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Fire Management Notes

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Short Features

Front Cover: *Five representatives of the 555th Parachute Infantry Battalion help Smokey celebrate their mutual 50th anniversary. Left to right, Lt. Col. Bradley Biggs, 2nd Lt. Walter Morris, 1st Sgt. Hubert Bridges, Cpl. Paul Lyles, and T. Sgt. Ted Lowry. Smokey's uniformed escort is the USDA Forest Service's Fire and Aviation Management Director, Mary Jo Lavin. See Carl Gidlund's article, pages 24-26. Photo: Karl Perry, USDA Forest Service, Washington, DC, 1994.*

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A Case for Management Ignitions in Wilderness

James K. Brown

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The Wilderness Act of 1964 sets forth several objectives, one of which is to maintain natural conditions by allowing the forces of nature to operate. Because fire is a primary ecological force, its presence is often essential to preserve the natural character of wilderness areas. In some situations, however, managers may need to consider how fire will affect recreation, safety, existing plant communities, endangered species, air quality, and adjacent nonwilderness land. The challenge is to maintain primeval conditions with fire while satisfying other wilderness goals and constraints on the use of fire.

A commonly debated issue is whether to accept human-caused ignitions in wilderness as natural (Kilgore 1985, Van Wagner 1985). Philosophical arguments aside, management ignitions have been allowed under Federal agency policies and are considered compatible with wilderness goals (USDA and USDI 1989). In some cases, especially in smaller wildernesses, achieving natural fire objectives may be impractical without the use of prescribed fire.

In many wilderness areas, especially small ones, management-ignited prescribed fire may be the best way to preserve natural conditions.

Because of concerns over liability and conflicting wilderness goals, fire managers have been reluctant to use management ignitions in wilderness. Yet absence of fire may mean a gradually increasing risk of uncontrollable and damaging wildfire due to accumulation of fuels (Arno and Brown 1991). Management ignitions will be essential to restoring fire and mimicking natural processes in the following situations:

- **To prevent fires from escaping wilderness and threatening life and property.** The size, shape, and location of many wilderness areas may not safely allow lightning-caused fires to accomplish natural fire objectives. Management-ignited prescribed fires may even be necessary to reduce hazardous fuels in portions of larger wilderness areas (Brown 1991).
- **To reintroduce fire where lightning-ignited fires no longer occur.** In some areas, most lightning fires historically entered from adjacent nonwilderness (typically lower elevation) lands. Large fires often originate at low to medium elevations and sweep upward to higher elevations, particularly where slopes are steep (Barrows 1951). Such wildfires now are suppressed when they occur outside of wilderness boundaries.
- **To resolve conflicting wilderness goals.** Management ignitions may be required to control fire severity or to restrict the location and extent of fire on the landscape. For example, to restore natural conditions in old-growth ponderosa pine where unnatural quantities of fuel have accumulated due to successful fire protection, some restraint on fire severity may be necessary to avoid excessive tree mortality (Biswell et al. 1973; Ryan and Frandsen 1991). Once stand structure and surface fuels will support low-intensity fire with limited smoldering, lightning ignitions may be reallowed. Protection or enhancement of endangered species may also require management ignitions. In the case of grizzly bears, management ignitions may be needed to assure the sustained presence of whitebark pine, a critical food source for grizzlies in some ecosystems.
- **To meet air quality regulations.** In some situations, management ignitions may be needed to ensure that smoke emissions occur during acceptable periods.

Management Ignition Prescriptions

Once a decision has been made to employ management ignitions, a difficult task still lies ahead: preparing the fire prescription. Management ignitions can be "unrestrained"—that is, the time of year and location for ignition are determined by managers, but the fire is allowed to burn without further ignition or suppression actions. Usually, however, management ignitions involve efforts to burn specified areas at predetermined severities.

The following process is suggested for developing fire prescriptions based on ecological knowledge:

1. Determine fire history for the wilderness area.
2. Compare current successional status of vegetation with the historical profile of fire visitation and vegetation.
3. Determine areas that should be burned and the appropriate fire severity.

An inherent problem in using fire history to determine what should be considered as natural is that disturbance history can only be readily and reliably measured for the past 200 to 400 years. Variability in such factors as climate, vegetation composition, and disturbance patterns has been substantially greater over the past several thousand years than over just the last 400 years.

Also, there is no guarantee that the climate of the future will produce the same vegetation it produced in the past several hundred years (Sprugel 1991). But land managers need a consistent basis on which to plan—and starting with measurable fire history seems the most practical approach.

Determining Fire History

The first step in determining fire history is to map fire regime types. Fire regimes can be described as major vegetation types having a characteristic range in fire frequencies and fire severities. Fire severity should be prescribed as the desirable range of fire intensity and surface fuel consumption (Ryan and Noste 1985). In forest vegetation, it may be helpful to prescribe fire severity as the desired proportions of nonlethal underburn, lethal underburn, and lethal crown fire. These descriptors are the result of fire intensity and surface fuel consumption. Characterization of fire history can be based on published knowledge (Barrett et al. 1991), historical records (Gruell 1985), and photographs (Gruell 1983), or determined by sampling stand age and fire scars (Arno and Sneck 1977; Barrett and Arno 1988; Morrison and Swanson 1990; Johnson and Van Wagner 1985).

If specific information cannot be obtained, the probable fire history can be reconstructed through inferences from the literature and examination of the natural vegetation, climate, and geographic setting (Heinselman 1978). Qualitative information, judgment, and experience can be important in appraising fire history. This is especially true when timely management action is needed to protect ecological values—for example, maintenance of old-growth ponderosa pine.

Interpreting Fire History

How much accuracy and precision in fire history information is needed? Managers must judge the answer for themselves. They must consider objectives for achieving natural disturbance, complexity of vegetation and terrain, size of area, cost, and the public need for information. Objectives for achieving natural disturbance can involve both structure- and process-oriented goals (Agee and Huff 1986). That is, do we need knowledge of natural fire regime characteristics (process), or of the vegetation that would have resulted from a natural fire regime (structure) (Van Wagner 1985)?

One approach is to hypothesize different levels of precision in fire frequency and fire severity, then compare how the various levels would influence decisions in applying management ignitions. Cost of acquiring information may also be important. Once acceptable precision has been determined, managers can estimate the proportion of wilderness landscape for which recent fire frequency and severity fit the historical fire profile, and the proportion for which they do not. If a significant acreage of wilderness has had a lower fire frequency than the historical norm, prescribed fire is appropriate.

For example, let's look at the historic fire intervals (table 1) from a current study in the Selway–Bitterroot Wilderness in Montana and Idaho for three regime types—seral ponderosa pine *(Pinus ponderosa)*, lodgepole pine *(Pinus contorta)*, and spruce-fir *(Picea engelmannii-Abies lasiocarpa)*— and compare them with hypothetical time-since-fire data for current stands (table 2).

For Ponderosa Pine. The maximum number of years between fires in ponderosa pine by the underburn severity class is 36 years and the mean is 20 years. From table 2, the hypothetical time since last fire for 80 percent of the seral ponderosa pine regime is 50 years, which greatly exceeds both the maximum and mean fire intervals. Thus the comparison clearly indicates the need for fire.

The mean fire interval or mean plus one standard deviation appear reasonable as statistics to compare with time between fires to determine when management ignition is needed in ponderosa pine and other short-return-interval fire regimes. Waiting for the time since last fire to exceed the historical maximum fire interval may jeopardize attainment of natural process goals. The likelihood of stand replacement fire, especially from wildfire, can increase substantially as time since last fire exceeds the mean fire interval. Prescribed fires also become more difficult and costly to conduct as fuels accumulate.

For Spruce-Fir. The hypothetical time between fires (200 years) in spruce-fir is greater than the mean fire interval (170 years) but less than the maximum (240 years) and even the mean plus one standard deviation (170 + 42 = 212 years). Currently, a management ignition seems inappropriate. In this case and probably with other stand replacement fire regimes, the maximum fire interval or perhaps the 90th percentile fire interval appears to be a reasonable statistic to compare with time between fires to determine when management ignition is appropriate. Risk of unnaturally modifying ecological values by extending the time since last fire seems small. Future likelihood of wildfire should also be considered. If the risk of a wildfire burning through the area in the future appears high, it may be best to delay management ignition unless hazard abatement is considered important.

For Lodgepole Pine. Fire history of lodgepole pine and other variable fire regime types is more complicated to analyze because it involves both underburn and stand replacement fire severities. In the lodgepole pine example, the mean time since last fire is 108 years for stand replacement and 88 years for underburn. (In table 2, times since last fire were weighted by area percentages.) These values fall well within the distribution of historic fire intervals for stand replacement, but not for underburn severity. The data indicate that fire of underburn severity is due on 80 percent (55 + 25 = 80%) of the regime area because times since last fire of 80 and 160 years exceed the historical maximum of 63 years. Although conducting an underburn in lodgepole pine without some stand replacement could prove difficult, prescribing a fire with severities that create mostly underburn and some stand replacement might be accomplished and would be supported by comparison of current and historic fire activity.

The scope of landscape analysis can also influence the decision of whether to use management ignitions. For example, comparison of current and historic fire activity can be interpreted for individual wilderness areas or for a

Table 1—*Historical fire intervals in the Selway-Bitterroot Wilderness in Montana and Idaho by fire severity class*

Fire regime	Years between fires by severity class Min.	Max.	Mean	Standard deviation
		Underburn severity		
Seral ponderosa pine	12	36	20	7
Lodgepole pine	29	63	45	12
		Stand replacement severity		
Spruce-fir	97	240	170	42
Lodgepole pine	93	188	110	25

Table 2—*Hypothetical years between fires by fire severity class for varying percentages of wilderness areas occupied by three fire regime types*

Fire regime	Area occupied %	Years between fires by severity class	
		Underburn severity	Stand replacement severity
Seral ponderosa pine	20	15	
	80	50	
Lodgepole pine	20		20
	30		80
	50		160
	20	20	
	55	80	
	25	160	
Spruce-fir	100		200

combination of wilderness areas in the same geoclimatic area. In one wilderness area, the time since last fire might substantially exceed the historic range of fire-free intervals, indicating that management ignition is appropriate. For several wilderness areas together, however, the average time since last fire might fall within the range of historic fire-free intervals, in which case management ignition would not be appropriate.

Conclusions

While the decision to use management ignitions must be biologically based and operationally well defined, keep in mind that exacting solutions to mimicking natural fire processes probably are not feasible. Neither the determination of fire history nor the application of prescribed fire is a precise undertaking. Greater knowledge of fire history and operational approaches to restoring fires of variable severity is needed to support management ignition decisions. Despite uncertainties in managing for natural fire processes, an appealing view of this situation has been offered by Christensen (1991): "We cannot set aside a piece of land and expect ecological processes to occur as if technological humankind had not altered them. We are obliged to manage."

The opportunity for restoring fire to wilderness areas through natural ignitions, such as lightning, may have been lost in some areas or may be limited due to the necessity of controlling fire inside or outside the wilderness boundary. In many wilderness areas, particularly small ones, management ignitions will be necessary to satisfy the wilderness goal of maintaining natural conditions. Management ignitions can mimic natural fire effects and provide an acceptable means of restoring fire if fire prescriptions are based on knowledge of fire history and the current successional status of vegetation. ■

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The Wilderness Size Dilemma

Since 1972, when prescribed natural fire was first approved for use in wilderness areas, most active programs have been in large wildernesses such as the Selway–Bitterroot, Frank Church–River of No Return, and Bob Marshall, and in Yosemite, Sequoia–Kings Canyon, and Yellowstone (not under the Wilderness Act) National Parks. Selected lightning ignitions have been allowed to burn for extended periods. Even though fire is not fully predictable, the programs have been highly successful (Greenlee and Gaudinski 1989, USDA and USDI 1989), except, perhaps, for the controversial extent of fire in 1988 (Davis and Mutch 1989). Following review of the 1988 season and reanalysis of wilderness fire plans, the programs were strengthened technically in accordance with recommendations of the "Final Report on Fire Management Policy" (USDA and USDI 1989).

Wilderness fire programs, however, are active almost entirely in large wilderness areas, typically those larger than about 700,000 acres (300,000 ha). Prescribed natural fires are well suited to large wilderness areas because lightning-caused fires do occur and can be confined within wilderness boundaries. But small wilderness areas have received little attention by fire managers, partly because of managers' reluctance to use management ignitions.

Small wilderness areas are considered here to be those in which limited size makes achievement of natural fire objectives impractical with lightning-caused fires. Although a size threshold can be roughly approximated only, it seems unlikely that lightning ignitions would be a significant source of fire in areas of less than 300,000 acres (121,410 ha), and certainly not in areas of less than 50,000 to 100,000 acres (20,235 to 40,470 ha). Given this definition, 74 to 94 percent of the wilderness areas in the contiguous United States are small (table 3). Even in the Western United States, 63 percent of the wilderness areas are less than 50,000 acres (20,235 ha), and 75 percent are less than 100,000 acres (40,470 ha). In terms of area, nearly half of the wilderness acreage in the contiguous United States is in small wilderness areas (table 4). In the Western United States, this proportion ranges from 12 percent for <50,000-acre (<20,235-ha) units to 48 percent for <300,000-acre (<121,410-ha) units. Small wilderness areas represent a substantial landscape of considerable biological diversity where management of natural processes is an important goal. ■

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Table 3—*Number and percent (by size class) of wilderness areas administered by the USDA Forest Service and USDI National Park Service, Bureau of Land Management, and U.S. Fish and Wildlife Service*[1]

Location	Number of areas by size class in acres (ha) x 1000					Percent of areas by size class in acres (ha) x 1000			
	<50 (<20)	<100 (<40)	<300 (<121)	300+ (121+)	all	<50 (<20)	<100 (<40)	<300 (<121)	300+ (121+)
Southeast[2]	82	83	83	2	85	97	98	98	2
Northeast	67	69	70	1	71	94	97	99	1
N. Rocky Mt.	9	11	17	4	21	43	52	81	19
Cen. Rocky Mt., SW	111	136	158	9	167	67	81	95	5
Pacific NW	70	80	101	11	112	62	71	90	10
Alaska, Hawaii	12	16	21	24	45	27	36	47	53
Contiguous U.S.	339	379	429	27	456	74	83	94	6

[1]Statistics were based on a 1989 map published by the Wilderness Society and American Forestry Association and updated for recent changes in June 1992
[2]Southeast includes AL, AR, FL, GA, LA, MS, MO, NC, SC, TN, and KT; Northeast includes IL, IN, ME, MA, MI, MN, NE, NH, NJ, NY, ND, OH, PA, SD, VA, WV, WI, and VT; Northern Rocky Mountain includes ID and MT; Central Rocky Mountain, Southwest includes CO, NV, NM, UT, WY, AZ, OK, TX, and S. CA; Pacific Northwest includes OR, WA, and N. CA.

Table 4—*Wilderness acres (by size class) administered by USDA Forest Service, and USDI National Park Service, Bureau of Land Management, and U.S. Fish and Wildlife Service*[1]

Location	Acres (ha) x 1000 by size class					Percent of acres (ha) x 1000 by size class			
	<50 (<20)	<100 (<40)	<300 (<121)	300+ (121+)	all	<50 (<20)	<100 (<40)	<300 (<121)	300+ (121+)
Southeast[2]	776 (314)	835 (338)	835 (338)	1,650 (668)	2,485 (1,006)	31	34	34	66
Northeast	608 (246)	752 (304)	884 (358)	798 (323)	1,682 (681)	36	45	53	47
N. Rocky Mt.	201 (81)	369 (149)	1,725 (698)	5,404 (2,187)	7,129 (2,885)	3	5	24	76
Cen. Rocky Mt., SW	2,281 (924)	3,993 (1,616)	7,430 (3,007)	4,288 (1,735)	11,718 (4,742)	19	34	63	37
Pacific NW	1,297 (525)	1,947 (788)	5,316 (2,151)	6,076 (2,459)	11,392 (4,610)	11	17	47	53
Alaska, Hawaii	136 (55)	474 (192)	1,542 (624)	54,785 (22,171)	56,327 (22,795)	<1	1	3	97
Contiguous U.S.	5,163 (2,089)	7,896 (3,196)	16,190 (6,552)	18,216 (7,372)	34,406 (13,924)	15	23	47	53

[1]See table 1, footnote 1.
[2]See table 1, footnote 2.

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A New Way To Analyze Prescribed Fire Costs

One of the points often discussed in prescribed fire is what costs should be included when doing the cost analysis. Often the "analysis" process consists of determining what expenditures should be charged to the benefiting activity and ignoring the rest. While this is a legitimate accounting function, it ignores many variables that should be included in an actual cost analysis. A cost analysis should be an attempt to accurately estimate cash-flows and opportunity costs of planning, scheduling, implementing, and monitoring prescribed fires. Using all costs associated with the burn dramatically increases the cost of the project and does not accurately represent cash-flows. Using only costs directly associated with implementing the project will not reflect all the true costs of doing a project.

The Pikes Peak Ranger District has been using a fixed/variable cost analysis for prescribed fire for the past 2 years. Fixed/variable cost analysis breaks costs into two categories and gives managers more accurate information to use.

Variable costs are expenditures directly related to the project; they would not be incurred if for some reason the project did not occur. Examples of these include overtime, vehicle mileage, helicopter time, and fuel costs. Most variable costs are charged to the project funding source.

Fixed costs are costs associated with the project that would be covered from some other funding source when the project is not undertaken. They may or may not be charged to the project funding source. The best example of fixed costs is the regular salary for personnel involved in the planning, support, and execution of a burn. These are opportunity costs to the administrative unit. While these costs do not affect cash-flows, they affect other activities that might otherwise finance or benefit from these resources.

Fixed/variable cost analysis breaks down all costs into either fixed or variable costs and presents managers with more accurate information on which to base decisions. Table 1 is an example of a fixed/variable cost analysis for a 175-acre (71-ha) prescribed fire:

Table 1—*An analysis of fixed and variable costs for a 175-acre (71-ha) prescribed fire (in dollars)*

	Fixed costs	Variable costs	Total costs
Planning	500	0	500
Site preparation	2,000	500	2,500
Burn day personnel	1,800	1,200	3,000
Equipment	0	800	800
Ignition fuel	0	250	250
Total	4,300	2,750	7,050
Cost/acre	24.57	15.71	40.29
(Cost/ha)	(60.71)	(38.82)	(99.55)

What this type of analysis provides is the actual costs of the project in terms of both cash-flow and opportunity costs. The actual cost of doing this project, aside from previously incurred obligations, is $2,750. The opportunity cost of this project, with the resulting impacts to other activities, is $4,300.

Fixed/variable cost analysis allows for all costs to be analyzed with the effect of each type of cost kept in perspective. This is not a decision analysis and needs to be considered along with other accounting and nonfinancial information. Fixed/variable cost analysis does provide managers with relevant data to aid in decisionmaking.

For further information about this new way to analyze prescribed fire costs, write W. Timothy Foley, USDA Forest Service, Pikes Peak Ranger District, Colorado Springs, CO 80903; or call 719-636-1602. ■

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Prescribed Burning: A Wildfire Prevention Tool?

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A number of fire managers recommend prescribed burning as a tool to prevent wildfires. However, there is little data to support this recommendation, and additional research has been needed to answer the following questions:

- Does prescribed burning reduce the size and intensity of wildfires?
- Are the effects of prescribed burning as a wildfire prevention tool measurable?
- Does prescribed burning eliminate the threat of wildfire?

Martin (1988) found that prescribed burning in Region 8 in the 1985 fire season reduced acres burned and average acres per wildfire. He reported that prescribed burning saved more than 11,000 acres (4,452 ha) from wildfire and that wildfires were less intense on 5,893 acres (2,385 ha) that had been previously burned by prescription. However, he felt that "the effect that prescribed burning had upon fire occurrence (number of fires) is, at best, speculative." He did show that for each $1.00 spent on prescribed burning, $1.76 in suppression and damage costs was saved.

Brown (1989) asked, "Could a program of prescribed fires have eliminated the undesirable consequences of wildfire in Yellowstone National Park in 1988?" Between 1972 and 1988—whenever weather conditions allowed—he analyzed fuel characteristics, fire prescriptions, logistics, and costs to implement prescribed burning. He determined that the Yellowstone fires could not have been avoided with a program of prescribed burning.

Throughout the literature, many references are made to the intrinsic benefits of prescribed burning to prevent wildfires or reduce their size and intensity. However, little is quantified on the tangible benefits of prescribed burning. Would a review of statistics in a Florida fire district provide information about the benefits of prescribed fire as a wildfire prevention tool?

As the use of prescribed burning increased in a Florida district, the number of wildfires, acres burned, and average acres per wildfire decreased.

Procedures

The study was based on fire statistics of the Florida Division of Forestry (FDF), Orlando District, from 1981 to 1990. Because of the variations among their prescribed burning practices, three areas within the district were included: Three Lakes Wildlife Management Area (WMA), Osceola County, and Brevard County.

Three Lakes WMA is a State-owned, 42,282-acre (17,112-ha) property on which the FDF began a prescribed burning program in 1984. They burn each management unit by prescribed fire every fourth year.

Osceola County is predominantly agricultural, and prescribed burning is used as a land management tool—generally between November and February. The land is held in large tracts by families who pioneered central Florida; they use prescribed burns across the county consistently. Ranchers in Osceola County burn every 2 to 4 years, depending upon the size of their herd, land available, and severity of the winter. The burning reduces the vegetative rough that builds up and produces new grasses that are rich in nutrients and supplement the cattle's winter diet. There are 523,182 acres (211,732 ha) of wildlands under fire protection.

Brevard County is bordered by Osceola County on the west and the Atlantic Ocean on the east. Over the years, land uses in Brevard County have shifted from agriculture to a mixture of other uses. During its urbanization, many investors purchased small landholdings for speculation purposes. Some of the land is leased as rangeland for cattle; however, much is not actively managed. Prescribed burning occurs within the county for the same reasons and under a similar schedule as in Osceola County. However, there is less prescribed burning in Brevard County because of land ownership patterns. There are 270,722 acres (109,561 ha) of wildlands in Brevard County under fire protection.

Retrieval of Data

Data used in this study were retrieved from the mainframe computer located in Tallahassee, FL. These included information on burn authorizations issued in the study areas from 1983 to 1990, data for agriculture and silviculture burning, and the numbers of wildfires and acres burned in the study areas from 1981 to 1990. Records on burn authorizations and fire data before 1983 and 1981, respectively, were stored on a district basis and were not available for retrieval on an area basis.

Study Limitations

There were several limitations to this study: local weather, time of day, vegetation type, and number of days since the last rain all affect the potential size and severity of each wildfire. Even though the study areas are contiguous, there were variations in the fires due to local weather differences.

Burn authorizations are issued by telephone with little on-site verification for actual acreage, type of burn, or whether the burn was conducted. Burning of the same acreage may be requested and approved the next day if the burn was not actually conducted. The data are recounted in total acres authorized for the year when this occurs. Unauthorized prescribed burning sometimes occurs. Fire prevention benefits from these burns are received but are not accounted for in the total acres of authorized burning.

The protected acres listed for the counties do not accurately reflect fire-occurrence and acreage-burned data. The district responds with mutual aid to city fire departments. The data from mutual-aid fires are included in the fire data but are outside of the fire district protected acreage.

Results

The percentages of the study areas burned by prescribed fire all had upward trend lines. Three Lakes WMA had the greatest increase in percentage of study area burned, while Brevard County had the lowest rate of increase (fig. 1). The trend lines for Three Lakes WMA and Osceola County show that as the use of prescribed burning increases, there are decreases

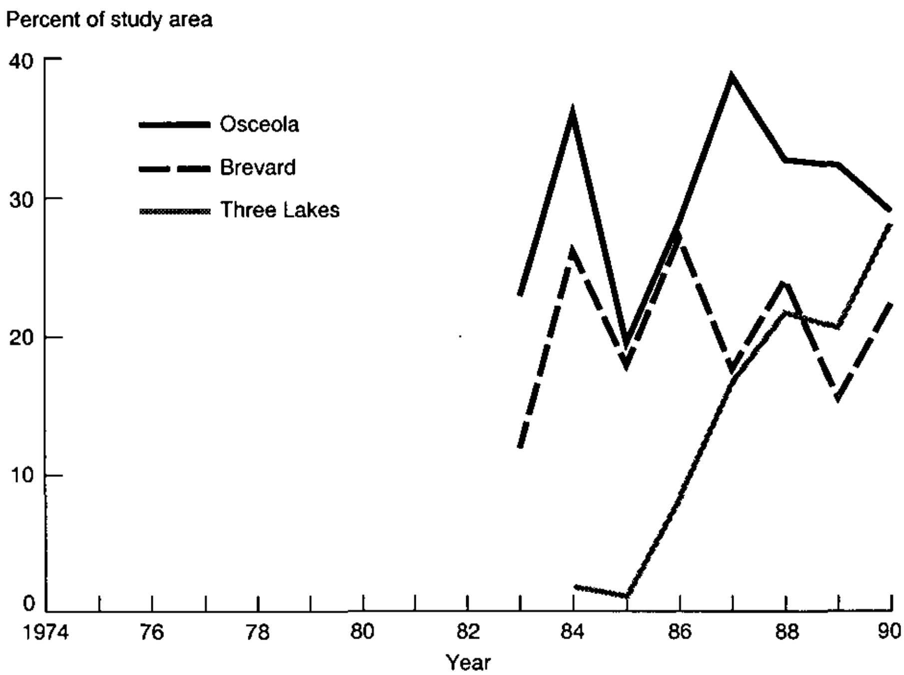

Figure 1—*Percent of study areas burned by prescribed fire.*

in the number of wildfires, acres burned, and average acres per wildfire. Both study areas had increasing levels of prescribed burning, and Osceola County had a higher level of sustained prescribed burning. These are strong influences on the positive results of prescribed burning in this study.

These results contradict those found by Martin (1988) because he took only 3 years of prescribed burning data and applied the results to 1 year of fire data. This "snapshot" look at prescribed burning does not show the cumulative effects of a sustained program.

The trend line for the number of wildfires within the district shows a decrease from 1974 to 1990. The trend lines for Three Lakes WMA and Osceola County show a decrease in wildfire occurrence, while the trend line for Brevard County is virtually flat, showing only a slight decrease (fig. 2). It is the sustained burning program that has the greatest effect on wildfire statistics. In the study areas, Osceola County and Three Lakes WMA had decreases in the number of wildfires. Osceola County had a pronounced decrease, while the Three Lakes WMA fire occurrence line was nearly level. Brevard County had a fire occurrence trend line that was relatively flat, with a slight increase in fire numbers.

The results on fire occurrence coincide with the amount of prescribed burning that occurred in the study areas. Osceola County had a high level of prescribed burning that increased over time. This county also had the greatest reduction in the number of wildfires. Three Lakes WMA had the

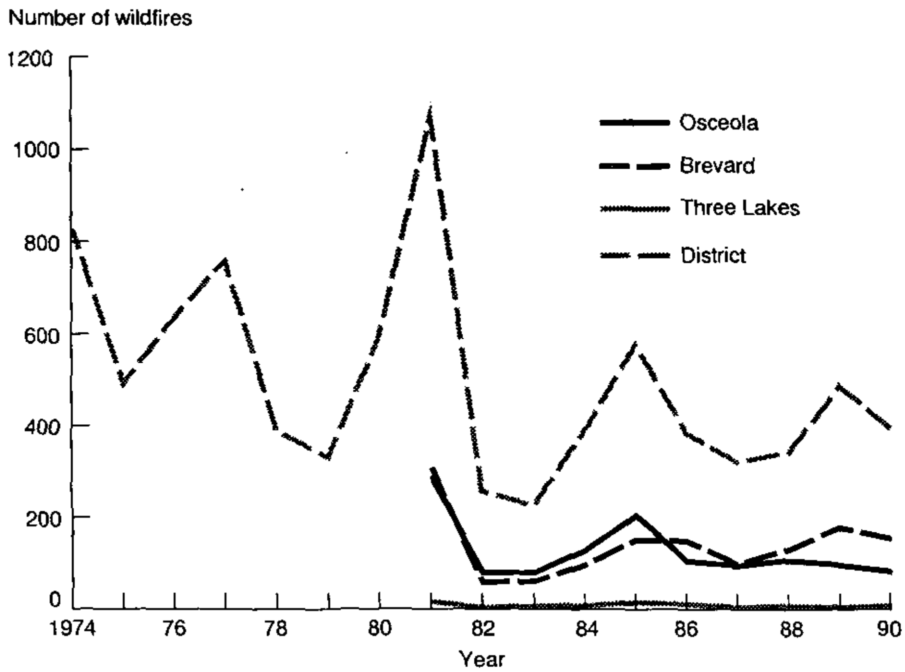

Figure 2—*Orlando District wildfire history—number of fires.*

largest increase in the level of prescribed burning, with a decrease in the number of wildfires. This decrease was not as pronounced as that in Osceola County but was greater than that in Brevard County. There was less prescribed burning in Three Lakes WMA, but the burning was more consistent than in Brevard County. The level of burning increased in Brevard County, but the yearly levels fluctuated widely. Hence, a sustained level of prescribed burning decreases the number of wildfires.

The acres burned by wildfire in the district show a decrease in the trend line from 1974 to 1990. The trend lines for the three study areas show decreases as well. Among the study areas and the district, Osceola County exhibits the highest rate of decrease in acres burned by wildfire. The Brevard County trend line parallels the rate of decrease for the district, and the Three Lakes WMA trend line is virtually flat, with only a minor decrease (fig. 3). In all three study areas, the acres burned by wildfire were reduced. Osceola County had the greatest decrease in acres burned, while Three Lakes WMA had the least reduction in acres burned. Brevard County reflected a decrease that paralleled the district trend line.

The decrease in acres burned by wildfire in Osceola and Brevard counties is related to the percentage of area burned by prescribed fire. Both areas had trend lines of higher percentages burned than Three Lakes WMA. It is anticipated that as the level of prescribed burning increases in Three Lakes WMA, the acres burned by wildfire will decrease.

The trend line for the district average acres per wildfire shows a decrease from 1974 to 1990. Osceola County has the largest decrease in its trend line for average acres per wildfire. The Three Lakes WMA trend line is flat, while the Brevard County trend line exhibits an increase (fig. 4). The effects of prescribed burning on average acres per wildfire were most significant in Osceola County. Brevard County experienced an increase in fire intensity, while Three Lakes WMA had a flat trend line. The benefits of prescribed burning are not so evident when one looks at average acres per wildfire. The benefits exist, but may be influenced by factors such as response time, local weather conditions, and fuel types. Part of this anomaly may be explained by the annual percentages of acres burned by prescribed fire. Brevard County has fluctuating levels of prescribed burned acres, high and low on alternating years. Osceola County and Three Lakes WMA have levels that are more constant from year to year. Even though the trend line for Three Lakes WMA is flat, the benefits from prescribed fire exist. During years of high and low fire occurrence, there was no change in the level of fire intensity. This shows that a sustained burning program can reduce the intensity of fires when conditions for extreme fires exist.

Discussion

The more active a prescribed burning program is, the greater the wildfire prevention benefits provided. The direct benefits are demonstrated by the Osceola County trend lines. The percentage of study area burned by prescribed fire is maintained at a higher level than the other two study areas. The results show a higher rate of decrease than that of the district as a whole and in relation to the other two study areas. Three Lakes WMA has the highest increase in percentage of study area burned by prescribed fire. The level is not sustained, as in Osceola County, and the results on the fire trend lines are not so dramatic. It can be concluded that the prescribed burning program in Three Lakes WMA keeps the number of wildfires, acres burned, and average acres per wildfire at a constant level. This consistency occurs during periods of drought as well as normal weather conditions and can be substantiated through the Brevard County trend lines. The percentage of study area burned by prescribed fire increases at a low rate. The number of wildfires in Brevard County is flat, showing only a slight increase. This trend is parallel to the trend line for percentage of the study area burned by prescribed fire. The acres burned trend line parallels the district decrease, while the acres per wildfire increases when the other study areas and the district decrease.

Brenner (1991) found a correlation coefficient of r = -0.71 between surface sea temperatures in the central and eastern Pacific Ocean and acres burned by wildfires in Florida. In this correlation, 1989 occurs as a peak in acres burned by wildfire in Florida, with a drop in acres burned in 1990. When the linear trend lines are converted to curvilinear trend lines for the Orlando District fire occurrence, acres burned, and fire intensity, peaks in all three areas occur in 1974, 1981, 1985, and 1989—the same years portrayed

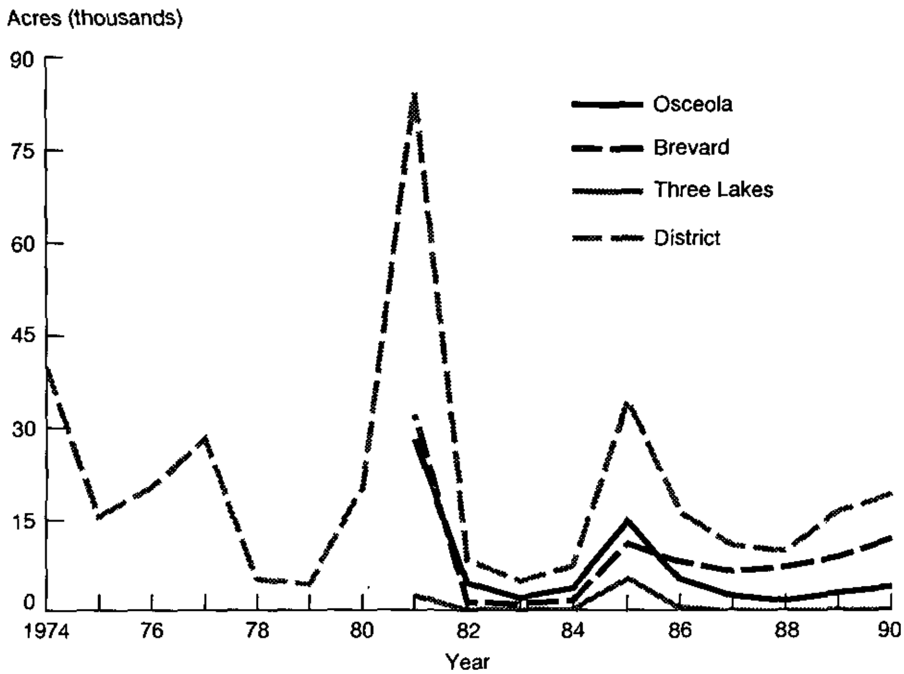

Figure 3—*Orlando District wildfire history—acres burned.*

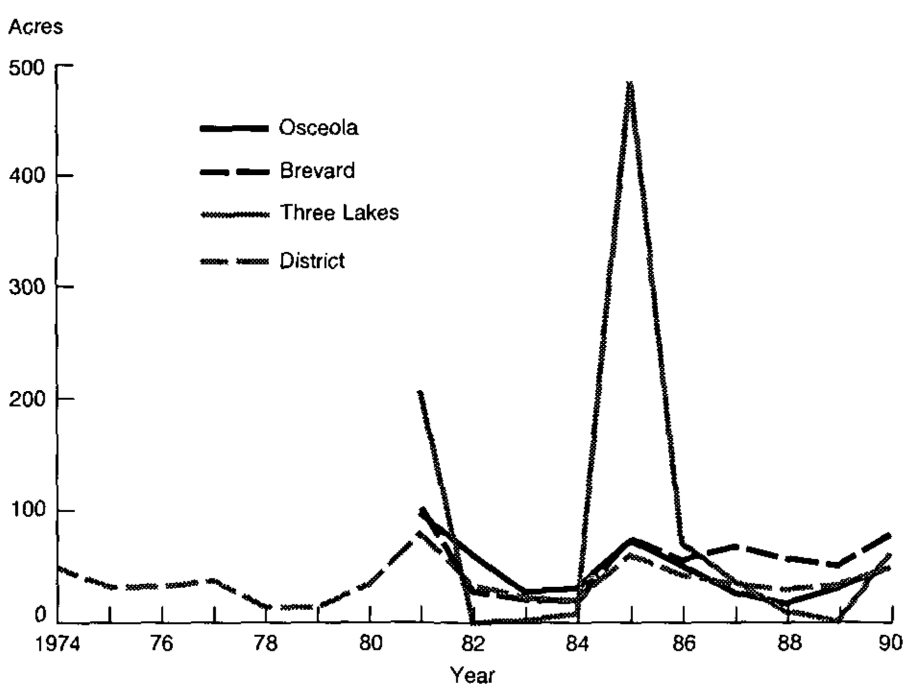

Figure 4—*Orlando District wildfire history—average acres per wildfire.*

in Brenner's model. When linear trend lines are converted to curvilinear trend lines on the three study areas and compared to Brenner's model, a diversion appears. The trend lines for Brevard County all peak in 1989, as do those of the district. The trend lines for Osceola County and Three Lakes WMA remain flat, with no increases in 1989.

The results show that an active prescribed burning program will reduce the number of wildfires, acres burned, and fire intensity. Furthermore, when devastating fire conditions exist, an active prescribed burning program will negate or moderate environmental influences on wildfires. Prescribed burning will not eliminate wildfires, but this practice does reduce the threat posed from wildfires. This is particularly important at the wildland–urban interface. However, homeowners generally object to prescribed fires because of the perceived threat to their homes and the inconvenience created by the smoke and ash.

The effects of prescribed burning are best measured in broad, rather than specific, terms. One can compare fire trends on lands that are actively managed with prescribed burning to fire trends on lands that are passively managed. The resulting trend lines show the overall effectiveness or ineffectiveness of the prescribed burning program better than a statistical 1-year "snapshot" of the program.

Recommendations

The results of this study indicate that prescribed burning is effective in preventing wildfires or reducing their size and intensity when they do occur. More studies should be done to further quantify and document the beneficial effects of prescribed burning as a wildfire prevention tool. The effectiveness of prescribed burning should be documented in reducing the number of wildfires, acreage burned, fire intensity, and cost-effectiveness of prevention versus suppression.

The fire services must:

- Use the information on these benefits to educate fire services, the public, and public officials in order to gain wider acceptance of prescribed burning as a fire prevention tool.
- Promote the active use of prescribed burning by landowners and land managers.
- Seek opportunities to increase prescribed burning through cost sharing.

Where properties are not actively managed and dangerous fuel levels exist, a mechanism to burn the property using prescribed fire should be sought. This could be done by ordinance or law, contracting the practice out, or assigning a fire agency the task. Reimbursement for the work would come from payment by the landowner or a lien placed on the property.

To prevent needless destruction of lives, property, and resources, fire services must use all of the tools at their disposal. Prescribed burning as a tool for wildfire prevention has not been documented fully and is therefore underutilized. ■

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Ignition Management at NARTC

"Ignition Management–A Dynamic Approach to Fire Protection Analysis" will be conducted June 5–9, 1995, at the National Advanced Resource Technology Center (NARTC), Marana, AZ. The course, originally entitled "A Dynamic Approach to Integrated Fire Prevention Planning," has been modified to better provide a broad spectrum of fire's role in a global environment. It is designed to enable participants

- To conduct and complete a fire protection analysis
- To identify the role of fire prevention in fire management planning
- To demonstrate and explain the role of fire protection in ecosystem management

The course is open to practitioners and staff and agency/organizational administrators who have comprehensive fire management responsibilities. Resource specialists whose programs interact with fire management applications and issues are also encouraged to attend. ■

Elsie W. Cunningham, *acting national fire prevention officer, USDA Forest Service, Fire and Aviation Management, Washington, DC*

Shred, Don't Burn—An Alternative for Treating Slash on Steep Terrain

Roy E. Johnson

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Air quality is a growing concern in the Pacific Northwest. State air quality standards, highly populated areas near national forests, and increased sensitivity throughout the USDA Forest Service to ecosystem management and public involvement in resource management affect how fuels can be treated. Yet foresters know that to protect areas from wildfires and to prepare sites for reforestation, heavy slash needs to be cleared. Slash burning as a way to treat fuels is becoming less viable, especially on steep terrain where controlled burning is difficult to manage, because:

- Fire moves very quickly uphill
- Fires on steep slopes are inaccessible, thus difficult to control
- Rolling debris can cause fires downslope

Other ways of treating fuels that protect air quality and have a light impact on the land need to be found. New, robot-like mechanical equipment with appendages like legs that step lightly on the land (disturbing forest soil very little) and can easily maneuver around trees on steep grades appear to offer a workable alternative to slash burning on steep terrain.

Mechanical Slash Clearing vs. Slash Burning

The Hood Canal Ranger District on the Olympic National Forest in Washington State (Region 6) has been experimenting with a piece of equipment called the Spyder™[1] that mechanically shreds slash on steep terrain as an alternative to burning it. The Spyder was originally designed in Germany as a steep slope backhoe and was later imported into the United States. Kemp West, Inc.,[1] redesigned the joy stick control to be more user-friendly for domestic operators and added special attachments to increase the machine's versatility.

As air quality becomes a growing concern, mechanical clearing of slash on steep terrain is emerging as a viable alternative to slash burning.

Evaluating the Equipment's Feasibility

Region 6's Fuels Equipment Development Committee authorized an experimental contract to test whether the Spyder could mechanically treat slash on steep slopes in place of burning. Hood Canal Ranger District staff selected the Blue Ox Timber Sale, Unit 3, as a testing area. Unit 3 covers 14 acres (5 ha) and has slopes exceeding 50-percent grades.

Methods and Materials. The 10-day contract (consisting of 8-hour test days) called for using the Spyder with the shredding attachment to grind and shred fuels on a strip 50 feet (15 meters) wide by 2,000 feet (600 meters) long. Only fuels in the 3 inch (7.6 cm) or less size classes were chosen to be shredded and ground because fine fuels have the greatest impact on fire behavior and hinder reforestation.

Table 1 compares prefuel and postfuel profiles after using the Spyder shredding and grinding equipment.

Other key fuels inventory data were fuel bed depth and duff depth. The pretreated fuel bed depth was 12.3 inches (31.2 cm), while the posttreated fuel bed depth was 3 inches (7.6 cm), yielding a difference of -9.3 inches (-23.6 cm). The duff depth remained at 2.1 inches (5.3 cm) throughout pretreatment and posttreatment.

The information presented in the list below and in table 2 was used in the BEHAVE fire analysis computer program to give the predicted fire behavior for the area tested. The weather station used for the analysis area was Jefferson Creek, located 4 miles (6 km) southwest of the work site.

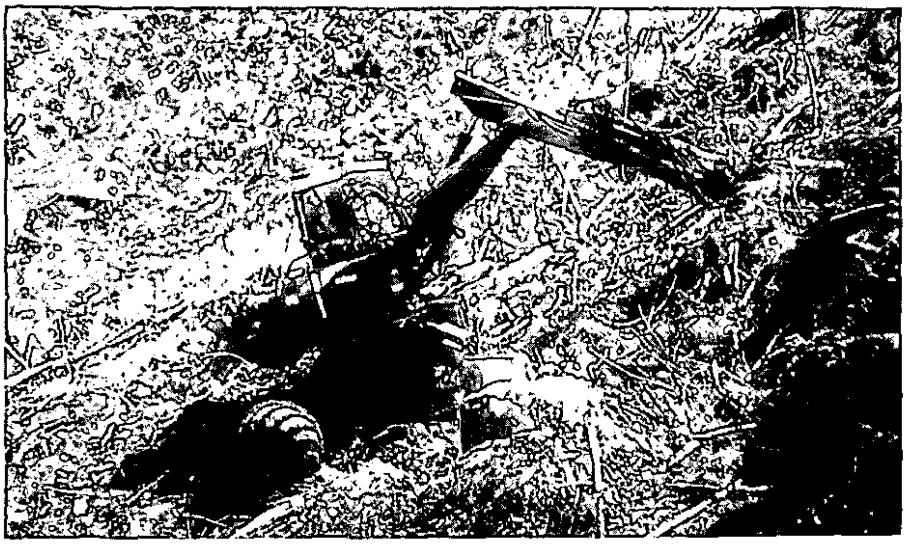
The weather parameters used for the test area were:

- Weather conditions — 10 percent cloud cover
- Temperature — 79 °F (26 °C)
- Humidity — 40 percent
- 1-hour fuel moisture — 5 percent
- 10-hour fuel moisture — 7 percent
- 100-hour fuel moisture — 9 percent
- Live fuel moisture — 100 percent
- 20-foot (6-m) wind speed — 8 mi/h (13 km/h)
- Mid-flame wind speed — 3 mi/h (5 km/h)

Results

The Spyder mulching fuel treatment method tends to increase the fine fuels by approximately 62 percent but reduces the fuel bed depth by 75 percent. Thus, this method reduces the expected fire behavior from 5.2 burned acres (2 ha) to 0.2 acres (.08 ha), a 96-percent reduction that saved $10,880 in costs. If the $2,250 cost of the fuel treatment is subtracted, the to-

[1]The USDA Forest Service does not endorse any product or company mentioned in this article. Trade names are for identification only.



Steep slopes are conquered by new machinery that mechanically grinds and shreds slash, reducing the need for burning. Photo: Roy E. Johnson, USDA Forest Service.

Table 1—*Fuels inventory data for mechanical fuels treatment experiment*

Size class in (cm)	Pretreatment T/acre (t/ha)	Posttreatment T/acre (t/ha)	Difference T/acre (t/ha)
0.0– 0.25 (00.00-00.64)	3.20 (7.17)	0.90 (2.02)	−2.30 (−5.15)
0.25– 1.00 (00.66-02.54)	5.30 (11.88)	10.90 (24.43)	+5.60 (+12.55)
1.00– 3.00 (2.54-07.62)	11.20 (25.11)	20.60 (46.17)	+9.40 (+21.06)
3.00– 6.00 (7.62-15.24)	3.00 (6.73)	1.00 (2.24)	−2.00 (−4.49)
6.00– 9.00 (15.24-22.86)	6.00 (13.46)	1.00 (2.24)	−3.00 (−6.73)
9.00–20.0 (22.86-50.80)	27.00 (60.52)	23.30 (52.23)	−3.70 (−8.29)
20.00+ (50.80+)	0.00	0.00	0.00
Rotten	6.00 (13.45)	2.00 (4.48)	−4.00 (−8.97)
Totals	61.70(138.31)	61.70(138.31)	

Table 2—*Comparison of pretreatment and posttreatment fire behavior in the test area*

Fire behavior outputs	Pretreatment fuel profile	Posttreatment fuel profile
Fuel bed depth	12.3 in (31.2 cm)	3 in (7.6 cm)
Rate of spread	10 chains/h (200 m/h)	2 chains/h (40m/h)
Flame length	5 ft (1.5 m)	2 ft (0.6 m)
Fireline intensity	180 Btu/ft/min (2,524 kJ/m/min)	27 Btu/ft/min (379 kJ/m/min)
Heat per unit	1,107 Btu/ft^2 (4,730 kJ/m^2)	781 Btu/ft^2 (3,337 kJ/m^2)
Area	5.2 acres (2.1 ha)	0.2 acres (.08 ha)
Costs + net value change	$11,315	$435

tal cost savings amounts to $8,630. The per-unit cost of the Spyder may be quite high, but if the cost is spread over the whole area receiving the benefit of the treatment, the cost is well within reason of analysis.

Treatment Cost. The actual treated area was 2.3 acres (0.9 ha), amounting to $987.26 per acre ($2,439.57 per ha) treated. The treatment took 18 hours to complete. If the cost were spread over the total 14-acre (5-ha) unit, the cost per acre works out to a reasonable $160.70 ($397.10 per ha).[2]

Equipment Durability. This heavy-duty machine appears to be durable; there were no major breakdowns during the 80-hour contract. The blade is designed to be periodically rebuilt and rotated, and approximately 15 hours into the contract, two new teeth were welded onto the machine's mulching blade. After 60 hours, the blade was replaced, which is considered normal wear for the mulching attachment. Operators visually inspected hydraulic hoses and fittings daily during the contract and lubricated them as necessary.

Slope. The machine is virtually unlimited by slope. However, the production rate falls off on slopes having grades greater than 60 percent. On slopes exceeding 60-percent grades, winching improves production, especially when the operator is traveling upslope. Winching also reduces the amount of soil disturbance. Lateral movement usually is not feasible on steep terrain. Because the machine

[2]Because procedures vary between agencies and units, this is not a recommendation to report accomplishments in this manner.

makes approximately a 50-foot (15-meter) swath per pass or a 25-foot (7.5-meter) reach on either side of the machine, managers should consider this factor when developing a fuels prescription.

Safety. The possibility of the Spyder rolling over on steep slopes has been reduced by hydraulic check valves. In addition, the machine has both seat belts and a roll cage. Because equipment operators are responsible for the safe placement of the machine and its operation, they should use a winch line whenever it might roll over. Equipment users should also wear normal field clothing with protective equipment such as boots, gloves, hard hat, and goggles.

The machine's cutting head is designed to throw the debris to the operator's front left, but it's possible that debris may fly in any direction. To reduce the amount thrown, a rubber deflector similar to a mud flap is mounted around the base of the cutting head. It may be necessary to use signs and barriers to restrict people from getting close to the machine, especially on the downhill side of the machine where the machine may be dislodging rolling debris. To prevent flying debris from causing injury, all access to the operation within a 300-foot (90-meter) minimum radius should be restricted.

The ranger district staff found that radio communication with the equipment operator was valuable when it was necessary to warn the operator that people were in the area or when someone needed to approach the machine.

Equipment Staffing Considerations

Under this contract, a "swamper" or an assistant to the equipment operator was not included in the operation. In future operations, it is recommended that a swamper be included to add to the safety and productivity of the project. When working on steep slopes where winching is necessary, a chain saw winch with a light 3/16-inch (.5 cm) aircraft cable could be used to haul the winch cable upslope.

Conclusions—Viability and Versatility

The Spyder machinery proved to be a valuable tool in treating fuels on steep terrain. This new technology can offer a viable option and free up limited airshed or result in less degradation of air quality for high-priority burns. For instance, one forestry unit, by mechanically treating slash instead of burning it, can free up a neighboring forestry unit so they can carry out a necessary, high-priority burn and stay within smoke management limits. Better air would result.

Costs of mechanical fuels treatment are relatively high, but, over time, the technique likely will be refined, leading to increased production and reduced costs. When production increases and costs drop, more acreage per unit will become treatable at a more cost-effective rate.

In addition to experimental treatment of slash, the Spyder is now being used in U.S. forests for ditching; resloping ditch edges; grinding and shredding slash and brush along power lines, rights-of-way, and roadsides; feller bunching and loading; grapple piling and loading; stream cleanout and enhancement; culvert cleanout; landscaping; and cement work. Its basic purchase price is $200,000; with attachments, the cost is higher.

Other potential uses for the Spyder may be in areas in which secondary roads are being closed with tank traps, yet where additional work such as erosion control, terracing, and culvert cleanout or removal still need to be accomplished. Another area in which this machine has great potential is fisheries—the Spyder can clean log jams or help build fish structures (i.e., habitat). ■

A Glimpse of the Future

As burning becomes a more restricted forestry practice and smoke management restrictions get tighter on forests, new methods to remove slash will emerge. One future alternative is to use equipment that mechanically grinds and shreds slash.

Robot-like equipment such as the Spyder—suitable for steep terrain because of its leg-like appendages that can walk on forest terrain—may be the slash treatment technology of the future. This kind of mechanical fuel treatment equipment is ecologically attractive because it disturbs the soil very little and even steps around trees. As a result, little harm is done to the soil and forest floor.

A Montana Approach to Rating Fire Risk in Wildland Developments

Michael T. DeGrosky

Fire program manager, Montana Department of State Lands, Northwestern Land Office, Kalispell, MT

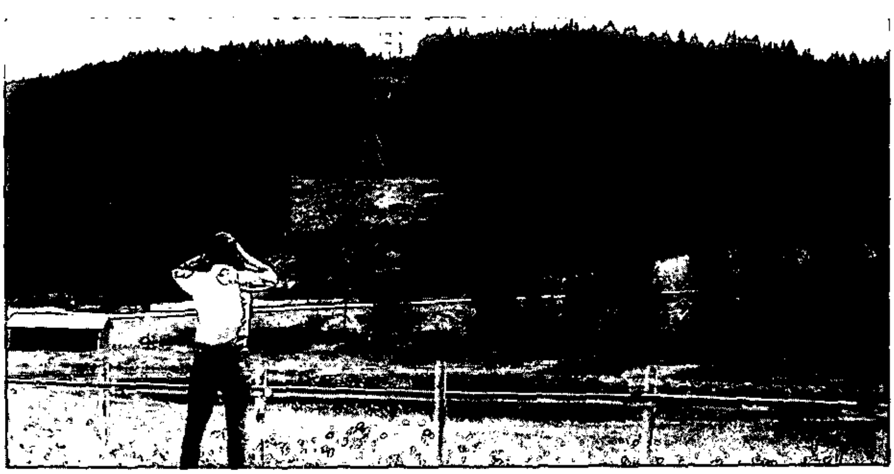
- An interagency team briefs 60 planning board members, elected officials, and influential citizens on the dangers of residential wildland development. An informed coalition, committed to safer development, results.
- A fire supervisor, faced with operating budget cutbacks, sets priorities for fire prevention patrols. His unit saves thousands of vehicle miles and reduces fire occurrence in its major cause categories.
- A local fire official evaluates a planned development and makes recommendations to the planning office. The development is approved with conditions requiring defensible space, Class A roofing, and adequate access.

What do these events have in common? All used a fire prevention "tool" developed by the Montana Department of State Lands (DSL) to guide efforts to confront interface fire problems.

That tool is a system documented in "Fire Risk Rating for Existing and Planned Wildland Residential Interface Development in Montana" (Montana DSL 1993). The system helps users to assess the wildfire risk associated with planned or existing residential–wildland situations or "rating areas." Any wildland development can constitute a rating area.

The Montana DSL has provided the fire service with one solution to the problem of wildland–urban interface fire protection that can be adapted and used elsewhere.

Montana's risk-rating system uses existing standards and knowledge and is objective. The first chapter of the document enables local fire officials to compare rating areas against one another to establish or help establish priorities for using fire prevention and presuppression resources. With information from the risk-rating system, fire specialists can target fire prevention and readiness actions by putting their limited time and money into areas that have the greatest potential for disaster. The second chapter enables fire officials to proactively evaluate proposed developments.



Bill Glaspey, Montana DSL fire team leader, conducting risk rating in the Lake Hills subdivision of Kalispell, MT. Photo: Michael T. DeGrosky, Montana DSL, 1992.

Efficient and Frugal Protection

The Montana DSL directly protects 5 million acres (2 million ha) of wildlands from fire as well as safeguards an additional 44 million acres (17.8 million ha) through its Cooperative County Program. After losing over 90 structures to wildfires in 1984, fire officials in Montana began to focus on the interface issue.

Because we are a vast State with a limited tax base, the Montana DSL must be frugal with our citizens' taxes. So we were glad to develop a tool that not only is inexpensive, but is also simple to use and does not require a lot of time or equipment.

Since we have implemented this system, we have discovered additional benefits to our prefire planning efforts. Current applications include combining the mapped risk-rating results with other planning data, such as fire occurrence, to establish engine patrol areas and plan initial response.

Our system is evolving, and we are studying ways to improve our information storage and retrieval without sacrificing cost-efficiency. For example, we will shortly begin a pilot project to link risk rating with geographic information systems.

Rating Existing Developments

Using the Montana system, a technician can evaluate an existing 160-acre (65-ha) rating area containing 30 homes in about 3 hours. A two-person team can accomplish a great deal more in the same time.

We first identify and map general interface zones by aerial reconnaissance. Aerial photos, if complete and current, can substitute for aerial reconnaissance. Our field personnel then refine those interface zones into individual rating areas. We could define detailed rating areas from the air or photos only but have chosen to rely on additional ground observations to refine them.

A rating area should be relatively homogenous, have similar site factors, and be large enough to include a representative portion of the surrounding terrain, fuels, and fire occurrence. This may be an entire community, a subdivision, a cluster of buildings such as a ranch or camp, or simply an area containing scattered residences. Changes in fuel type, road system, community identity, or other factors may mean that our fire supervisors will split interface zones into separate rating areas. Although at one point individual residences are assessed, the system is not intended to rate individual properties but the rating area as a whole.

Our rating personnel collect information on two forms (see fig. 1), evaluating and recording such factors as:

- Road access and egress
- Bridge capacity
- Slope and aspect
- Topographic features contributing to fire spread
- Fuels (Our process utilizes fuel types rather than detailed fuel models.)
- Risk sources
- Electrical service (The rating personnel determine whether the area's electrical service is above or below ground. If it is above ground, they evaluate the condition of the right-of-way through the rating area.)
- Number of homes
- Roofing
- Home construction "heat traps"
- Building density

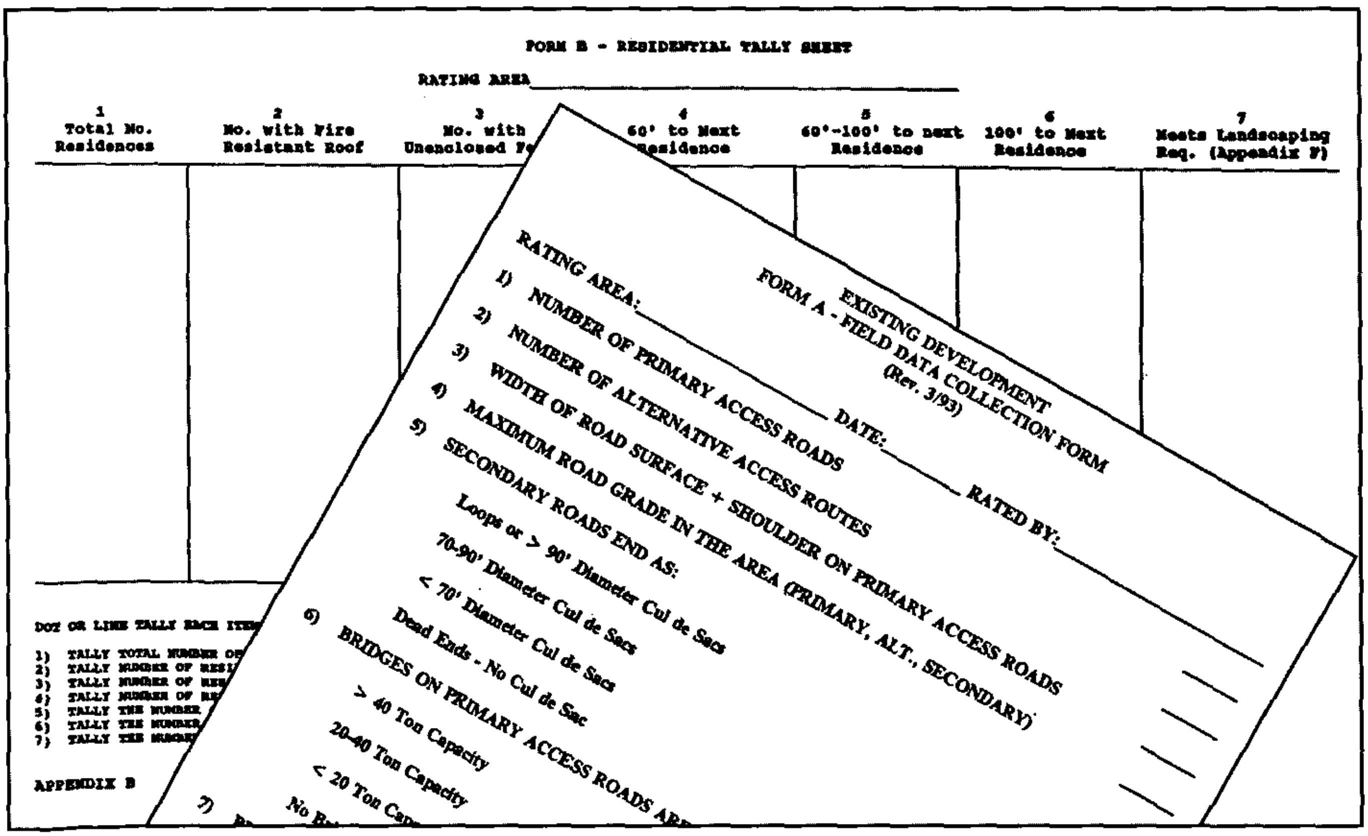


Figure 1.—*Two of the forms used for risk rating—the "Field Data Collection Form" for existing development and the "Residential Tally Sheet."*

HELICOPTER DIP SPOTS - Item 23

- Under 2 min. turnaround (<1 mi.) = 1
- Within 2-5 min. turnaround (1-2 mi.) = 2
- Within 6 min. turnaround (3 mi.) = 3
- Beyond 6 min. turnaround or Unavailable = 4

STRUCTURAL FIRE PROTECTION - Items 24 and 25

- <= 5 min. from fire department = 5; if VFC = 10
- 6-15 min. from fire department = 10; if VFC = 15
- 16-30 min. from fire department = 15; if VFC = 20
- No RFD, FSA, municipal fire district or VFC? = 20

HOMEOWNER CONTACT - Items 26 and 27

- Central contact - formal/well organized group (e.g., a homeowners assoc.) = 5
- Less central contact - an informal/loosely organized group (e.g., a civic club or development office) = 10
- Multiple groups - different contacts representing different parts of the community = 15
- No organized contacts = 20

FIRE OCCURRENCE - Item 28

- .00-.10 Fires/1000 ac./10 yr. = 5
- .11-.20 Fires/1000 ac./10 yr. = 10
- .21-.40 Fires/1000 ac./10 yr. = 15
- .40+ Fires/1000 ac./10 yr. = 20

TOTAL SCORE ______

Figure 2.—*Fourth page of the "Rating Form" for existing development; input comes from the field forms.*

- Defensible space and fire resistant landscaping (The DSL has adopted fire-safe landscaping standards.)
- Hydrant service
- Draft sources
- Helicopter dip spots
- Fire department coverage and response time
- Homeowner or community organization
- 10-year wildfire occurrence (We have greatly expedited this process by maintaining an updated, computerized database.)

We use a third form to actually rate or compute a numerical score for each area (fig. 2). The person completing this form requires little technical expertise since the form is objective, the input comes from the field forms, and the instructions are easy to follow. The scoring range classifies the rated area into one of five categories:

- Low risk and low priority
- Moderate risk and moderate priority
- High risk and high priority
- Very high risk and very high priority
- Extreme risk and extreme priority

Rating areas are also ranked within those categories. For example, 136–150 points defines the range for the "high" category. A development scoring 149 points would represent a higher risk than a community scoring 137 points, although they both fall within the same category. The relatively riskier development would therefore have a higher priority for receiving prevention programs.

Our fire staff can combine risk-rating results with fire occurrence records, fuel hazard maps, and other planning data. This enables us to take a more intensive, compartmentalized look at locations where we have the most to lose. These often coincide with our areas of greatest fire frequency.

We use the results to prioritize areas for nearly all of our fire prevention activities including:

- Public contact patrols
- Railroad right-of-way maintenance
- Burning permit restrictions
- Power line maintenance
- Homesite inspections
- Subdivision review

We also make excellent use of our risk-rating information to educate city and county planning boards, county commissioners, fire district trustees, and the public about critical fire problems in our fire-protection areas.

Rating Planned Developments

The Montana system includes a method to proactively assess proposed developments in wildland or rural areas that may pose a fire hazard or risk. A fire specialist having basic familiarity with subdivision plats can evaluate most planned developments in an hour or two following a site visit.

For developments in the planning process, the project proposal or subdivision plat essentially defines the rating area, which can be as large or small as necessary. However, our personnel refine the rating area, depending on the nature of the development and the surrounding environment.

continued on page 26

"Fire Protection in Rural America" Report Available

Bill Terry

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"Fire Protection in Rural America: A Challenge for the Future" is now available to the public. It is a "report to the Congress of the United States and other policymakers with recommendations for improving the protection of rural America from the ravages of uncontrolled wildfires" and was written by the Rural Fire Protection in America Steering Committee.

In 1992, the National Association of State Foresters (NASF) convened a consortium of national fire and emergency response agencies and organizations to focus on the effective delivery of fire and emergency services in rural America. This consortium subsequently formed the Rural Fire Protection in America (RFPIA) Steering Committee, representing the National Volunteer Fire Council, the USDA Forest Service, the National Emergency Management Association, the National Fire Protection Association, the U.S. Fire Administration, the National Wildfire Coordinating Group, the Congressional Fire Services Institute, and the NASF.

The report points out that per capita, more lives and property are lost to fire in rural communities than in urban areas. Some statistics:

- People in communities with populations lower than 2,500 are almost twice as likely to die in a fire as people living in communities with populations of 10,000 to 99,999 (Karter 1992).
- Compared to city dwellers, rural homeowners suffer more than twice the property loss from fire each year (Karter 1992).
- In 1992, nearly one-fourth of all firefighter deaths at the actual site of a fire occurred at uncontrolled wildland fires—all of those who died were volunteer firefighters (Washburn et al. 1993).

The RFPIA report to the Congress of the United States and other policymakers points out that per capita, more lives and property are lost to fire in rural communities than in urban areas.

In 1991, William P. Meade conducted a study to determine the cost of providing fire protection in America for the Center for Fire Research at the National Institute of Standards and Technology. One of the findings was how valuable volunteer firefighters, who protect most rural areas, are to America. Meade (1991) computed the cost of converting volunteer firefighters to paid firefighters by multiplying an estimated 964,500 volunteer firefighters concurrently serving times an annual average salary of $38,196 per firefighter. He found that the volunteers represent a national conversion cost of $36.8 billion per annum.

These volunteers benefit the taxpayer at no cost or at a greatly reduced cost compared to career firefighters. And while historically they have had an admirable tradition of service to their communities, they are the first to admit that *they need assistance in organization, training, and equipment to become more efficient in dealing with the rural fire problem.*

The RFPIA Steering Committee determined that its goals should be to increase the understanding and awareness of the importance of rural fire protection by finding and disseminating answers to the following questions:

- How is rural fire protection currently provided?
- What happens when there is inadequate or inefficient fire protection?
- Whose responsibility is it to prevent rural fires?
- What impact do fire losses have on both rural communities and on insurance rates throughout America?
- How can we fund rural fire protection when values protected increase and fire protection dollars decrease?
- Why is rural fire protection necessary to those who live in rural areas as well as to the rest of the U.S. citizens?
- Is rural fire protection the responsibility of local governments only?

To help achieve its goals, the RFPIA Steering Committee made a comprehensive study of rural fire protection in America. This study included a survey of over 35,000 fire departments that protect populations of 100,000 or less and analyses of the results of the survey. It also included field visits to fire sites in California, Florida, and West Virginia, followed by analyses of each of these visits.

From the results of the survey and field visits, the steering committee found that:

- Rural fire protection in America is provided through a loose-knit, multijurisdictional partnership, with each partner representing an essential building block in the system.
- Significant and unacceptable losses occur when these partners are unable to share their resources and coordinate their response actions.

Bare foundations serve as a reminder of the October 1993 Laguna Beach fire. Protecting lives and property in America's rural and suburban areas is an increasing problem of national importance. Photo: Bill Terry, USDA Forest Service, 1994.

- Responsibility for preventing rural fires is shared by each homeowner, landowner, fire service unit, and governmental entity.
- Rural fire losses impact rural communities directly and negatively, but they also drive up the costs of protection and fire insurance for everyone.
- As fire protection dollars continue to decrease while values protected continue to increase, it is important to use the dollars that are available for the greatest benefit.
- Fire protection is absolutely essential to the conservation of America's natural resources and to rural economic stability.
- All levels of government—local, State, and Federal—must cooperate to help provide rural fire protection by coordinating resource mobilization, training, and equipment.

Recurrent themes of the comprehensive study and this accompanying report are (1) the importance of local, rural fire departments to the rural fire and emergency response system in this country and (2) the critical need to integrate all rural fire and emergency response activities under a common incident management system.

The committee hopes this report will be a useful model for other agencies, organizations, and institutions. They also hope that each individual, organization, and governmental entity with responsibility for fire prevention and emergency response will assume ownership of the findings and cooperate in the continued search for long-term, cost-effective solutions to the problems inherent in the protection of our Nation's rural areas against wildfires. The rural fire service is a national asset that has too often been taken for granted. If it is to be the foundation of the fire and emergency response system in rural America in the next century, it must be recognized, supported, coordinated, and enhanced.

Anyone wanting to obtain a copy of the report can receive it by sending a request to Rural Fire Protection in America, USDA Forest Service, Northeastern Area State and Private Forestry, P. O. Box 6775, Radnor, PA 19087-8775. ■

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Cooperative Education: A Personnel Pipeline

Rhonda Toronto

Co-op program manager, USDA Forest Service, National Interagency Fire Center, Branch of Telecommunications, Boise, ID

Where does the USDA Forest Service or the USDI Bureau of Land Management go to find highly qualified, diverse, entry-level technicians? Electronics technicians and telecommunications specialists fitting those descriptions can be hired from the National Interagency Fire Center (NIFC), Branch of Telecommunications, Electronics Trainee Program—a "personnel pipeline." The program is funded by the Forest Service's Washington Office, Fire and Aviation Management, Workforce Diversity Program.

Cooperative education students attend college and spend approximately 4 hours per day getting "hands-on training" in radios, telephones, and data communications at NIFC. They also spend their summer breaks working on a sponsoring forest as a trainee, where they get mountain-top repeater experience, mobile installation experience, and an understanding of the type of work that forest electronics technicians and telecommunications specialists encounter on a day-to-day basis.

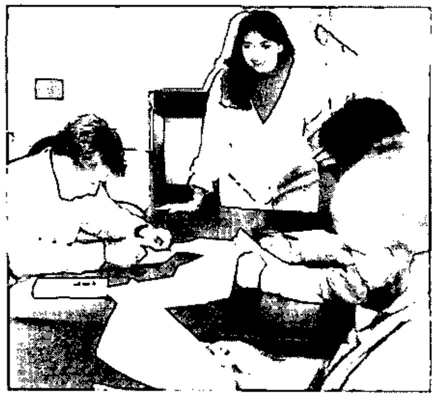
The program has been highly successful: from 1991 to 1994, 15 students have been placed in permanent positions with the Forest Service in 7 regions; 2 students were placed by the Bureau of Land Management at the NIFC Branch of Telecommunications.

Some Success Stories

- Lincoln Cowan graduated from the program in the spring of 1992 and now has a permanent position on the Ouachita National Forest in Region 8, where he maintains mountain-top repeaters, base stations, and mobile and hand-held radios.

After cooperative education students graduate from the NIFC, Branch of Telecommunications, Electronics Trainee Program, they are highly successful in finding positions with the USDA Forest Service and the USDI Bureau of Land Management.

- Graduating in the spring of 1992, Julie Drake has a permanent position on the Prescott National Forest in Region 3. She assists in the maintenance of the forest net radio system and telephone system.
- Robin German graduated in the fall of 1991. She has a permanent position on the Caribou National Forest in Region 4, where she's in charge of all the telecommunications, radio, voice, and data. Her job entails pulling wire; repairing radios, phones, and modems; and maintaining mountain-top repeaters and base stations. Robin also handles frequency coordination, ordering Federal Telephone Service equipment, supplies, and services; maintaining inventories; and handling all the other assorted paperwork that is necessary to keep a telecommunications shop in business.
- Dianna Knadel graduated in the spring of 1992 and has a permanent position on the Payette National Forest in Region 4. She works on King hand-held radios and the MITEL telephone system.
- Marco Munoz also graduated from the program in the spring of 1992. He has a permanent position on the Malheur National Forest in Region 6, where he is assisting in the upgrading of the entire radio system and also works on telephones and data.



Rhonda Toronto (standing) instructing co-op students in radio repeater and duplexer theory as part of their training in the NIFC, Branch of Telecommunications, Trainee Program. Photo: Tiana Glenn, NIFC, 1992.

- A graduate in the spring of 1991, Gary Stewart has a permanent position on the Colville National Forest in Region 6. He assists in the maintenance of mountain-top repeaters and base stations, solar and wind power systems, and hand-held and mobile radios. Gary also works on the telephone systems for the Supervisor's Office and five ranger districts, and does all telephone and data wiring for the forest.
- Juan Vargas, who has a permanent position on the Chequamegon National Forest in Region 9, graduated from the program in the spring of 1991. He works in a shared services position with both the Nicolet and the Chequamegon National Forests, where he is responsible for installation, maintenance, procurement, testing, and modification of existing and new equipment.
- Ann Mavencamp graduated in 1991 and works at the NIFC, Branch of

René Suarez, student, and Rhonda Toronto, instructor, working on radio repeater and duplexer theory. Photo: Tiana Glenn, NIFC, 1992.

Telecommunications, in Boise, repairing hand-held radios for the National Incident Radio Support Cache.

- Woody Smith graduated in 1989 and works in field operations at the NIFC. He has been the communications unit leader on numerous fires and other natural disasters.

Other recent graduates of the program include Bret Lane on the Routt National Forest in Region 2; Brian Rowan on the Bridger-Teton National Forest in Region 4; and Jack Archer on the Manti–La Sal National Forest in Region 4.

We are currently training nine students. Students are selected from Boise State University's College of Technology and ITT Technical Institute, where they are pursuing their Associates Degree in Applied Science, Electronics. They are hired based on factors such as grade point average, previous experience, faculty recommendations, and personal interviews.

One of our students was on the "reduction in force" list in Region 6. The forest determined that it would be more cost-effective to retrain her to work in telecommunications, where they had a current opening and she had expressed interest. She attends Boise State University to learn electronics theory and works with other Electronics Cooperative Education students to get the hands-on training that is necessary for her to become a highly qualified technician.

The curriculum is constantly changing and expanding to train the students in new technologies. For example, we have incorporated telephone training, which includes PBX (Private Branch Exchange) programming, installation, and wiring. In preparation for the Forest Service's Project 615, we are also training in fiber optics and local area networks. New radios now have to be programmed and tuned with a computer, so our students work with personal computers. We have several different programs on radios that are set up in a "Windows" environment, which they are required to learn and use. In the future, we will begin working with video and satellite technologies as they become more viable.

With the training being conducted at NIFC, Branch of Telecommunications, the students have the advantage of drawing on the expertise of technicians who work at the National Incident Radio Support Cache. Our technicians tune and repair repeaters, duplexers, and radios every day, which gives them a chance to work with people who have solved more technical problems with the equipment than the manufacturers have probably dealt with. As the co-op program manager, I bring my background in telecommunications from the Colville National Forest to teach students not just about radios and repeaters, but telephones and data too.

Former co-op student Ann Mavencamp working at her bench on a hand-held radio that has just been returned from a fire. Photo: Tiana Glenn, NIFC, 1992.

We have our own engineering lab to design and build communications equipment as we see a need, such as the ground-to-air aircraft link that is now used extensively on fires. Often the students are involved in manufacturing these new systems. The variety of test equipment available for them to work with is also an advantage that would be hard to duplicate elsewhere. For instance, before graduating, the students must have worked extensively with several different types of service monitors, oscilloscopes, and power supplies.

Readers with questions regarding the Electronics Technician/Telecommunications Technician Trainee program should call Rhonda Toronto at 208-387-5666 or 208-387-5484 (fax), or write to her at NIFC, 3833 S. Development Avenue, Boise ID 83705-5354. Her Data General address is R.Toronto:W02A, and her Internet address is fswa/s=r.toronto/ou=w02a@mhs.attmail.com. ■

African-American Smokejumpers Help Celebrate Smokey's 50th

Carl Gidlund

Public affairs officer, USDA Forest Service, Upper Columbia River Basin Environmental Impact Statement team, Boise, ID

Thousands gathered on the Ellipse in Washington, DC, on August 9, 1994, to help celebrate Smokey Bear's 50th anniversary. Among them was a small group of World War II Army veterans to whom the fire prevention bear owes a huge debt.

They were members of the first African-American airborne unit, the 555th Parachute Infantry Battalion. In 1945, they helped save millions of acres of Northwest forests from fires ignited by lightning and balloon bombs.

Not only did the "Triple Nickles" fight fire, always a dangerous job, they labored in the riskiest arm of the profession. They were smokejumpers. The unit, formed and trained at Army posts in Georgia and North Carolina, was shipped west after balloon-borne fire bombs, launched into the jet stream above Japan, began landing in west coast forests. These bombs had helped trigger the first Smokey Bear fire prevention program the year before. Authorities feared that the balloon bombs, coupled with a dry summer, would spark a fire storm that would blacken the forests of the Western United States and Canada.

Among those helping celebrate Smokey Bear's 50th were veterans of the "Triple Nickle" Parachute Infantry Battalion.

Indeed, the crackling hot spring of 1945 produced lightning storms, and with most trained firefighters under arms, the Forest Service asked the Army for help. The War Department responded by assigning the job to the 555th, and in military fashion, dubbed their new assignment "Operation Firefly."

A group of "Triple Nickle" loadmasters heft fire gear into an Army Air Corps C-47 at the Pendleton, OR, smokejumper base. Photo: Army Signal Corps, 1945, courtesy of Carl Gidlund, USDA Forest Service, National Forests and Grasslands in Texas.

Army paratroopers of the 555th Parachute Infantry Battalion stand at ease during inspection. The men were issued the usual "let-down" ropes and football helmets with wire face masks, but wore sheepskin outer garments rather than canvas smokejumper suits. Photo: Army Signal Corps, 1945, courtesy of Carl Gidlund, USDA Forest Service, National Forests and Grasslands in Texas.

A former battalion officer, retired Lt. Col. Bradley Biggs, recalls the mission in a unit history, "The Triple Nickles" (1986):

> Working in teams . . . we would be on emergency call to rush to forest fires in any of several western states and join with the Forest Service men in suppressing the blaze.
>
> At the same time, we would be prepared to move into areas where there were suspected Japanese bombs, cordon off the area, locate the bombs and dispose of them.
>
> We knew how to jump from airplanes. But the heavily forested areas of the Northwest presented drop zones that were more difficult and dangerous than any we had faced before.

> We knew how to handle parachute lines. But here we would be using a new type of 'chute—one with special "shroud lines" for circling maneuvers. We knew how to read military maps. But the Forest Service maps were something new. We were used to explosives, but we had little, if any, experience in the disarming of bombs.
>
> Firefighting, of course, was an entirely new experience (Biggs, 1986).

The colonel recalls that the Forest Service and the Army put the paratroopers through an intensive 3 weeks of training. In addition to firefighting and "let downs" for tree landings, training included "jumping into pocket-sized drop zones studded with rocks and tree stumps, survival in wooded areas, and extensive first-aid training for injuries—particularly broken bones" (Biggs 1986).

The Forest Service had been parachuting men to Northwest fires since 1940 and had developed specialized equipment in addition to the steerable parachutes. That included football helmets with wire face masks for which the paratroopers traded their GI-issue steel helmets. The new headgear protected the jumpers' faces as they crashed through trees to the forest floor.

However, the new smokejumpers had to don heavy, fleece-lined flying jackets and trousers, rather than smokejumper canvas jump suits, to protect their bodies from whipping tree limbs.

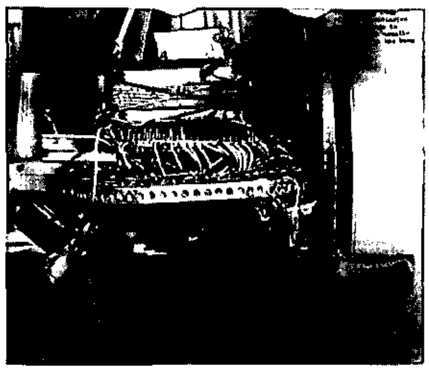
The colonel writes of the troopers' association with the Forest Service personnel: "They were a fine group of men. They could walk up the hills like a cat on a snake walk. They taught us how to climb, use an axe, and what vegetation to eat" (Biggs 1986).

Five representatives of the 555th Parachute Infantry Battalion assemble on the stage at "Smokey's 50th — A Celebration on the Ellipse." Their battalion was also celebrating its 50th anniversary, and in honor of their efforts in fighting wildfires, the "Triple Nickles" received Distinguished Service medallions at the event. Left to right, Lt. Col. Bradley Biggs, North Palm Beach, FL; 2nd Lt. Walter Morris, Palm Coast, FL; 1st Lt. Jesse Hickerson, Washington, DC; T. Sgt. Ted Lowry, Norwalk, CT; and 1st Sgt. Hubert Bridges, Detroit, MI. Photo: Karl Perry, USDA Forest Service, Washington, DC.

After three training jumps with their new gear, battalion members were dispatched to two bases. The largest contingent was stationed in Pendleton, OR, for deployment to bombs and fires in Oregon, Washington, Montana, and Idaho. The other group worked out of Chico, CA, to provide the same coverage for nearby forests.

From mid-July to early October 1945, the African-American smokejumpers participated in 36 missions and amassed more than 1,200 jumps. Their job, recalls Colonel Biggs, was tough.

> We planned on being dirty and smelly for the duration of any mission, which lasted an average of four to six days. Sometimes we operated in Canada to keep fires out of the U.S.



A side view of the ballast-dropping device on a balloon bomb. The jet stream carried the bombs across the Pacific to Northwest forests during 1944 and 1945. Photo: Army Signal Corps, circa 1945, courtesy of Carl Gidlund, USDA Forest Service, National Forests and Grasslands in Texas.

> We blew up only those bombs that represented a danger. The bomb disposal unit would retrieve others for delivery to intelligence personnel (Biggs, 1986).

The battalion suffered casualties. For instance, one man was killed while attempting to lower himself from a 150-foot tree with a smokejumper let-down rope. He slipped or lost his grip and plunged to the rocks below. Thirty others suffered injuries that included a crushed chest, broken legs, and a fractured spine. But the future was hopeful, as Biggs writes:

> By late autumn 1945, it became apparent that Operation Firefly was nearing its end. The hot dry season would soon be over. More important, a rapid demobilization of the military was underway. Civilians would resume many operations that had been assigned to military units, including ours (Biggs, 1986).

The battalion was shipped back to North Carolina, where it was initially assigned to the 13th Airborne Division and then to the 82nd Airborne Division.

Nearly a half-century later, Secretary of Agriculture Mike Espy and Forest Service Chief Jack Ward Thomas honored the men of the 555th Parachute Infantry Battalion. They received the 50th Anniversary of Smokey Bear Award for Distinguished Service in Support of Wildfire Prevention. If you were on the Ellipse in Washington, DC, for Smokey's 50th, you saw a knot of senior African-American vets, who looked fit enough to be smokejumpers today. They were standing mighty tall. ■

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A Montana Approach *continued from page 19*

Subdivisions, phases, or plats covered under a "Planned Unit Development," "Neighborhood Plan," "Overall Development Plan," or similar document are usually separated. In addition, we will rate a single development in separate parts if those portions are somehow unique.

Chapter II of Montana's risk-rating document (Montana DSL 1993) contains one less form than Chapter I and a few altered elements but essentially operates like the risk-rating process for existing developments. The extra form is unnecessary because the rater is not evaluating existing properties. The rater completes a data collection form to record information from the site and the plat map. The rating can then be made on a separate form that can be completed by a staff member with little technical expertise. The scoring range for planned developments has the same five categories used for existing developments.

Our fire staff has found this risk-rating method to be quite useful in areas where we are experiencing residential growth in our wildland fire protection areas. Our staff can efficiently evaluate a proposed development using established criteria; communicate concerns to citizen boards, elected officials, and developers; and influence planning and development in our jurisdiction.

We envision that this approach will become critical to us as the pace of growth surpasses our ability to fund additional suppression resources.

Summary

We, at the Montana DSL, have rated over 500 existing communities and evaluated more than 100 proposed developments using our risk-rating system and find that it helps our fire managers target fire prevention and public education efforts, plan preattack strategies, develop initial attack guidelines and responses, and plan for evacuation.

Recently we also used our risk-rating data to brief the steering committee and the consulting firm that are rewriting the county master plan in Montana's fastest growing county. As a result of that effort, the master plan will include development standards for fire protection.

National experts have called wildland–urban interface fire protection "a national problem with local solutions." The Montana DSL has provided the fire service with one such solution that can be adapted and used elsewhere.

Readers interested in obtaining a copy of the "Fire Risk Rating for Existing and Planned Wildland Residential Interface Developments in Montana," including all the necessary forms and instructions, should contact Prevention Supervisor; Montana DSL, Division of Forestry; 2705 Spurgin Rd.; Missoula, MT 59801; tel. 406-542-4300; fax: 406-542-4242. ■

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Montana Department of State Lands. 1993. Fire risk rating for existing and planned wildland residential interface developments in Montana. Missoula, MT: Montana Department of State Lands. 47 p.

Letter Restating USDA Forest Service Policy on Harassment

The following letter restating USDA Forest Service policy on harassment in the workplace was sent by Joan M. Comanor, Forest *Service Deputy Chief, and Mary Jo Lavin, then Acting Director of Fire and Aviation Management, to all Forest Service firefighters.*

United States Department of Agriculture | Forest Service | Washington Office | 14th & Independence SW P.O. Box 96090 Washington, DC 20090-6090

Reply to: 1700/5100 **Date:** May 31, 1994

Subject: National F&AM Policy on Harassment on the Fireline

To: Regional Foresters and Area Director

The national policy of the Forest Service ensures a harassment-free workplace. In fire and aviation management, our workplace is the fireline as well as the office.

Staff sometimes mistakenly consider a remote location or the incident environment enough of a departure from the usual workplace to depart from acceptable workplace behavior. We in the fire community must correct this misconception wherever we find it.

HARASSMENT IN ANY FORM IS NOT ACCEPTABLE AND WILL NOT BE TOLERATED. Each fire incident this season is an opportunity to reinforce the message of the Department of Agriculture and the Forest Service:

HARASSMENT--IT COULD COST YOU YOUR JOB AND A WHOLE LOT MORE!

We ask your personal commitment and support for the fire organization to spread this message that harassment in any form involving Forest Service personnel will not be tolerated.

Mary Jo Lavin

MARY JO LAVIN
Acting Director
Fire and Aviation Management

Joan M. Comanor

JOAN M. COMANOR
Deputy Chief

Enclosure

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Readers wishing to receive the complete "Harassment-Free Workplace Policy" should contact Fran Russ, General Manager; *Fire Management Notes;* USDA Forest Service; Fire & Aviation Management; P.O. Box 96090; Washington DC 20090-6090; telephone 202-205-0891.