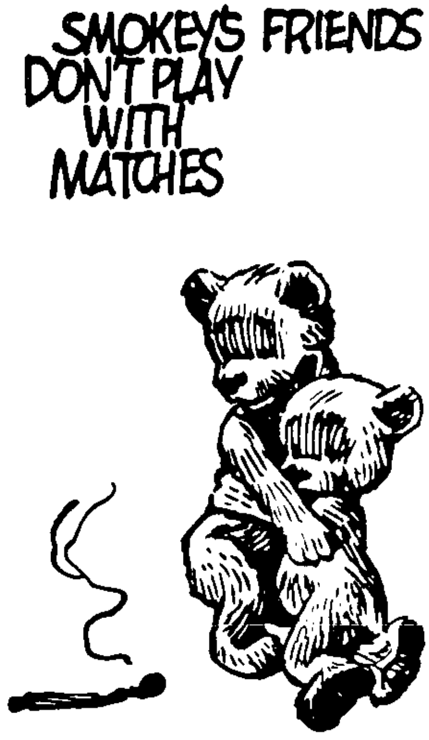
One of the greatest problems incident management teams have struggled with over the years is having the air attack supervisor based in town at the nearest fixed-wing base and the difficulty of sharing information, such as shift plans, maps, control strategy, and order of priorities. Various techniques for improving communication have been tried, such as having the air attack flying the next-to-the last shift of the day drive out to the incident base, but these techniques usually involve long hours and long drives, and still the information sharing is less than desirable. By using rotor-wing aircraft, the air attack is able to stay in base camp, is fully involved in strategy, can furnish intelligence immediately upon landing, and is all-around more available to interact with the rest of the incident management team.

For air attack on a given incident, rotor-wing operation is probably no more costly than using fixed-wing aircraft and indeed may be more cost efficient. Flight cost of a Forest Service contract light helicopter averages approximately $160.00 per hour. Contracts for light twin-engine fixed-wing aircraft for air attack also average $160.00 to $175.00 per hour. On the contract helicopter, however, there is the daily availability that must be taken into account. This is a budgeted cost that must be paid regardless of whether the ship is being used for air attack or for some other purpose. In terms of flight time, if an air attack is immediately available at the incident helibase and is used only as needed, the flight hours will be reduced greatly and the time used more efficiently. Also, the flight time to and from an airport on individual mission assignments is saved. Although difficult to measure, the increased accuracy of target identification and tactical mission definition undoubtedly saves additional money.

The only disadvantages to use of rotor-wing aircraft for air attack that we identified were (1) limited radio capability of helicopters, which required continual dialing up of frequencies on the aircraft VHF, and (2) slow travel time around or across a large fire. For air-attacking several fires over a large area, such as a national forest, the airspeed of a helicopter may be so slow that its use in this situation may not be feasible.

The VHF radio situation can be improved, however, by installing a portable VHF radio in the helicopters assigned air attack responsibilities. Helicopters used under the standard Forest Service contract are required to have an auxiliary FM portable radio wiring harness that can be adapted to accept a portable VHF radio from the National Fire Radio Cache.

Overall, both ground personnel as well as the air operations organization were well pleased with the use of rotor-wing aircraft for air attack and, when possible, intend to utilize it further. ■



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