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ARKANSAS' INCENDIARY WILDFIRE RECORD: 1983-1987

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ABSTRACT

All wildfire reports from lands protected by the Arkansas Forestry Commission for the calendar years 1983 through 1987 were studied. The number of wildfires steadily increased from 2,185 in 1983 to 4,150 in 1987, burning a total of 27,146 hectares in 1987. Incendiarism on forested lands in 1987 comprised 77% of the total fires and 84% of the area burned. Incendiarism was responsible for 40% of all fires and 60% of the area burned in 1983, but increased to 54% of all fires and 69% of the area burned in 1987. In 1987, 80% of all incendiary fires on industry lands were started by local residents. Most incendiary fires occurred on Class 3 (52%) and Class-2 (27%) fire-danger class-days. More incendiary fires (64%) occurred during the spring fire season (January through June). The general public reported 66% the non-incendiary fires, but only 56% of the incendiary-cuased fires. Implications of these findings for wildfire prevention programs are discussed.

INTRODUCTION

There is strong archaeological evidence documenting man's use of fire (Brown and Davis, 1973). Innumerable uncontrolled encounters no doubt predate this evidence. While controlled combustion as a tool has molded modern civilization, uncontrolled fire tends to disrupt civilized patterns, destroy property and provoke primitive responses from humans. Reports of broad-scale conflagration, such as the Yellowstone National Park fires in the summer of 1988, kindle responses of fear, anger and wonder on the part of land managers, legislators and the general public. Few individuals remain without opinion in the face of such loss.

It is, perhaps, man's primal reactions to wildfire that have prompted its use as a weapon of fear and destabilization. The use of fire as an implement of terror is recorded in the Bible with Samson's raid using jackals carrying torches to incinerate Philistine crops (New English Bible, Judges 15:1-8). In 1943, the American and British Royal Air Forces used saturation fire bombing to create cataclysmic fire storms in Hamburg, Germany (Middlebrook, 1981). The successful intent was not only to destroy military targets, but to demoralize the German population. In a similar manner, incendiarists today may use wildfire as a weapon against landowners to redress real or perceived offenses. Incendiarism in response to changes in private land management practices is abundantly documented in Arkansas and elsewhere (Kluender *et al.*, 1988; Bradshaw and Huff, 1985; Bertrand *et al.*, 1970; Bertrand and Baird, 1975). Finally, some individuals set forest and open-land fires on their own and other's lands due to a misunderstanding of fire's ecological effects. Because many individuals who set fires are ignorant of fire behavior or over-estimate their ability to control fire, many fires escape control and culminate in wildfires. To fire-fighters, however, why fires were started makes little difference; smoke and heat have the same effect, regardless of ignition source. Fire-fighters and landowners are both apprehensive of wildfire due to its potential threat to life and property.

The number of wildfires and the frequency of incendiarism have been increasing in recent years (Kluneder *et al.*, 1988; U.S. Forest Service, 1984). Despite active wildfire awareness campaigns, wildfire losses are increasing. Substantial losses continue to occur on both private and public ownerships. A complicating factor is that many rural southern communities tolerate and empathize with the acts of incendiarists (Bertrand *et al.*, 1970). When wildfire occurs, regardless of reason, society ultimately loses through the direct and indirect costs passed back to the general public in insurance costs and increased taxes for protection.

In Arkansas the principal organization charged with wildfire suppression is the Arkansas Forestry Commission (AFC). The AFC is charged with wildfire detection and suppression as well as enforcement of the state's wildfire law (Act 85 of the 1935 Session of the Arkansas State Legislature, as amended). The AFC has collected information on individual wildfires since the 1930s.

This study was initiated to provide a better understanding of the extent and nature of incendiary wildfires in Arkansas. Specific objectives were to determine the patterns of incendiary occurrence in Arkansas and to identify emerging trends that may call for changes in forest use, fire use or fire management policy.

METHODS

A data set, including the records of all reported wildfires on lands protected by the AFC in Arkansas for the period January 1983 through December 1987, was used (Arkansas Forestry Commission unpublished data). The individual fire records are developed from Individual Fire Reports (AFC Form 2410.1) which are filled out by suppression personnel immediately after a fire has been investigated. Information recorded for each fire included: year, county, origin (original fire or break-over), type of fire (forest, non-forest, or a mixture), day of the year, cause (e.g. incendiary, debris burning), who discovered the fire (aerial detection, tower or ground surveillance by the AFC, or the public), how the fire was extinguished (suppression, burn out, or rain out), acres burned and fire-danger class-day. Fire-danger class-day is an index of the total wildfire danger anticipated for an area and is rated on a scale of 1 to 5, with Class 1 indicating predictable fire behavior with little chance of spread and Class 5 extreme fire behavior with rapid spread. The data set included reports of 13,136 fires.

Analysis of the fire data was done using SPSS/PC+ (Norusis, 1988) and began with a multiple dimension frequency analysis. Because most variables were of a categorical nature, they were tested for significance using standard one-way and multi-way analysis of variance procedures against the principal dependent variables of interest (e.g. forest

hectares burned). Additionally, testing of categorical variables against each other for significant association was done using Chi-square contingency tables. Statistical significance was accepted at the .05 level.

RESULTS AND DISCUSSION

Total wildfires increased from 1984 through 1987, with substantial rises in 1986 and 1987 (Table 1). Of greater importance, however, is that while the total burned area decreased from 1983 to 1985, it increased sharply during 1986 and 1987. Of the total area burned, the greatest proportion was consistently forested land (84%). Additionally, the average forested area burned per fire remained relatively constant (5 ha or 12 ac burned). Seventy-five percent of all fires were less than 4.2 ha (10 ac) in size, and 98% of all fires were 42 ha (100 ac) or less. The largest fire was 900 ha (2160 ac).

Table 1. Incendiary wildfires by property ownership and local residents in Arknasas, 1983-1987.

		1983	1984	1985	1986	1987	MEAN
All Lands	N	2,185	1,650	1,981	3,170	4,150	2,627
	Ha	12,873	11,112	7,683	22,040	27,146	16,171
Nonindustrial Private Lands	N	71%	70%	66%	69%	61%	66%
	Ha	73%	69%	64%	64%	58%	61%
Industrial Lands	N	26%	22%	29%	25%	32%	28%
	Ha	20%	21%	31%	30%	29%	27%
Other Lands[1]	N	3%	8%	5%	6%	7%	6%
	Ha	7%	10%	5%	6%	13%	6%
Incendiary Fires							
All Lands	N	870	638	848	1,558	2,233	1229
		40%	39%	43%	49%	54%	47%
	Ha	7,761	6,647	4,086	14,546	18,770	10,362
		60%	60%	53%	66%	69%	64%
Nonindustrial Private Lands[2]	N	535	392	445	911	1,123	681
		34%	34%	34%	42%	44%	39%
	Ha	5,789	4,422	2,357	8,049	9,703	6,064
		61%	57%	48%	57%	61%	58%
	Ha/Fire	10.8	11.3	5.3	8.8	8.6	8.9
Industrial Lands[2]	N	280	168	350	531	947	455
		50%	46%	60%	68%	70%	62%
	Ha	1,252	1,442	1,439	5,195	5,856	3,036
		48%	60%	60%	80%	74%	70%
	Ha/Fire	4.5	8.6	4.1	9.8	6.2	6.7
Incendiarism by Local Residents[3]							
All Lands	N	662	451	576	1146	1692	905
		72%	71%	68%	74%	76%	74%
	Ha	6,110	5,221	2,799	11,268	14,163	7,900
		79%	78%	68%	77%	75%	76%
Nonindustrial Private Lands[4]	N	386	277	294	667	815	488
		72%	58%	66%	73%	73%	72%
	Ha	4,551	3,542	1,651	6,102	7,048	4,579
		79%	80%	70%	76%	73%	76%
Industrial Lands[4]	N	200	112	237	385	755	338
		71%	67%	68%	72%	80%	74%
	Ha	902	1,072	872	4,211	4,446	2,300
		72%	74%	61%	81%	76%	76%

[1] Mostly state ownerships, federal ownerships are not included in the data set.

[2] Proportions calculated using wildfires from the corresponding land ownership.

[3] A person who lives in the area but did not start the fire on their own land.

[4] Proportions calculated using incendiary fires from the corresponding land ownership.

These trends in wildfires were influenced in part by weather factors. Statewide, precipitation was usually below average monthly levels during the spring fire season (January through June), but variable and slightly above average during the fall fire season (July through December) (National Climatic Data Center, 1987). As an example, the fall of 1984 was exceptionally wet. The residual spring moisture in 1985 combined with a second abnormally wet fall accounted for the lower total area burned in 1985. The years 1986 and 1987 were opposites; 1986 had a dry spring and moist fall while the spring of 1987 was normal and the fall very dry, until December when precipitation increased dramatically.

SEASON, FIRE-DANGER CLASS-DAY AND DISCOVERED BY

Three percent of the incendiary fires occurred on Class-1 days, 27% on Class-2 days, 52% on Class-3 days, 13% on Class-4 days, and 5% on Class-5 days. These numbers were not significantly different from the proportions for all other wildfire causes, suggesting that incendiarists do not select days with more severe fire-danger to set fires. Seasonally, 64% of all incendiary fires occurred during the spring fire season (January through June); 36% occurred during the fall fire season (July through December). Again, these proportions were not significantly different from those for all other causes. Sixty-three percent of the Class-1 and 53% of the Class-2 wildfires occurred days during the fall fire season. However, 64% of the Class-3, 77% of the Class-4, and 88% of the Class-5 day wildfires occurred during the spring season. In the spring, fuels are cured and winds are higher. Therefore, if a fire does occur, it will spread more rapidly, cause more damage, and cost more to suppress.

Significant differences were found among whom wildfires were detected by and their ignition source. The general public detected 56% of the incendiary fires and 66% of the other fires, while organized detection units such as the AFC and active patrols by industrial employees discovered 44% of the incendiary fires and 34% of the others. This information suggests the general public is more likely to report fires started by debris burning and other such causes, probably because these fires are more apt to occur on lands close to or used by them.

CAUSES OF AND RESPONSIBILITY FOR WILDFIRES

Incendiarism was consistently the principal cause of wildfires, averaging 47% of the fires and 64% of the area burned. The second most frequent cause was debris-burning fires that escaped control, averaging 27% of the fires and 18% of the area burned. Other identified causes were smokers (5.6%) equipment use (3.9%), children (2.5%), railroads (2.3%), lightning (2.2%), and campfires (1.4%). A miscellaneous category accounted for 8.7% of all wildfires. Wildfire statistics for the five-year period 1983-1987 in the southern U.S. showed incendiarism averaged 44% and debris burning 30% of the wildfires (U.S. Forest Service, 1988). In this respect, Arkansas differs little from the southwide average for 1983 to 1987.

However, our data show that the number of incendiary fires, the area burned, and their corresponding proportions are escalating (Table 1). The percentage of incendiary fires increased from 40% in 1983 to 54% in 1987. Similarly, the area burned by incendiarists also increased from 60% in 1983 to 69% in 1987, with 1985 an exception due to the moist conditions.

Probably no trend in landowner/public relations concerns forest managers as much as the rising trend of incendiarism. Of the increase in wildfires from 1984 through 1987, 64% (1,595) were incendiary. Further, in the period 1986 to 1987, there was an increase of 980 total wildfires, 69% (675) of which were incendiary. Of these incendiary fires, 93% (628) were on nonindustrial private (212) and industry lands (416); 82% (518) of these fires were incendiarism by local residents (a person who lives in the area but did not start the fire on their own land).

Nonindustrial private landowners received the brunt of the incendiary fires in terms of number of fires and area burned (Table 1). However, as a proportion of wildfires on nonindustrial private lands, incendiary-caused fires were much less the similar percentages for industrial lands. Additionally, the average size of fires is higher on nonindustrial private lands than on industry lands.

Industrial landowners increasingly appear to be the target of incendiarists, as the proportion of incendiary fires and area burned on industry lands increased with time. Moreover, proportionately more

fires on industry land are incendiary (average of 62% on industry vs. 39% on nonindustrial private), while incendiarism and debris burning share the load on private land (debris burning averaged 14% on industry vs. 33% on nonindustrial private).

Local residents were responsible, on average, for 74% of all fires and 76% of the area burned by incendiarists (Table 1). The proportions of local-resident caused incendiary fires and the area burned were similar on nonindustrial private and industrial lands, suggesting local residents showed little preference for land ownership when starting these fires.

IMPLICATIONS FOR PREVENTION

Wildfire investigation and enforcement is an assigned role of AFC District Foresters and Rangers who shoulder this responsibility as well as landowner assistance. Suppression costs are levied and collected from landowners who lose control of a fire. Additionally, active cases are developed on 15% of all fires each year.

Generally, enforcement activities, including investigation, active prosecution, conviction and settlements, are designed to reduce incendiarist activities. When adequate evidence exists, criminal charges are filed on incendiary cases, with the burden of proof resting on the AFC. Upon conviction, damage awards may include suppression cost, property damages, court costs, fines and incarceration.

During the calendar year 1987 the courts convicted two incendiarists (Arkansas Forest Commission, unpublished data). Each conviction resulted only in fines, court costs and suspended jail sentences.

Thus, little in the way of punitive deterrence awards was levied on these known incendiarists. With 2,233 suspected cases of incendiary wildfire in Arkansas in 1987, this conviction rate underscores the difficulty of deterring incendiarism by using law enforcement.

Donoghue *et al.* (1986) studied the potential for reducing incendiarism in Arkansas based on models developed South-wide. The general relationship found was one of sharp decreases in incendiarism after initial enforcement activities followed by rapidly decreasing results to additional efforts. Since settlements related to negligent debris-burners represent the majority of the total enforcement effort in Arkansas, incendiarists will probably continue their activities unchecked.

Enforcement alone is not sufficient to keep the number of incendiary fires at manageably lower levels. Brown and Davis (1973) discuss regulating the use of public and private lands, and public education as equally important components of prevention activities. These activities are designed to break the chain of incendiarism. They list the components of an incendiary fire as 1) a person, 2) with a motive for burning, and 3) incendiary devices. Incendiary devices can be as simple as a match, or a can of gasoline with an ignition device. Except in more sophisticated forms, incendiary devices cannot be denied the general population. Regulation of public use of high hazard areas removes persons from incendiary targets. Closing national forests and state parks in times of extreme fire danger are examples of this type of control. Educational activities are generally aimed at changing the reasons for starting fires and defusing incendiary activities through local social pressure.

Clearly, given the number of yearly incendiary fires in Arkansas, and the recent increases in such fires, more effective long-term solutions to incendiarism need to be developed. Based on the Donoghue *et al.* (1986) model, enforcement benefit-cost ratios fall rapidly after initial levels. But, since it is also obvious that enforcement cannot be abandoned, determining how much incendiary reduction to buy through enforcement is crucial.

Restricting use of forest land is an effective deterrent during intervals when high use corresponds with high fire danger (e.g. high fire-danger concurrent with fall hunting season). However, on nonindustrial private or industrial lands this may be construed as threatening to those practicing free access to traditional hunting areas.

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