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Research of Regional Forest Fire Prediction Method based on Multivariate Linear Regression

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Abstract

In order to achieve the predicted speed, high accuracy, the use of simple purpose, forest fire prediction of the key issues is to choose the main predictors. Forest fire prediction involves many factors, some of which are stable factors such as climate, topography, forest characteristics; and some unstable factors, such as fuel moisture content, meteorological factors, and other sources of ignition. Currently leading factor in the prediction of forest fire is often used in the fuel moisture, precipitation or dry days, relative humidity, temperature and wind five factors. In this paper, some of the data Yichun fire nearly a decade predict the forest fire meteorological data analysis, using multivariate linear regression to derive forest fire prediction method in the wireless sensor networks.

Keywords: *wireless sensor network, forest fire prediction, Multivariate Linear Regression*

1. Regional Overview Research

Yichun is the northern of Heilongjiang Province in China. Geographic coordinates of longitude 126°03′-126°24′, latitude 47°22′-47°36′, Area of 36,400 square kilometers. Territory is hilly areas, thus extending the main vein Xiaoxing'anling to the southeast. It is the temperate continental monsoon climate, annual rainfall 630 mm, with an average annual temperature of 1 degree, in January average temperature of minus 25 degrees, in July the average temperature of 21 degrees above zero.

The area of Yichun includes Yichun , Nancha , Dailing , Xilin , Jinshantun , Meixi, Cuiluan , Wumahe , Youhao , Shangganling , Wuying, Hongxing , Xinqing , Tangwanghe , Wuyiling 15 municipal districts and Jiayin , Tieli . You can see from Table 1 that the number of forest fires each year are more in Yichun: Before the 1990s, forest fires occur each year more than 300 times ; while in the 1990s , due to the rainfall , the relative humidity of air and therefore less number of fires ; but after 2000 , due to the changes in the weather , climate worsening , a substantial increase in the number of fires . Throughout the Yichun area, the area of the fire occurred Wuyiling , Jiayin and Hongxing , which happens to be in three places with frequent forest fire area .

Table 1. Yichun Forest Fires Occurrence

Year	Frequency
1960~1069	372
1970~1979	488
1980~1989	312
1990~1999	93
2000~2009	225

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2. Analysis of Factors Affecting the Occurrence of Forest Fires

Factors forest fires occur for many reasons, including seasonal changes, weather and climate conditions, the natural environment, geographic location, etc., following a detailed analysis for these factors.

2.1. The Influence of Seasonal Variation on the Occurrence of Forest Fires

Yichun is mostly in the temperate zone, freezing cold in winter, the ground covered with snow, litter and hay covered with snow , a white ground , although the precipitation is not, but the low temperatures , melting snow is not easy , so do not occur forest fires in winter.

Spring arrival of warmer weather, the temperature gradually increased , the snow begins to melt , litter and weeds nudity and spring wind big , being dried , is the largest forest fires season . In Yichun, spring is the longest season of a year, dry period is long, a fire source is prone to occur forest fires. Therefore, the focus of the spring is the season of forest fires, according to statistics, the ratio of fire up to 70% in April and May.

As temperatures rise into the summer, the plant begins to grow, and this time of the year is the rainy season. Water in plants is also more, and it is non-fire season generally. However, the encounter special summer drought, forest fires will occur.

Autumn comes, the temperature dropped, the plant stops growing, deciduous trees a lot , the gradual emergence of drought, the forest entered the autumn fire period ; but fire period is shorter in autumn , once the snow cover is material to enter the winter residence of the non- fire period .

2.2. The Influence of Meteorological Factors on the Occurrence of Forest Fires

Closely related to the development of forest fires and meteorological factors, especially drought, high temperatures and little rain, high winds, it is more prone to moments of forest fires. Meteorological factors affecting the major forest fires have temperature, humidity, precipitation and wind speed, as well as their combined effects. Meteorological factors changes with time and space quickly, is an important factor affecting the occurrence of forest fires.

(1) Air relative humidity

Relative humidity (*RH*) is the percentage of the actual vapor pressure of air (*e*) saturation vapor pressure with temperature (*E*) (Equation 1):

$$RH = \frac{e}{E} \times 100\ \% \tag{1}$$

The relative humidity effects on of the fuel moisture content changes. The larger the relative humidity, the faster fuel moisture absorption, the slower evaporation, fuel moisture content increases; Conversely, the slower fuel moisture absorption, the faster evaporation, fuel moisture content is reduced. When the relative humidity is 100%, the saturated water vapor in the air, fuel evaporation is stopped, absorbs moisture from the air, fuel moisture content will also be maximized[1].

Relative humidity can be used to forecast forest fire. In general, *RH*> 75%, does not fire; *RH* at 55%~75%, a fire may occur, *RH* at 30%~55%, may be a major fire; *RH* <30%, catastrophic fire may occur. But if long-term drought, more than 80% relative humidity may also fire. The relative humidity is high in the morning and evening; while the midday and afternoon sessions relative to the lowest, driest flammable fuel, is prone to forest fires in the period.

(2) Precipitation

Precipitation directly affects the water content of combustible material, especially dead combustibles. Precipitation also increased to a maximum relative humidity of the air.

Precipitation is the thickness of the falling rain or melting snow on the ground water level. If annual precipitation over 1500mm in an area, and evenly distribution, generally little or no forest fires , such as tropical rain forests , hot and humid all year round[2]. If annual precipitation lot, but the distribution is uneven, with a clear dry and wet season of points, a fire occurred in the dry season, such as seasonal forest; if precipitation is less than 1000mm, prone to forest fires. The monthly precipitation is different, not the same incidence of forest fires. According to the survey, the monthly precipitation greater than 100mm, generally does not occur forest fires.

The longer intervals of precipitation (continuous drought) , the higher the temperature , the smaller the relative humidity, the more the forest fuel drying , especially coarse fuel moisture content reduced more prone to forest fires. In the spring of Yichun, a few days more than 10 days drought prone to fire; over 30 days, they tend to catastrophic forest fires.

Winter snow can cover the surface fuel to the fire source isolation, usually before the snow melts, the fire does not occur.

Frost, dew, fog and other levels of precipitation have an impact on fuel humidity. Fuel moisture can thus be increased by about 10%.

(3) Temperature

Temperature and forest fires very closely, it can directly affect the relative humidity changes. Temperature rises, the air saturated vapor pressure increases, the relative humidity decreases, directly affects the small dead fuel moisture content. Meanwhile, higher temperatures can increase the temperature of fuel itself, so that ignite combustible materials needed to achieve greatly reduced. Generally, 14:00 can be represented maximum temperatures in a day.

Diurnal temperature range (difference between the maximum temperature and minimum temperature), the occurrence of forest fires have a significant impact. Diurnal temperature range is an important parameter of a continental climate and maritime climate (the greater diurnal temperature range, more significant the continental climate), to reflect the characteristics of the different types of weather, it is to reveal the level of forest fire important information[3].

(4) Cloudiness

How much cloudiness direct impact of solar radiation intensity on the ground, the impact of the changes in temperature also affects the fuel temperature change itself. In the sun, surface fuel temperature than the temperature is high above 10 degrees. Surface temperature rises, the relative humidity near the lower strata, accelerate the evaporation of fuel moisture, reducing the moisture content. How much influence cloudiness to the size of the fuel and air temperature difference. The more cloud cover, the difference is smaller. Therefore, the cloud volume, lowers the temperature in a certain extent, reduce the fire.

(5) Wind speed

Wind speed of air moving in a horizontal distance per unit time. Blown onto combustibles, flammable materials can accelerate the evaporation of water, making it quick drying and flammable; supplemental oxygen can continue to increase the combustion conditions, accelerating the combustion process; alter the thermal convection, increase the heat advection, reduce the heat radiation from the accelerate the spread of forest fires forward speed; also have a major fire power to fly. So, wind is the most important factor of forest fires.

From the general experience, when the average wind levels below the fire and fire suppression are relatively safe; while the average wind at four or more, the risk increases. According to statistics, more than 80% when the major forest fires and large forest fires occurred in five or more windy weather.

(6) Pressure

Ground weather conditions closely related to altitude temperature and pressure fields, changes in air pressure directly affects the temperature, relative humidity, changes in precipitation and other weather factors. In general, under high pressure weather is sunny, high temperature, relative humidity is small, easy to forest fire; low pressure can form clouds and precipitation, difficult or rare to forest fires.

2.3. The Influence of Other Factors on the Occurrence of Forest Fires

In the process of forest fires, the largest man-made causes are also a factor, many residents and tourists near the fire consciousness, but this aspect of the recent attention has been Forest Authority, thus minimizing personnel into the fire period, minimizing human factors.

3. The Contribution of a Single Factor of Meteorological Factors Occurring Forest Fires

Through the above analysis, forest fires has more factors, such as the maximum temperature of the day, the day the humidity, Diurnal temperature range, wind speed, precipitation and their synthesis. This section discusses the contribution of meteorological factors on the occurrence of forest fires through a single evaluation model proposed by Dong Guangsheng [4].

3.1. The Contribution of the Daily Maximum Temperature on Forest Fire Occurrence

The daily maximum temperature on the impact of forest fires (formula 2):

$$r_1 = \begin{cases} \dfrac{1}{1 + (\frac{1}{5}(20 - x_1))^4} & x_1 < 20\ °C \\ 1 & x_1 >= 20\ °C \end{cases} \tag{2}$$

r_1 is determined by a single factor in determining the contribution of high fire risk value(%). x_1 is the highest temperature of the day, where the temperature is 14:00 as the maximum temperature of the day. At 14:00 the temperature is low, especially in the following 8℃ the risk of fire basically no; temperature is between 8℃ and 12℃, the degree of risk of fire is gradually increasing; at between 12℃ and 20℃, the rapid changes in the risk function, in the low to high transition phase fire should pay particular attention to possible fire; special attention will be above 20℃.

3.2. The Contribution of Diurnal Temperature Range on Forest Fire Occurrence

The diurnal temperature range effects on forest fires (formula 3):

$$r_2 = \begin{cases} \dfrac{1}{1 + (\frac{1}{10}(25 - (x_1 - x_2)))^6} & (x_1 - x_2) < 25\ °C \\ 1 & (x_1 - x_2) >= 25\ °C \end{cases} \tag{3}$$

(x_1-x_2) is the single factor reflected by the diurnal temperature high fire risk contribution value (%).x_1 is the highest temperature of the day, and x_2 is the lowest temperature of the day, where the temperature of 2:00 is the minimum temperature of the day. Under normal circumstances, when (x_1-x_2)<12℃, cloudy, rainy and foggy weather phenomenon more, so difficult to fire; while (x_1-x_2) is between 12℃ and 20℃, the great increase in the degree of risk of fire; when(x_1-x_2)>20℃, weather controlled by high pressure situation, the performance of sunny, daytime warming intense , afternoon the wind speed increases, the fire to maintain a higher state.

3.3. The Contribution of Diurnal Temperature Range on Forest Fire Occurrence

The relative humidity affect the occurrence of forest fires (formula 4):

$$r_3 = \begin{cases} \dfrac{1}{1 + (\frac{1}{10}(E - 20))^4} & E > 15\% \\ 1 & E \le 15\% \end{cases} \tag{4}$$

r_3 is the relative humidity reflects the contribution of a high fire risk value (%). E is the relative air humidity of 14:00(%). When the relative humidity is greater than 45%, chance of a fire occurring is low. While between 10% and 45%, the ratio of high fire risk begins to increase. And when the relative humidity is below 15%, fires will occur at high risk.

3.4. The Average Relative Humidity of the Air Three Days Before on Forest Fire Occurrence

Three days before the average relative air humidity on the impact of forest fires (formula 5):

$$r_4 = \begin{cases} \dfrac{1}{1 + (\frac{1}{10}(EE - 20))^3} & E > 20\% \\ 1 & E \le 20\% \end{cases} \tag{5}$$

r_4 is average relative air humidity three days before a high fire risk reflects the contribution value (%). EE is three-day average relative air humidity at 14:00 (%). When the three-day average relative air humidity is greater than 40%, the lower the probability of occurrence of fire; when between 20% and 40%, the ratio of high fire begins to increase; relative humidity below 20%, the occurrence of the fire appear high risk.

3.5. The Contribution of 24 Hours of Precipitation on Forest Fire Occurrence

24 hours precipitation effects on forest fires (formula 6):

$$r_5 = \begin{cases} \dfrac{1}{1 + x_5^3} & x_5 > 0mm \\ 1 & x_5 = 0mm \end{cases} \tag{6}$$

r_5 is reflected in the 24 hours of high fire risk precipitation contribution value (%). x_5 is precipitation of 24 hours. Changes in precipitation curve was smooth downward trend, with increasing precipitation, fire danger index declining. When rainfall is less than 1mm, you are in a high fire danger and fire trend will not significantly decrease. At this time if precipitation decreased, it will again appear high fire condition.

3.6. The Contribution of Wind Speed on Forest Fire Occurrence

The wind speed effects on forest fires (formula 7):

$$r_6 = \begin{cases} \dfrac{1}{1 + (\frac{1}{12}(7 - x_6))^{14}} & x_6 < 7m/s \\ 1 & x_6 \ge 7m/s \end{cases} \tag{7}$$

r_6 is the single factor reflecting the contribution of high fire risk value (%). x_6 is as measured ground 10m~12m height average wind speed at 14:00. In the north the wind and precipitation generally occur simultaneously, so the wind speed measurements to eliminate the influence of its precipitation. When the wind speed 3m/s or less, have little effect on the occurrence of forest fires; wind between 3m/s and 7m/s, the impact of forest fires started its rapid growth; when the wind speed reaches 8m/s, once the forest fires difficult to control.

The main contribution of meteorological factors from forest fires occur above analysis point of view, there are certain factors that affect every single occurrence of forest fires, but not the causes of forest fires can be one factor in the decision, but a number of result of factors working together.

4. Logistic Regression Test the Contribution of Various Meteorological Factors

Logistic regression is mainly based on the sample data to determine whether an event occurred, and by the probability of the log-likelihood value occurred. This article will Logistic regression method, using the associated probability of occurrence of each meteorological factors Yichun meteorological data to calculate and forest fires, according to the contribution of each single factor determining this article forest fire forecasting meteorological factors.

4.1. Logistic Regression Method

The occurred incident is defined as *Y=1*. The non-occurred situation is defined as *Y=0*. So the value is *0, 1* variable can be written as Equation 8:

$$Y = \begin{cases} 1 & fire \\ 0 & fire\ does\ not\ occur \end{cases} \quad (8)$$

Usually p indicates the probability of an event occurring, the probability of the event did not occur for $1-p$, and p to be seen as a linear function of the independent variables, as shown in Equation 9:

$$p = P(y=1) = F(\beta_i x_i) \qquad i = 1,2,\ldots, k \quad (9)$$

The use of the simple linear function is expressed as shown in Equation 10:

$$p = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \ldots \beta_k x_k + \varepsilon \quad (10)$$

This transformation in the relationship between Logistic and p as shown in Equation 11:

$$\theta(p) = \log it(p) = \ln(\frac{p}{1-p}) \quad (11)$$

Equation 11 into Equation 10 as shown in equation 12,13:

$$\theta(p) = \ln(\frac{p}{1-p}) = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \ldots \beta_k x_k + \varepsilon \quad (12)$$

$$p = \frac{e^{\theta}}{1+e^{\theta}} = \frac{e^{\beta_0 + \beta_1 x_1 + \beta_2 x_2 + \ldots \beta_k x_k + \varepsilon}}{1+e^{\beta_0 + \beta_1 x_1 + \beta_2 x_2 + \ldots \beta_k x_k + \varepsilon}} \quad (13)$$

4.2. Calculate the Likelihood Ratio of the Meteorological Factors Using Logistic Regression

In this paper, the daily maximum temperature, the daily diurnal temperature range, the daily minimum humidity, humidity minimum three-day average, daily precipitation and wind speed were calculated by Logistic regression method, Logistic model for equation 14[5]:

$$\ln(\frac{p_i}{1-p_i}) = \beta_0 + \beta_1 x_i + \varepsilon \quad (14)$$

x_i is the value of meteorological factors, using SPSS statistical tools to calculate natural logarithm and the likelihood ratio statistic of the meteorological factors maximum likelihood function as show in Table 2 :

Table 2 Likelihood Ratio Statistic of Meteorological Factors

Meteorological factors	Variable	Maximum Likelihood natural logarithm of the likelihood function	Likelihood statistic
Daily maximum temperature of 14:00	x_1	-172.57	66.69
Diurnal temperature range	x_2	-167.59	56.71
Daily minimum humidity	x_3	-157.36	36.25
The three-day average of the minimum humidity	x_4	-181.37	84.28
Daily precipitation	x_5	-141.59	0.187
Wind speed	x_6	-146.99	15.05

As can be seen from Table 2, the influence of meteorological factors to predict fires, the three-day average of the minimum humidity of forest fires occurred, followed by the daily maximum temperature of 14:00. In six major factors of the impact of forest fires precipitation is minimum. Therefore, this paper will use a large contribution, x_1,x_2,x_4 as important indicators of integrated forest fire prediction, but the wind on forest fires with the role of combustion, can not be overlooked, thus adding wind meteorological factors in the composite indicator of this article make forecasts more accurate.

5. The Achievement of Integrated Meteorological Indicators to Predict Forest Fire Method

A single meteorological factor has poor predictive accuracy characteristics in affecting the occurrence of the forest fires. The forest fire prediction requires the combined effect of a number of meteorological factors. After analysis of the previous sections, integrated meteorological indicators include the maximum temperature at 14:00, diurnal temperature range, the average of three days minimum humidity and wind speed, in order to determine the method for predicting the occurrence of forest fires, according to a large forest fire occurred before the meteorological data, using multiple linear regression method to establish the occurrence of forest fires of linear equations, the four meteorological factors as independent variables linear regression equation.

5.1. Multiple Linear Regression Equation

Suppose $x_1,x_2,\ldots,x_p$ is independent variables, and y is dependent variable, the use of independent variables and the dependent variable with the establishment of the equation for the linear relationship shown in Equation 15:

$$y = \beta_0 + \beta_1 x_1 + \cdots + \beta_p x_p + \varepsilon \tag{15}$$

Substituting results, we have in Equation 16:

$$\begin{cases} y_1 = \beta_0 + \beta_1 x_{11} + \beta_2 x_{12} + \cdots + \beta_p x_{1p} + \varepsilon_1 \\ y_2 = \beta_0 + \beta_1 x_{21} + \beta_2 x_{22} + \cdots + \beta_p x_{2p} + \varepsilon_2 \\ \cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots \\ y_n = \beta_0 + \beta_1 x_{n1} + \beta_2 x_{n2} + \cdots + \beta_p x_{np} + \varepsilon_n \end{cases} \tag{16}$$

The purpose of multiple regression equation is estimated parameter β , $b_0, b_1, \cdots, b_p$ is β the least squares estimation, so the regression equation is shown in Equation 17:

$$\hat{y} = b_0 + b_1 x_1 + b_2 x_2 + \cdots + b_p x_p \tag{17}$$

According to the principle of least squares, the regression coefficients of $b_0, b_1, \cdots, b_p$ is min in squares sum Q of difference of all observations y_i and regression value $\hat{y}_i$ (Equation 18):

$$Q = \sum_{i=1}^{n} (y_i - \hat{y}_i)^2 \tag{18}$$

The Q for partial derivative of $b_0, b_1, \cdots, b_p$, so that each partial derivative is zero, and the regression equation 17 in all experiments the return values $\hat{y}_i$ into equation, we get the following normal equations, formulas 19:

$$A \cdot b = B$$

$$A = \begin{bmatrix} n & \sum_{i=1}^{n} x_{i1} & \sum_{i=1}^{n} x_{i2} & \cdots & \sum_{i=1}^{n} x_{ip} \\ \sum_{i=1}^{n} x_{i1} & \sum_{i=1}^{n} x_{i1}^2 & \sum_{i=1}^{n} x_{i1} x_{i2} & \cdots & \sum_{i=1}^{n} x_{i1} x_{ip} \\ \cdots & \cdots & \cdots & \cdots & \cdots \\ \sum_{i=1}^{n} x_{ip} & \sum_{i=1}^{n} x_{i1} x_{ip} & \sum_{i=1}^{n} x_{i2} x_{ip} & \cdots & \sum_{i=1}^{n} x_{ip}^2 \end{bmatrix}$$

$$b = \begin{bmatrix} b_0 \\ b_1 \\ \vdots \\ b_p \end{bmatrix} \qquad \mathbf{B} = \begin{bmatrix} \sum_{i=1}^{n} y_i \\ \sum_{i=1}^{n} x_{i1} y_i \\ \vdots \\ \sum_{i=1}^{n} x_{ip} y_i \end{bmatrix} \tag{19}$$

Therefore, the least squares estimation value obtained using Equation 20:

$$b = A^{-1} B = (X^T X)^{-1} X^T Y \tag{20}$$

In the calculation of the regression equation, in order to facilitate the calculation, using the regression model as shown in Equation 21:

$$y_i = \mu_0 + \beta_1 (x_{i1} - \bar{x}_1) + \beta_2 (x_{i2} - \bar{x}_2) + \cdots + \beta_p (x_{ip} - \bar{x}_p) + \varepsilon_i, i = 1,2,\cdots, n \tag{21}$$

Among: $\bar{x}_i = \frac{1}{n} \sum_{k=1}^{n} x_{ki} (i = 1,2,\cdots, p)$

5.2. Multiple Linear Regression Equation to Predict Forest Fires Fire Rating

According to the analysis, the meteorological factors in forecast of forest fires have included the daily maximum temperature at 14:00, the daily diurnal temperature range, the average of three days minimum humidity and wind speed, thus using the data in Yichun and Equation 21 regression models to predict the establishment of forest fires based on the above four factors regression equation 22. y_i representatives of fire danger rating, x_1 is the maximum t temperature at 14:00, x_2 is the daily diurnal temperature range, x_3 is the average of three days minimum humidity and x_4 is wind speed.

$$y_i = \mu + \beta_1 (x_{i1} - \bar{x}_1) + \beta_2 (x_{i2} - \bar{x}_2) + \beta_1 (x_{i3} - \bar{x}_3) + \beta_1 (x_{i4} - \bar{x}_4) + \varepsilon_i \tag{22}$$

(1) Calculating the sum, the arithmetic mean, the cross product of the variables.

(2) Calculating the coefficient matrix A, the constant matrix B, and the inverse matrix A^{-1}.

$$A=\begin{bmatrix} n & 0 \\ 0 & L \end{bmatrix}=\begin{bmatrix} 64 & 0 & 0 & 0 & 0 \\ 0 & 74.766 & 223.250 & -887.852 & 119.872 \\ 0 & 223.250 & 393.68 & -448.266 & 23.582 \\ 0 & -887.852 & -448.266 & 3149.874 & -196.202 \\ 0 & 119.872 & 23.582 & -196.202 & 105.697 \end{bmatrix}$$

$$B=\begin{bmatrix} \sum_{i=1}^{64} y_i \\ l_{1y} \\ l_{2y} \\ l_{3y} \\ l_{4y} \end{bmatrix}=\begin{bmatrix} 200 \\ 96.855 \\ 28.69 \\ 21.21 \\ 108.25 \end{bmatrix}$$

$$A^{-1}=\begin{bmatrix} 0.015625 & 0 & 0 & 0 & 0 \\ 0 & -0.00407 & 0.001158 & -0.00079 & 0.002895 \\ 0 & 0.001158 & 0.00282 & 0.000727 & -0.00059 \\ 0 & -0.00079 & 0.000727 & 0.000287 & 0.001263 \\ 0 & 0.002895 & -0.00059 & 0.001263 & 0.008655 \end{bmatrix}$$

(3) Calculating the regression coefficients and regression equations.

$$b=\begin{bmatrix} \mu \\ b_1 \\ b_2 \\ b_3 \\ b_4 \end{bmatrix}=A^{-1}B=\begin{bmatrix} 3.125 \\ -0.0643 \\ 0.1446 \\ 0.0871 \\ 1.2272 \end{bmatrix}$$

$$\hat{y}=3.125-0.0643(x_1-16.643)+0.1446(x_2-13.799)+0.0871(x_3-18.339)+1.2272(x_4-4.619)$$

From the calculations, forecast fire rating with linear regression equation is shown in Equation 23:

$$\hat{y}=-5.066-0.0643x_1+0.1446x_2+0.0871x_3+1.2272x_4 \tag{23}$$

The regression equation 23 after significant inspection meets normal distribution F table. Therefore there is a linear relationship between y and x_1,x_2,x_3,x_4. The occurrence of forest fires can predict the fire danger rating, fire danger rating table as shown in Table 3:

Table 3 Regression Equation to Predict the Fire Danger Rating

Fire danger rating	Regression equation	Degree of risk	Forest flammability
Ⅰ	<1	No danger	General nonflammable
Ⅱ	1~2	Rarely danger	After the fire spread very slowly
Ⅲ	2~3	Medium danger	Quick flammable
Ⅳ	3~4	High danger	Spread faster
Ⅴ	>4	Extremely danger	Fire was fierce and difficult to save

6. Conclusion

Since the meteorological factors on forest fires are an important role. So in this paper, the contribution of the various meteorological factors on the occurrence of forest fires is compared to select the probability of an impact on the larger fires factors as regression factor. According to a large meteorological data in front of forest fire has occurred, the use of multiple linear regression equation forecast fire danger rating.

This method will consider the four important factors of the daily maximum temperature, the daily diurnal temperature range, the average of three days minimum humidity and wind speed, abandoned the single meteorological factors on forest fire prediction uncertainty. In the humidity factor to consider, there is no single minimum humidity in a day, but considering the average three-day minimum humidity, increase the accuracy of forecasts. In the regression equation, it adds wind factor to enhance the accuracy of prediction of forest fires, and further improve the usefulness of prediction methods.

In comparison with similar prediction methods, the method than the relative humidity, temperature and humidity prediction method, and so comprehensive index method has higher prediction usefulness and predictive reference, suitable for promotion method according to different regions, has a good practical application value.

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