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Endangered ornamental plants are the effects of global climate change on the spread of the Liriodendron Chinense and Liriodendron tulipfera

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Abstract. Climate change has a significant impact on the number and distribution of species, biodiversity and ecological status. Liriodendron contains two species: Liriodendron chinense and Liriodendron tulipfera, both considered an ornamental tree and rich in unique nectar (honey), in addition, high-quality wood for furniture is important for medicinal and landscape purposes. However, little is known to us about the distribution characteristics of their population and the important climatic factors that shape their suitability. Global warming, climate change have become the most influential, decisive factor in the distribution of these two species in nature. Predicting the spatial variation and migration trend of species distributions endangered by climate change has become one of the latest research points in biology and forest ecology conservation. In order to develop strategies for future forest cultivation, management and conservation, the data obtained using prediction of distribution areas using the MaxEnt program of these two tree species will be the basis for further biogeographic research.

Keywords: Liriodendron chinense, liriodendron tulipfera, global warming, climate, ecology

1. Introduction.

The geographical distribution of species is a spatial feature influenced by the environment and human activities. Climate change is a major environmental factor affecting species population distribution, geographic distribution, species biodiversity, composition, richness, structure and function of ecosystems. Therefore, the analysis of the potential geographical distribution of species under a changed climate is of great importance for biodiversity conservation, ecological restoration, and sustainable ecosystem maintenance.

According to past reports, the climate is clearly changing and temperatures around the world are increasing year by year. [1, 2] This results in constant temperature fluctuations and extreme precipitation and temperature ranges is causing a sharp change. [3] Annual global temperatures are expected to continue to rise, with unimaginable impacts on Earth's biodiversity and ecosystems. [4, 5] Global warming may promote the migration of plants to regions with higher altitudes and latitudes. [6, 7] Climate change is known to have caused a drastic reduction in the habitat of some European forest tree species.[8] The researchers predicted the geographic distribution of 2319 woody plants in Yunnan, China and found a maximum extinction rate of about 6% under the most extreme climate change scenario. In addition, they estimated that about 1400 species would lose more than 30% under the most extreme climate change scenario. Conversely, changes in the distribution of species populations also affect the climate change of the entire area, as surface vegetation strongly influences atmospheric properties. [9]. Global warming has become the most important factor affecting the distribution of Liriodendron chinense and Liriodendron tulipfera species. Predicting the spatial variation of relevant distribution areas and migration trends of endangered species threatened by climate has become one of the latest research points in the field of conservation biology and forest ecology. [10]

2. Materials and methods.

2.1. Distribution and use of Liriodendron chinense and Liriodendron tulipfera.

Liriodendron is a fossil plant of the third period. Due to the effects of climate change during the Late Tertiary and Quaternary Ice Ages, there are only two natural species in the genus Liriodendron, Liriodendron chinense in East Asia and Liriodendron tulipifera in North America [11]. Liriodendron chinense is commonly

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known as Chinese tulip tree, Chinese white tree. It is found in Central and South China, Anhui, Guangxi, Fujian, Hunnan, Shaanxi, Zhejiang and also in northern Vietnam. In particular, Liriodendron chinense is an endangered species on the Red List of Threatened Species of the World Conservation Union. [12] Liriodendron tulipfera is a tall, greenish-yellow deciduous forest tree with tulip-like flowers, conical fruits. Liriodendron tulipfera is commonly called tulip tree or yellow poplar. It is a large deciduous tree native to eastern North America. Although common throughout Missouri, it is also found in forests in several counties in the far southeast corner of the state. It is also one of the main street trees for high-quality wood, medicinal and ornamental purposes . [13] Liriodendron plants are of great scientific, economic, and ecological importance in population genetics, paleogeography, paleoclimate and evolution. However, the reproductive characteristics of liriodendron populations are very low and the rate of natural seed reproduction has decreased dramatically due to climate and environmental changes.

2.2. Studying the potential distribution of Liriodendron species under changing global climate conditions.

Maximum Entropy MaxEnt (prediction) model by scientists Y. Cao, J. Feng, D. Hwarari, B. Ahmad , H. Wu, J. Chen to obtain the geographical distribution characteristics of Liriodendron species population and climate factors affecting their habitats and geographic distribution data of Liriodendron were used. The predicted results of their geographical distribution areas as the climate changes in the future are studied. The main thing in this research is the coordinate data of the habitat and distribution areas of Liriodendron chinense and Liriodendron tulipfera and the climate data was collected and processed using the data of a total of 6 climate scenario combinations. The projected results of climate factors and the potential distribution area of Liriodendron chinense and Liriodendron tulipfera in the future are obtained in the form of statistically variable areas data. Therefore, it is necessary to study the spatial range of suitable zones of Liriodendron under climate change and to understand the ecological requirements of Liriodendron. [14](Alterations in population distribution of Liriodendron chinense (Hemsl) Sarg. And Liriodendron tulipfera Linn. Caused by climate change) mdpi.com

3. Results.

The analysis results showed that the potentially very suitable habitats of L. chinense mainly spread from central China to eastern China in the Yangtze River Basin.But this is consistent with the actual distribution area range of Liriodendron chinense. This region belongs to subtropical monsoon climate with hot and rainy summer and mild and less rainy winter. The high growth period of Liriodendron chinense is the warmest quarter in its suitable habitat and may be an important factor influencing its survival. Climate change may cause Liriodendron tulipfera to spread in the western United States to West Virginia and western Pennsylvania. This result is consistent with the actual distribution area of Liriodendron tulipifera. We can see from these studies that the MaxEnt model also takes into account only climate components and predicts changes in regions based on this. But these studies do not give us the conclusion that the two species of Liriodendron will definitely shift towards the above-mentioned regions as a result of climate change. A disadvantage of such studies has shown that further analysis is needed taking into account the characteristics of suitable areas in these zones, taking into account soil, altitude, slope orientation and other environmental factors.

4. Discussion.

The geographical distribution data of Liriodendron were studied to find out the distribution characteristics of the population of the genus Liriodendron and the climatic factors affecting their habitat suitability. Based on the input statistical data, the predictive model shows the emergence of Liriodendron chinense and Liriodendron tulipifera in new geographic areas suitable for global climate change conditions, indicating the emergence of these two species. It has shown that protection strategies need to be formulated and developed to reduce the potential impacts of climate change. The results of the analysis showed that long-term high carbon emissions will lead to a reduction of suitable habitats for Liriodendron in the long term. The main goal of such research is to identify plants that are threatened with extinction as a result of global climate change, adapt to the changing climate and discover new areas where they can live, develop non-native zones and reduce It has been shown to make strategic measures against changes in biology and forest ecology based on this, in order to preserve and prevent the threat of extinction by preserving the species of the flora world.

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Anticipating future impacts of global climate change on flora and fauna is a huge achievement for humanity. It predicts which regions of the earth will grow the species that are rare and valuable for us due to global climate change, precipitation, drought and other unfavorable conditions and predicts the development of those areas.

According to previous studies in the forest community, Liriodendron chinense has a long generation period and low reproductive ability, Liriodendron the flowering period of chinense falls from the end of April to the beginning of June, that is the period of abundant precipitation in favorable habitats. Rainfall can significantly affect its pollination and reproduction. This is one of the important reasons why rainfall-related factors have become the main factors influencing the distribution of Liriodendron chinense.

Supplementary Materials: The following are available online at https://www.mdpi.com/article/10.3390/f13030488/s1 (Google Scholar)

Data Availability Statement: Data is contained within the article or Supplementary Materials.

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