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A Survey of Rural Population Density and Forest Fire Occurrence in the South, 19564970

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SUMMARY

Rural residents comprise a high risk potential population regarding person-caused wildfire incidence in the South. However, rural population density (RPD=number of people per square mile) was found to be indeterminately associated with fire occurrence rate (FOR=number of fires per million acres protected) in protected lands in 13 Southern states. Thus, changes in density patterns of rural residents are poor indicators of real or potential wildfire incidence and Southern Regional fire problems most likely result from the activities of a small percentage of the total rural population at risk.

Keywords: Rural residents, risk, fire occurence rate, rural population density, southern region, fire incidence.

INTRODUCTION

Forest fire risk is sometimes defined as a function of the presence and activity of causative agents (USDA, Forest Service 1956). Because it is a prerequisite to activity, presence takes on primacy. Since we rarely know the actual number of causative agents within a given human population, we ascribe levels of risk to the presence of these populations in their entirety. That is, we assume everyone in a given population is a potential fire risk. In this context, presence can be considered an indicator of fire-causing activities, hence, potential fire incidence.

In general, woods-burning is a rural cultural practice of long standing in the South (Bertrand and Baird 1975 Doolittle and Lightsey 1979). Most reported person-caused wildfires, of whatever administratively ascribed cause, are the result of the activities of rural residents, i.e. persons residing in or close to the areas in which fires occur. A logical extension of this is an assumption that in the South' rural population size would be a singularly strong factor in assessing the potential for fires occurring; that is, the greater concentration of people, the more fire potential. Indeed, previous research in selected Southern counties (Doolittle 1972; Hansbrough 1961) has shown direct statistical relationships between fire occurrence and density of rural populations. But are high rural population densities consistently associated with high rates of fire occurrence, making density a practical indicator of fire incidence potential?

A qualified answer to this question was obtained by considering it in a regional perspective, i.e., surveying macro-level relationships between rural pop-

[1] The South as used here includes: Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, N. Carolina, Oklahoma, S. Carolina, Tennessee, Texas, and Virginia.

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ulation density (RPD=number of people per square mile) and fire occurrence rate (FOR=number of fires per million acres protected) on state lands under organized fire protection, 1956 to 1970.

METHODS

The period 1956–1970 was selected because it included three decennial population censuses and coincided almost entirely with data from Doolittle's summaries of forest fire occurrence for Southern counties, 1956-1965 and 1966-1975 (Doolittle 1969; Doolittle 1977).

Fire occurrence rates for protected area (counties) in each State by year were available from Doolittle's data. With exceptions explained later, populaton data for the same area were extracted from final census reports for States (U.S. Bureau of the Census, 1960; 1970). The total rural population* was used to represent protected areas' fire-risk-potential populations. Use of this figure assumed general comparability in the composition-sex, age, birth, and death rates-of rural populations region-wide. Yearly intercensal population counts were arrived at by arithmetic interpolation (Smith and Zope, 1970).

Rural population densities were computed on the basis of total land area. Except in the cases of a few large metropolitan areas, which were taken into consideration, bias introduced by inclusion of area occupied by urban entities was insignificant. Also, both RPD and FOR represent an average distribution of people and fires, respectively, per unit of area. They do not take into account the general patterns of concentration known to exist with regard to where fire occur and where rural people reside. Even so, these parameters permit the normalization of size variation when comparing areal units, e.g., county, state.

The survey, then, was limited to State-protected areas in the Sotuhern Region included in Doolittle's county fire occurrence report summaries. A further limiting factor to protected area usable for the survey was the unavailability of county level fire data in some States. For example, data for Arkansas, Oklahoma, and Florida were reduced to four, one, and 14 years, respectively.

[2]According to Bureau of Census definition, rural population is comprised of those people residing in incorporated and unincorporated places of less than 2500, which includes open country.

RESULTS

County based data were combined, and RPDs and FORs for total protected area in each state were computed by year (table 1). This provided a regional view of RPD along with FOR.

With the exception of Kentucky (15 percent decrease) and Tennessee (nine percent decrease), changes in RPD in states ranged from none in Louisiana to relatively insignificant for the other States. Year-to-year fluctuations were minor and in some states trends were evident.

On the other hand, without exception the FOR fluctuated markedly in all States during the survey period. Since fire occurrence is greatly affected by factors such as weather and a significant (but unknown) amount of deliberateness regarding activities of the potential risk populations, some fluctuation was expected. However, fluctuations were such as to preclude the emergence of any period trends in FOR by State. The average regional RPD and FOR for each year in table 1 serves to illustrate the obvious trend in the former and the lack of any trend in the latter.

A look at state average RPD and FOR for the entire period in table 1 further reinforces the lack of association between these two parameters. RPD averages varied from a high of 55 in North Carolina to lows of 19 in Texas and Arkansas. FOR averages varied from a high of 552 in Louisiana to a low of 161 in Texas. Only South Carolina appeared in the highest five as ranked by RPD and FOR, respectively. Louisiana with the highest FOR ranked ninth in RPD. Virginia with the lowest FOR ranked third in RPD.

A statistical test of the relationship between FOR and RPD was conducted on the basis of a ten percent sample of the 990 counties that provided the data base for this survey. The sample population was stratified by State, and the 99 samples resulted from a ten percent random selection within each State. Average annual RPD and FOR for the survey period were computed for each sample county, and a scatter diagram of FOR and RPD was constructed. By inspection a weak linear relationship was inferred, and a simple linear regression was run on the data as:

$$FOR = 181 + 2.72\ RPD,\ r = .272$$

Although the resultant equation had a significant correlation coefficient (97 degres of freedom), less than 10 percent of the variation in FOR was explained by RPD.

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Table 1.—*Rural population densities and fire occurrence rates on state protected lands in the southern region by state and year, 1956-1970*

State		1956	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	1966	1969	1970	State average
AL	RPD	31	30	30	29	29	29	29	29	26	26	26	26	26	26	26	29
	FOR	314	201	262	302	295	292	347	532	266	391	334	364	511	450	367	351
AR	RPD	[2]	...	...				..					19	19	16	16	19
	FOR	...	...	...	...	...	...					...	231	141			
FL	RPD	25	24	24	25	25	25	24	23	23	'ii	25	25	25	215	226 24	203 24
	FOR	493	260	266	226	303	362	495	384	288	306	284	392	378	...	457	350
GA	RPD	32	32	32	31	31	31	31	31	32	31	31	31	31	31	31	31
	FOR	354	238	330	298	383	401	365	443	271	288	342	404	480	351	467	381
KY	RPD	46	45	48	45	43	42	42	41	41	40	40	40	39	39	39	42
	FOR	253	190	226	438	335	163	319	457	267	279	214	215	271	279	210	274
LA	RPD	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25
	FOR	801	209	393	522	537	302	772	872	506	580	479	797	507	709	509	552
MS	RPD	29	29	28	28	28	28	27	27	27	27	27.	28	28	26	26	27
	FOR	518	328	408	486	459	325	486	828	336	376	480	437	399	435	387	446
NC	RPD	54	54	54	54	55	55	55	55	55	55	55	55	55	55	55	55
	FOR	189	135	145	182	173	197	184	276	193	269	280	307	357	233	275	225
OK	RPD	...	...	...	...	...	..	..			.					17	
	FOR	...	...	...	...	...	...	...	...	...	...	...	...	...	...	279	...
SC	RPD	44	45	46	46	46	46	46	46	46	46	45	45	45	45	45	45
	FOR	431	288	318	306	353	409	360	500	223	318	454	414	575	323	401	378
TN	RPD	43	42	41	41	41	41	40	40	40	39	39	38	38	39	39	40
	FOR	371	188	284	365	292	277	282	441	252	284	329	367	280	255	248	301
TX	RPD	21	20	20	20	19	19	19	19	19	19	19	19	19	20	19	19
	FOR	501	71	136	198	167	97	176	242	149	100	65	187	85	151	87	161
VA	RPD	42	43	43	43	43	43	43	43	43	43	43	43	43	43	43	43
	FOR	101	75	77	172	108	82	115	236	118	172	150	133	187	134	126	132
Region Average	RPD	36	35	35	35	35	35	35	35	35	34	34	33	33	31	31	
	FOR	375	198	261	318	310	284	355	474	261	304	310	354	346	296	312	

[1]Rural Population Density (RPD) = Number of people per square mile. Fire Occurrence Rate (FOR) = Number of fires per million acres of protected lard.
[2]Data Not Available.

DISCUSSION

Results of this macro-level survey strongly indicate that density of rural residential populations, per se, is at best indeterminately associated with the general incidence of person-caused fires in the Southern Region. On a practical level this suggests that changes in density patterns of rural residents are poor indicators of real or potential wildfire incidence. Further, the absence of a strong relationship between fire occurrence and the presence of this high risk potential population tends to reinforce an assertion about the Southern person-cause wildfire situation: most fire problems are the result of the activities of a small percentage of the total population at risk.

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