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Original Research

The Response of Chinese Fir Forest Tree Ring Growth to Climate Change in China's Dagangshan Region

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Abstract

Chinese fir (*Cunninghamia lanceolata* (Lamb) Hook.) in the Dagangshan region of Jiangxi Province in southern China was selected to explore the impact of climatic factors on tree ring width growth. Results showed that the signal-to-noise ratio (SNR) and mean sensitivity (MS) were large while the first order autocorrelation coefficient (FOAC) was small, and the chronology contains abundant climatic information. The tree ring width index of Chinese fir was significantly positively correlated with the precipitation in December of the previous year and June of the current year, and significantly negatively correlated with that in the current May and August. The tree ring width index was significantly positively correlated with the temperature in April and May of the current year, but significantly negatively correlated with that in July of the current year. The tree ring width index had a good change consistency with the warmth index (W_i) and humidity index (H_i). The response function of Chinese fir ring width analysis shows that the warmth index is the main factor affecting tree ring growth, followed by the humidity index, mean annual precipitation, and mean annual temperature. The comprehensive effect of temperature and precipitation factors have significant influence on the tree ring width growth of Chinese fir. Results can provide a scientific basis for studying the effect of climatic factors on tree growth in sub-tropical regions in China and many other parts of the world.

Keywords: Chinese fir, dendrochronology, warmth index, humidity index

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Introduction

Climatic factors are affected by temperature, wind, rain, and drought when people feel comfortable or uncomfortable in an area because of bad planning and management [1-4]. With the frequent occurrence of abnormal weather in recent years, an increasing number of people are becoming concerned about climate change. Dendrochronology is one of the most important methods in the research of tree ring width to climatic factors [5], because the dendrochronological method has the advantage of accurate dating and strong continuity, and copies of the core can be easily acquired [6, 7]. During their growth and formation process, tree rings can be affected by numerous climatic factors in the current and previous year [8-10]. Tree rings growth is not only constrained by genetic factors but also by environmental factors [11-13]. Moreover, the influence of climatic factors and tree radial growth can be used to construct a model of tree growth based on climate changes, which can be used to roughly estimate the growth of trees with meteorological datum. The studies on the relationships between tree ring width growth and climatic factors were initiated in the 1970s in China. Climate influences the structure and function of forest ecosystems and plays an essential role in the growth and health of forests [14, 15]. Moreover, climate change affects the growth and production of forests directly through changes in the meteorological drivers of growth and through carbon dioxide fertilization, and indirectly through the complex interactions present in forest ecosystems [16, 17]. Tree ring changes are relatively insensitive to moisture and temperature under a warm and humid climate in tropical and subtropical regions. Studies about tree ring width and climatic factors have mainly been undertaken in arid and semi-arid regions [18, 19]. Few studies on tree rings have been performed in tropical and subtropical regions, and recent studies in these areas mostly focus on the southeastern coastal and the southwestern tropical regions of China. Moreover, most of the forests researched are original and the artificial forests have seldom been studied in mid-subtropical regions. Artificial forests of Chinese fir, i.e., Chinese fir planted by humans, grow rapidly and healthily, have good wood quality and straight trunks, and are widely used [20]. Therefore, it was widely planted and has become the main species in the tropical and subtropical regions of China. Climate change, especially in recent decades, have been fast and diverse. Moreover, as a fast-growing species, Chinese fir can record lots of climate information. Currently, the studies on Chinese fir mainly focus on upkeep and management, net primary production, and soil microbes and properties [21, 22]. Studies on the response of Chinese fir tree ring width to climatic factors are not to be found. Consequently, it is meaningful to select Chinese fir to study the relationships between tree ring growth and climatic factors in subtropical areas.

In summary, we selected Chinese fir at the Forest Ecosystem Research Station of the Dagangshan region in Jiangxi Province as a sample for chronology construction. The cores were collected and the standard chronology (STD) was built. The correlation analysis of STD to climate change was studied and the response function of tree growth was made. The study aimed to research the effect of climatic factors on tree growth in sub-tropical regions, provide a rough estimate of tree growth with meteorological datum and a scientific basis for climate change research, and provide the future management of the structure and composition of forest communities under warm and humid climatic conditions in both China and the rest of the world.

Materials and Methods

Study Area and Environmental Conditions

The study area is located in the Forest Ecosystem Research Station of the Dagangshan region in the city of Xinyu, Jiangxi Province, China (114°30'-114°45' E, 27°30'-27°50' N). The core samples were gathered from 10 plots in the same altitude, which represent a 100 km^2 area in Dagangshan (Fig. 1). The Dagangshan area is the main catchment of the Gan River, which is a first-class tributary of the Yangtze River. The experimental area is a subtropical humid monsoon climate with a mean annual temperature of 15.8ºC, a mean annual precipitation of 1,590.9 mm, and a mean annual evaporation of 1,503.8 mm. The precipitation was mainly concentrated between April and June, which accounts for 44.6% of annual total precipitation. The annual extreme minimum temperature is –8.3ºC, the annual extreme maximum temperature is 39.9ºC, and the frost-free period is approximately 269 days. The vegetation type belongs to the subtropical evergreen broad-leaved forest, and the forest coverage is 76.4%.

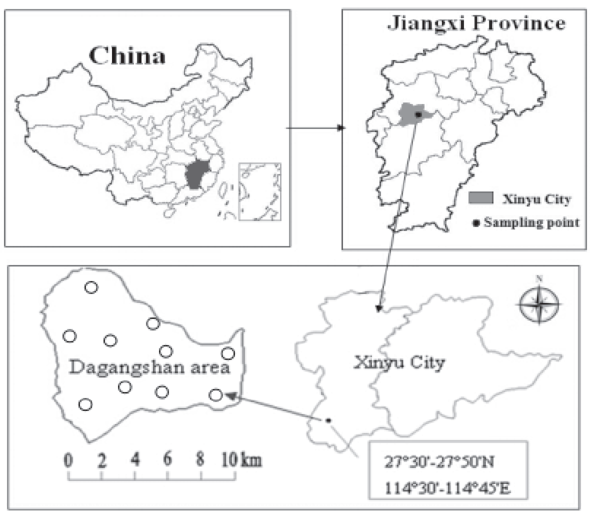

Fig. 1. Map of the location of the study area.

Table 1. Basic condition of Chinese fir forest sample sites.

Stand Type	No. of trees	Cores (No.)	Altitude (m)	Slope (º)	Slope Aspect	Mean Height of Tree (m)	Mean Diameter at Chest Height (cm)	Canopy Density	Density (No. hm$^{-2)}$
Chinese fir	37	75	248	11	South	18.7	24.6	0.7	1520

The existing forest categories are mainly natural secondary evergreen broad-leaf forest, broad-leaf deciduous forest, theropencedrymion, Moso bamboo forest (*Phyllostachys pubescens* (Carr.) Mitford), Liriodendron forest (*Liriodendron chinensis* Sarg.), and a large area of Chinese fir forest (*Cunninghamia lanceolata*) [23].

Research Methods

Sampling

The project area setup, observational indicators, and test methods were based on "Observation Methodology for Long-term Forest Ecosystem Research" of National Standards of the People's Republic of China (GB/T 33027-2016). Healthy Chinese fir trees ranging in age from 1971 to 2013 years in typical districts were chosen as samples. Based on the standard of the International Tree-Ring Data Bank (ITRDB), we obtained Chinese fir cores by drilling holes into the tree in a parallel direction along the slope (specifically, the samples were cored along the level slope). We selected large diameter trees isolated in the forest, and took samples at chest height using an increment borer. Two to three cores were collected from every sampled tree and the total was 75 tree cores from 37 trees [24, 25] (Table 1).

Treatment of the Samples

A "skeleton diagram method" [26] was used to perform primary cross-dating on the cores after they were dried, fixed, and polished. Cross-dating permits the reliable identification of missing or partially missing rings and "false rings" [27]. The tree rings of each core were dated, and each tree ring assigned to its exact year of formation. Tree rings were identified and dated by counting them from bark to pith with the help of a stereomicroscope. The raw tree-ring widths of each dated core were visually checked using time series analysis and presentation (TSAP) [28, 29], and then synchronized according to the year-to-year agreement between the interval trends of two chronologies based on the sign of agreement. Then the tree ring widths (Fig. 2) were measured using the Lintab5 Ring Analyzer (Frank Rinn, Germany) with 0.01 mm accuracy.

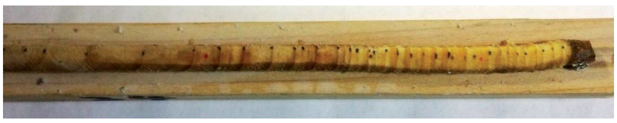

Fig. 2. Photograph of the tree rings.

All measured ring width sequences were plotted, and the patterns of wide and narrow rings were cross-dated to identify possible false rings, missing rings, or measurement errors. The accuracy of all measurements was examined and confirmed using the COFECHA software [17], and the cores that could not be cross-dated were discarded. ARSTAN software was selected and the polynomial was used to construct the standard chronology (STD) of the Chinese fir tree rings [30]. Compared with the splines, moving average functions, and exponential functions, the formula of polynomial was selected as below:

$$y = 0.00003x^4 - 0.00303x^3 + 0.08172x^2 - 0.65286x+4.4435 \quad (r^2 = 0.57602)$$

…where y stands for the expectations values of Chinese fir ring width and x stands for related temporal covariate values. The quality of the chronologies was assessed by the expressed population signal (EPS), with a value greater than 0.85 providing a good compromise to determine the reliable part of a chronology [31]. Some of the computing methods of the important chronology factors are presented below:

(1) Mean sensitivity (MS): MS is the factor for measuring climate information contained in the chronology. This factor reflects low or high frequency change in the climate. The higher the MS, the more information is contained in the chronology [14]. The formula is:

$$MS = \frac{1}{n-1}\sum_{i=1}^{n-1}\left|\frac{2(X_{i+1}-X_i)}{X_{i+1}+X_i}\right|$$

… where X_i is the width of the i^{th} tree ring, X_{i+1} is the width of the $(i+1)^{th}$ tree ring, and n is the total number of tree rings of the sample.

(2) Signal-to-noise ratio (SNR): The SNR is the ratio of the climatic factors and non-climatic factors in the chronology and is used to express the common environmental information of the samples. The larger the SNR, the more climatic information the samples contain, and the samples have more information in common [25]. The formula is

$$SNR = t\frac{r_{bt}}{1-r_{bt}}$$

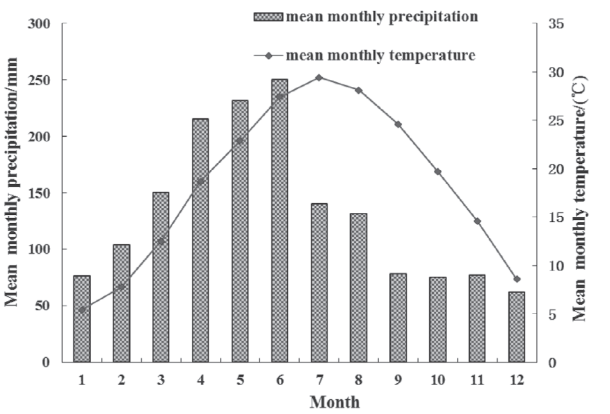

Fig. 3. Mean monthly precipitation and temperature in the study area (1971-2013 year).

…where t is the total number of samples and r_{bt} is the correlation coefficient of the trees.

(3) First-order autocorrelation coefficient (FOAC): The FOAC of the samples reflects the effect of the climatic factors in the last year on tree ring width in the current year. The smaller the FOAC, the lower the effect [27].

Climate-Growth Relationships

Correlation function analysis was performed to examine the relationships between the climatic factors and tree ring width. The processing of the correlation analysis was conducted using SPSS-PC statistical software (SPSS 19). We computed Pearson's correlation coefficients over the complete overlapping period of the records [31]. The STD was selected to study the correlation between Chinese fir tree ring growth and precipitation and temperature. Since monthly temperature and precipitation of the preceding growing season often influence tree ring growth, the values of these variables from October of the previous year to November of the current year were used to analyze the tree ring width chronologies [32].

Source of meteorological data: The meteorological data were obtained from the FenYi Weather Station (1971-2013), which is adjacent to the sample site. The precipitation in the study area occurred mainly from April to June, based on the meteorological data analysis. The precipitation and heat occurred in different periods and a dry and a wet season were present (Fig. 3). The climatic factors from October of the previous year to November of the current year (a total of 14 months) were chosen to analyze the correlation with the chronology.

Warmth and Humidity Indices

Warmth index (W_i): The warmth index (W_i) is a different temperature metric proposed in 1945 by a Japanese scientist, Professor Kira Tatsuo. It has been proven that the warmth index is actually a simplified and effective accumulated temperature. According to local long-term observation and studies about Chinese fir, temperature above 5ºC can ensure that it grows normally [16]. The formula is

$$W_i = \sum_{i=1}^{n} (T_i - 5)$$

…where W_i is the warmth index, T_i is average temperature over 5ºC, and n is the total month of the temperature over 5ºC.

Humidity index (H_i): The humidity index (H_i) can reflect the dry or wet situation by using the calculation of precipitation and temperature in an area. The formula is

$$H_i = P_i/T_i$$

…where H_i is the humidity index, and P_i and T_i are the mean month precipitation and temperature, respectively, in the same period.

Results

Statistical Characteristics of the Chinese Fir Chronology

The statistical characteristics of the chronology can reflect some basic information on tree ring growth. The statistics of chronologies are given in Table 2. The STD of Chinese fir was built with 60 cores.

In general cases, the smaller the FOAC, the higher the SNR and MS, and the larger the amount of climate information that will be contained in the tree chronology [33, 34]. The FOAC of the chronology, which indicated strong growth persistence between consecutive years, was 0.132. The SNR value indicated that the samples have much information in common. The MS was

Table 2. Statistics of the tree ring and the standard chronology (STD) of Chinese fir.

Statistics	Measured Value	STD
Total sample/tree	75/37	60/29
Standard deviation	1.945	0.11
Mean Sensitivity (MS)	-	0.28
Signal to Noise Ratio (SNR)	-	40.17
First Order Autocorrelation Coefficient (FOAC)	-	0.132
Average Correlation Coefficient Between Trees (ACCBT)	-	0.483
Overall Sample Representativeness	-	0.92
Variance of first principal component	-	0.427

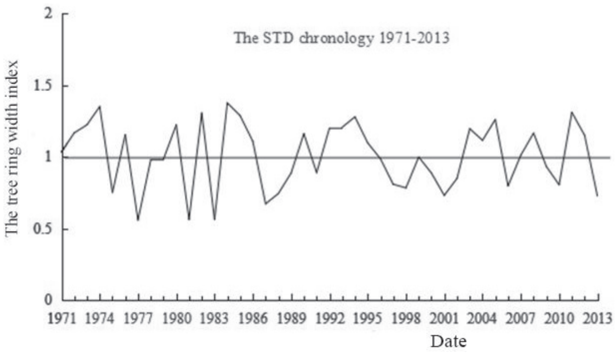

Fig. 4. Standard chronology from Chinese fir tree ring width.

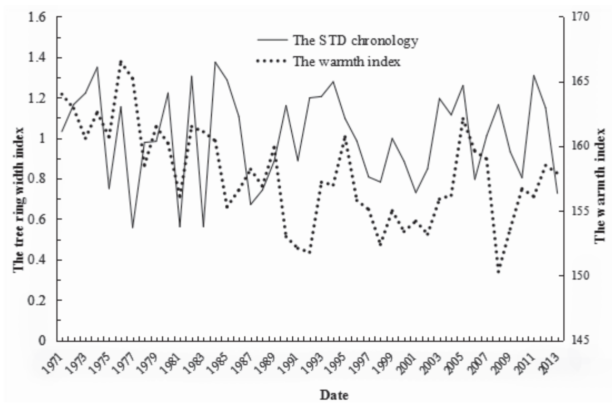

Fig. 6. Trend of the tree ring width index and the warmth index.

0.28, which exceeds the acceptable level of 0.1 and shows that tree growth is quite sensitive to the regional environmental change. The ACCBT was 0.483, which shows that the variations of samples are consistent. The overall sample representativeness of the chronology was 0.92, which is larger than the acceptable level of 0.85, and the variance of the first principal component was 0.427. The values indicated that the chronology recorded considerable climatic information, which can be used to analyze the relationship between tree ring width and climatic factors. The SNR was 40.17, which indicated that the STD has a certain amount of climate information and can be used to perform correlation analysis with the climatic factors. The STD kept more low-frequency signals of climate change, which can well express the effects of climate on tree ring growth. The STD (Fig. 4) was selected to perform correlation analysis with the climatic factors.

Correlation Analysis between Tree Ring Width Index and Mean Monthly Temperature

The STD of Chinese fir and the mean monthly temperature were selected to perform the correlation analysis. The results showed (Fig. 5) that the correlation between the tree ring width growth and the temperature in the former growing season was negative. The tree ring width growth of Chinese fir had a positive correlation (P<0.05) with the temperature in April and May of the current year, and a highly significant positive correlation (P<0.01) with the temperature in May of the current year. The correlation between the tree ring growth of Chinese fir and the temperature in July of the current year was negative (P<0.5). The tree ring width growth of Chinese fir had a positive correlation with the temperature in the growing season and a negative correlation in the non-growing season.

The tree ring width index and the warmth index were selected to fit the change trends. The results (Fig. 6) showed that the peak-to-valley value had good consistency, but there were still some differences.

Correlation Analysis between Tree Ring Width Index and Mean Monthly Precipitation

The results of correlation analysis between STD and mean monthly precipitation are shown in Fig. 7. The tree ring width of Chinese fir had a significant positive correlation (P<0.05) with the precipitation of December of the previous year and June of the current year, and a significant negative correlation (P<0.05) with precipitation in May and August of the current year. The relationship between the tree ring width of Chinese fir and the mean monthly precipitation is generally complex.

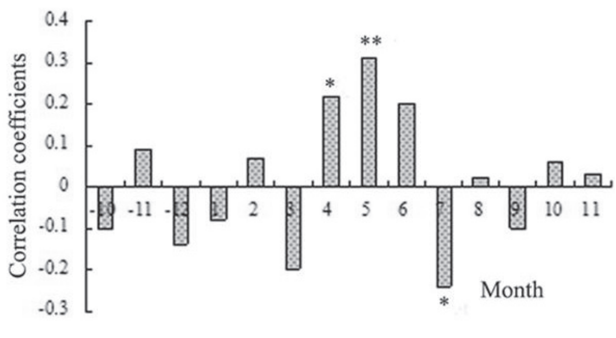

Fig. 5. Correlation coefficients between tree ring width and mean monthly temperature. Note: * is $p<0.05$, ** is $p<0.01$.

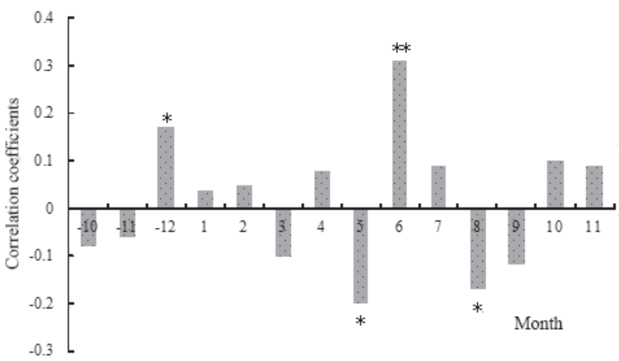

Fig. 7. Correlation coefficients between tree ring width and mean monthly precipitation. Note: * is $p<0.05$, ** is $p<0.01$.

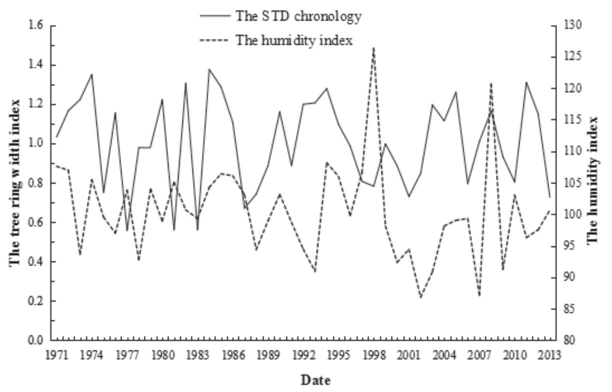

Fig. 8. Trend of the tree ring width index and the humidity index.

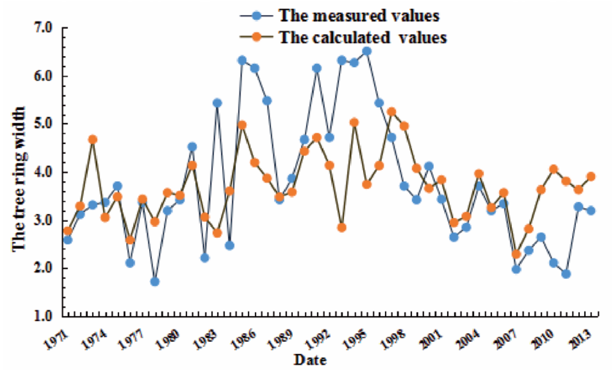

Fig. 9. Trend of the modeled ring width values and the measured values.

The tree ring width index and the humidity index were selected to fit the change trends. The results (Fig. 8) showed that the peak-to-valley value had a good consistency, but some differences exist.

Analysis of the Response Function of Chinese Fir Tree Ring Width

The tree ring width of Chinese fir and the warmth index (W_i), the humidity index (H_i), the mean annual temperature (T_m), and mean annual precipitation (P_m) were selected to do the correlated function analysis.

The results (Table 3) showed that tree ring width had significant correlation with climatic factors, particularly a highly significant correlation with the warmth index (W_i) and the humidity index (H_i); the correlation coefficients were 0.642 and 0.58, respectively. The results showed that the influence of last year was higher than that of the current year on Chinese fir ring width growth in the Dagangshan area.

Temperature and precipitation had good consistency. Both could affect the tree ring width growth of Chinese fir in tropical and subtropical regions. Warmth index (W_i), humidity index (H_i), mean annual temperature (T_m), and mean annual precipitation (P_m) were selected to reflect the climatic factors, and the four factors were selected to make the linear regression with tree ring width. The response function formula was: $R = -0.874*H_i - 0.128*W_i - 5.751*T_m + 0.061*P_m + 105.941$ ($F = 3.363$, $P = 0.019$).

Table 3. The correlation coefficients between the tree ring width and climatic factors.

	R	H_i	W_i	T_m	P_m
R	1	0.58^{**}	0.642^{**}	-0.21^{*}	-0.37^{*}
H_i	0.58^{**}	1	-0.027	-0.64^{**}	0.688^{**}
W_i	0.642^{**}	-0.027	1	0.366^{*}	-0.151^{*}
T_m	-0.21^{*}	-0.64^{**}	0.366^{*}	1	0.111^{*}
P_m	-0.37^{*}	0.688^{**}	-0.151^{*}	0.111^{*}	1

Note: R is the tree ring width of Chinese fir; H_i is the humidity index; W_i is the warmth index; T_m is the mean annual temperature; P_m is the mean annual precipitation.
** Correlation is significant at the 0.01 level
* Correlation is significant at the 0.05 level

Comparing the modeled tree ring width value with the measured value, there was good consistency (Fig. 9). The results indicated that the equation can be used to estimate the tree ring width of Chinese fir in the Dagangshan region. The results may provide a scientific basis for the construction of Chinese fir plantations in subtropical regions.

Discussion

A High-Quality Chronology Can be Constructed in Subtropical Areas

Research indicates that good chronology can be constructed in subtropical warm and wet areas. The SNR of the Chinese fir chronology is relatively high, which indicates that more climatic information is included in the chronology; this is probably because Chinese fir is a fast-growing species and is more sensitive to climate change. Tree ring growth is not only affected by the climatic factors in the current year but also in the previous year. The FOAC of the chronology reflects the influence of the climatic factors in the previous year on tree ring growth of the current year. The larger the FOAC, the greater the influence [34]. The FOAC of Chinese fir chronology is smaller than that of the *Cryptomeria fortunei* chronology constructed by Chen [35]. This may be because the temperature and rain were more suitable in the Dagangshan area, resulting in rapid cell division and acceleration of tree growth. Consequently, the photosynthetic products of Chinese fir can be used for tree ring growth in time, so that the influence was less. The studies on *Larix gmelinii* chronology performed by Sano showed a good agreement with the results of Chinese fir [6]. This indicates that the Chinese fir chronology contains abundant climate information and can be used to study the relationship between tree ring width and climatic factors. It also indicates that tree rings can be used to conduct climatology research in subtropical areas.

Influence of Precipitation and Temperature on Tree Ring Growth of Chinese Fir

Our study showed that tree ring growth of Chinese fir had a significant positive correlation with the precipitation in current June, and that the correlation was stronger than that of *Cryptomeria fortunei* conducted by Chen [35]. This was probably because the latitude is lower and the temperature is higher in our study area, which resulted in greater transpiration of vegetation. The evaporation of soil water was relatively high, which decreased water availability. Consequently, precipitation was the primary factor affecting Chinese fir growth in current June. The results showed that the tree ring width growth of Chinese fir had a significant negative correlation with the precipitation in current May. This may be because the increasing precipitation led to a saturated soil water condition, and excessive water limited water absorption by roots [36]. The tree ring growth of Chinese fir showed a significant negative correlation with the precipitation in current August. This was because the excessive precipitation saturated the soil. High and sustained levels of precipitation limit the water absorption capacity of tree roots, which affected the growth of Chinese fir. The tree ring width growth of Chinese fir had a significant positive correlation with precipitation in December of the previous year. The result was similar to that presented by Primicia [36]. This may be because the precipitation increased the soil water in December of the previous year, which provided water for the primary growth of Chinese fir in the next spring. There were some differences of the peak-to-valley values between the tree ring width index and warmth index. For example, the warmth index decreased rapidly in 2008; however, the tree ring width index was less sensitive in the current year but showed a larger sensitivity in the next year. This may be because temperature has a hysteresis effect on tree ring width growth, which leads to the influence being significant in the next year. The tree ring width index and the warmth index had a good change consistency, which illustrated that the temperature factor had a strong influence on the tree ring growth of Chinese fir, and the tree ring can record lots of climate information.

Our study found that tree ring growth of Chinese fir had a significant positive correlation with the temperature in current April and May, which were different from the results of Liu [22]. This may be because the rainy season begins in April, and the precipitation increased and was sustained in May in the Dagangshan area. However, the rate of temperature increase was slower than the rate of precipitation increase; therefore, temperature was the primary factor restricting the growth of Chinese fir at this time. Temperature increase can accelerate tree ring width growth, so the tree ring growth of Chinese fir showed a significant correlation with temperature. Similar to most of the studies in the northern hemisphere [37-39], the tree ring width growth of Chinese fir had a negative correlation with the temperature in July of the current year. This may be because July had the highest temperature in the northern hemisphere. The excessive temperature changed the energy metabolism and osmotic adjustment, enhanced the transpiration and respiration of the vegetation, and influenced the photosynthetic rate of the vegetation; consequently, the rate of tree ring growth was slowed and restricted. Therefore, tree ring growth showed a negative correlation with the temperature in July of the current year. The peak-to-valley values between tree ring width index and humidity index exist with some differences. For example, the humidity index rapidly rose in 1998, but the tree ring width index was slightly increased in the current year and greatly increased in the next year. This was because the influence of precipitation and temperature change and other climatic factors on tree ring growth could not be reflected immediately; there was a hysteresis. The tree ring width index and the humidity index had good consistency in change trend, which indicates that the humidity index can affect the tree ring growth of Chinese fir, and the tree ring can record lots of climate information.

Response Function between Chinese Fir Ring Width and Climatic Factors

The climatic factors can be used to model tree ring width. The response function can reflect the influence of climatic factors on tree ring width growth. The results showed that the warmth index had the highest correlation with tree ring width, followed by the humidity index, mean annual temperature, and mean annual precipitation. The warmth index is the accumulate temperature above 5ºC, which is the initial growth temperature for Chinese fir [15]. The warmth index is a standard way of judging cold or warm weather in a region. If the index is larger than the average value, the region is considered warm and the climatic factors can promote tree ring growth; otherwise, it is considered cold and believed to be unfavorable to tree ring growth. So the correlation between the warmth index and the tree ring width index can be explained by the influence of temperature on tree ring width growth. Chinese fir is a kind of fast-growing vegetation that needs more nutrients for growth. As a result, it needs the temperature to be suitable and the lighting to be adequate. The Chinese fir showed a good change of consistency with the warmth index. The study also found that temperature had a hysteresis effect on tree ring width growth [25], which may be because tree ring growth can decompose the nutrients stored in the previous year for the growth in current year when low temperatures occur. Photosynthesis cannot meet the needs of growth and there is no storage or less storage of nutrients for the growth for next year, so that the growth of next year will be affected, hence the influence of low temperature on the tree ring growth of Chinese fir.

The humidity index was second only to the warmth index on the tree ring growth of Chinese fir. It then combined the actions of temperature and precipitation and reflected the situation of wet or dry weather in a region. If the humidity index is large it indicates that the region is wet; if it is small, it indicates that the region is dry. The plots were located in the humid subtropical region, with the precipitation mainly concentrated in April to June, and the precipitation and heat occurred in different periods and a dry and a wet season were present [23]. During the months with the highest precipitation, the temperature is not the optimum growth temperature, and the excessive rainfall will affect the absorption of water. As a result, the comprehensive action of temperature and rainfall affect the tree ring width growth of Chinese fir. July and August were the warmest months in the northern hemisphere, but the precipitation was relatively reduced during this period in our study area, and the excessive temperature may lead to an increasing rate in the evaporation capacity and transpiration, which would reduce the available water [35]. Moreover, most of the absorbed water would evaporate. Therefore, the photosynthesis of Chinese fir was reduced and the growth rate slowed. The influence of precipitation and temperature affect tree ring width growth, and the tree ring records lots of climatic information and can be used to analyze the correlation with climatic factors.

The response function was selected to model the tree ring width of Chinese fir. The modeled values and the measured values had a good consistency, which indicates that the warmth index, the humidity index, mean annual temperature, and the mean annual precipitation can be used to rebuild the tree ring width of Chinese fir [32]. The results had a great significance on the research of tree ring width and the climatic factors in the subtropical region of China, and indicated that the study of the tree ring width to climatic factors can also be adapted to the tropical and subtropical regions, which can generate many benefits to the research of tree ring width in China and the rest of the world.

Conclusions

1) High-quality chronology of Chinese fir can be made in subtropical regions. The chronology contains lots of climatic information and can be used to measure the response of tree ring width and the climatic factors in the Dagangshan region.
2) The tree ring width index and the warmth index and the humidity index have a good consistency in the change trend, and the climatic factors show a hysteresis effect on the tree ring growth of Chinese fir.
3) Tree ring width can be modeled with the warmth index, humidity index, the mean annual temperature, and the mean annual precipitation factors. The response of tree ring width to climatic factors also adapts to the tropical and subtropical regions in China. The study can provide a scientific method regarding tree ring width growth and climatic factors both inside China and around the world.

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Conflict of Interest

The authors declare no conflict of interest.

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