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ANALYSIS OF WILDFIRE OCCURRENCE IN SOUTHEASTERN ARKANSAS, 1984-1987

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ABSTRACT

Wildfire statistics for Arkansas Forestry Commission District I in southeastern Arkansas were analyzed for the period 1984 through 1987. A mean of 313 fires and 1103 hectares burned annually during the study period. Most (87%) of the land burned was forested. The greatest number (90%) of wildfires occurred when fire-danger was moderate to high. Most fires were started (90%) and detected (51%) by local residents. Arson was responsible for the majority of fires (68%) and hectares burned (65%). A disproportionately high number (43%) of the incendiary fires occurred in Ashley County. Mean fire size was smaller in this county. Fire suppression professionals attribute this to increased surveillance and suppression efforts in this county as compared with other counties. Many more fires occurred in 1987 than in other years. On forest-industry land more fires occurred in 1987 than in previous years (65% vs. 42%). Also, for all lands, more fires were of incendiary origin in 1987 than in previous years (78% vs. 60%). The authors provide evidence that the change in fire pattern in 1987 was due in part to a drastic change in administration of hunting privileges by a major forest industry in the area.

INTRODUCTION

Despite the fear or respect with which most people treat fire, considerable loss of property, and occasionally human life, occurs annually from forest wildfires. In spite of the wildfire awareness crusades championed by Smokey Bear, arson continues to be the largest single cause of wildfires in the South (U.S. Department Agriculture, 1980). Unfortunately, well-meaning individuals continue to set forest and openland fires due to a misunderstanding of fire's ecological effects or an overestimation of their ability to control fire. Many of these fires escape control and culminate in wildfires.

The Arkansas Forestry Commission (AFC) is the principal organization charged with wildfire suppression in the state. For administrative purposes the AFC is organized into districts of about 0.7 million hectares each that typically include four to seven counties.

The 1987 spring fire season (January through June) in southeastern Arkansas was typical. However, the fall fire season was an anomaly, compared to the three previous years. Beginning with the first weekend in September, the number of wildfires increased sharply and continued for several months. These fires were concentrated on forest-industry lands and were of incendiary origin (arson). This research was undertaken to determine the typical pattern of wildfire occurrence in southeastern Arkansas and to investigate causes of the anomaly that occurred in 1987.

METHODS

A data set for AFC District I was developed from Individual Fire Reports for 1984-1987 (AFC Form 2410.1). For each year, 20% of the Individual Fire Reports were randomly sampled. District I includes Ashley, Chicot, Cleveland, Desha, Drew, Jefferson and Lincoln counties in southeastern Arkansas (Figure 1). Chicot and Desha counties include mostly Delta agricultural land and fire occurrence in these counties is extremely low. The random sample did not include fires in either of these two counties.

Information recorded for each fire included: year, county, type of fire (forest, non-forest or a combination), day of the year, statistical cause (e.g. arson — wildfires willfully set by anyone to burn vegetation or property not owned or controlled by the person, and without consent of the owner or the owner's agent; debris burning — wildfires spreading from clearing land, burning trash, range, stubble, logging debris, or other prescribed burning), who discovered the fire (aerial,



Figure 1. Seven-county study area in southeast Arkansas.

tower, or ground surveillance by AFC, or general public), how the fire was extinguished (suppression, burn out or rain out) and fire-danger class-day. Fire-danger class-day is a measure of the total wildfire danger anticipated for an area. It is calculated based on anticipated fire behavior. Class 1 denotes low fire-danger, while Class 5 denotes extreme fire-danger. Arkansas uses a modified form of the 1972 National Fire-Danger Rating System (Deeming *et al.*, 1972). A second data set was compiled which contained the year, day of the year, month, and class-day for each day of the four-year period. Finally, data on number of fires by statistical cause and hectares burned for Arkansas and each county in District I were obtained from the Annual Fire Reports—Classification and Size Statistics, published by the Arkansas Forestry Commission.

The analysis of fire data was done with a standard statistical package (Morusis, 1988) using a multiple dimension frequency analysis.

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Table 1. Number and size of forest/non-forest wildfires in Arkansas Forestry Commission District I (southeastern Arkansas), 1984-1987.

	Year				Mean
	1984	1985	1986	1987	
Total Wildfires (N)	123	274	322	533	313
Forest Fires (N)	103 (84%)	225 (82%)	267 (83%)	490 (92%)	271 (86%)
Non-Forest Fires (N)	10 (8%)	15 (5%)	10 (3%)	10 (2%)	11 (4%)
Mixed Forest & Non-Forest Fires (N)	10 (8%)	34 (13%)	45 (14%)	33 (7%)	31 (10%)
Total Area Burned (Ha)	439	804	1448	1720	1103
Forest Area Burned (Ha)	344 (78%)	695 (86%)	1314 (91%)	1434 (87%)	962 (87%)
Non-Forest Area Burned (Ha)	95 (22%)	109 (14%)	134 (9%)	226 (13%)	141 (13%)
Forest Area Burned per Fire (Ha)	2.8	2.5	4.1	2.8	3.1
Non-Forest Area Burned per Fire (Ha)	0.8	0.4	0.4	0.4	0.4
Average Fire Size (Ha)	3.6	2.9	4.5	3.2	3.5

Source: Arkansas Forestry Commission, Annual Fire Reports

Table 2. Number and percentage of wildfires by the two leading causes and area burned for Arkansas and for Arkansas Forestry Commission District I (southeastern Arkansas), 1984-1987.

	Year									
	1984		1985		1986		1987		Mean	
	N	Ha	N	Ha	N	Ha	N	Ha	N	Ha
Arkansas										
Totals	1,650	11,111	1,981	7,683	3,170	22,040	4,150	27,146	2,738	16,997
Cause	%									
Arson	39	60	43	53	49	66	54	55	48	59
Debris burning	31	22	30	21	26	17	23	15	26	17
District I										
Totals	123	439	274	804	322	1,448	533	1,720	313	1,103
Cause	%									
Arson	54	65	63	60	61	69	78	64	68	65
Debris burning	33	29	21	21	24	19	11	12	19	18

Source: Arkansas Forestry Commission, Annual Fire Reports

RESULTS

The completed data set included 252 fires occurring over the four-year study period. Table 1 shows the number and size of wildfires by type. The number of fires and hectares burned increased each year, with a mean of 313 fires and 1,103 hectares per year over the 4-year period. Of the total hectares burned, 87% were forested. Each fire burned about 3.1 forested hectares and 0.4 non-forested hectare.

Table 2 shows the two major causes of wildfires by year for all of Arkansas and for District I. As expected from historical records (U.S. Department Agriculture, 1980), arson remained the leading cause of wildfires, with fire escapes from debris burning distant second. Notably, the percentage of fires caused by arsonists increased with time, both

state-wide and in southeastern Arkansas. However, there was no trend for percentage of hectares burned by arson-caused fires. Wildfires caused by debris burning tended to decrease with time, both state-wide and in District I for percentage of fires and for percentage of hectares burned. Mean percentage of wildfires caused by arsonists was much higher in southeastern Arkansas than the state-wide average (68% vs. 48%). Although the trend was similar for hectares burned, the difference was not as great (65% vs. 59%). The reverse pattern was true for mean numbers of fires caused by debris burning, with southeastern Arkansas lower than the state-wide mean (19% vs. 26%). Mean percentage of hectares burned by wildfires started by debris burning was similar for Arkansas and District I. For southeastern Arkansas, arson and debris burning combined for 87% of the fires started and 83% of the hectares burned. The remaining fires were started by: equipment 2.8%, children 2.1%, railroads 1.7%, campfires 0.8%, lightning 0.8%, smokers 0.5%, and other miscellaneous causes 4.6%.

The AFC's aerial patrols discovered 28% of the fires, observers in towers discovered 8% and AFC ground patrols 12%, while local residents reported 51%. Almost 70% of the fires on non-industry private land were discovered by local residents. However, fires on forest-industry land were more often (53%) discovered by active patrols. Incendiary fires were more likely (53%) to be discovered by local residents than by active patrols. Active fire suppression extinguished 97% of the fires, while 3% burned out by themselves. Fires were as likely to occur in spring (49%) as in fall (51%).

The owner of the land on which the fire occurred was responsible for starting 14% of the wildfires. Local residents accounted for 59%, non-residents of the area accounted for 9% and "unidentified agents" started 18% of the wildfires. Only three groups were responsible for arson fires: local residents started 82%, non-residents started 12% and unknown persons caused the remaining 6%.

On days when fires occurred, 7% were ignited on Class 1 fire-danger days, 48% on Class 2, 42% on Class 3, 2% on Class 4 and 1% on Class 5 days. These percentages for fire-days by class-day did not differ over the study period.

Ashley County has historically been an area with a high incidence of incendiary fires; this trend continues. Of the total arson fires recorded for District I over the 4-year period, 43% were started by local residents of Ashley County. Arson-starts by local residents for the other counties were: Jefferson 15%, Drew 14%, Cleveland 8%, and Lincoln 2%. Ashley County consistently reports a disproportionately large number of all District I fires (43%) and District arson-caused fires (34%) (Table 3). However, in Ashley County, the percentage of hectares burned by

Table 3. Comparison of number of arson-caused wildfires and area burned in selected counties to respective totals for Arkansas Forestry Commission District I, 1984-1987.

	County	Fires	Year									
			1984		1985		1986		1987		Mean	
			N	Ha	N	Ha	N	Ha	N	Ha	N	Ha
District I												
Dist. Total			123	439	274	804	322	1448	533	1720	313	1103
County												
Ashley	All	37	30	43	17	36	20	48	27	43	23	
	Arson	20	19	32	16	26	18	43	20	34	17	
Cleveland	All	13	6	12	17	8	13	10	15	10	14	
	Arson	6	1	8	18	5	8	7	12	7	10	
Drew	All	20	16	20	28	26	31	22	30	22	28	
	Arson	11	8	11	32	12	20	13	11	12	15	
Jefferson	All	19	23	16	18	22	27	16	25	18	24	
	Arson	12	19	7	17	13	17	10	17	10	16	
Lincoln	All	12	25	10	20	8	9	5	4	7	11	
	Arson	4	18	5	17	6	6	4	4	4	6	

Source: Arkansas Forestry Commission, Annual Fire Reports

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incendiary fires has been less than the percentage of incendiary fires by number. In other counties in the District these percentages are usually reversed (Table 3). These statistics may be attributed to the detection and suppression activities of AFC and forest-industry fire fighters, which are concentrated in Ashley County. Emphasis on detection and suppression in areas of high wildfire-incidence tends to keep fire size smaller by reducing total suppression time from detection to control.

For District I, fire-danger was significantly higher statistically in 1987 than in the other three years of the study. For 1984-1986, 41% of the days were Class 1, and 58% were Class 2 or 3 days. However, for 19887, 28% were Class 1 and 70% were Class 2 or 3 days. Fire-danger did not by itself, however, explain the anomalous fall fire-season of 1987. More fires occurred on forest-industry land (65%) during 1987 than in the previous three years (42%). In addition, there were many more incendiary fires in 1987 (78%) than other years (60%). Also, in 1987, 91% of the fires on forest-industry land originated by arson, with local residents responsible for 90%. The majority (65%) of 1987 fires on non-industry private lands were also the product of arsonists, with 92% started by local residents.

DISCUSSION

The increasing number of fires over time is a cause for concern to fire suppression organizations and to forest landowners. Industrial forestland managers, facing the additional threat of arson, have just cause to be anxious.

Results of a study of national wildfire statistics from 1973 to 1978 (U.S. Department Agriculture, 1980) revealed that 39% of the wildfires and 55% of the hectares burned in the southern region were of incendiary origin, 26% of the fires and 20% of the hectares burned were started by debris burning. Arkansas and southeastern Arkansas are almost 10 and 20 percentage points, respectively, above the 5-year regional mean. Although explanations for these phenomena are many, several dominate. First, southeastern Arkansas has a mostly rural population that traditionally uses fire for land-management purposes, especially burning to manage unwanted vegetation and fuels that accumulate in the vast pine forests of southern Arkansas. Second, southeastern Arkansas has a climate that produces both an abundance of fuels and the seasonal weather patterns that carry wildfires through these cured fuels (Schroeder and Buck, 1970). Third, there is a tendency for local residents to deliberately set fires on the lands of another. The forested areas of southeastern Arkansas, especially in Ashley County, have a lengthy history of incendiary fires. Fortunately, the wildfires in Ashley County are kept "smaller" due to the surveillance and suppression efforts concentrated there.

There are several possible explanations of the anomalous 1987 fall fire season. The higher occurrence of Class 2 and 3 days played a part in the spread of fires once started. The class-day fire-danger classification scheme takes into account weather and fuel-flammability conditions. While there was an increase in fire-danger during 1987, the increase alone did not totally explain the disproportionate rise in incendiary fires, nor the fact that the majority of the increase in fire numbers was on forest industry land.

Concurrent with the beginning of the increase in incendiary fires was the beginning of small-game hunting season on September 12 and deer-archery hunting season on October 1 in southeastern Arkansas. The 1987 hunting season also marked the beginning of a drastically different policy concerning hunting on forest-industry lands in the study area. Prior to 1987, public access to most forest-industry lands in the seven-county area was unrestricted. Access was on a first-come basis, with some local hunting clubs claiming "rights" to certain areas by tradition. However, in 1987, the principal forest-industry landowner in the areas leased all hunting privileges on about 200 thousand hectares to hunting clubs. This precluded unrestricted and free access by the general public and denied access to many individuals who had hunted on these lands all of their lives. Most of these individuals had viewed the forest-industry lands as quasi-public in nature. Thus, we feel that the decision to lease land for hunting was the single most important factor in the high incidence of incendiary fires on forest-industry lands in 1987.

Studies of arsonists have indicated that people starting fires general-

ly come from a rural background, are less well socially integrated and tend to have less formal education than the norm (Bertrand *et al.*, 1970; Bertrand and Baird, 1975; Bradsaw and Huff, 1985). Additionally, results reported by Doolittle and Lightsey (1979) showed that the conduct of starting fires on the lands of another for traditional land-management reasons is at least tolerated if not often approved of in many cases by local populations. However, acts of pure vandalism are seldom condoned. Social protection of fire starters and the general perception that industry or public lands belong to everyone add to the problem of curtailing such behavior.

Doolittle and Lightsey (1979) emphasized that local perception of public and industry lands is strongly shaped by the company or agency's representative with local responsibility. If the local representative is viewed as a policeman from outside, rather than as a community member, there is a high likelihood of multiple land-management problems.

Based on results of a survey of forest industries in the southeastern U.S., Kluender (1978) found that 91% of the responding companies leased land for hunting and/or other privileges. Public response to these leasing programs was highly favorable (95%). Additionally, it was concluded in the same study that promoting a feeling of surrogate ownership and the use of local residents to actively help in protecting industry land was desirable and achievable. Such a high degree of cooperation was generally realized by preferential treatment of locals in hunting-lease assignments, firewood permits and educational endeavors.

CONCLUSIONS

Organized wildfire detection in high risk areas and during high risk periods coupled with rapid response by trained fire suppression professionals are important factors in reducing the total acreage burned by wildfires. While the anomalous fall fire season of 1987 did incinerate valuable timber and open land, it was not the catastrophe that could have occurred had active surveillance and suppression not been practiced during the fall fire season. Finally, successful local administration of policy changes by large landowners requires a sustained flow of information in addition to well nurtured interpersonal relationships between landowner representatives and local residents.

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