LIGHTNING FIRE OCCURRENCES IN SOUTHEASTERN GEORGIA

James T. Paul
Southeastern Forest Experiment Station
USDA Forest Service
Macon, Georgia 31208
and
Marshall P. Waters III
National Oceanic and Atmospheric Administration
National Environmental Satellite Service
Washington, D.C. 20233

ABSTRACT

The 1532 lightning fires occurring in southeast Georgia from May through August of 1960 through 1968 were most heavily concentrated around the Okefenokee Swamp, probably because of the high incidence of thunderstorms there. Fire occurrence gradually diminished with distance from the swamp. Most lightning fires occurred in the afternoon, between 1600 and 1900 EST. The total number of such fires was greatest in June, and the total number of days with fires was greatest in July. Mean values for buildup index and spread index in the National Fire Danger Rating System were highest on days with no thunderstorms, intermediate on days with lightning fires, and lowest on days with thunderstorms but no lightning fires. Ratings of fire danger could be used as a relative measure of the probability of lightning fire occurrence; that is, on days when thunderstorms are forecast, the higher the fire danger, the greater the probability of lightning fire. However, because of high standard deviations, these fire-danger measures are of limited usefulness in making accurate predictions of lightning fires.

1. INTRODUCTION

Although only 3% of all forest fires in Georgia are caused by lightning, such fires are a major problem in the southeastern section of the state, accounting for 16% of all fires there. In this 16-county area which surrounds the Okefenokee Swamp, 63% of all lightning fires in the state occur; 90% of them in the summer months from May through August. This paper describes: the magnitude of the lightning-fire problem during the summer months in southeast Georgia; how it varies by hour of day, month, and distance from the Okefenokee Swamp; how measures of fire danger reflect the occurrence of such fires in the area; and how forest-land managers can minimize the impact of lightning fire.

2. METHODS

Forest-fire data for the study were obtained from the Georgia Forestry Commission and covered the months of May, June, July, and August of 1960 through 1968. Figure 1 shows the 16-county study area, formerly designated as Georgia Forestry Commission District 8. Vegative cover is primarily slash pine (*Pinus elliottii* Engelm.) and longleaf pine (*Pinus palustris* Mill.), with occasional deciduous hardwood and cypress swamps and cleared agriculture sites. Topography is level to gently rolling, with few points in this part of the state higher than 100 meters msl.

In order to analyze differences in fire danger that may have existed, the 1107 days covered by the study period were classified as those with: (1) lightning fires (LF); (2) thunderstorms but no lightning fire (NF); or (3) no thunderstorms (NT).

To differentiate between days with and without thunderstorms, hourly radar reports prepared by the National Severe Storms Center at Kansas City, MO were analyzed for thunderstorm development. A day was classified as thunderstorm-no-lightning fire (NF) if no lightning fire was reported but a radar cell with a cloud top to at least 7620 m was shown for any hour of the day or night; according to these criteria, there were 485 NF days in the period of the study. There were 385 LF days, on which one or more lightning fires were reported in the study area. The remaining 237 days were classified as NT, having no thunderstorms.

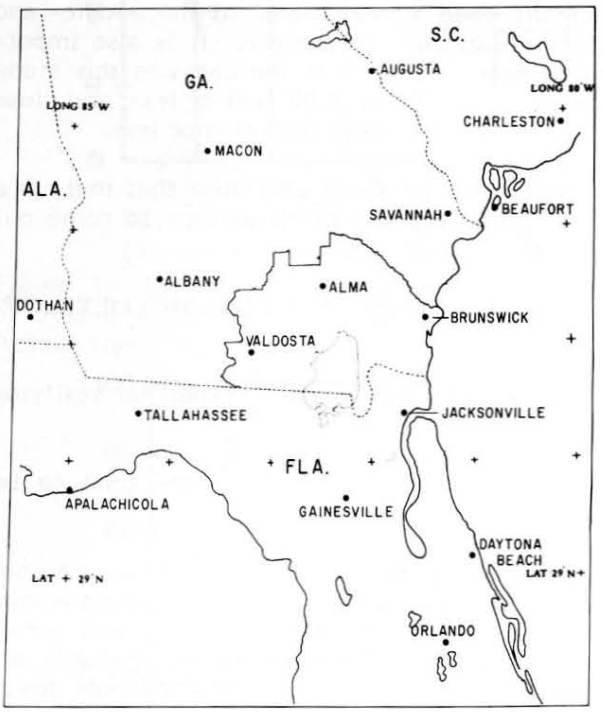

Figure 1. The study area in southeast Georgia is roughly bounded by the cities of Valdosta, Alma, and Brunswick, GA, and Jacksonville, FL. Interior of the study area outlined as dotted area is the Okefenokee Swamp.

Fire-danger data were recorded in accordance with the 8-100-0 Fire Danger System (Keetch, 1954) for 1960 to 1964 and in accordance wtih the National Fire Danger System introduced in 1964 (Nelson, 1964) for 1964 to 1968. The two systems

are not directly comparable; hence, it was necessary to translate measures of one into the other to provide a consistent data base from which to make analyses.

The data for the 8-100-0 Fire Danger System were converted to the 1964 National Fire Danger parameters of BUI (buildup index) and SI (spread index). Fuel moisture in the 8-100-0 System was determined by weighing exposed basswood slats. In the 1964 National System, fuel moisture was expressed in terms of relative humidity and temperature and was representative of the moisture content of small fuels such as pine needles. An equation was developed that converted 8-100-0 fuel moisture into the National System fuel moisture (Paul et al., 1972). With the predicted fuel moisture, BUI was calculated directly in the National System. The buildup index was used to represent the accumulated net effect of past weather conditions on intermediate-sized fuel such as branches and small branchwood (up to 1.2 cm in diameter) and duff to a depth of 1.2 to 1.6 cm. Since BUI is increased by low humidity and decreased by rainfall, the index was adjusted daily by an amount corresponding to the drying or wetting conditions that prevailed during the preceding 24 hours. The spread index, which is a relative measure of a potential fire's forward movement, was calculated directly in the National System, using BUI, fuel moisture, and windspeed. Where data were available for more than one location within the study area, simple averages of BUI and SI were taken to represent fire danger in the area for any given day.

3. RESULTS

During the 1107-day period of study, 1532 lightning-caused fires occurred in the area. A geographical plot of these fires is shown in Figure 2. (The few fires within the swamp itself were on higher ground, on small islands.) Figure 3 shows the occurrence of fires by distance from the swamp. The numbers along the positive Y axis show the distance in kilometers from an arbitrarily chosen point within the swamp. The numbers between the lines along an angle to the northwest give the incidence of lightning fires between the two adjacent semicircles. (The number of lightning fires does not total 1532 because the data from the southeast and southwest quadrants were not used in constructing Figure 3.)

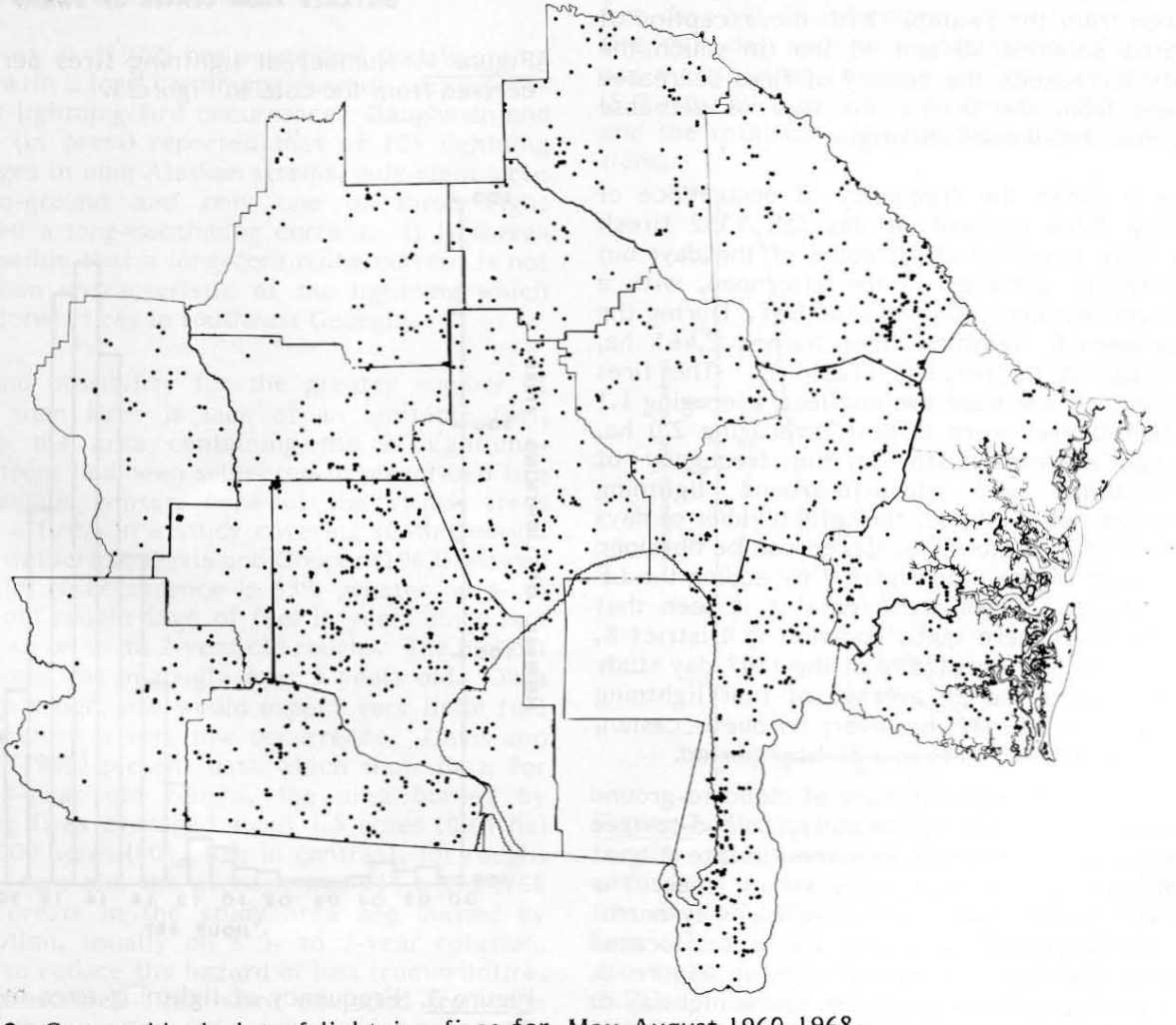

Figure 2. Geographical plot of lightning fires for May-August 1960-1968.