REPORT DOCUMENTATION PAGE			*Form Approved* *OMB No. 0704-0188*

1. REPORT DATE *(DD-MM-YYYY)*
17/Jan/2002

2. REPORT TYPE
THESIS

3. DATES COVERED *(From - To)*

4. TITLE AND SUBTITLE
FIR REGIMES AND CLIMATIC INIDCATORS: RELATIONSHIPS IN THE UNITED STATES

5a. CONTRACT NUMBER

5b. GRANT NUMBER

5c. PROGRAM ELEMENT NUMBER

6. AUTHOR(S)
2D LT HETTINGA JENNIFER A

5d. PROJECT NUMBER

5e. TASK NUMBER

5f. WORK UNIT NUMBER

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
OHIO STATE UNIVERSITY

8. PERFORMING ORGANIZATION REPORT NUMBER
CI02-5

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)
THE DEPARTMENT OF THE AIR FORCE
AFIT/CIA, BLDG 125
2950 P STREET
WPAFB OH 45433

10. SPONSOR/MONITOR'S ACRONYM(S)

11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION/AVAILABILITY STATEMENT
Unlimited distribution
In Accordance With AFI 35-205/AFIT Sup 1

DISTRIBUTION STATEMENT A:
Approved for Public Release -
Distribution Unlimited

13. SUPPLEMENTARY NOTES

14. ABSTRACT

20020204 096

15. SUBJECT TERMS

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE		92	19b. TELEPHONE NUMBER *(Include area code)*

Standard Form 298 (Rev. 8/98)
Prescribed by ANSI Std. Z39.18

FIRE REGIMES AND CLIMATIC INDICATORS: RELATIONSHIPS IN THE UNITED STATES

A Thesis

Presented in Partial Fulfillment of the Requirements for

the Degree Master of Sciences in the

Graduate School of The Ohio State University

By

Jennifer Holland Hettinga, B.S.

* * * * *

The Ohio State University
2001

Master's Examination Committee:

Dr. Jeffrey C. Rogers, Adviser

Dr. Jay S. Hobgood

Approved by

Adviser
Department of Geography

ABSTRACT

Relationships between annual fire data and climate data from 1984-1997 were examined for ten states across the U.S. The data used included annual fire data from the U.S. Forest Service and monthly precipitation and Palmer drought severity index (PDSI) values from the National Oceanic and Atmospheric Administration (NOAA). Correlation tests were performed to find variables that showed statistical significant at the $\alpha = 0.05$ level. All states tested showed statistically significant correlations between multiple fire and climate data sets. The exact data sets showing high levels of correlation varied from state to state. Arizona had a high positive correlation between winter precipitation and PDSI values and fire activity for fires of medium size over the time period studied. All other states showed negative correlations between various precipitation or PDSI values and fire activity. In many cases, more PDSI values showed high correlations to fire activity than precipitation values. It was found that, in general, the most extreme annual drought conditions were highly correlated with fire activity. Also, the largest fires (Classes F and G) were linked to precipitation or the Palmer index in fewer states than fires of medium sizes.

ACKNOWLEDGMENTS

I wish to thank my adviser, Jeff Rogers, for his guidance, and for taking the time to correct my many mistakes.

I would also like to thank Stewart Lundgren at the Washington office of the U. S. Forest Service for providing me with fire data.

Finally, I wish to thank Capt Derek West for his advice and encouragement.

VITA

July 5, 1978......................Born – Williamsburg, Virginia

2000..............................B.S. Geography, United States Air Force Academy

FIELDS OF STUDY

Major Field: Atmospheric Science

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER 1

INTRODUCTION

Wildland fire packs a global punch. Few land masses are immune to its effects. As one of the major disturbances in forest and grassland landscapes, fire can severely impact the ecosystems of entire regions. At local levels, it spews aerosols into the atmosphere and destroys habitats and vegetation. It changes the radiation and energy budgets of vegetation and surfaces for long periods of time. One study conducted in central Canada found that surface radiometric temperatures increased by up to 6°C following wildfire and remained high even fifteen years after a fire (Amiro et al. 1999). Burning consumes resources, and fighting wildfire uses men, material, and energy. Wildland fires can block travel, inhibiting commerce. They can also force the evacuation of communities, and, in some cases, devastate populated areas.

Wildland fires have global effects. Aerosols and greenhouse gases released by fire can affect climate on large scales. Fire has a widespread impact on species distribution patterns and globally important biogeochemical cycles. The monetary cost to fight fires is high; in 1994 the cost of fire suppression to federal agencies in the United States was $965 million (Pyne et al. 1996). Occasionally the fight against wildfire also costs human lives.

Increased forest fire activity is expected to be an early and significant result of a trend toward warmer and drier conditions (Stocks et al. 1998). Thus, if global temperatures are indeed increasing, the fire regime merits study more than ever. We need to understand how climatic factors affect fire occurrence in different regions. The fire regime details the features of historic, natural fires typical to an ecosystem or set of ecosystems (Pyne et al. 1996). It can be thought of as the temporal-spatial pattern of fire disturbance for a given region over a long period (Li et al. 1999). The fire regime is strongly affected by both short and long term fire weather. It is controlled by climatic, topographic, and anthropogenic factors (Grau 2001). Understanding the fire regime is critical to ecosystem management and conservation. A more thorough understanding of the effect of climatic factors on fire occurrence will also aid those preparing for and battling wildland fire.

This study attempts to bridge some of the gaps in existing research on the links between climatic factors and fire regime. The purpose of the study is to determine how the annual number of fires and acres burned are linked to two climatic variables, precipitation and the Palmer drought severity index, across a spectrum of different fire sizes in several states across the United States. The fire regimes of different regions are affected in differing ways by changing climatic conditions. This study examines regionally specific conclusions that may be drawn from the data, as well as investigating the general conclusions to which the data lead.

1.1 Rationale

Fire weather is not a common term. Yet this sub-field of meteorology is very important to those affected by fire. Fire weather describes weather predictions made specifically for fire managers. It covers weather elements that may have direct impacts on fire behavior and may affect how fire is attacked (BLM 2000). The National Weather Service's Storm Prediction Center provides fire weather forecasts on its website. Firefighters and forest managers in fire-prone states seek out meteorologists who will specialize in regional fire weather. A significant facet of the meteorology field, fire weather impacts people and ecosystems worldwide.

While fire weather itself focuses on daily or weekly predictions, the theories used to generate fire weather predictions take seasonal or annual variables into account. Fire weather predictions require knowledge of continuing climatic conditions. Thus it is important to analyze the role played by these conditions on fire occurrence. While many studies have examined the short term effects of weather on fire ignition, less information exists concerning how a changing water balance and other climatic factors affect fire frequency over longer periods of time (Clark 1989). Fire weather predictions are also affected by regional differences, necessitating the examination of different areas to better understand the effect of climate and weather variables on the fire regimes of different regions.

Though it may seem obvious, the problem is not as simple as "more drought, bigger fires." For instance, repeated ground level fires in western forests diminish the amount of intermediate-height vegetation, which often acts as fuel used by fire to transition from lower intensity surface fires to high intensity crown fires (Dale et al.

2000). Thus frequent ground level fires in drier conditions may decrease the occurrence of larger, more intense crown fires. Over long time scales, fire may be self-limiting due to time required to accumulate new fuels. Fire behaves in complicated ways. As a major factor in forest disturbances, its response to changing climatic conditions should be closely examined.

1.3 Scope

This project focuses on ten states across the United States. Fire, precipitation, and Palmer drought index records from 1984-1997 were examined. An attempt to determine if climate factors were causal, significantly affecting the fire regime, was made. The specific conclusions drawn are applicable to the ten states in particular, possibly extending to nearby states. The general conclusions should apply worldwide.

CHAPTER 2

BACKGROUND

When initiating a scientific study, reviewing the literature gives one a better knowledge of the subject matter and helps to focus the study topic. An examination of the literature on the topic allows one to see strengths and weaknesses in the area of study. This section gives a general overview of literature on the relationship of fire frequency and size to climatic variables. It gives strengths and weaknesses in the area of study, and concludes with the relationship of this study to the general body of literature.

2.1 Literature Review

Many studies have been made of fire regime patterns and their relationship to climate. Researchers investigating these topics utilize many resources. Some authors calculate fire frequency from historical records, journal accounts, and fire occurrence records. Others compare photographs from different times, analyze lake sediments for charcoal, examine tree-ring records from cores or stumps, date fire scar samples on standing trees, or infer the record from vegetation stand age (Pyne et al. 1996). Meteorological data used to find patterns in the fire regime also comes from many different sources. A wide variety of resources are used to generate conclusions. Most studies focus on specific environments, producing conclusions particular to those environments, and others like them. Some authors are able to draw widely applicable conclusions as well.

Clark (1988) used petrographic thin sections prepared from lake sediment cores to obtain the annual production of charcoal at Denning Lake in northwestern Minnesota. He then compared the reconstructed fire regime determined from the charcoal record to climate records from other sources over a period of 750 years. He found that size and frequency of fires in northwestern Minnesota reached a maximum during warm dry periods and a minimum during colder wetter periods. He hypothesized that fire cycles in the region derived from the time required for sufficient fuel buildup following a fire. In his study region, he found that fire cycles, driven by climate and fuel buildup, consisted of short-term, low intensity fires interposed upon rarer intense burns.

In another study, Clark (1989) developed water balances from 150 years of temperature and precipitation data recorded at Minneapolis, Minnesota. He compared the water balances to the long term fire history data obtained in Clark (1988) to determine the effect of climatic variability on fire occurrence. He suggested that water balance was more useful in predicting fire than precipitation alone, as it combines the effects of temperature and precipitation on the amount of moisture in fuel. He found that fires tended to occur during decades of high moisture deficits, or in dry years in the middle of moister decades. In some cases the annual water balance poorly predicted his annual fire data record, but usually the fire season water balance (March-June and October-November) predicted the fire record well. He found that fire frequency increased with moisture deficit, and showed that fire probability responds to climatic variance on a yearly scale. At seasonal to decadal scales, Clark found fire occurrence in his study areas related to dry intervals and seasonal precipitation. Non-fire years experienced much greater autumn precipitation than fire years. He stated that length of dry periods was one of the best predictors of area burned in modern Canadian forests.

Swetnam and Betancourt (1990) examined the relationship between fire and the Southern Oscillation in the southwestern United States. Using fire scars on tree rings, they developed regional fire histories and compared them to the Southern Oscillation index and spring precipitation. They found spring precipitation in the U.S. southwest highly correlated against area burned and the Southern Oscillation over the course of three centuries. Area burned was greatest when the Southern Oscillation Index was highest, accompanied by reduced rainfall and severe winter-spring droughts. Their results show that seasonal climate, not just daily fire weather, determines area burnt and frequency of large-scale fires.

Johnson and Larsen (1991) used aerial photography in combination with field verification to infer fire frequency data from tree stand age. In a study of the fire frequency of the Kananaskis Watershed in southern Canada, they constructed stand-origin maps of the region, showing the time since the last fire for each area. They examined aerial photographs to approximate fire boundaries (different stand ages). Through field sampling, they verified or corrected the aerial interpretation, refining the fire boundaries and adding patches not recognized from the aerial photographs. Using the results of other dendroclimatological studies, they tested relationships between fire frequency and climate. In their study area, they found during colder, moister periods, fire had a much longer return interval than during warmer, drier periods. They stated that regional climate seemed the most useful variable in determining and understanding fire frequency in their region of study.

Swetnam (1993) analyzed spatial and temporal fire regime changes in giant sequoia groves in the Sierra Nevada, California. Using tree rings, he constructed 1500-2000 year regional fire histories. He then compared these with dendroclimatic reconstructions of winter-spring precipitation and summer temperatures. He showed that regional fires in the Sierra Nevada were inversely related to yearly fluctuations in precipitation and directly related to longer-term variations in temperature. In his study, he determined that fire intensity was inversely related to fire frequency.

Bessie and Johnson (1995) focused on the relative roles of weather and fuel in fire behavior. They sampled forty-seven tree stands to estimate surface and crown fuel properties, and used daily noon weather data (temperature, precipitation, wind speed, and relative humidity) for July and August (the largest area burned months), 1954-1988, at Banff, Alaska, representing the southern Canadian Rockies, to predict fuel moisture contents. Using the surface fire intensity predictions derived from the data, they partitioned the prediction between a fuel variable and a weather variable to determine which was more important to fire intensity. They also tested the relationship of fire intensity and area burned. They found fire intensity correlated to annual area burned–large area-burned years had higher fire intensities than smaller area-burned years. They determined that weather was more highly correlated to fire intensity predictions than was fuel in their fire behavior model. Average fire intensity predictions using daily weather data were much higher for large area-burned years versus small area-burned years. They concluded that fires occurring in average or wetter/colder than average weather conditions remain small, while fires occurring in extreme weather conditions produce large area burned years.

Knapp (1997) examined wildfire frequency in grassland communities of the western United States between 1980 and 1994. From National Interagency Fire Center (NIFC) fire and lightning strike data for seventeen Bureau of Land Management (BLM) districts, he mapped fire frequency and lightning density patterns. Using these patterns, he tried to determine the environmental characteristics of fire frequency in grasslands of the intermountain west. He found higher ignition frequencies associated with higher elevation values and moderate climates. Knapp concluded that fire frequency patterns tend to reflect the local topography.

Levin and Saaroni (1999) examined 109 major forest fires in Israel between 1987-1995 and the weather conditions at 12 UTC on the day the fires occurred. Using a fire database of the Jewish National Fund and data from several meteorological stations, they compared general climatic characteristics such as annual rainfall, monthly averages of daily maximum temperature during the fire season, and monthly averages of relative humidity during the fire season to fire frequency and area burnt. They found that winter rainfall was highly positively correlated to total burnt area and number of fires in Israel. Relative humidity at 12 UTC for fire season months had a negative correlation to size and frequency of fires. Larger fires, however, were not significantly correlated with either maximum temperature or humidity.

Grau and Veblen (2000) examined montane forests in northwest Argentina. They described the fire history of five sites using tree cores, and statistically compared fire history with recorded precipitation and water balance calculations derived from recorded weather data. They found that in drier sites, fire had a positive correlation to high humidity during the growing season two years prior. At wet sites, fire was negatively correlated with high winter moisture availability the year prior to the fire season. Intermediate humidity sites had positive correlations between fire and growing season precipitation from that year and the previous year.

In another study, Veblen et al. (2000) found warmer and drier spring-summers strongly associated with years of widespread fire. They also found that widespread fire years tend to be preceded between two and four years by years of wetter than average springs, increasing fine fuel production. They determined that the wet-dry alternation over two to five years in the Colorado Front Range has its roots in El Niño Southern Oscillation events, and is very conducive to fire spread.

Grau (2001) studied fire and rainfall gradients in mountain ranges of northwest Argentina. He generated a map of annual rainfall isolines from 50 meteorological station records, and defined nineteen spatial sampling units of relatively homogenous rainfall. He then analyzed Landsat TM images of the region, taken on a single date at the end of the yearly fire season, attempting to determine a relationship between spatial fire patterns and rainfall gradients. He found that size distribution of burns was highly skewed in northwestern Argentina, with more than 85% of the burns less than 200 ha, and only five burns greater than 2000 ha. Fire density per unit area peaked at regions of intermediate rainfall, and Grau concluded that this would be expected; dry sampling units should have lower fire frequencies due to lower fuel production and wet sampling units should have lower fire frequencies due to higher fuel moisture.

Haberle and Ledru (2001) analyzed charcoal preserved in lake sediments from fifteen sites in Indonesia, Papau New Guinea, and Central and South America. Using these data, they spatially mapped the fire histories of those regions in hopes of determining similarities forced by global climate change. They stated that large areas of rain forest are rendered highly susceptible to fire during times of extreme drought. Their results indicated that times of frequent regional burning tended to coincide with rapid climate change or high climatic variability. They found that regional fire regimes seemed to respond most strongly to global climate changes, despite different vegetation and local weather characteristics at each site.

The body of knowledge concerning the relationship between fire size and frequency and climate is strong but incomplete. A great deal of regional variance exists. Many factors limit the interpretation of fire history information. According to Pyne (1996), these include: flammable exotic species obscuring natural fire regimes, changing anthropogenic impacts over time that alter the natural fire history, climatic changes, grazing pattern changes, and more. Recent fires may mask the impacts of, and evidence for, older fires. For long term fire history, one must rely on proxy data sources.

Fire frequency and severity may be affected over long time periods by the development of different organisms in fire-prone areas. As an example, in one region that saw a stand replacing fire, shrub birch replaced the more fire-resistant aspen following the fire (Campbell and Campbell 2000). This increased the likelihood of larger fires, as well as possibly changing fire frequency.

In some studies, climate data and fire data do not spatially coincide. Clark's (1989) study area was the Itasca State Park in northwestern Minnesota. He used the fire record from the state park, and temperature and precipitation records from Minneapolis, Minnesota, closer to the southeastern corner of Minnesota. Although he stated that mean annual precipitation did not differ significantly between Itasca and Minneapolis, the correlation between the two areas had much unexplained variance.

Some studies were either very time or space limited. Grau (2001) used satellite pictures from a single day to analyze the relationship between fire regime and rainfall. Such low temporal distribution may skew the study results. Many other authors have confined their studies to certain regions. A broader approach may yield more generally applicable conclusions.

A survey of recent literature reveals that fire regime is closely coupled to climate. Extreme weather conditions seem to produce larger, more intense fires. In general, for most regions, high area burned years are dry, especially during the fire season itself. On annual time scales, as precipitation increases, fires decrease. Some fires, especially large ones, may not always be correlated with dry seasonal conditions. Fire season precipitation seems to inhibit fires in many areas, while growing season precipitation in the year or years prior to the fire season may enhance regional fire susceptibility by stimulating fine fuel production. Moister periods seem linked to longer fire return intervals, and drier ones to high fire frequency. Fire intensity increases with decreasing frequency, and higher fire intensity generally means a greater area burned. Generally there are only a few large burns in a region per year, yet those few comprise the vast majority of the area burned.

As for regional difference, the fire regimes of different climate regions respond differently to similar moisture. Some studies indicate that fire is more frequent in mesic climates than in xeric ones due to greater fuel accumulations, despite moister conditions. Global climate changes, however, may produce similar fire regime changes worldwide in climate regions that are similar.

From current knowledge, definitively forecasting wildfire potential and behavior from known climatic factors in different regions still presents problems. Continued research is needed in order to better predict the effects of climate on wildfire.

This study examines fire frequency and area burned across the United States. The time period, though limited by the data set available, provides a recent sampling of fire regimes in different regions. Fire data and climate data spatially coincide. A wide region was studied in attempt to generate general conclusions about the relationship between fire regimes and climate, as well as to examine relationships specific to certain areas.

CHAPTER 3

DATA AND ANALYSIS

An attempt to determine the relationships between fire regimes and climate across the United States required several steps. Data for fire regimes and various climatic variables were obtained and converted into usable form. Statistical tests evaluated the data and conclusions were generated. This section provides an overview of the steps taken during this study.

In this study, annual state fire data were obtained from the U.S. Department of Agriculture from 1984-1997. The U.S. Department of Agriculture records state fire data according to fire size. The data used included (1) the number of fires in a state in each size class per year, and (2) the acres burned in a state in each size class per year. The size classes are as follows (USDA Forest Service 1992):

A = 0.25 acres of less (0.001 km^2 or less)
B = 0.26 - 9 acres (0.001 - 0.04 km^2)
C = 10 – 99 acres (0.04-0.4 km^2)
D = 100 – 299 acres (0.4 – 1.2 km^2)
E = 300 – 999 acres (1.2 – 4 km^2)
F = 1 000 – 4 999 acres (4 – 20 km^2)
G = 5 000 acres or more (20 km^2 or more)

Unfortunately, accurate fire records of this type do not exist prior to 1984, with the exception of a few states and federal land areas. Before 1984, the Forest Service had not accumulated data of this type on both federal and private lands (Lundgren 2001). Therefore, this study was restricted to a fourteen year time period.

Ten states spread across the U.S. were chosen for study: Arizona, California, Colorado, Florida, Maine, Minnesota, Missouri, Ohio, Texas, and Washington. These states were chosen in order to get an overall picture of fire regime-climate relationships across the United States. The ten states are spread across the U.S. and capture climatic extremes within the continental U.S.

Monthly precipitation and Palmer drought index values for the ten states from 1983-1997 were obtained from the National Climate Data Center (NCDC). The data were manipulated to find annual and seasonal precipitation totals, and maximum, minimum, and seasonal Palmer drought index values for the time period. The seasonal values computed were for winter (December-January-February), spring (March-April-May), summer (June-July-August), and autumn (September-October-November). The maximum and minimum monthly values per year of the Palmer drought index were found. Three monthly indices were averaged to form seasonal Palmer indices.

The Palmer drought severity index (PDSI) (Palmer 1965) was chosen for this study because it uses both temperature and rainfall data in determining soil moisture levels. It is standardized to local climate, and thus can be applied anywhere in the country to measure relative drought or moisture conditions. The PDSI is a slow-response index, most effective in determining long term drought (a period of several months). It ranges from approximately –6.0 and +6.0, with positive values indicating wetter time periods and negative values dryer time periods. An absolute value of 2 is considered moderate, 3 severe, and 4 extreme (Hayes 1999; NOAA 2001).

Number of fires and acres burned in each size class were statistically compared to annual and seasonal precipitation totals as well as maximum, minimum, and seasonal Palmer index values for the ten states studied. Using Minitab computer software and Microsoft Excel, correlation tests were performed on the data. The correlation coefficient (*r*) and the significance of the correlation coefficient (p-value) were obtained through the statistical tests.

The standard criterion for meaningful evidence in research work is the 5% significance level (Moore and McCabe 1999). Thus the statistical significance level chosen for this study was 5%. All correlations with a maximum p-value of 0.05 were noted. These highly correlated data sets were tabulated in order to search for patterns both within states and between states.

Finally, maps were developed to visually depict the significant correlations between fire activity and climatic variables across the continental U.S. The maps show which climatic variables examined exhibited significant correlations in the states studied.

CHAPTER 4

RESULTS

Over the fourteen years studied, correlation between precipitation and Palmer drought index values varied widely across the United States. The following sections detail the results of each statewide data set studied. The presented statistical correlations were found to be significant at a minimum level of 95%. Appendix 1 presents the full list of correlation coefficients and p-values. The tables of correlation data for each state provide a visual summary of the significant results. The sign in front of each season or value refers to the type of correlation, positive or negative.

4.1 Arizona

Correlation tests on the number of fires and precipitation yielded significant results in this state. Table 4.1 shows that annual, spring, summer, and autumn precipitation were not highly correlated with the number of fires in any class size. Winter precipitation, however, was strongly positively correlated to the number of Class B, C, D, and E fires, with less than a 0.005 chance of error, indicating that with greater winter precipitation, more middle-sized fires may occur.

Correlation tests on the acres burned per size class and precipitation gave similar, but slightly varying results. Once again, winter precipitation was significantly positively correlated with the acres burned in Class B, C, D, and E fires. Acres burned by Class A fires, however, were strongly negatively correlated with the same year's autumn precipitation. Annual, spring, and summer precipitation were not highly correlated to the acres burned in any size class.

The Palmer drought severity index yielded interesting correlations to number of fires. The number of Class A, E, F, and G fires were not highly correlated to the drought index at all, as shown in Table 4.1. Neither was the total number of fires. The number of Class B fires was strongly positively correlated to the spring Palmer index average. The number of Class C fires per year was significantly positively correlated to the annual maximum monthly Palmer index value and the winter and spring Palmer index averages. Once again, this indicates that the number of middle-sized fires increase with wetter winter-spring conditions. The number of Class D fires was also strongly positively correlated to the winter and spring Palmer index averages.

The Palmer index also showed significant correlation to acres burned in some size classes. The number of acres burned by Class A and Class G fires was strongly negatively correlated to the annual minimum monthly Palmer index value and the autumn Palmer index average. This implies that under dry autumn conditions, and when the lowest annual Palmer index value is particularly low, there are more acres burned by the smallest and largest fire classes. Acres burned by Class B fires were significantly positively correlated with maximum monthly Palmer index value and winter and spring

Fire class	Number of fires/ precipitation	Acres burned/ precipitation	Number of fires/ PDSI	Acres burned/ PDSI
Class A		-Autumn		-Minimum -Autumn
Class B	+Winter	+Winter	+Spring	+Maximum +Winter +Spring
Class C	+Winter	+Winter	+Maximum +Winter +Spring	+Winter +Spring
Class D	+Winter	+Winter	+Winter +Spring	+Winter +Spring
Class E	+Winter	+Winter		
Class F				
Class G				-Minimum -Autumn
Total				

Table 4.1: Seasons exhibiting statistically significant positive (+) or negative (-) correlations between number of fires, acres burned, and precipitation and PDSI for Arizona.

Palmer index averages. Acres burned by Class C and D fires were strongly positively correlated with winter and spring Palmer index averages as well.

4.2 California

Correlation tests on number of fires and precipitation yielded no significant results over the time period studied.

Only three correlation test results between acres burned and precipitation were significant, but the validity of these results seems questionable, as they are contradictory. Table 4.2 shows that Class A acres burned were strongly negatively correlated with autumn precipitation, while Class C acres burned were strongly positively correlated with autumn precipitation. Class B acres burned were negatively correlated with spring precipitation. None of the other values were statistically significant.

Correlation tests on the number of fires and the Palmer index values gave few significant results. As shown in Table 4.2, the number of Class A fires was strongly negatively correlated with the maximum monthly Palmer index value for each year, as well as the spring, summer, and autumn Palmer index averages. The total number of fires was also highly negatively correlated to the same sets of values.

No significant correlations were returned from the tests on acres burned per size class and the Palmer index.

Fire class	Number of fires/ precipitation	Acres burned/ precipitation	Number of fires/ PDSI	Acres burned/ PDSI
Class A		-Autumn	-Maximum -Spring -Summer -Autumn	
Class B		-Spring		
Class C		+Autumn		
Class D				
Class E				
Class F				
Class G				
Total			-Maximum -Spring -Summer -Autumn	

Table 4.2: As for Table 4.1, except for California.

4.3 Colorado

Colorado showed a few instances of significant correlation between number of fires and precipitation. The number of fires in Classes B, C, E, and F displayed strong negative correlation with both annual and summer precipitation, as shown in Table 4.3. All other correlations were weak.

There were also significant correlations between acres burned and precipitation. Total acres burned, as well as acres burned in Classes C, D, E, and F, were strongly negatively correlated with annual precipitation. Summer precipitation showed a significant negative correlation with acres burned in Classes B, C, E, and F. Annual and summer precipitation exhibited strong negative correlation with acres burned; no other seasonal precipitation showed any linkages.

Correlations between the Palmer drought index and number of fires did not extend over many fire classes. Table 4.3 shows that the number of Class B fires possessed a strong negative correlation to the maximum and minimum Palmer index value for the year, as well as the summer and autumn Palmer index averages. The number of Class C fires displayed a strong negative correlation with only the autumn Palmer index average. All other correlations calculated were weak.

The Palmer index and the number of acres burned exhibited slightly more consistent correlation values over the fourteen years in the study. The acres burned by Class B fires showed significant negative correlation to summer precipitation. Autumn precipitation and the acres burned by Class B, C, and D fires also showed strong negative correlation.

Fire class	Number of fires/ precipitation	Acres burned/ precipitation	Number of fires/ PDSI	Acres burned/ PDSI
Class A				
Class B	-Annual -Summer	-Summer	-Maximum -Minimum -Summer -Autumn	-Summer -Autumn
Class C	-Annual -Summer	-Annual -Summer	-Autumn	-Autumn
Class D		-Annual		-Autumn
Class E	-Annual -Summer	-Annual -Summer		
Class F	-Annual -Summer	-Annual -Summer		
Class G				
Total		-Annual		

Table 4.3: As for Table 4.1, except for Colorado.

4.4 Florida

Several strong correlations between precipitation and number of fires appeared after data analysis. Table 4.4 shows that annual precipitation correlated negatively with the number of Class A, B, C, and D fires and the total number of fires. Autumn precipitation showed a strong negative correlation to the number of Class B fires. Strong correlations existed between winter precipitation and number of fires in several classes. Classes C, D, E, F, and G exhibited significant negative correlation with winter precipitation, with p-values as low as 0.000 to three decimal places.

The number of acres burned in Florida also showed strong correlations with precipitation. Acres burned in Classes A, B, C, and D showed significant negative correlation with annual precipitation. In addition, in all classes but Class B, the acres burned per year were strongly negatively correlated with winter precipitation. Total acres burned per year also exhibited strong correlation with winter precipitation.

Number of fires and the Palmer drought index also showed strong correlations in Florida, as shown in Table 4.4. The maximum annual Palmer index value exhibited a strong negative correlation with number of fires in all classes, including the total number of fires per year. The minimum annual Palmer index value also showed a strong negative correlation with number of fires in all classes except F and G. The winter Palmer index average and number of fires in the larger classes, D, E, F, and G, displayed significant negative correlation. The correlation between the spring Palmer index average and total fires, as well as fires in Classes C, D, E, F, and G, was strongly negative. The summer Palmer index average correlated negatively to the number of Class D fires, and both the summer and autumn Palmer index averages showed strong negative correlation to the total number of fires and fires in Classes A, B, and C.

As with the number of fires, the Palmer drought index displayed significant correlations with acres burned. Again, the maximum annual Palmer index value showed strong negative correlation to the acres burned in all classes, including the total acres burned. The minimum annual Palmer index value was not significantly correlated with the total acres burned or with acres burned in Classes F or G, but showed strong negative correlation to acres burned in all other classes. The winter Palmer index average exhibited significant negative correlation to the acres burned by Class D, E, and F fires, as well as the total acres burned. The spring Palmer index average showed strong negative correlation with all but Class B acres burned. The summer Palmer index average displayed strong negative correlation with acres burned by Class A, C, and D fires. Acres burned in Classes B and C fires showed strong negative correlation to the autumn Palmer drought index average.

Fire class	Number of fires/ precipitation	Acres burned/ precipitation	Number of fires/ PDSI	Acres burned/ PDSI
Class A	-Annual	-Annual -Winter	-Maximum -Minimum -Summer -Autumn	-Maximum -Minimum -Spring -Summer
Class B	-Annual -Autumn	-Annual	-Maximum -Minimum -Summer -Autumn	-Maximum -Minimum -Autumn
Class C	-Annual -Winter	-Annual -Winter	-Maximum -Minimum -Spring -Summer -Autumn	-Maximum -Minimum -Spring -Summer -Autumn
Class D	-Annual -Winter	-Annual -Winter	-Maximum -Minimum -Winter -Spring -Summer	-Maximum -Minimum -Winter -Spring -Summer
Class E	-Winter	-Winter	-Maximum -Minimum -Winter -Spring	-Maximum -Minimum -Winter -Spring
Class F	-Winter	-Winter	-Maximum -Winter -Spring	-Maximum -Winter -Spring
Class G	-Winter	-Winter	-Maximum -Winter -Spring	-Maximum -Spring
Total	-Annual	-Winter	-Maximum -Minimum -Spring -Summer -Autumn	-Maximum -Winter -Spring

Table 4.4: As for Table 4.1, except for Florida.

4.5 Maine

Table 4.5 shows that consistent correlations were apparent between precipitation and number of fires in Maine. Annual precipitation showed a significant correlation with number of Class B, C, and D fires, as well as total fires. Maine experienced no Class G fires during the study period.

Fewer significant correlations existed between precipitation and acres burned. Annual precipitation did, however, show a strong negative correlation to acres burned in Class C and D fires, as well as total acres burned.

Several significant correlations were apparent between the Palmer drought index and number of fires, though few were consistent over several fire classes. The exception was the minimum annual Palmer index value, which showed a strong negative correlation to total number of fires, as well as the number of fires in Classes A, B, D, and F, as shown in Table 4.5. The spring Palmer index average showed a significant negative correlation to the number of Class D fires, and the autumn Palmer index average exhibited a strong negative correlation to the number of Class E fires. Both the total number of fires and the Class A fires showed significant negative correlation to the summer Palmer index average.

Fewer significant correlations existed between the Palmer drought index and acres burned in each size class. The minimum annual Palmer index value showed a strong negative correlation to acres burned by Class B, D, and F fires, as well as the total acres burned. The autumn Palmer index average was also significantly negatively correlated with the total number of acres burned in all size classes.

Fire class	Number of fires/ precipitation	Acres burned/ precipitation	Number of fires/ PDSI	Acres burned/ PDSI
Class A			-Minimum -Summer	
Class B	-Annual		-Minimum	-Minimum
Class C	-Annual	-Annual		
Class D	-Annual	-Annual	-Minimum -Spring	-Minimum
Class E			-Autumn	
Class F			-Minimum	-Minimum
Class G	---	---	---	---
Total		-Annual	-Minimum -Summer	-Minimum -Autumn

Table 4.5: As for Table 4.1, except for Maine.

4.6 Minnesota

Minnesota showed only one significant correlation between number of fires and precipitation, depicted in Table 4.6. The number of Class A fires showed strong negative correlation to annual precipitation.

Only one significant correlation existed between acres burned and precipitation. Once again, the number of acres burned by Class A fires exhibited strong negative correlation to the annual precipitation.

The number of fires in Minnesota seemed strongly correlated to almost all derivations of the Palmer index used in this study, as Table 4.6 shows. The minimum

Palmer index value and the spring, summer, and autumn Palmer index averages showed strong negative correlations to ALL fire classes, including total number of fires. In addition, the maximum Palmer index values and the winter Palmer index averages also showed strong negative correlation to the number of fires in Classes C and D, as well as the total number of fires.

The acres burned in Minnesota exhibited strong correlations to many Palmer index values used. The minimum Palmer index value and the spring Palmer index average showed strong negative correlation to acres burned by all fire classes, including the total acres burned. The summer and autumn Palmer index averages correlated negatively with acres burned in all classes except Class E. The winter Palmer index averages and the acres burned by Classes C, F, and G, and total acres burned showed significant negative correlation. Finally, the maximum Palmer index value displayed strong negative correlation to the total acres burned as well as the acres burned by Classes F and G.

Fire class	Number of fires/ precipitation	Acres burned/ precipitation	Number of fires/ PDSI	Acres burned/ PDSI
Class A	-Annual	-Annual	-Minimum -Spring -Summer -Autumn	-Minimum -Spring -Summer -Autumn
Class B			-Minimum -Spring -Summer -Autumn	-Minimum -Spring -Summer -Autumn
Class C			-Maximum -Minimum -Winter -Spring -Summer -Autumn	-Minimum -Winter -Spring -Summer -Autumn
Class D			-Minimum -Spring -Summer -Autumn	-Minimum -Spring -Summer -Autumn
Class E			-Minimum -Spring -Summer -Autumn	-Minimum -Spring
Class F			-Maximum -Minimum -Winter -Spring -Summer -Autumn	-Maximum -Minimum -Winter -Spring -Summer -Autumn
Class G			-Maximum -Minimum -Winter -Spring -Summer -Autumn	-Maximum -Minimum -Winter -Spring -Summer -Autumn
Total			-Minimum -Spring -Summer -Autumn	-Maximum -Minimum -Winter -Spring -Summer -Autumn

Table 4.6: As for Table 4.1 except for Minnesota.

4.7 Missouri

Missouri showed only one strong correlation between number of fires and precipitation. Table 4.7 shows that the number of Class F fires possessed significant negative correlation to the annual precipitation. Missouri experienced no Class G fires during the study period. Correlation tests on acres burned and precipitation yielded no significant results over the period of the study.

In contrast, there were several strong correlations between number of fires and the Palmer drought index, as exhibited in Table 4.7. The maximum Palmer index values were negatively strongly correlated to the number of Class F fires, and the minimum Palmer index values showed strong negative correlation to the total number of fires, as well as the number of fires in Classes B, C, D, E, and F. The winter Palmer index average displayed strong negative correlation to the number of fires in Classes A, B, C, and D and the total number of fires. The number of fires in Classes A, B, C, and F and the total number of fires also showed significant negative correlation to the spring Palmer index average. The summer Palmer index average showed strong negative correlation to the number of fires in Classes A and F.

Fire class	Number of fires/ precipitation	Acres burned/ precipitation	Number of fires/ PDSI	Acres burned/ PDSI
Class A			-Winter -Spring -Summer	
Class B			-Minimum -Winter -Spring	-Minimum -Winter -Spring
Class C			-Minimum -Winter -Spring	-Minimum -Winter -Spring
Class D			-Minimum -Winter	-Minimum -Winter
Class E			-Minimum	
Class F	-Annual		-Maximum -Minimum -Spring -Summer	-Winter
Class G	---	---	---	---
Total			-Minimum -Winter -Spring	-Minimum -Winter -Spring

Table 4.7: As for Table 4.1, except for Missouri.

Several correlations existed between the acres burned per year and Palmer index values. The minimum Palmer index value and the winter and spring Palmer index averages showed strong negative correlation to the total acres burned and the acres burned by fires in Classes B and C. The minimum Palmer index value also exhibited significant negative correlation to the acres burned by Class D fires, and the winter Palmer index average showed strong negative correlation to the acres burned by fires in Classes D and F.

4.8 Ohio

Correlation tests on number of fires and precipitation yielded several results of significance, shown in Table 4.8. Annual precipitation showed a strong negative correlation to the total number of fires, and to the number of Class A and B fires. Spring precipitation was also linked to number of fires—it showed a significant negative correlation to the number of Class A and C fires and the total number of fires. Also, autumn precipitation appeared to have a strong negative correlation to the number of Class B fires. Ohio had no Class G fires during the period of study.

Similar correlations were significant in comparisons between acres burned and precipitation. Annual precipitation displayed a strong negative correlation to the number of Class B and C fires, and the total number of fires. Spring precipitation exhibited significant negative correlation to the total number of fires and the number of fires in Classes A and C. Once again, autumn precipitation showed a strong negative correlation to the acres burned by Class B fires.

Table 4.8 shows the small number of correlations that were apparent between the number of fires per year and the Palmer drought index. The maximum annual Palmer index showed a strong negative correlation to the number of fires in Classes A and B and to the total number of fires. The summer and autumn Palmer index averages also displayed significant negative correlation to the number of Class A fires.

There were also only a few significant correlations between acres burned and the Palmer index. The maximum Palmer index showed a strong negative correlation to the total acres burned, as well as the acres burned by Class A, B, and C fires. The only other correlation was between the spring Palmer index average and the acres burned by Class C fires, which was also strongly negative.

Fire class	Number of fires/ precipitation	Acres burned/ precipitation	Number of fires/ PDSI	Acres burned/ PDSI
Class A	-Annual -Spring	-Spring	-Maximum -Summer -Autumn	-Maximum
Class B	-Annual -Autumn	-Annual -Autumn	-Maximum	-Maximum
Class C	-Spring	-Annual -Spring		-Maximum -Spring
Class D				
Class E				
Class F				
Class G	---	---	---	---
Total	-Annual -Spring	-Annual -Spring	-Maximum	-Maximum

Table 4.8: As for Table 4.1, except for Ohio.

4.9 Texas

Correlation tests on precipitation and number of fires in Texas yielded several significant, consistent results. First, Table 4.9 shows that annual precipitation possessed a strong negative correlation to the total number of fires, and the number of fires in Classes B, C, D, and E. Also, spring precipitation exhibited a significant negative correlation to the number of fires in Classes B, C, and E, and the total number of fires.

As in the tests on number of fires, correlation tests on precipitation and acres burned also gave several strong, consistent results. Both annual and spring precipitation showed strong negative correlations to the number of fires in Classes B, C, D, and E, as well as the total number of fires.

Correlations between the number of fires and the Palmer drought index were more scattered, as Table 4.9 indicates. The minimum annual Palmer index exhibited significant negative correlation to the number of fires in Classes B, C, and E, and the total number of fires. The spring Palmer index average and the number of fires in Classes C and E also showed strong negative correlation.

Several correlations were apparent between the acres burned and the Palmer drought index as well. The minimum annual Palmer index showed a strong negative correlation to the acres burned by Class B, C, D, and E fires, as well as the total acres burned. Acres burned by Class B fires displayed a significant negative correlation to the autumn Palmer drought index average. The spring Palmer index average showed a strong negative correlation to the total acres burned, and the acres burned by fires in Classes C, D, and E.

Fire class	Number of fires/ precipitation	Acres burned/ precipitation	Number of fires/ PDSI	Acres burned/ PDSI
Class A				
Class B	-Annual -Spring	-Annual -Spring	-Minimum -Autumn	-Minimum -Autumn
Class C	-Annual -Spring	-Annual -Spring	-Minimum -Spring -Autumn	-Minimum -Spring
Class D	-Annual	-Annual -Spring		-Minimum -Spring
Class E	-Annual -Spring	-Annual -Spring	-Minimum -Spring	-Minimum -Spring
Class F				
Class G				
Total	-Annual -Spring	-Annual -Spring	-Minimum -Autumn	-Minimum -Spring

Table 4.9: As for Table 4.1, except for Texas.

4.10 Washington

Correlation tests between the number of fires and precipitation yielded a few significant results in Washington, shown in Table 4.10. Spring precipitation showed a strong negative correlation to the number of Class A, B, and C fires, as well as the total number of fires. Summer precipitation correlated significantly with the number of Class D fires.

There were only two significant correlations between acres burned and precipitation in this state. Spring precipitation showed a significant negative correlation to acres burned by fires in Classes B and C.

Correlation tests on the number of fires and the Palmer drought index gave more complicated results, depicted in Table 4.10. The minimum annual Palmer index and the spring and summer Palmer index averages showed strong negative correlation to the total number of fires and the number of fires in Classes A, B, C, and D. The maximum annual Palmer index value and the autumn Palmer index average exhibited significant negative correlation to the total number of fires and the number of fires in Classes A, B, and C. Also, the winter Palmer index average showed a strong negative correlation to the number of fires in Class C and the total number of fires.

Several significant correlations were also observed between the acres burned and the Palmer drought index. The acres burned by Class A fires were strongly negatively correlated to the autumn Palmer index average. The acres burned by Class D fires were strongly negatively correlated to the summer Palmer index average. The maximum annual Palmer index value, and the spring, summer and autumn Palmer index averages showed significant negative correlations to the acres burned by Class B and C fires. The acres burned by Class C fires also showed strong negative correlations to the minimum annual Palmer index value and the winter Palmer index average.

Fire class	Number of fires/ precipitation	Acres burned/ precipitation	Number of fires/ PDSI	Acres burned/ PDSI
Class A	-Spring		-Maximum -Minimum -Spring -Summer -Autumn	-Autumn
Class B	-Spring	-Spring	-Maximum -Minimum -Spring -Summer -Autumn	-Maximum -Spring -Summer -Autumn
Class C	-Spring	-Spring	-Maximum -Minimum -Winter -Spring -Summer -Autumn	-Maximum -Minimum -Winter -Spring -Summer -Autumn
Class D	-Summer		-Minimum -Spring -Summer	-Summer
Class E				
Class F				
Class G				
Total	-Spring		-Maximum -Minimum -Winter -Spring -Summer -Autumn	

Table 4.10: As for Table 4.1, except for Washington.

CHAPTER 5

DISCUSSION

In this chapter the findings of the study are discussed and possible explanations of the results are examined for each state. Maps are presented to visually depict the results and aid in drawing regional conclusions. This section also discusses general conclusions to which the study leads.

5.1 Arizona

Precipitation showed strong correlations to the number of fires and the acres burned in several classes. Over the time period studied, winter precipitation showed very strong positive correlation to the number of fires between 0.001 - 4.043 km^2 and the acres burned by fires in this size range. More winter precipitation is associated with an increase in the number of smaller fires and the acres burned by such fires. The fire season in Arizona occurs mainly during May and June. (Fire seasons were obtained from Schroeder and Buck (1970)). Precipitation in December-January-February may stimulate fine fuel growth in late winter and early spring, producing more vegetation on which fire can prey in late spring and summer. Additionally, the acres burned by Class A fires showed a strong negative correlation to autumn precipitation. Though this does not occur during the fire season, perhaps these small fires occurring during the fall were affected by a decrease in precipitation during this time. The number of fires does not show significant correlation to autumn precipitation; approximately the same number of fires may have occurred, but the area burned dropped with greater autumn precipitation.

The PDSI also showed several strong correlations to the number of fires and the acres burned in quite a few classes. Winter and spring Palmer index averages most likely showed strong positive correlation for the same reason that winter precipitation did. As the Palmer index is a slow-response index, the spring value would also show strong correlation to the number of fires and the acres burned. The strong correlation between the maximum Palmer index values and the number of Class C fires and acres burned by Class B fires may also be explained by the stimulation of fine fuel growth through winter precipitation; the majority of the maximum Palmer index values occurred during the winter months. The minimum Palmer index values and the autumn averages showed strong negative correlation to acres burned by both the smallest and largest fire classes. The minimum values were evenly split between summer and winter; drought conditions in summer probably led to fires during the fire season, and drought conditions in the winter, though inhibiting fine fuel buildup, may have more thoroughly dried the fuel available and increased fire potential. The smallest class of fires may be least affected by climatic factors—these include house fires that may have little relation to weather. As Levin and Saaroni (1999) found, the largest fires may also be less affected by rainfall or climatic conditions.

5.2 California

In California, precipitation showed an odd combination of correlations to the number of fires and acres burned. In northern California, the fire season lasts from June through September; in the southern part, critical fire weather can occur during all parts of the year. The strong negative correlation between acres burned by Class B fires and spring precipitation probably existed because high levels of spring precipitation added moisture to the fuel, keeping it from burning for much of the fire season. While autumn precipitation showed a strong positive correlation to the acres burned by Class C fires, the strong correlation to acres burned by Class A fires was negative. Strong dry winds can produce heavy fire danger in late summer and early fall; this may have caused the negative correlation between autumn precipitation and acres burned by Class A fires. Possibly the strong positive correlation to Class C fires is related to lightning that accompanies autumn thunderstorms, increasing ignition frequencies. The state of California encompasses many climatic regions, and the results may have been contradictory due to the consolidation of so many different climate types into one broad study.

Several other correlations between the PDSI and number of fires bear discussion as well. These existed between the number of Class A fires and the number of total fires. Because the number of Class A fires generally comprises approximately three-quarters of the total number of fires, it is logical to assume that the correlation between the Palmer index and the total number of fires was due, for the most part, to the number of Class A fires. This study found that lower maximum, spring, summer, and autumn Palmer drought indices were associated with more Class A fires. The maximum Palmer drought index value per year occurred in all different seasons with approximately equal frequency over the course of the study period. It seems that the number of Class A fires was affected by drought conditions over the entire year. This concurs with the southern California fire season.

5.3 Colorado

In Colorado, annual and summer precipitation showed strong negative correlations to the number of fires and acres burned in several classes. Colorado's peak fire season occurs from June or July through September. It receives most of its annual precipitation during the warmer half of the year. Thus it appears that with a decrease in precipitation during fire-prone months, the number of fires and the acres burned by fires both increase.

Several correlations between the Palmer index and number of fires or acres burned can also be explained this way. Summer and autumn PDSI averages showed strong negative correlations to the number of fires and acres burned by several smaller fire classes. The autumn PDSI averages are likely linked because of the slow response nature of the index itself. As in Arizona and California, the larger fires did not appear to be as closely linked to either precipitation or the Palmer drought index.

5.4 Florida

Florida showed strong correlations between precipitation and number of fires/acres burned in all classes. The greatest number of significant correlations existed with either annual or winter precipitation or both. In Florida, fires can occur year-round, but the bulk of the fires take place in spring and fall. Most of the precipitation falls in spring and fall as well. Low winter precipitation decreases the amount of moisture present at the start of the spring fire season, exacerbating fire weather conditions. Low annual precipitation was strongly linked to the number of, and acres burned by, smaller fires. As Florida is dominated by flash fuels which may ignite even shortly after rain, lower annual precipitation can strongly influence the number of fires (Schroeder and Buck 1970). Unlike the other states discussed thus far, Florida's Class F and G fires did show strong negative correlation to winter precipitation, both in number and in acres burned. This may be due to the climatic region in which Florida lies. Unfortunately, no other states in this region were examined in this study.

All fire classes showed strong correlations to the Palmer drought index in Florida. All showed a strong negative correlation to the maximum PDSI values. Smaller fires also exhibited strong negative correlation to the minimum PDSI values and summer and autumn Palmer index averages, while larger fires tended to have significant correlations to the winter and spring Palmer index averages. This may indicate that larger fires tend to occur during the spring, burning large areas and decreasing the threat of large fires in the fall. Smaller fires might then spring up in widespread areas in the second peak of the fire season. The maximum PDSI values occurred mainly in winter and spring; it seems that the wetter the wettest winter/spring conditions are, the smaller the likelihood of fires of all classes.

5.5 Maine

Maine showed strong negative correlation between annual precipitation and the number of fires/acres burned in a few of the smaller fire classes. Maine's annual precipitation peaks to a slight maximum in the summer, building from and tapering back to a slightly lower value in the winter. The fire season is from April to October, peaking in spring and fall. No one seasonal precipitation correlated as strongly as annual precipitation. This may result from location. In Maine, winter snows may persist well into the spring. Coniferous trees may protect ground from drying during winter and spring, and deciduous trees may aid this as well during summer and fall. According to Schroeder and Buck (1970), drought years, while infrequent, may be severe. Once again, the larger fires did not show strong correlation to precipitation.

The most consistent correlation between the PDSI and number of fires/acres burned in Maine occurred between most fire classes and the yearly minimum Palmer index value. This minimum took place most often during winter or spring. More severe winter/spring drought conditions indicate less ground moisture availability leading into the fire season in spring. Significant negative correlations also existed between the summer and autumn Palmer index averages for a few fire classes. This indicates that the number of fires increases when drought conditions become more severe in the summer, leading into the fall fire season. The number of and acres burned by the largest fires in Maine during the study period did show correlation to the minimum annual Palmer index value. Large fires in this northeastern state were strongly influenced by the most severe annual drought conditions.

5.6 Minnesota

Only Class A fires showed significant correlation to precipitation in this state. Minnesota has a microthermal snow forest climate (Espenshade et al. 1995). It appears that during this study period, small fires occurred more frequently during years of lower than normal precipitation. Minnesota experiences colder temperatures than most states during much of the year. Most likely, greater precipitation inhibits small fires every year. Larger fires, however, probably require more dry fuel buildup than simply one year of low precipitation.

Many of the various PDSI values tested were correlated to the number of fires or acres burned in Minnesota over the study period. The minimum and spring values showed strong correlations to all number of fires and acres burned. Most fires in Minnesota occur during spring or fall. The annual minimum PDSI values were found almost exclusively in winter and summer. Drought conditions most likely preceded the fire season, allowing fuel buildup. Larger fires were correlated to the winter Palmer index averages and smaller fires were not. As in Florida, perhaps large fires burnt large areas of available fuel early in the year, leaving smaller amounts of fuel in scattered places for smaller fires in summer and autumn. In Minnesota, however, large fires were correlated to ALL Palmer index values tested for correlation, which may indicate large fires throughout both fire seasons.

5.7 Missouri

Only one correlation existed between precipitation and fires in Missouri. The number of Class F fires showed strong negative correlation to annual precipitation. In

Missouri, Class F fires were the largest fires during the study period. It seems that the number of fires in this class size showed strong links to annual moisture-deficit conditions. Smaller fires, according to the analysis of the PDSI values, show stronger links to seasonal drought conditions, which include both temperature and moisture.

Missouri fires showed high correlations to many Palmer index values tested. Minimum, winter, and spring Palmer index vales showed the greatest number of correlations to the number of fires and acres burned in several classes. The minimum values occurred mostly in winter or summer, preceding the fire season, which in Missouri is mostly during spring and fall. Low winter and spring Palmer index averages indicate dry conditions leading into and during the spring fire season. Summer Palmer index averages also correlated with the number of Class A and F fires. This may indicate dry summer conditions precipitating both large and small autumn fires. Missouri shows the classic "more drought, more fires" type explanation for fires, without being linked as strongly to precipitation values.

5.8 Ohio

Ohio's fire season lasts from April through October, peaking in spring and fall. The correlations between precipitation and fires reflect this. Fires in Classes A and C showed strong negative correlation to spring precipitation, both in number of fires and acres burned. Class B fires exhibited significant negative correlation to autumn precipitation. In both cases, fire season precipitation may have inhibited fires, and lack of such may have encouraged fire outbreaks. Annual precipitation also showed significant correlation to fires in these three classes. Overall dry years probably also promote fire occurrence by creating dry conditions leading into and during the fire seasons.

Several links between the Palmer index values and fires also bear discussion. The maximum annual Palmer index value showed strong negative correlation to several smaller fire classes. This value occurred mostly in winter or autumn, preceding the spring fire season or during the autumn time of high fire activity. Drier "wet" conditions than normal were usually accompanied by an increase in the fire activity of the smaller fire classes. Correlation between the spring Palmer index average and the acres burned by Class C fires may indicate that these fires occurred mostly during the spring fire season and were aided by dry spring conditions. Large fires did not show significant correlations to precipitation or PDSI values for the year of the fires.

5.9 Texas

In Texas, precipitation and number of fires/acres burned were strongly correlated in all but the smallest and the largest two fire classes. Both annual and spring precipitation exhibited strong negative correlation to the four middle fire classes. The fire season in Texas occurs mainly in spring and fall; most likely, the fires in these classes were strongly affected by lack of spring precipitation during the fire season. A decrease in the annual precipitation over Texas would also exacerbate dry conditions and possibly lead to increases in fire activity.

Correlations between the PDSI values and fire activity also show the influence of the fire seasons. As seen in other states, the smaller fires (Classes B and C) had strong links to autumn Palmer index averages, and the larger fires (Classes D and E) had strong ties to spring Palmer index averages. Perhaps much of the available dry fuel was influenced by burning earlier in the year, leaving patchy areas dried through the summer to fuel autumn fires. The minimum Palmer index values occurred mainly in winter or autumn, and were strongly linked to fires in these four classes as well. Drought conditions in winter precede the spring fire season, exacerbating fuel moisture deficit and aiding fire activity during spring. Drought conditions in autumn aid the autumn fire season as well.

5.10 Washington

Washington, like California, encompasses many different climates; the fire season in the west occurs in later summer and early fall, and in the east, begins in early summer and lasts through September or October. Spring precipitation showed strong correlation in the three smallest fire classes, and summer precipitation exhibited significant negative correlation to the number of Class D fires. Low spring precipitation appears to have a direct effect on fires that begin in summer. Larger fires, more strongly influenced by summer precipitation, may occur later in the year, in contrast to the apparent results in other states. However, the largest three fire classes showed no links to precipitation during the year of the fires.

Several strong correlations existed between PDSI values and fire activity in Washington. Class D fires were linked to spring and summer Palmer index averages, while Class A acres burned were linked only to the autumn average. In contrast to the precipitation correlations, this agrees with the conclusions of states discusses earlier; larger fires may take out available fuel in the early fire season, with smaller fires following later in the year. The largest three fire classes, however, also showed no correlation to yearly Palmer drought index values.

5.11 Regional Conclusions

Figure 1 depicts significant correlations that existed between precipitation and fire activity for the states examined in this study. In order to give a better overview, the map shows only the significant correlations that existed in multiple fire classes. Single class fire correlations were disregarded. Minnesota and Missouri, in the north-central part of the U.S., showed no significant correlations to precipitation in multiple fire classes; neither did California. Strong correlations to annual precipitation are the most prominent regional similarity, but this does not extend to the west coast or north-central United States. Except for Florida and Colorado, the correlations between precipitation and fire activity were apparent only in the smaller fire classes, A-E.

Figure 2 shows the significant correlations that existed between PDSI values and fire activity in fire classes A-E. Once again, the map gives only the significant correlations that existed in multiple fire classes. The correlations between PDSI values and the larger fire classes, F and G, are shown in Figure 3 on page 56. The two maps are slightly different; four states shown in the first map had no strong correlations between fire activity and PDSI values in fire classes F and G. Large fire activity also showed strong correlations to different PDSI values than smaller fires. Figure 2 shows that small fire activity in over half the states examined showed significant correlation to the minimum annual PDSI value, and four states had high correlations between the maximum annual PDSI value and small fire activity. Figure 3 shows that four of the ten

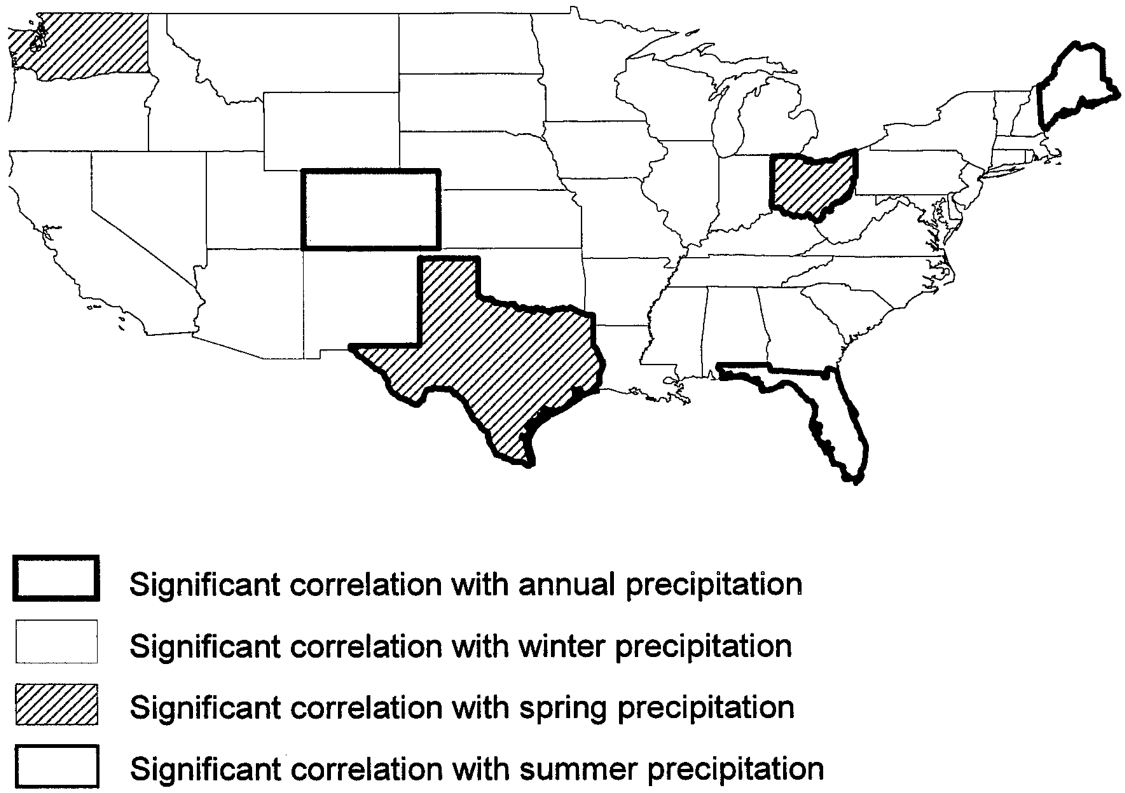

Figure 1: U.S. map showing significant correlations that existed between precipitation and either number of fires or acres burned in multiple fire classes for the states examined in this study.

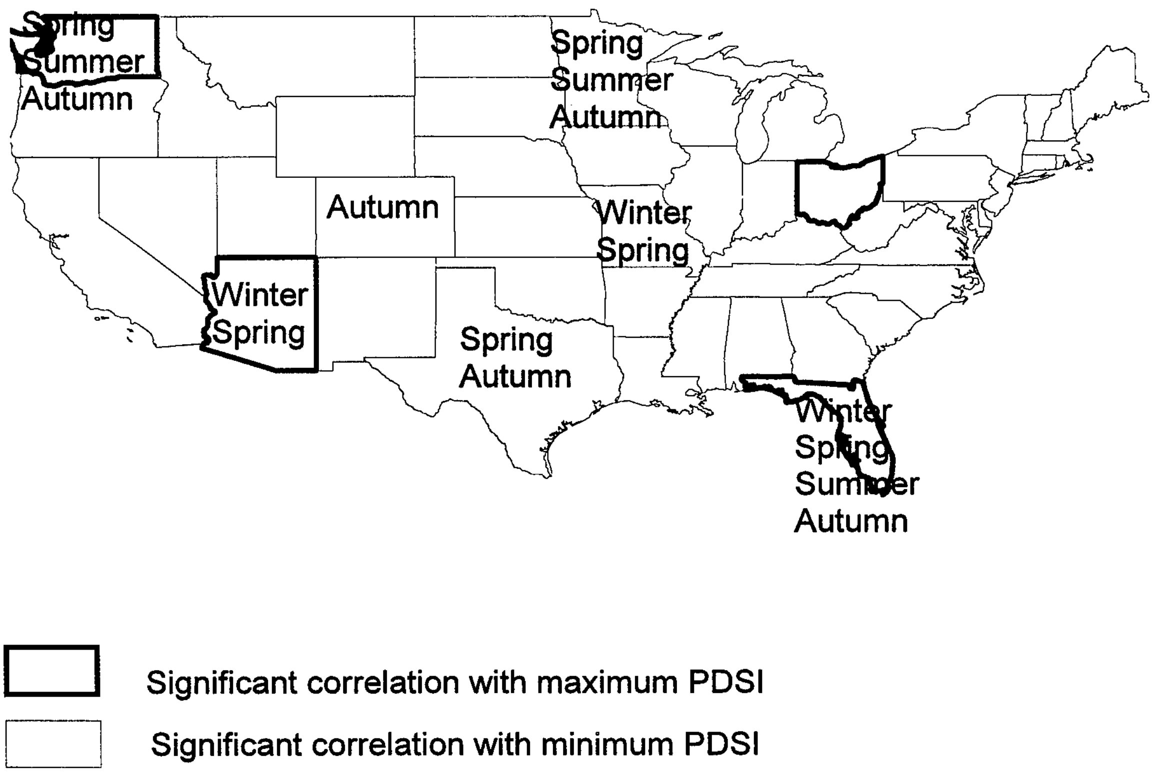

Figure 2: U.S. map showing significant correlations that existed between the PDSI values and either number of fires or acres burned in multiple fire classes in fire classes A-E for the states examined in this study.

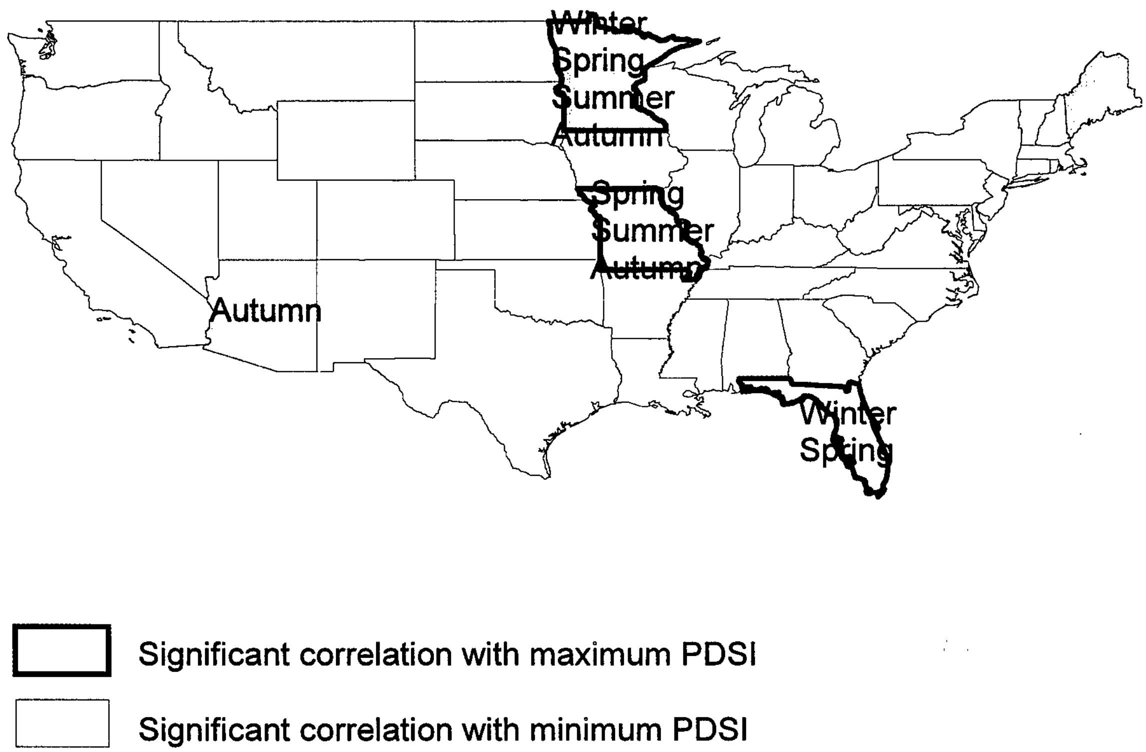

Figure 3: U.S. map showing significant correlations that existed between the PDSI values and either number of fires or acres burned in fire classes F and G.

states examined exhibited strong correlations between minimum annual PDSI values and large fire activity. Maine was the only state possessing the same general correlations between large fire activity and PDSI values and small fire activity and PDSI values.

5.12 General Results

Many conclusions appear to be state specific, but a few general conclusions were drawn from the results of this study. First, as expected from previous studies, increased drought conditions very often may lead to more fires. A decrease in the Palmer drought index of the fire season and the seasons prior to and following it is associated with an increase in the number of fires and acres burned in most states examined. The most extreme annual drought conditions were also often associated with an increase in fire activity. Also, an increase in annual precipitation, or precipitation during or just prior to the fire season may also decrease the likelihood of fire activity.

The combination of available moisture and temperature was more strongly linked to fire activity over many seasons than precipitation alone, especially in the central United States, Florida, and Washington state. This may be partially due to the slow-response nature of the drought index used. Also, however, temperature aids in drying fuel, and fire responds to more variables than simply precipitation. Thus the drought index is a valuable tool in predicting long term fire season activity.

In some states with spring/fall fire seasons, larger fires were strongly correlated to spring precipitation or the spring Palmer index average, while smaller fires showed significant ties to autumn precipitation or the autumn drought index average. Larger fires in some regions may be more prevalent in spring, and smaller fires during the autumn fire season.

Finally, the largest fires (Classes F and G) were often not linked to precipitation or the Palmer index values tested. There were exceptions (Florida, Maine, Minnesota and Missouri for PDSI), but in general, one year's largest fires were not linked to that same year's precipitation deficit or low drought index. This concurs with the results of Levin and Saaroni (1999).

CHAPTER 6

CONCLUSION

This study has examined the annual number of fires and acres burned in ten states across the United States and their relationship to precipitation and the Palmer drought index. Several state and regionally specific conclusions were generated. As might be expected, drier fire season conditions were linked to greater fire activity. Large fires, however, were not found to be correlated to the same year's climatic conditions for most states examined. The general conclusions support the results of other research concerning the links between fire activity and climatic variables.

6.1 Future Research

Many concerns raised in this study should be further investigated. Future research should include smaller regions within larger climatically diverse states like California and Washington. Correlation tests on these states generated conflicting results. Smaller study regions might give clearer information on the links between climate and fire regime in the area examined. Also, a thorough study of all states might be in order, permitting better analysis of regional similarities among states. It would also expand the applicability of the study. Smaller-scale regional studies accompanied by an increase in the area examined are necessary to obtain the big picture. It would also be interesting to investigate how one year's fires correlate with the precipitation or drought indices of the previous few years. Strong correlations might exist, especially with larger fires. As more fire data accumulates, thorough studies spanning more time should be undertaken. Some possibilities raised by this study merit further investigation. Seasonal fire data might allow seasonal correlations to be made. Such data might aid in determining which types of fires are more prevalent during different periods of the year.

6.2 Application

Utilizing this and other studies, fire managers in many different climate zones will hopefully be able to better predict periods of high fire activity. With better predictions, they can better prepare, stocking up on fire fighting resources, conducting controlled burns around populated areas to minimize the abundance of fine fuels, decreasing the hazards of wildland fire to humans and valuable resources. Through examination of the results of this study and others, governments can be more aware of dangerous fire conditions and better prepare to save lives and property. Fire studies such as this may also aid predictions of fire regime changes in a changing climate. Conducting further fire regime studies will be necessary in order to better understand and be better prepared for this ecosystem altering phenomenon.

BIBLIOGRAPHY

Amiro, B. D., J. I. MacPherson, and R. L. Desjardins, 1999: BOREAS flight measurements of forest-fire effects on carbon dioxide and energy fluxes. *Agricultural and Forest Meteorology*, **96**, 199-208.

Bessie, W. C., and E. A. Johnson, 1995: The relative importance of fuels and weather on fire behavior in subalpine forests. *Ecology*, **76**, 747-762.

Bureau of Land Management (BLM), 2000: Fire terms and definitions. http://205.156.54.206/er/gyx/firewx_definitions.html

Campbell, I. D., and C. Campbell, 2000: Late Holocene vegetation and fire history at the southern boreal forest margin in Alberta, Canada. *Palaeogeography, Palaeoclimatology, Palaeoecology*, **164**, 263-280.

Clark, J. S., 1988: Effect of climate change on fire regimes in northwestern Minnesota. *Nature*, **334**, 233-235.

Clark, J. S., 1989: Effects of long-term water balances on fire regime, north-western Minnesota. *Journal of Ecology*, **77**, 989-1004.

Dale, V. H., L. A. Joyce, S. McNulty, and R. P. Neilson, 2000: The interplay between climate change, forests, and disturbances. *The Science of the Total Environment*, **262**, 201-204.

Espenshade, E. B., J. C. Hudson, and J. L. Morrison, eds, 1995: *Goode's World Atlas, 19th Ed.* Rand McNally and Company, 371 pp.

Grau, H. R., 2001: Regional-scale spatial patterns of fire in relation to rainfall gradients in sub-tropical mountains, NW Argentina. *Global Ecology and Biogeography*, **10**, 133-146.

Grau, H. R., and T. T. Veblen, 2000: Rainfall variability, fire and vegetation dynamics in neotropical montane ecosystems in north-western Argentina. *Journal of Biogeography*, **27**, 1107-1121.

Haberle, S. G., and M-P. Ledru, 2001: Correlations among charcoal records of fires from the past 16,000 years in Indonesia, Papau New Guinea, and Central and South America. *Quaternary Research*, **55**, 97-104.

Hayes, M. D., 1999: Drought indices. http://enso.unl.edu/ndmc/enigma/indices.htm

Johnson, E. A., and C. P. Larsen, 1991: Climatically induced change in fire frequency in the southern Canadian Rockies. *Ecology*, **72**, 194-201.

Knapp, P. A., 1997: Spatial characteristics of regional wildfire frequencies in intermountain west grass-dominated communities. *Professional Geographer*, **49**, 39-51.

Levin, N., and H. Saaroni, 1999: Fire weather in Israel. *GeoJournal*, **47**, 523-538.

Li, C., I. G. Corns, and R. C. Yang, 1999: Fire frequency and size distribution under natural conditions: a new hypothesis. *Landscape Ecology*, **14**, 533-542.

Lundgren, S., 2001: Personal communication. USDA Forest Service employee.

Moore, D. S., and G. P. McCabe, 1999: *Introduction to the Practice of Statistics, 3rd Ed.* W. H. Freeman and Company, 825 pp.

National Oceanic and Atmospheric Administration (NOAA), 2001: The Palmer Drought Severity Index. http://www.drought.noaa.gov/palmer.html

Pyne, S. J., P. L. Andrews, and R. D. Laven, 1996: *Introduction to Wildland Fire, 2nd Ed.* John Wiley and Sons, Inc, 769 pp.

Schroeder, M. J., and C. C. Buck, 1970: *Fire Weather...A Guide for Application of Meteorological Information to Forest Fire Control Operations*. U.S. Department of Agriculture Forest Service Agricultural Handbook 360, 229 pp.

Stocks, B. J., M. A. Fosberg, T. J. Lynham, L. Mearns, B. M. Wotton, Q. Yang, J-Z. Jin, K. Lawrence, G. R. Hartley, J. A. Mason, and D. W. McKenney, 1998: Climate chance and forest fire potential in Russian and Canadian boreal forests. *Climatic Change*, **38**, 1-13.

Swetnam, T. W., 1993: Fire history and climate change in giant sequoia groves. *Science*, **262**, 885-889.

Swetnam, T. W., and J. L. Betancourt, 1990: Fire-Southern Oscillation Relations in the Southwestern United States. *Science*, **249**, 1017-1020.

United States Department of Agriculture Forest Service, State and Private Forestry, Fire and Aviation Management Staff, 1992: *1984-1990 Wildfire Statistics.*

United States Department of Agriculture Forest Service, State and Private Forestry, Fire and Aviation Management Staff, 1998: *1991-1997 Wildfire Statistics.*

Vazquez, A., and J. M. Moreno, 2001: Spatial distribution of forest fires in Sierra de Gredos (Central Spain). *Forest Ecology and Management*, **147**, 55-65.

Veblen, T. T., T. Kitzberger, and J. Donnegan, 2000: Climatic and human influences on fire regimes in ponderosa pine forests in the Colorado Front Range. *Ecological Applications*, **10**, 1178-1195.

APPENDIX A

CORRELATION COEFFICIENTS AND P-VALUES BETWEEN ANNUAL NUMBER OF FIRES/ACRES BURNED AND PRECIPITATION/PDSI

Number of fires/Precipitation

		Correlation	P-value
Class A	Annual	-0.249	0.391
	Winter	-0.011	0.971
	Spring	-0.078	0.791
	Summer	-0.244	0.400
	Autumn	-0.297	0.303
Class B	Annual	0.180	0.539
	Winter	0.695	0.006
	Spring	0.137	0.640
	Summer	-0.408	0.148
	Autumn	-0.140	0.633
Class C	Annual	0.247	0.395
	Winter	0.706	0.005
	Spring	0.082	0.780
	Summer	-0.231	0.426
	Autumn	-0.175	0.551
Class D	Annual	0.134	0.649
	Winter	0.705	0.005
	Spring	-0.009	0.976
	Summer	-0.224	0.442
	Autumn	-0.083	0.778

Acres burned/Precipitation

		Correlation	P-value
Class A	Annual	-0.319	0.267
	Winter	0.017	0.953
	Spring	0.108	0.712
	Summer	-0.399	0.158
	Autumn	-0.625	0.017
Class B	Annual	0.305	0.289
	Winter	0.764	0.001
	Spring	0.113	0.699
	Summer	-0.274	0.344
	Autumn	-0.052	0.861
Class C	Annual	0.241	0.462
	Winter	0.687	0.007
	Spring	0.082	0.781
	Summer	-0.290	0.315
	Autumn	-0.207	0.479
Class D	Annual	0.115	0.696
	Winter	0.710	0.004
	Spring	-0.027	0.927
	Summer	-0.268	0.354
	Autumn	-0.063	0.830

Table A.1 (continued)

Table A.1: Correlation coefficients and p-values between annual number of fires/acres burned and precipitation/PDSI for Arizona.

Table A.1 (continued)

Number of fires/Precipitation

		Correlation	P-value
Class E	Annual	0.047	0.872
	Winter	0.603	0.023
	Spring	-0.085	0.772
	Summer	-0.260	0.369
	Autumn	-0.278	0.337
Class F	Annual	0.109	0.712
	Winter	0.477	0.085
	Spring	0.019	0.948
	Summer	-0.229	0.430
	Autumn	-0.052	0.860
Class G	Annual	-0.407	0.149
	Winter	0.184	0.530
	Spring	-0.127	0.665
	Summer	-0.444	0.112
	Autumn	-0.326	0.255
Total	Annual	0.025	0.933
	Winter	0.495	0.072
	Spring	0.046	0.875
	Summer	-0.366	0.199
	Autumn	-0.233	0.422

Acres burned/Precipitation

		Correlation	P-value
Class E	Annual	-0.077	0.793
	Winter	0.560	0.037
	Spring	-0.184	0.529
	Summer	-0.336	0.241
	Autumn	-0.258	0.374
Class F	Annual	0.038	0.897
	Winter	0.429	0.126
	Spring	0.010	0.973
	Summer	-0.268	0.354
	Autumn	-0.062	0.834
Class G	Annual	-0.457	0.100
	Winter	0.031	0.915
	Spring	-0.253	0.382
	Summer	-0.405	0.151
	Autumn	-0.177	0.546
Total	Annual	-0.276	0.339
	Winter	0.302	0.294
	Spring	-0.182	0.533
	Summer	-0.419	0.136
	Autumn	-0.181	0.536

Number of fires/PDSI

		Correlation	P-value
Class A	Max	-0.189	0.517
	Min	-0.470	0.090
	Winter	-0.179	0.541
	Spring	-0.163	0.579
	Summer	-0.310	0.281
	Autumn	-0.390	0.168

Acres burned/PDSI

		Correlation	P-value
Class A	Max	-0.366	0.199
	Min	-0.621	0.018
	Winter	-0.387	0.171
	Spring	-0.236	0.417
	Summer	-0.434	0.121
	Autumn	-0.664	0.010

Table A.1 (continued)

Table A.1: Correlation coefficients and p-values between annual number of fires/acres burned and precipitation/PDSI for Arizona.

Table A.1 (continued)

Number of fires/PDSI

		Correlation	P-value
Class B	Max	0.468	0.092
	Min	0.072	0.808
	Winter	0.516	0.059
	Spring	0.561	0.037
	Summer	0.290	0.314
	Autumn	-0.022	0.940
Class C	Max	0.532	0.050
	Min	0.148	0.613
	Winter	0.601	0.023
	Spring	0.597	0.024
	Summer	0.374	0.188
	Autumn	0.053	0.858
Class D	Max	0.507	0.065
	Min	0.204	0.485
	Winter	0.651	0.012
	Spring	0.605	0.022
	Summer	0.393	0.165
	Autumn	0.017	0.954
Class E	Max	0.359	0.207
	Min	0.016	0.957
	Winter	0.484	0.080
	Spring	0.430	0.124
	Summer	0.197	0.500
	Autumn	-0.155	0.596
Class F	Max	0.398	0.158
	Min	0.153	0.600
	Winter	0.501	0.068
	Spring	0.468	0.092
	Summer	0.281	0.330
	Autumn	0.012	0.966

Acres burned/PDSI

		Correlation	P-value
Class B	Max	0.619	0.018
	Min	0.200	0.492
	Winter	0.661	0.010
	Spring	0.672	0.009
	Summer	0.436	0.119
	Autumn	0.134	0.647
Class C	Max	0.492	0.074
	Min	0.083	0.778
	Winter	0.546	0.043
	Spring	0.557	0.039
	Summer	0.313	0.276
	Autumn	-0.018	0.951
Class D	Max	0.486	0.078
	Min	0.192	0.510
	Winter	0.647	0.012
	Spring	0.596	0.024
	Summer	0.366	0.198
	Autumn	-0.004	0.989
Class E	Max	0.267	0.355
	Min	-0.106	0.718
	Winter	0.404	0.152
	Spring	0.338	0.237
	Summer	0.079	0.787
	Autumn	-0.274	0.343
Class F	Max	0.315	0.273
	Min	0.071	0.809
	Winter	0.411	0.145
	Spring	0.392	0.166
	Summer	0.203	0.485
	Autumn	-0.062	0.833

Table A.1 (continued)

Table A.1: Correlation coefficients and p-values between annual number of fires/acres burned and precipitation/PDSI for Arizona.

Table A.1 (continued)

Number of fires/PDSI

		Correlation	P-value
Class G	Max	-0.165	0.574
	Min	-0.415	0.140
	Winter	-0.025	0.931
	Spring	-0.021	0.943
	Summer	-0.269	0.352
	Autumn	-0.521	0.056
Total	Max	0.263	0.364
	Min	-0.136	0.643
	Winter	0.311	0.279
	Spring	0.338	0.237
	Summer	0.088	0.764
	Autumn	-0.176	0.547

Acres burned/PDSI

		Correlation	P-value
Class G	Max	-0.338	0.238
	Min	-0.563	0.036
	Winter	-0.211	0.470
	Spring	-0.225	0.440
	Summer	-0.439	0.117
	Autumn	-0.553	0.040
Total	Max	-0.033	0.910
	Min	-0.342	0.232
	Winter	0.108	0.713
	Spring	0.082	0.780
	Summer	-0.174	0.552
	Autumn	-0.414	0.141

Table A.1: Correlation coefficients and p-values between annual number of fires/acres burned and precipitation/PDSI for Arizona.

Number of fires/Precipitation

		Correlation	P-value
Class A	Annual	-0.428	0.126
	Winter	-0.475	0.086
	Spring	-0.403	0.153
	Summer	-0.052	0.860
	Autumn	-0.020	0.946
Class B	Annual	-0.112	0.704
	Winter	-0.060	0.839
	Spring	-0.297	0.302
	Summer	-0.044	0.881
	Autumn	0.006	0.983
Class C	Annual	-0.092	0.755
	Winter	-0.011	0.970
	Spring	-0.510	0.062
	Summer	-0.354	0.214
	Autumn	0.465	0.094
Class D	Annual	0.214	0.462
	Winter	0.212	0.466
	Spring	-0.314	0.275
	Summer	-0.118	0.687
	Autumn	0.199	0.494
Class E	Annual	0.158	0.590
	Winter	0.135	0.647
	Spring	-0.337	0.239
	Summer	-0.388	0.171
	Autumn	0.196	0.503
Class F	Annual	0.182	0.534
	Winter	0.062	0.834
	Spring	-0.256	0.378
	Summer	-0.317	0.269
	Autumn	0.153	0.602
Class G	Annual	-0.115	0.696
	Winter	-0.186	0.525
	Spring	-0.319	0.266
	Summer	-0.378	0.183
	Autumn	0.087	0.767

Acres burned/Precipitation

		Correlation	P-value
Class A	Annual	0.005	0.987
	Winter	-0.095	0.748
	Spring	0.108	0.713
	Summer	0.027	0.927
	Autumn	-0.598	0.024
Class B	Annual	-0.143	0.625
	Winter	-0.077	0.792
	Spring	-0.535	0.049
	Summer	-0.216	0.458
	Autumn	0.329	0.250
Class C	Annual	-0.037	0.901
	Winter	0.065	0.826
	Spring	-0.520	0.057
	Summer	-0.248	0.393
	Autumn	0.555	0.039
Class D	Annual	0.291	0.314
	Winter	0.262	0.365
	Spring	-0.275	0.340
	Summer	-0.123	0.675
	Autumn	0.250	0.388
Class E	Annual	0.292	0.310
	Winter	0.211	0.469
	Spring	-0.262	0.366
	Summer	-0.331	0.247
	Autumn	0.228	0.433
Class F	Annual	0.177	0.545
	Winter	0.015	0.959
	Spring	-0.213	0.464
	Summer	-0.336	0.241
	Autumn	0.134	0.647
Class G	Annual	0.012	0.967
	Winter	-0.126	0.668
	Spring	-0.277	0.337
	Summer	-0.511	0.062
	Autumn	0.123	0.676

Table A.2 (continued)

Table A.2: As for Table A.1, except for California.

Table A.2 (continued)

Number of fires/Precipitation

		Correlation	P-value
Total	Annual	-0.339	0.236
	Winter	-0.345	0.227
	Spring	-0.451	0.105
	Summer	-0.090	0.759
	Autumn	0.026	0.929

Acres burned/Precipitation

		Correlation	P-value
Total	Annual	0.049	0.868
	Winter	-0.091	0.758
	Spring	-0.286	0.321
	Summer	-0.496	0.071
	Autumn	0.143	0.627

Number of fires/PDSI

		Correlation	P-value
Class A	Max	-0.725	0.003
	Min	-0.503	0.067
	Winter	-0.476	0.085
	Spring	-0.623	0.017
	Summer	-0.594	0.025
	Autumn	-0.738	0.003
Class B	Max	-0.460	0.098
	Min	-0.161	0.582
	Winter	-0.254	0.382
	Spring	-0.385	0.174
	Summer	-0.255	0.378
	Autumn	-0.444	0.112
Class C	Max	-0.350	0.220
	Min	0.127	0.665
	Winter	0.156	0.595
	Spring	-0.315	0.272
	Summer	-0.379	0.181
	Autumn	-0.221	0.447

Acres burned/PDSI

		Correlation	P-value
Class A	Max	-0.236	0.416
	Min	-0.210	0.472
	Winter	-0.446	0.110
	Spring	-0.120	0.683
	Summer	0.006	0.984
	Autumn	-0.396	0.161
Class B	Max	-0.513	0.061
	Min	-0.021	0.944
	Winter	-0.012	0.968
	Spring	-0.454	0.103
	Summer	-0.435	0.120
	Autumn	-0.421	0.134
Class C	Max	-0.215	0.460
	Min	-0.213	0.465
	Winter	0.294	0.308
	Spring	-0.243	0.402
	Summer	-0.307	0.286
	Autumn	-0.086	0.769

Table A.2 (continued)

Table A.2: As for Table A.1, except for California.

Table A.2 (continued)

Number of fires/PDSI				Acres burned/PDSI			
		Correlation	P-value			Correlation	P-value
Class D	Max	-0.173	0.542	Class D	Max	-0.084	0.774
	Min	0.333	0.245		Min	0.441	0.114
	Winter	0.185	0.527		Winter	0.269	0.352
	Spring	-0.095	0.748		Spring	-0.015	0.960
	Summer	-0.053	0.856		Summer	0.002	0.995
	Autumn	-0.079	0.788		Autumn	0.037	0.901
Class E	Max	-0.248	0.393	Class E	Max	-0.104	0.723
	Min	0.310	0.281		Min	0.452	0.105
	Winter	0.095	0.746		Winter	0.204	0.484
	Spring	-0.194	0.506		Spring	-0.068	0.818
	Summer	-0.202	0.488		Summer	-0.095	0.748
	Autumn	-0.164	0.576		Autumn	0.012	0.967
Class F	Max	-0.210	0.471	Class F	Max	-0.267	0.357
	Min	0.394	0.164		Min	0.338	0.238
	Winter	0.089	0.762		Winter	0.049	0.869
	Spring	-0.116	0.694		Spring	-0.155	0.597
	Summer	-0.068	0.817		Summer	-0.110	0.708
	Autumn	-0.068	0.817		Autumn	-0.094	0.749
Class G	Max	-0.488	0.077	Class G	Max	-0.366	0.198
	Min	-0.058	0.843		Min	0.052	0.860
	Winter	-0.166	0.570		Winter	-0.107	0.716
	Spring	-0.351	0.218		Spring	-0.248	0.394
	Summer	-0.339	0.236		Summer	-0.295	0.305
	Autumn	-0.442	0.114		Autumn	-0.292	0.310
Total	Max	-0.728	0.003	Total	Max	-0.354	0.215
	Min	-0.390	0.168		Min	0.115	0.696
	Winter	-0.421	0.134		Winter	-0.068	0.817
	Spring	-0.620	0.018		Spring	-0.237	0.415
	Summer	-0.546	0.043		Summer	-0.274	0.343
	Autumn	-0.717	0.004		Autumn	-0.262	0.366

Table A.2: As for Table A.1, except for California.

Number of fires/Precipitation

		Correlation	P-value
Class A	Annual	-0.075	0.800
	Winter	-0.378	0.182
	Spring	0.105	0.720
	Summer	-0.172	0.556
	Autumn	0.023	0.938
Class B	Annual	-0.559	0.038
	Winter	-0.171	0.558
	Spring	-0.133	0.649
	Summer	-0.562	0.037
	Autumn	-0.165	0.573
Class C	Annual	-0.574	0.032
	Winter	-0.168	0.566
	Spring	-0.062	0.832
	Summer	-0.657	0.011
	Autumn	-0.181	0.535
Class D	Annual	-0.524	0.054
	Winter	-0.213	0.465
	Spring	-0.211	0.470
	Summer	-0.482	0.081
	Autumn	-0.069	0.816
Class E	Annual	-0.582	0.029
	Winter	-0.098	0.739
	Spring	-0.043	0.883
	Summer	-0.645	0.013
	Autumn	-0.229	0.432
Class F	Annual	-0.623	0.017
	Winter	0.085	0.773
	Spring	-0.170	0.562
	Summer	-0.638	0.014
	Autumn	-0.251	0.387
Class G	Annual	-0.397	0.159
	Winter	-0.071	0.809
	Spring	-0.259	0.371
	Summer	-0.163	0.578
	Autumn	-0.127	0.665

Acres burned/Precipitation

		Correlation	P-value
Class A	Annual	-0.075	0.799
	Winter	-0.351	0.219
	Spring	0.023	0.937
	Summer	-0.050	0.866
	Autumn	-0.031	0.915
Class B	Annual	-0.521	0.056
	Winter	-0.169	0.563
	Spring	-0.095	0.745
	Summer	-0.581	0.029
	Autumn	-0.145	0.620
Class C	Annual	-0.541	0.046
	Winter	-0.294	0.308
	Spring	-0.080	0.785
	Summer	-0.671	0.009
	Autumn	-0.032	0.913
Class D	Annual	-0.544	0.044
	Winter	-0.197	0.499
	Spring	-0.222	0.446
	Summer	-0.492	0.074
	Autumn	-0.075	0.799
Class E	Annual	-0.590	0.026
	Winter	-0.159	0.587
	Spring	-0.115	0.695
	Summer	-0.624	0.017
	Autumn	-0.157	0.592
Class F	Annual	-0.558	0.038
	Winter	0.005	0.986
	Spring	-0.233	0.423
	Summer	-0.606	0.022
	Autumn	-0.096	0.745
Class G	Annual	-0.338	0.237
	Winter	-0.032	0.914
	Spring	-0.261	0.367
	Summer	-0.130	0.658
	Autumn	-0.075	0.800

Table A.3 (continued)

Table A.3: As for Table A.1, except for Colorado.

Table A.3 (continued)

Number of fires/Precipitation

		Correlation	P-value
Total	Annual	-0.286	0.322
	Winter	-0.335	0.242
	Spring	0.023	0.938
	Summer	-0.361	0.205
	Autumn	-0.054	0.856

Acres burned/Precipitation

		Correlation	P-value
Total	Annual	-0.585	0.028
	Winter	-0.080	0.785
	Spring	-0.271	0.348
	Summer	-0.504	0.066
	Autumn	-0.117	0.690

Number of fires/PDSI

		Correlation	P-value
Class A	Max	-0.170	0.561
	Min	-0.408	0.147
	Winter	-0.346	0.225
	Spring	-0.300	0.297
	Summer	-0.250	0.388
	Autumn	-0.237	0.415
Class B	Max	-0.597	0.024
	Min	-0.589	0.027
	Winter	-0.306	0.287
	Spring	-0.445	0.111
	Summer	-0.642	0.013
	Autumn	-0.690	0.006
Class C	Max	-0.484	0.079
	Min	-0.374	0.188
	Winter	-0.075	0.800
	Spring	-0.251	0.386
	Summer	-0.494	0.073
	Autumn	-0.632	0.015

Acres burned/PDSI

		Correlation	P-value
Class A	Max	-0.265	0.360
	Min	-0.491	0.075
	Winter	-0.470	0.090
	Spring	-0.425	0.130
	Summer	-0.314	0.274
	Autumn	-0.295	0.306
Class B	Max	-0.516	0.059
	Min	-0.464	0.095
	Winter	-0.202	0.489
	Spring	-0.331	0.247
	Summer	-0.569	0.034
	Autumn	-0.615	0.019
Class C	Max	-0.489	0.076
	Min	-0.359	0.207
	Winter	-0.069	0.815
	Spring	-0.250	0.388
	Summer	-0.521	0.056
	Autumn	-0.570	0.033

Table A.3 (continued)

Table A.3: As for Table A.1, except for Colorado.

Table A.3 (continued)

Number of fires/PDSI

		Correlation	P-value
Class D	Max	-0.106	0.717
	Min	-0.203	0.486
	Winter	-0.052	0.860
	Spring	-0.255	0.378
	Summer	-0.243	0.403
	Autumn	-0.025	0.931
Class E	Max	-0.184	0.528
	Min	-0.181	0.535
	Winter	0.253	0.384
	Spring	0.014	0.962
	Summer	-0.274	0.343
	Autumn	-0.413	0.143
Class F	Max	-0.334	0.244
	Min	-0.198	0.497
	Winter	0.200	0.492
	Spring	-0.045	0.878
	Summer	-0.377	0.184
	Autumn	-0.508	0.064
Class G	Max	-0.298	0.301
	Min	-0.266	0.358
	Winter	-0.119	0.685
	Spring	-0.313	0.276
	Summer	-0.284	0.326
	Autumn	-0.375	0.187
Total	Max	-0.350	0.219
	Min	-0.505	0.066
	Winter	-0.339	0.235
	Spring	-0.372	0.191
	Summer	-0.423	0.132
	Autumn	-0.441	0.114

Acres burned/PDSI

		Correlation	P-value
Class D	Max	-0.449	0.108
	Min	-0.324	0.258
	Winter	0.026	0.931
	Spring	-0.273	0.345
	Summer	-0.468	0.092
	Autumn	-0.532	0.050
Class E	Max	-0.248	0.393
	Min	-0.271	0.350
	Winter	0.181	0.537
	Spring	-0.088	0.766
	Summer	-0.370	0.192
	Autumn	-0.447	0.109
Class F	Max	-0.350	0.219
	Min	-0.221	0.447
	Winter	0.179	0.541
	Spring	-0.093	0.753
	Summer	-0.455	0.102
	Autumn	-0.465	0.094
Class G	Max	-0.256	0.377
	Min	-0.222	0.446
	Winter	-0.102	0.728
	Spring	-0.286	0.322
	Summer	-0.246	0.396
	Autumn	-0.310	0.280
Total	Max	-0.385	0.174
	Min	-0.307	0.286
	Winter	0.043	0.884
	Spring	-0.244	0.401
	Summer	-0.448	0.108
	Autumn	-0.509	0.063

Table A.3: As for Table A.1, except for Colorado.

Number of fires/Precipitation

		Correlation	P-value
Class A	Annual	-0.806	0.001
	Winter	-0.393	0.164
	Spring	-0.210	0.471
	Summer	-0.484	0.079
	Autumn	-0.513	0.061
Class B	Annual	-0.793	0.001
	Winter	-0.488	0.076
	Spring	-0.288	0.319
	Summer	-0.309	0.283
	Autumn	-0.532	0.050
Class C	Annual	-0.758	0.002
	Winter	-0.576	0.031
	Spring	-0.346	0.226
	Summer	-0.252	0.385
	Autumn	-0.489	0.076
Class D	Annual	-0.621	0.018
	Winter	-0.755	0.002
	Spring	-0.420	0.135
	Summer	-0.088	0.764
	Autumn	-0.373	0.190
Class E	Annual	-0.441	0.114
	Winter	-0.731	0.003
	Spring	-0.368	0.195
	Summer	-0.011	0.969
	Autumn	-0.204	0.485
Class F	Annual	-0.381	0.179
	Winter	-0.827	0.000
	Spring	-0.387	0.172
	Summer	0.106	0.717
	Autumn	-0.162	0.580
Class G	Annual	-0.485	0.078
	Winter	-0.769	0.001
	Spring	-0.454	0.103
	Summer	-0.015	0.959
	Autumn	-0.286	0.321

Acres burned/Precipitation

		Correlation	P-value
Class A	Annual	-0.613	0.020
	Winter	-0.604	0.022
	Spring	-0.294	0.307
	Summer	-0.279	0.334
	Autumn	-0.279	0.334
Class B	Annual	-0.761	0.002
	Winter	-0.518	0.058
	Spring	-0.294	0.308
	Summer	-0.252	0.385
	Autumn	-0.511	0.062
Class C	Annual	-0.738	0.003
	Winter	-0.602	0.023
	Spring	-0.368	0.195
	Summer	-0.225	0.440
	Autumn	-0.463	0.096
Class D	Annual	-0.603	0.022
	Winter	-0.766	0.001
	Spring	-0.415	0.140
	Summer	-0.072	0.808
	Autumn	-0.367	0.197
Class E	Annual	-0.433	0.122
	Winter	-0.729	0.003
	Spring	-0.344	0.229
	Summer	-0.013	0.965
	Autumn	-0.207	0.478
Class F	Annual	-0.329	0.251
	Winter	-0.831	0.000
	Spring	-0.354	0.214
	Summer	0.153	0.601
	Autumn	-0.129	0.661
Class G	Annual	-0.409	0.147
	Winter	-0.664	0.010
	Spring	-0.386	0.173
	Summer	-0.044	0.880
	Autumn	-0.187	0.523

Table A.4 (continued)

Table A.4: As for Table A.1, except for Florida.

Table A.4 (continued)

Number of fires/Precipitation

		Correlation	P-value
Total	Annual	-0.781	0.001
	Winter	-0.527	0.053
	Spring	-0.305	0.289
	Summer	-0.306	0.287
	Autumn	-0.509	0.063

Acres burned/Precipitation

		Correlation	P-value
Total	Annual	-0.480	0.083
	Winter	-0.767	0.001
	Spring	-0.421	0.134
	Summer	-0.035	0.906
	Autumn	-0.231	0.428

Number of fires/PDSI

		Correlation	P-value
Class A	Max	-0.659	0.010
	Min	-0.764	0.001
	Winter	-0.287	0.320
	Spring	-0.462	0.096
	Summer	-0.648	0.012
	Autumn	-0.701	0.005
Class B	Max	-0.696	0.006
	Min	-0.675	0.008
	Winter	-0.323	0.260
	Spring	-0.488	0.077
	Summer	-0.545	0.044
	Autumn	-0.634	0.015
Class C	Max	-0.744	0.002
	Min	-0.685	0.007
	Winter	-0.430	0.125
	Spring	-0.590	0.026
	Summer	-0.576	0.031
	Autumn	-0.616	0.019

Acres burned/PDSI

		Correlation	P-value
Class A	Max	-0.607	0.021
	Min	-0.654	0.011
	Winter	-0.417	0.138
	Spring	-0.551	0.041
	Summer	-0.541	0.046
	Autumn	-0.479	0.083
Class B	Max	-0.680	0.007
	Min	-0.646	0.013
	Winter	-0.336	0.241
	Spring	-0.488	0.076
	Summer	-0.503	0.066
	Autumn	-0.593	0.025
Class C	Max	-0.756	0.002
	Min	-0.697	0.006
	Winter	-0.472	0.088
	Spring	-0.629	0.016
	Summer	-0.580	0.030
	Autumn	-0.600	0.023

Table A.4 (continued)

Table A.4: As for Table A.1, except for Florida.

Table A.4 (continued)

Number of fires/PDSI

		Correlation	P-value
Class D	Max	-0.788	0.001
	Min	-0.649	0.012
	Winter	-0.608	0.021
	Spring	-0.752	0.002
	Summer	-0.562	0.036
	Autumn	-0.524	0.055
Class E	Max	-0.656	0.011
	Min	-0.588	0.027
	Winter	-0.663	0.010
	Spring	-0.734	0.003
	Summer	-0.470	0.090
	Autumn	-0.367	0.197
Class F	Max	-0.655	0.011
	Min	-0.449	0.107
	Winter	-0.633	0.015
	Spring	-0.705	0.005
	Summer	-0.378	0.183
	Autumn	-0.279	0.334
Class G	Max	-0.775	0.001
	Min	-0.480	0.082
	Winter	-0.598	0.024
	Spring	-0.756	0.002
	Summer	-0.527	0.053
	Autumn	-0.452	0.104
Total	Max	-0.719	0.004
	Min	-0.699	0.005
	Winter	-0.375	0.186
	Spring	-0.540	0.046
	Summer	-0.578	0.031
	Autumn	-0.638	0.014

Acres burned/PDSI

		Correlation	P-value
Class D	Max	-0.789	0.001
	Min	-0.646	0.013
	Winter	-0.616	0.019
	Spring	-0.759	0.002
	Summer	-0.560	0.037
	Autumn	-0.517	0.058
Class E	Max	-0.643	0.013
	Min	-0.585	0.028
	Winter	-0.655	0.011
	Spring	-0.715	0.004
	Summer	-0.451	0.106
	Autumn	-0.360	0.206
Class F	Max	-0.593	0.025
	Min	-0.374	0.188
	Winter	-0.571	0.033
	Spring	-0.645	0.013
	Summer	-0.304	0.291
	Autumn	-0.208	0.475
Class G	Max	-0.668	0.009
	Min	-0.352	0.217
	Winter	-0.490	0.075
	Spring	-0.641	0.013
	Summer	-0.478	0.084
	Autumn	-0.384	0.175
Total	Max	-0.744	0.002
	Min	-0.454	0.103
	Winter	-0.575	0.031
	Spring	-0.725	0.003
	Summer	-0.517	0.058
	Autumn	-0.424	0.131

Table A.4: As for Table A.1, except for Florida.

Number of fires/Precipitation

		Correlation	P-value
Class A	Annual	-0.477	0.085
	Winter	-0.042	0.887
	Spring	-0.348	0.223
	Summer	-0.244	0.400
	Autumn	0.114	0.697
Class B	Annual	-0.554	0.040
	Winter	-0.219	0.451
	Spring	-0.243	0.403
	Summer	0.061	0.836
	Autumn	-0.150	0.609
Class C	Annual	-0.564	0.036
	Winter	-0.393	0.165
	Spring	-0.206	0.479
	Summer	-0.043	0.885
	Autumn	-0.221	0.448
Class D	Annual	-0.580	0.030
	Winter	-0.503	0.067
	Spring	-0.357	0.210
	Summer	-0.238	0.412
	Autumn	-0.221	0.448
Class E	Annual	-0.214	0.462
	Winter	0.400	0.156
	Spring	-0.001	0.998
	Summer	0.196	0.501
	Autumn	-0.432	0.123
Class F	Annual	-0.513	0.060
	Winter	-0.056	0.849
	Spring	-0.308	0.284
	Summer	0.155	0.596
	Autumn	-0.422	0.133
Class G	Annual	no Class G fires	
	Winter		
	Spring		
	Summer		
	Autumn		

Acres burned/Precipitation

		Correlation	P-value
Class A	Annual	0.001	0.997
	Winter	-0.029	0.923
	Spring	-0.201	0.491
	Summer	-0.326	0.255
	Autumn	0.472	0.088
Class B	Annual	-0.437	0.118
	Winter	-0.117	0.690
	Spring	-0.054	0.854
	Summer	0.199	0.495
	Autumn	-0.346	0.225
Class C	Annual	-0.554	0.040
	Winter	-0.441	0.114
	Spring	-0.148	0.614
	Summer	-0.094	0.749
	Autumn	-0.211	0.470
Class D	Annual	-0.549	0.042
	Winter	-0.389	0.169
	Spring	-0.283	0.328
	Summer	0.295	0.306
	Autumn	-0.305	0.289
Class E	Annual	-0.322	0.262
	Winter	0.263	0.363
	Spring	-0.259	0.372
	Summer	0.202	0.488
	Autumn	-0.327	0.254
Class F	Annual	-0.494	0.072
	Winter	0.013	0.965
	Spring	-0.272	0.347
	Summer	0.177	0.544
	Autumn	-0.480	0.083
Class G	Annual	no Class G fires	
	Winter		
	Spring		
	Summer		
	Autumn		

Table A.5 (continued)

Table A.5: As for Table A.1, except for Maine.

Table A.5 (continued)

Number of fires/Precipitation

		Correlation	P-value
Total	Annual	-0.566	0.035
	Winter	-0.163	0.578
	Spring	-0.317	0.270
	Summer	-0.094	0.750
	Autumn	-0.036	0.903

Acres burned/Precipitation

		Correlation	P-value
Total	Annual	-0.658	0.011
	Winter	-0.230	0.428
	Spring	-0.276	0.339
	Summer	0.178	0.544
	Autumn	-0.445	0.111

Number of fires/PDSI

		Correlation	P-value
Class A	Max	-0.251	0.387
	Min	-0.706	0.005
	Winter	-0.221	0.447
	Spring	-0.399	0.157
	Summer	-0.576	0.031
	Autumn	-0.412	0.143
Class B	Max	-0.307	0.286
	Min	-0.781	0.001
	Winter	-0.281	0.330
	Spring	-0.423	0.132
	Summer	-0.460	0.098
	Autumn	-0.440	0.115
Class C	Max	-0.460	0.098
	Min	-0.408	0.147
	Winter	-0.285	0.323
	Spring	-0.359	0.207
	Summer	-0.267	0.356
	Autumn	-0.359	0.208

Acres burned/PDSI

		Correlation	P-value
Class A	Max	-0.233	0.423
	Min	0.180	0.593
	Winter	0.001	0.996
	Spring	-0.125	0.669
	Summer	-0.505	0.065
	Autumn	0.187	0.523
Class B	Max	-0.103	0.727
	Min	-0.746	0.002
	Winter	-0.154	0.600
	Spring	-0.233	0.422
	Summer	-0.186	0.523
	Autumn	-0.482	0.081
Class C	Max	-0.471	0.089
	Min	-0.428	0.127
	Winter	-0.337	0.238
	Spring	-0.370	0.193
	Summer	-0.254	0.381
	Autumn	-0.356	0.211

Table A.5 (continued)

Table A.5: As for Table A.1, except for Maine.

Table A.5 (continued)

Number of fires/PDSI

		Correlation	P-value
Class D	Max	-0.528	0.052
	Min	-0.647	0.012
	Winter	-0.524	0.054
	Spring	-0.574	0.032
	Summer	-0.397	0.160
	Autumn	-0.303	0.293
Class E	Max	0.010	0.974
	Min	-0.176	0.546
	Winter	0.222	0.446
	Spring	0.188	0.520
	Summer	0.057	0.847
	Autumn	-0.535	0.049
Class F	Max	-0.208	0.476
	Min	-0.574	0.032
	Winter	-0.227	0.434
	Spring	-0.283	0.328
	Summer	-0.076	0.796
	Autumn	-0.475	0.086
Class G	Max	no Class G fires	
	Min		
	Winter		
	Spring		
	Summer		
	Autumn		
Total	Max	-0.319	0.267
	Min	-0.785	0.001
	Winter	-0.278	0.335
	Spring	-0.445	0.110
	Summer	-0.545	0.044
	Autumn	-0.460	0.098

Acres burned/PDSI

		Correlation	P-value
Class D	Max	-0.440	0.115
	Min	-0.617	0.019
	Winter	-0.418	0.136
	Spring	-0.491	0.075
	Summer	-0.340	0.235
	Autumn	-0.336	0.240
Class E	Max	-0.209	0.473
	Min	-0.126	0.669
	Winter	0.075	0.800
	Spring	-0.006	0.985
	Summer	-0.102	0.728
	Autumn	-0.433	0.122
Class F	Max	-0.159	0.587
	Min	-0.557	0.039
	Winter	-0.151	0.607
	Spring	-0.202	0.488
	Summer	-0.023	0.939
	Autumn	-0.520	0.057
Class G	Max	no Class G fires	
	Min		
	Winter		
	Spring		
	Summer		
	Autumn		
Total	Max	-0.395	0.162
	Min	-0.683	0.007
	Winter	-0.298	0.302
	Spring	-0.378	0.183
	Summer	-0.248	0.392
	Autumn	-0.571	0.033

Table A.5: As for Table A.1, except for Maine.

Number of fires/Precipitation

		Correlation	P-value
Class A	Annual	-0.588	0.027
	Winter	0.110	0.709
	Spring	-0.481	0.081
	Summer	-0.374	0.187
	Autumn	-0.330	0.249
Class B	Annual	-0.487	0.077
	Winter	-0.139	0.636
	Spring	-0.315	0.273
	Summer	-0.352	0.216
	Autumn	-0.258	0.373
Class C	Annual	-0.419	0.135
	Winter	-0.473	0.087
	Spring	-0.124	0.673
	Summer	-0.340	0.235
	Autumn	-0.280	0.333
Class D	Annual	-0.388	0.171
	Winter	-0.500	0.069
	Spring	-0.093	0.752
	Summer	-0.270	0.350
	Autumn	-0.316	0.271
Class E	Annual	-0.365	0.199
	Winter	-0.430	0.125
	Spring	-0.160	0.585
	Summer	-0.356	0.211
	Autumn	-0.172	0.556
Class F	Annual	-0.458	0.100
	Winter	-0.427	0.128
	Spring	-0.270	0.351
	Summer	-0.497	0.070
	Autumn	-0.097	0.741
Class G	Annual	-0.466	0.093
	Winter	-0.516	0.059
	Spring	-0.122	0.678
	Summer	-0.389	0.169
	Autumn	-0.316	0.272

Acres burned/Precipitation

		Correlation	P-value
Class A	Annual	-0.563	0.036
	Winter	0.054	0.856
	Spring	-0.463	0.095
	Summer	-0.253	0.382
	Autumn	-0.413	0.142
Class B	Annual	-0.465	0.094
	Winter	-0.208	0.475
	Spring	-0.253	0.382
	Summer	-0.349	0.222
	Autumn	-0.267	0.357
Class C	Annual	-0.382	0.177
	Winter	-0.426	0.128
	Spring	-0.118	0.687
	Summer	-0.316	0.271
	Autumn	-0.247	0.395
Class D	Annual	-0.417	0.138
	Winter	-0.438	0.117
	Spring	-0.13	0.658
	Summer	-0.283	0.328
	Autumn	-0.328	0.252
Class E	Annual	-0.328	0.252
	Winter	-0.429	0.126
	Spring	-0.105	0.721
	Summer	-0.318	0.268
	Autumn	-0.184	0.528
Class F	Annual	-0.512	0.061
	Winter	-0.425	0.130
	Spring	-0.307	0.285
	Summer	-0.504	0.066
	Autumn	-0.155	0.596
Class G	Annual	-0.503	0.067
	Winter	-0.457	0.101
	Spring	-0.182	0.534
	Summer	-0.340	0.234
	Autumn	-0.393	0.165

Table A.6 (continued)

Table A.6: As for Table A.1, except for Minnesota.

Table A.6 (continued)

Number of fires/Precipitation

		Correlation	P-value
Total	Annual	-0.530	0.051
	Winter	-0.159	0.586
	Spring	-0.336	0.240
	Summer	-0.378	0.183
	Autumn	-0.298	0.300

Acres burned/Precipitation

		Correlation	P-value
Total	Annual	-0.513	0.061
	Winter	-0.480	0.082
	Spring	-0.204	0.483
	Summer	-0.392	0.166
	Autumn	-0.343	0.231

Number of fires/PDSI

		Correlation	P-value
Class A	Max	-0.480	0.083
	Min	-0.624	0.017
	Winter	-0.406	0.150
	Spring	-0.574	0.032
	Summer	-0.630	0.016
	Autumn	-0.648	0.012
Class B	Max	-0.462	0.096
	Min	-0.615	0.019
	Winter	-0.433	0.122
	Spring	-0.565	0.035
	Summer	-0.607	0.021
	Autumn	-0.605	0.022
Class C	Max	-0.533	0.050
	Min	-0.720	0.004
	Winter	-0.561	0.037
	Spring	-0.679	0.008
	Summer	-0.630	0.016
	Autumn	-0.634	0.015

Acres burned/PDSI

		Correlation	P-value
Class A	Max	-0.456	0.102
	Min	-0.634	0.015
	Winter	-0.436	0.119
	Spring	-0.568	0.034
	Summer	-0.584	0.028
	Autumn	-0.639	0.014
Class B	Max	-0.479	0.083
	Min	-0.656	0.011
	Winter	-0.468	0.091
	Spring	-0.627	0.016
	Summer	-0.621	0.018
	Autumn	-0.626	0.017
Class C	Max	-0.499	0.069
	Min	-0.697	0.006
	Winter	-0.540	0.046
	Spring	-0.661	0.010
	Summer	-0.595	0.025
	Autumn	-0.603	0.022

Table A.6 (continued)

Table A.6: As for Table A.1, except for Minnesota.

Table A.6 (continued)

Number of fires/PDSI

		Correlation	P-value
Class D	Max	-0.449	0.107
	Min	-0.631	0.015
	Winter	-0.478	0.084
	Spring	-0.588	0.027
	Summer	-0.542	0.046
	Autumn	-0.556	0.039
Class E	Max	-0.518	0.058
	Min	-0.612	0.020
	Winter	-0.480	0.083
	Spring	-0.608	0.021
	Summer	-0.557	0.039
	Autumn	-0.540	0.046
Class F	Max	-0.614	0.020
	Min	-0.790	0.001
	Winter	-0.576	0.031
	Spring	-0.726	0.003
	Summer	-0.739	0.003
	Autumn	-0.678	0.008
Class G	Max	-0.736	0.003
	Min	-0.802	0.001
	Winter	-0.786	0.001
	Spring	-0.746	0.002
	Summer	-0.668	0.009
	Autumn	-0.677	0.008
Total	Max	-0.513	0.061
	Min	-0.680	0.007
	Winter	-0.482	0.081
	Spring	-0.629	0.016
	Summer	-0.656	0.011
	Autumn	-0.661	0.010

Acres burned/PDSI

		Correlation	P-value
Class D	Max	-0.474	0.087
	Min	-0.670	0.009
	Winter	-0.501	0.068
	Spring	-0.625	0.017
	Summer	-0.571	0.033
	Autumn	-0.595	0.025
Class E	Max	-0.486	0.078
	Min	-0.589	0.027
	Winter	-0.486	0.078
	Spring	-0.594	0.025
	Summer	-0.512	0.061
	Autumn	-0.509	0.063
Class F	Max	-0.658	0.011
	Min	-0.823	0.000
	Winter	-0.618	0.019
	Spring	-0.760	0.002
	Summer	-0.771	0.001
	Autumn	-0.727	0.003
Class G	Max	-0.719	0.004
	Min	-0.849	0.000
	Winter	-0.798	0.001
	Spring	-0.770	0.001
	Summer	-0.671	0.009
	Autumn	-0.711	0.004
Total	Max	-0.706	0.005
	Min	-0.862	0.000
	Winter	-0.754	0.002
	Spring	-0.796	0.001
	Summer	-0.717	0.004
	Autumn	-0.736	0.003

Table A.6: As for Table A.1, except for Minnesota.

Number of fires/Precipitation

		Correlation	P-value
Class A	Annual	-0.260	0.368
	Winter	-0.399	0.158
	Spring	-0.467	0.092
	Summer	-0.195	0.504
	Autumn	0.319	0.266
Class B	Annual	-0.420	0.135
	Winter	-0.470	0.090
	Spring	-0.424	0.131
	Summer	-0.109	0.710
	Autumn	0.022	0.941
Class C	Annual	-0.431	0.124
	Winter	-0.423	0.132
	Spring	-0.172	0.557
	Summer	-0.220	0.450
	Autumn	-0.132	0.653
Class D	Annual	-0.399	0.158
	Winter	-0.419	0.136
	Spring	-0.036	0.903
	Summer	-0.203	0.486
	Autumn	-0.128	0.663
Class E	Annual	-0.442	0.113
	Winter	-0.297	0.302
	Spring	0.034	0.909
	Summer	-0.406	0.150
	Autumn	-0.051	0.862
Class F	Annual	-0.536	0.048
	Winter	-0.212	0.467
	Spring	-0.293	0.310
	Summer	-0.527	0.053
	Autumn	0.103	0.725
Class G	Annual	no Class G fires	
	Winter		
	Spring		
	Summer		
	Autumn		

Acres burned/Precipitation

		Correlation	P-value
Class A	Annual	-0.289	0.316
	Winter	-0.150	0.608
	Spring	-0.039	0.895
	Summer	-0.294	0.307
	Autumn	-0.112	0.703
Class B	Annual	-0.338	0.238
	Winter	-0.480	0.082
	Spring	-0.302	0.294
	Summer	-0.108	0.712
	Autumn	0.068	0.818
Class C	Annual	-0.429	0.126
	Winter	-0.442	0.113
	Spring	-0.107	0.715
	Summer	-0.217	0.455
	Autumn	-0.174	0.551
Class D	Annual	-0.480	0.082
	Winter	-0.406	0.150
	Spring	-0.068	0.817
	Summer	-0.251	0.387
	Autumn	-0.180	0.537
Class E	Annual	-0.382	0.177
	Winter	-0.378	0.183
	Spring	0.013	0.966
	Summer	-0.349	0.221
	Autumn	0.021	0.942
Class F	Annual	-0.259	0.371
	Winter	-0.324	0.258
	Spring	-0.025	0.933
	Summer	-0.310	0.281
	Autumn	0.156	0.594
Class G	Annual	no Class G fires	
	Winter		
	Spring		
	Summer		
	Autumn		

Table A.7 (continued)

Table A.7: As for Table A.1, except for Missouri.

Table A.7 (continued)

Number of fires/Precipitation

		Correlation	P-value
Total	Annual	-0.410	0.145
	Winter	-0.466	0.093
	Spring	-0.377	0.184
	Summer	-0.166	0.570
	Autumn	0.044	0.882

Acres burned/Precipitation

		Correlation	P-value
Total	Annual	-0.422	0.132
	Winter	-0.428	0.127
	Spring	-0.084	0.774
	Summer	-0.266	0.358
	Autumn	-0.078	0.791

Number of fires/PDSI

		Correlation	P-value
Class A	Max	-0.388	0.171
	Min	-0.504	0.066
	Winter	-0.675	0.008
	Spring	-0.709	0.004
	Summer	-0.543	0.045
	Autumn	-0.023	0.938
Class B	Max	-0.385	0.175
	Min	-0.601	0.023
	Winter	-0.620	0.018
	Spring	-0.725	0.003
	Summer	-0.450	0.106
	Autumn	-0.195	0.504
Class C	Max	-0.417	0.138
	Min	-0.652	0.012
	Winter	-0.621	0.018
	Spring	-0.643	0.013
	Summer	-0.424	0.131
	Autumn	-0.341	0.234

Acres burned/PDSI

		Correlation	P-value
Class A	Max	-0.397	0.160
	Min	-0.325	0.257
	Winter	-0.141	0.630
	Spring	-0.403	0.153
	Summer	-0.424	0.131
	Autumn	-0.349	0.221
Class B	Max	-0.351	0.219
	Min	-0.586	0.028
	Winter	-0.702	0.005
	Spring	-0.660	0.010
	Summer	-0.388	0.170
	Autumn	-0.128	0.664
Class C	Max	-0.419	0.136
	Min	-0.658	0.011
	Winter	-0.673	0.008
	Spring	-0.616	0.019
	Summer	-0.379	0.181
	Autumn	-0.340	0.235

Table A.7 (continued)

Table A.7: As for Table A.1, except for Missouri.

Table A.7 (continued)

Number of fires/PDSI

		Correlation	P-value
Class D	Max	-0.315	0.273
	Min	-0.567	0.035
	Winter	-0.582	0.029
	Spring	-0.471	0.089
	Summer	-0.280	0.333
	Autumn	-0.259	0.371
Class E	Max	-0.368	0.196
	Min	-0.547	0.043
	Winter	-0.464	0.094
	Spring	-0.414	0.141
	Summer	-0.367	0.197
	Autumn	-0.336	0.240
Class F	Max	-0.633	0.015
	Min	-0.612	0.020
	Winter	-0.520	0.057
	Spring	-0.678	0.008
	Summer	-0.726	0.003
	Autumn	-0.376	0.186
Class G	Max	no Class G fires	
	Min		
	Winter		
	Spring		
	Summer		
	Autumn		
Total	Max	-0.411	0.144
	Min	-0.623	0.017
	Winter	-0.663	0.010
	Spring	-0.728	0.003
	Summer	-0.481	0.082
	Autumn	-0.207	0.478

Acres burned/PDSI

		Correlation	P-value
Class D	Max	-0.367	0.196
	Min	-0.600	0.023
	Winter	-0.556	0.039
	Spring	-0.495	0.072
	Summer	-0.328	0.253
	Autumn	-0.331	0.248
Class E	Max	-0.301	0.296
	Min	-0.512	0.061
	Winter	-0.495	0.072
	Spring	-0.391	0.167
	Summer	-0.310	0.281
	Autumn	-0.238	0.413
Class F	Max	-0.336	0.240
	Min	-0.455	0.102
	Winter	-0.577	0.031
	Spring	-0.434	0.121
	Summer	-0.367	0.196
	Autumn	-0.112	0.702
Class G	Max	no Class G fires	
	Min		
	Winter		
	Spring		
	Summer		
	Autumn		
Total	Max	-0.386	0.173
	Min	-0.611	0.020
	Winter	-0.630	0.016
	Spring	-0.549	0.042
	Summer	-0.370	0.193
	Autumn	-0.283	0.327

Table A.7: As for Table A.1, except for Missouri.

Number of fires/Precipitation

		Correlation	P-value
Class A	Annual	-0.659	0.010
	Winter	-0.291	0.312
	Spring	-0.616	0.019
	Summer	-0.261	0.368
	Autumn	-0.366	0.199
Class B	Annual	-0.579	0.030
	Winter	-0.337	0.238
	Spring	-0.381	0.179
	Summer	-0.030	0.918
	Autumn	-0.577	0.031
Class C	Annual	-0.170	0.561
	Winter	-0.403	0.153
	Spring	-0.551	0.041
	Summer	0.111	0.706
	Autumn	0.155	0.598
Class D	Annual	-0.023	0.936
	Winter	-0.221	0.447
	Spring	-0.392	0.166
	Summer	0.062	0.833
	Autumn	0.303	0.292
Class E	Annual	-0.279	0.333
	Winter	-0.198	0.498
	Spring	-0.467	0.092
	Summer	0.050	0.864
	Autumn	-0.049	0.868
Class F	Annual	0.016	0.956
	Winter	-0.191	0.513
	Spring	-0.365	0.200
	Summer	0.066	0.823
	Autumn	0.337	0.238
Class G	Annual	no Class G fires	
	Winter		
	Spring		
	Summer		
	Autumn		

Acres burned/Precipitation

		Correlation	P-value
Class A	Annual	-0.436	0.119
	Winter	-0.520	0.057
	Spring	-0.577	0.031
	Summer	0.033	0.912
	Autumn	-0.191	0.514
Class B	Annual	-0.533	0.049
	Winter	-0.431	0.124
	Spring	-0.340	0.235
	Summer	0.055	0.852
	Autumn	-0.577	0.031
Class C	Annual	-0.616	0.019
	Winter	-0.220	0.450
	Spring	-0.653	0.011
	Summer	-0.133	0.650
	Autumn	-0.404	0.152
Class D	Annual	-0.211	0.469
	Winter	-0.387	0.171
	Spring	-0.476	0.085
	Summer	0.075	0.799
	Autumn	0.080	0.785
Class E	Annual	-0.380	0.180
	Winter	-0.151	0.607
	Spring	-0.413	0.142
	Summer	0.020	0.946
	Autumn	-0.249	0.392
Class F	Annual	0.016	0.956
	Winter	-0.191	0.513
	Spring	-0.365	0.200
	Summer	0.066	0.823
	Autumn	0.337	0.238
Class G	Annual	no Class G fires	
	Winter		
	Spring		
	Summer		
	Autumn		

Table A.8 (continued)

Table A.8: As for Table A.1, except for Ohio.

Table A.8 (continued)

Number of fires/Precipitation

		Correlation	P-value
Total	Annual	-0.593	0.026
	Winter	-0.452	0.104
	Spring	-0.608	0.021
	Summer	-0.023	0.938
	Autumn	-0.397	0.159

Acres burned/Precipitation

		Correlation	P-value
Total	Annual	-0.546	0.044
	Winter	-0.407	0.148
	Spring	-0.633	0.015
	Summer	0.003	0.992
	Autumn	-0.322	0.262

Number of fires/PDSI

		Correlation	P-value
Class A	Max	-0.757	0.002
	Min	-0.351	0.219
	Winter	-0.046	0.875
	Spring	-0.447	0.109
	Summer	-0.604	0.022
	Autumn	-0.575	0.031
Class B	Max	-0.728	0.003
	Min	-0.282	0.329
	Winter	-0.242	0.405
	Spring	-0.343	0.230
	Summer	-0.333	0.244
	Autumn	-0.440	0.115
Class C	Max	-0.297	0.303
	Min	-0.102	0.729
	Winter	-0.116	0.693
	Spring	-0.323	0.260
	Summer	-0.195	0.505
	Autumn	0.042	0.888

Acres burned/PDSI

		Correlation	P-value
Class A	Max	-0.564	0.035
	Min	-0.159	0.586
	Winter	-0.040	0.892
	Spring	-0.386	0.172
	Summer	-0.343	0.230
	Autumn	-0.273	0.345
Class B	Max	-0.667	0.009
	Min	-0.263	0.363
	Winter	-0.216	0.459
	Spring	-0.377	0.184
	Summer	-0.291	0.313
	Autumn	-0.427	0.128
Class C	Max	-0.772	0.001
	Min	-0.491	0.075
	Winter	-0.354	0.214
	Spring	-0.546	0.043
	Summer	-0.531	0.051
	Autumn	-0.448	0.108

Table A.8 (continued)

Table A.8: As for Table A.1, except for Ohio.

Table A.8 (continued)

Number of fires/PDSI

		Correlation	P-value
Class D	Max	-0.063	0.831
	Min	0.002	0.995
	Winter	0.055	0.852
	Spring	-0.170	0.560
	Summer	-0.108	0.713
	Autumn	0.123	0.674
Class E	Max	-0.339	0.235
	Min	-0.072	0.807
	Winter	0.051	0.863
	Spring	-0.226	0.437
	Summer	-0.196	0.501
	Autumn	-0.076	0.796
Class F	Max	-0.006	0.984
	Min	0.020	0.945
	Winter	0.068	0.817
	Spring	-0.140	0.632
	Summer	-0.081	0.783
	Autumn	0.160	0.584
Class G	Max	no Class G fires	
	Min		
	Winter		
	Spring		
	Summer		
	Autumn		
Total	Max	-0.763	0.001
	Min	-0.298	0.300
	Winter	-0.215	0.460
	Spring	-0.451	0.106
	Summer	-0.422	0.133
	Autumn	-0.391	0.167

Acres burned/PDSI

		Correlation	P-value
Class D	Max	-0.337	0.238
	Min	-0.070	0.812
	Winter	-0.013	0.965
	Spring	-0.295	0.305
	Summer	-0.204	0.484
	Autumn	-0.056	0.849
Class E	Max	-0.483	0.080
	Min	-0.139	0.637
	Winter	-0.015	0.958
	Spring	-0.258	0.373
	Summer	-0.235	0.420
	Autumn	-0.202	0.489
Class F	Max	-0.006	0.984
	Min	0.020	0.945
	Winter	0.068	0.817
	Spring	-0.140	0.632
	Summer	-0.081	0.783
	Autumn	0.160	0.584
Class G	Max	no Class G fires	
	Min		
	Winter		
	Spring		
	Summer		
	Autumn		
Total	Max	-0.715	0.004
	Min	-0.318	0.268
	Winter	-0.204	0.483
	Spring	-0.493	0.073
	Summer	-0.417	0.138
	Autumn	-0.349	0.221

Table A.8: As for Table A.1, except for Ohio.

Number of fires/Precipitation

		Correlation	P-value
Class A	Annual	-0.416	0.139
	Winter	-0.033	0.911
	Spring	-0.438	0.117
	Summer	-0.271	0.350
	Autumn	-0.136	0.642
Class B	Annual	-0.863	0.000
	Winter	-0.373	0.189
	Spring	-0.778	0.001
	Summer	0.243	0.403
	Autumn	-0.403	0.153
Class C	Annual	-0.836	0.000
	Winter	-0.386	0.173
	Spring	-0.830	0.000
	Summer	0.150	0.608
	Autumn	-0.334	0.244
Class D	Annual	-0.534	0.049
	Winter	-0.299	0.300
	Spring	-0.305	0.289
	Summer	0.196	0.501
	Autumn	-0.360	0.206
Class E	Annual	-0.681	0.007
	Winter	-0.441	0.114
	Spring	-0.709	0.005
	Summer	0.245	0.398
	Autumn	-0.181	0.536
Class F	Annual	-0.519	0.057
	Winter	-0.153	0.601
	Spring	-0.197	0.499
	Summer	0.212	0.466
	Autumn	-0.526	0.053
Class G	Annual	0.178	0.543
	Winter	-0.086	0.770
	Spring	0.226	0.436
	Summer	-0.192	0.510
	Autumn	0.172	0.557

Acres burned/Precipitation

		Correlation	P-value
Class A	Annual	-0.016	0.957
	Winter	-0.053	0.857
	Spring	0.307	0.287
	Summer	0.153	0.602
	Autumn	-0.384	0.175
Class B	Annual	-0.825	0.000
	Winter	-0.368	0.195
	Spring	-0.805	0.001
	Summer	0.159	0.586
	Autumn	-0.328	0.253
Class C	Annual	-0.780	0.001
	Winter	-0.403	0.153
	Spring	-0.829	0.000
	Summer	0.182	0.532
	Autumn	-0.268	0.354
Class D	Annual	-0.668	0.009
	Winter	-0.428	0.127
	Spring	-0.547	0.043
	Summer	0.286	0.321
	Autumn	-0.315	0.273
Class E	Annual	-0.604	0.022
	Winter	-0.406	0.150
	Spring	-0.674	0.008
	Summer	0.366	0.198
	Autumn	-0.160	0.584
Class F	Annual	-0.464	0.095
	Winter	-0.228	0.433
	Spring	-0.155	0.596
	Summer	0.258	0.373
	Autumn	-0.435	0.120
Class G	Annual	0.195	0.503
	Winter	-0.036	0.903
	Spring	0.171	0.558
	Summer	-0.235	0.419
	Autumn	0.227	0.435

Table A.9 (continued)

Table A.9: As for Table A.1, except for Texas.

Table A.9 (continued)

Number of fires/Precipitation

		Correlation	P-value
Total	Annual	-0.869	0.000
	Winter	-0.378	0.182
	Spring	-0.805	0.001
	Summer	0.193	0.509
	Autumn	-0.387	0.172

Acres burned/Precipitation

		Correlation	P-value
Total	Annual	-0.729	0.003
	Winter	-0.461	0.097
	Spring	-0.660	0.010
	Summer	0.232	0.425
	Autumn	-0.281	0.330

Number of fires/PDSI

		Correlation	P-value
Class A	Max	-0.183	0.532
	Min	-0.111	0.705
	Winter	0.131	0.655
	Spring	-0.091	0.756
	Summer	-0.195	0.503
	Autumn	-0.436	0.119
Class B	Max	-0.469	0.091
	Min	-0.632	0.015
	Winter	-0.267	0.355
	Spring	-0.517	0.059
	Summer	-0.417	0.138
	Autumn	-0.592	0.026
Class C	Max	-0.435	0.120
	Min	-0.663	0.010
	Winter	-0.280	0.332
	Spring	-0.543	0.045
	Summer	-0.473	0.088
	Autumn	-0.554	0.040

Acres burned/PDSI

		Correlation	P-value
Class A	Max	-0.250	0.389
	Min	-0.050	0.865
	Winter	-0.165	0.574
	Spring	-0.032	0.912
	Summer	-0.039	0.894
	Autumn	-0.267	0.356
Class B	Max	-0.441	0.114
	Min	-0.623	0.017
	Winter	-0.269	0.353
	Spring	-0.519	0.057
	Summer	-0.440	0.116
	Autumn	-0.552	0.041
Class C	Max	-0.403	0.153
	Min	-0.673	0.008
	Winter	-0.309	0.283
	Spring	-0.557	0.039
	Summer	-0.481	0.082
	Autumn	-0.470	0.090

Table A.9 (continued)

Table A.9: As for Table A.1, except for Texas.

Table A.9 (continued)

Number of fires/PDSI

		Correlation	P-value
Class D	Max	-0.479	0.083
	Min	-0.430	0.125
	Winter	-0.308	0.283
	Spring	-0.412	0.143
	Summer	-0.355	0.214
	Autumn	-0.454	0.103
Class E	Max	-0.429	0.126
	Min	-0.725	0.003
	Winter	-0.423	0.132
	Spring	-0.582	0.029
	Summer	-0.519	0.057
	Autumn	-0.381	0.180
Class F	Max	-0.454	0.103
	Min	-0.509	0.063
	Winter	-0.424	0.131
	Spring	-0.378	0.183
	Summer	-0.321	0.264
	Autumn	-0.487	0.078
Class G	Max	-0.180	0.538
	Min	-0.030	0.919
	Winter	-0.225	0.440
	Spring	-0.096	0.743
	Summer	-0.176	0.548
	Autumn	-0.017	0.953
Total	Max	-0.473	0.088
	Min	-0.645	0.013
	Winter	-0.269	0.353
	Spring	-0.530	0.051
	Summer	-0.450	0.107
	Autumn	-0.603	0.022

Acres burned/PDSI

		Correlation	P-value
Class D	Max	-0.519	0.057
	Min	-0.626	0.017
	Winter	-0.413	0.142
	Spring	-0.575	0.031
	Summer	-0.487	0.078
	Autumn	-0.444	0.112
Class E	Max	-0.333	0.245
	Min	-0.659	0.010
	Winter	-0.370	0.193
	Spring	-0.536	0.048
	Summer	-0.425	0.129
	Autumn	-0.261	0.367
Class F	Max	-0.359	0.207
	Min	-0.520	0.056
	Winter	-0.381	0.179
	Spring	-0.333	0.245
	Summer	-0.285	0.323
	Autumn	-0.419	0.135
Class G	Max	-0.111	0.705
	Min	0.038	0.898
	Winter	-0.140	0.634
	Spring	-0.049	0.867
	Summer	-0.123	0.675
	Autumn	0.029	0.923
Total	Max	-0.530	0.051
	Min	-0.754	0.002
	Winter	-0.487	0.077
	Spring	-0.633	0.015
	Summer	-0.562	0.036
	Autumn	-0.496	0.071

Table A.9: As for Table A.1, except for Texas.

Number of fires/Precipitation

		Correlation	P-value
Class A	Annual	-0.399	0.157
	Winter	-0.331	0.247
	Spring	-0.591	0.026
	Summer	-0.284	0.324
	Autumn	-0.229	0.430
Class B	Annual	-0.338	0.237
	Winter	-0.288	0.318
	Spring	-0.632	0.015
	Summer	-0.367	0.197
	Autumn	-0.083	0.777
Class C	Annual	-0.435	0.120
	Winter	-0.371	0.192
	Spring	-0.587	0.027
	Summer	-0.337	0.238
	Autumn	-0.249	0.391
Class D	Annual	-0.434	0.121
	Winter	-0.406	0.150
	Spring	-0.371	0.191
	Summer	-0.537	0.048
	Autumn	-0.194	0.506
Class E	Annual	-0.303	0.292
	Winter	-0.263	0.363
	Spring	-0.171	0.558
	Summer	-0.092	0.754
	Autumn	-0.200	0.494
Class F	Annual	-0.194	0.506
	Winter	-0.186	0.523
	Spring	-0.378	0.183
	Summer	-0.448	0.109
	Autumn	0.192	0.511
Class G	Annual	-0.194	0.507
	Winter	-0.161	0.582
	Spring	-0.315	0.272
	Summer	-0.349	0.222
	Autumn	-0.058	0.843

Acres burned/Precipitation

		Correlation	P-value
Class A	Annual	0.007	0.981
	Winter	0.112	0.704
	Spring	-0.150	0.609
	Summer	-0.081	0.782
	Autumn	-0.302	0.294
Class B	Annual	-0.409	0.147
	Winter	-0.358	0.209
	Spring	-0.643	0.013
	Summer	-0.458	0.099
	Autumn	-0.060	0.840
Class C	Annual	-0.414	0.141
	Winter	-0.354	0.215
	Spring	-0.536	0.048
	Summer	-0.466	0.093
	Autumn	-0.184	0.530
Class D	Annual	-0.411	0.145
	Winter	-0.347	0.224
	Spring	-0.267	0.355
	Summer	-0.500	0.069
	Autumn	-0.213	0.464
Class E	Annual	-0.275	0.342
	Winter	-0.213	0.465
	Spring	-0.163	0.578
	Summer	-0.185	0.527
	Autumn	-0.146	0.619
Class F	Annual	-0.145	0.620
	Winter	-0.127	0.665
	Spring	-0.382	0.178
	Summer	-0.447	0.109
	Autumn	0.188	0.520
Class G	Annual	-0.044	0.882
	Winter	-0.052	0.859
	Spring	-0.208	0.476
	Summer	-0.333	0.245
	Autumn	0.121	0.681

Table A.10 (continued)

Table A.10: As for Table A.1, except for Washington.

Table A.10 (continued)

Number of fires/Precipitation

		Correlation	P-value
Total	Annual	-0.391	0.167
	Winter	-0.329	0.251
	Spring	-0.610	0.020
	Summer	-0.330	0.249
	Autumn	-0.183	0.531

Acres burned/Precipitation

		Correlation	P-value
Total	Annual	-0.081	0.782
	Winter	-0.081	0.782
	Spring	-0.252	0.386
	Summer	-0.367	0.197
	Autumn	0.120	0.684

Number of fires/PDSI

		Correlation	P-value
Class A	Max	-0.738	0.003
	Min	-0.578	0.030
	Winter	-0.512	0.061
	Spring	-0.712	0.004
	Summer	-0.769	0.001
	Autumn	-0.676	0.008
Class B	Max	-0.726	0.003
	Min	-0.535	0.049
	Winter	-0.522	0.056
	Spring	-0.712	0.004
	Summer	-0.793	0.001
	Autumn	-0.623	0.017
Class C	Max	-0.706	0.005
	Min	-0.631	0.015
	Winter	-0.593	0.025
	Spring	-0.768	0.001
	Summer	-0.817	0.000
	Autumn	-0.686	0.007

Acres burned/PDSI

		Correlation	P-value
Class A	Max	-0.496	0.072
	Min	-0.501	0.068
	Winter	-0.493	0.073
	Spring	-0.458	0.100
	Summer	-0.444	0.112
	Autumn	-0.573	0.032
Class B	Max	-0.736	0.003
	Min	-0.494	0.073
	Winter	-0.474	0.086
	Spring	-0.675	0.008
	Summer	-0.779	0.001
	Autumn	-0.569	0.034
Class C	Max	-0.649	0.012
	Min	-0.593	0.025
	Winter	-0.560	0.037
	Spring	-0.722	0.004
	Summer	-0.800	0.001
	Autumn	-0.578	0.031

Table A.10 (continued)

Table A.10: As for Table A.1, except for Washington.

Table A.10 (continued)

Number of fires/PDSI

		Correlation	P-value
Class D	Max	-0.475	0.086
	Min	-0.568	0.034
	Winter	-0.497	0.071
	Spring	-0.597	0.024
	Summer	-0.670	0.009
	Autumn	-0.504	0.066
Class E	Max	-0.294	0.308
	Min	-0.382	0.178
	Winter	-0.266	0.358
	Spring	-0.340	0.234
	Summer	-0.349	0.222
	Autumn	-0.400	0.156
Class F	Max	-0.266	0.358
	Min	-0.402	0.154
	Winter	-0.384	0.175
	Spring	-0.483	0.081
	Summer	-0.518	0.058
	Autumn	-0.166	0.571
Class G	Max	-0.215	0.460
	Min	-0.433	0.122
	Winter	-0.393	0.164
	Spring	-0.488	0.077
	Summer	-0.512	0.061
	Autumn	-0.293	0.309
Total	Max	-0.737	0.003
	Min	-0.582	0.029
	Winter	-0.533	0.050
	Spring	-0.729	0.003
	Summer	-0.795	0.001
	Autumn	-0.666	0.009

Acres burned/PDSI

		Correlation	P-value
Class D	Max	-0.391	0.167
	Min	-0.526	0.053
	Winter	-0.419	0.136
	Spring	-0.492	0.074
	Summer	-0.563	0.036
	Autumn	-0.439	0.116
Class E	Max	-0.276	0.339
	Min	-0.377	0.185
	Winter	-0.246	0.396
	Spring	-0.320	0.265
	Summer	-0.361	0.204
	Autumn	-0.363	0.202
Class F	Max	-0.210	0.472
	Min	-0.336	0.240
	Winter	-0.344	0.229
	Spring	-0.444	0.111
	Summer	-0.491	0.075
	Autumn	-0.145	0.620
Class G	Max	-0.124	0.673
	Min	-0.366	0.198
	Winter	-0.386	0.173
	Spring	-0.406	0.150
	Summer	-0.416	0.139
	Autumn	-0.152	0.603
Total	Max	-0.161	0.582
	Min	-0.383	0.176
	Winter	-0.394	0.163
	Spring	-0.434	0.121
	Summer	-0.454	0.103
	Autumn	-0.176	0.548

Table A.10: As for Table A.1, except for Washington.