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Research Article

Forest Ecological Diversity Change Prediction Discrete Dynamic Model

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Forest ecosystem is the most important terrestrial ecosystem type of species diversity in the world. The protection and sustainable use of forest ecological diversity is of great significance to forest protection and sustainable management. In order to maintain biodiversity, the traditional concept of forest resources management must be changed. In recent years, the mining and application of big data have become the frontier content of international ecological diversity and macroecology research. By establishing the discrete dynamic model of forest ecological diversity change, this study finds a method that can keep the number of trees stable in a short time and ensure the sustainable development of forest resources. This article studies and constructs the forest information system and constructs an open-source WebGIS (network geographic information system) scheme for the field of spatial information and supporting OGC (occupationally generated content). At the same time, the grey theory GM (1,1) model is used to predict the development trend of forest resources in China. The results show that under the promotion of policies and research projects, China's forestry development has realized the double growth of forest area and volume, and the forest coverage rate has reached a new level.

1. Introduction

Ecological civilization is the main theme of today's society, and it is a great progress in the form of human civilization and the concept, road, and mode of civilization development. Advocating ecological civilization has become an important guarantee for sustainable development in the new century. As an indispensable part of ecological civilization construction, forest is one of the most precious resources on the earth and plays an irreplaceable role in maintaining the global ecological balance and improving the ecological environment of the earth. The growth and decline of forest resources is the key to the coordinated and sustainable development of social, economic, and environmental systems. Studying the dynamic changes of forest resources, analyzing and mastering the laws of forest resources changes, and predicting its development trend can objectively and accurately evaluate the effect of forestry management and provide reliable and scientific arguments and basis for macro decision-making of forestry development.

At present, big data are affecting human life, science and technology, economy, culture and political development all over the world and are gradually changing our way of thinking. The mechanism of the origin, maintenance, and loss of ecological diversity is the foundation and frontier of ecological research [1], and it is also the core issue of ecological diversity science and macroecology [2]. The components of the ecosystem are extremely diverse and often have complex interactions, and the feedback and regulation modes in the ecosystem are also very diverse and constantly changing, and the system components and related processes often show a high degree of temporal and spatial heterogeneity [3]. Then, how can we scientifically and rationally utilize and optimize the management of forest resources to ensure the sustainable development of the forestry and forestry economy? Many researches on forest ecological diversity change prediction are qualitative or simple quantitative models, without in-depth study of dynamic economic model explanation for sustainable development of forest resources, and it is far from enough to rely solely on these qualitative discussions or simple quantitative studies. It is also necessary to conduct in-depth qualitative and quantitative research, dynamically analyze the harvesting of forest resources system, and benefit calculation, optimization, and decision-making of sustainable management schemes. Theoretical derivation based on mathematical models is the most important work in theoretical methods [4, 5].

Ecological diversity is an important part of the ecological environment, which is related to human survival and sustainable development of economy and society, and is the commonwealth of mankind. First, ecological diversity provides a basic material guarantee for human life and production activities [6]. Second, ecological diversity plays an important role in environmental protection and ecological security, especially in reducing the greenhouse effect, purifying air, reducing carbon emissions, maintaining soil fertility, ensuring water quality, water and soil conservation, and other ecological benefits, thus promoting the harmonious development of man and nature. Finally, ecological diversity is the solid foundation of national sustainable development. Rich ecological diversity is an important strategic resource of the country, which is very important for strengthening agriculture, scientific and technological innovation and promoting development, and has valuable development, utilization, and scientific research value [7]. Therefore, this study attempts to explore the establishment of a quantitative measurement system of forest ecological diversity in China, improve the measurement methods of forest ecological diversity, strengthen people's awareness of forest ecological diversity and protection awareness, and promote the protection and sustainable development of forest ecological diversity in China.

Based on the analysis of relevant research results at home and abroad, this study comprehensively analyzes the current situation and dynamic changes of forest resources in China by collecting forest resources data over the years and uses the grey theory model to predict the development trend of local forest resources. Innovation contributions include the following: (1) by establishing a discrete dynamic model for predicting the change of forest ecological diversity, the changes of ecological and economic characteristics in the dynamic process of forest resources can be found. (2) The quantitative relationship between the changes of ecological and economic characteristics in the dynamic process of forest resources is obtained and the goal of ecological and economic development of forest resources is realized. (3) It provides a theoretical reference for China's forestry development to realize the double growth of forest area and volume, and the forest coverage rate has reached a new level.

This study is divided into five parts. The first part expounds that ecological diversity is an important part of the ecological environment. The research on the prediction of forest ecological diversity change was qualitatively carried out. The second part analyzes the relevant research results at home and abroad. The third part expounds the relationship between ecological diversity and forest ecological diversity, as well as ecological diversity and sustainable development. The fourth part studies the forest management and assessment system and the discrete dynamic model of prediction. Finally, the service value of forest ecological diversity was discussed. The service function quality of forest ecological diversity in China was predicted and analyzed.

2. Related Work

Literature [8] thinks that the absolute abundance of species can be summed and measured by individual number, base area, plant coverage, frequency, biomass, and productivity, and the concepts of α, β, and γ are introduced. Among them, diversity mainly focuses on the number of species in a local uniform habitat, and α, β, and γ indices are the three most frequently used indices for measuring species diversity at present. Emily et al. [9, 10] evaluate the service value of 38 kinds of forest ecological diversity in China. Omwenga et al. [11] evaluate the service value of forest ecological diversity according to the evaluation criterion. Periyasamy and Arirangan [12] put forward that forest resources should be used sustainably—the theory of forest sustainable utilization, the core of which is oriented to the use value of forest resources, and the single production of wood resources and the maximum output of wood resources products are private, with the aim of pursuing maximum economic benefits, but the maximum annual forest harvest should be less than the annual growth. Nprsa et al. [13] carry on the dynamic analysis to the landscape elements, which can effectively reveal the law of the overall landscape change in the study area and the possible influencing factors.

With the contradiction between the overexploitation of forest resources and the protection of the human living environment becoming increasingly prominent, there are more and more methods studied by scholars, including the analysis of the driving forces of forest resources change. Dunne et al. [14, 15] summarized the knowledge gaps in the study of ecological diversity and pointed out that there were knowledge gaps in seven aspects, namely, the discovery of new species, the geographical distribution of known species, the population number, and temporal and spatial dynamics, the evolutionary history of species, functional traits, and the interaction between species and environment. According to the continuous inventory of forest resources, Wang et al. [16] comprehensively analyzed the forest resources in the whole region and put forward the corresponding countermeasures for the management of forest resources in this region. [17] Based on the sustainable utilization of forest resources, this study puts forward the basic hypothesis, mathematical model, and sustainable degree of forest age vector characteristics of sustainable forestry and constructs a gradual adjustment model of a sustainable target structure of forest resources with tending and selective cutting as decision variables, which provides theoretical and practical technical methods for the best way to realize regional sustainable forestry. Couture et al. [18] use aerial remote sensing data, geomorphic data, and topographic elevation model in different periods as a data layer to perform spatial superposition operations and analyze forest dynamics and changes in different geomorphic types and different watersheds. Ernst et al. [19] use the macroecological forest system model and L-band vertical observation of forest dispersion profile data to analyze the changes in the tree structure. Fekadu et al. [20] discuss the sustainable development of forests by using the dynamic programming method, establishing the natural development model of forests and the optimized development model of sustainable development of forests, and give the corresponding iterative formulas.

At present, researches on the service value evaluation of ecological diversity have been widely carried out at home and abroad. The main feature is that scholars apply different methods to carry out research from different angles. However, the existing assessment theories and methods have some limitations, which hinder the research process of ecological diversity services. First, scholars have multiple understandings of value. As the research core of economics, axiology has been widely debated by various schools, and there are different opinions on whether the ecological diversity service is really valuable. The innovation of this study is that the optimized management of forest resources is written as a generalized discrete control system model, which is a dynamic economic model with input and output, and can be used for dynamic evaluation of forests or planning for planting and cutting of forest resources. And the model is used to solve the optimal related data, and the feasibility of the research model is also analyzed. Based on the state vector, the above model can evaluate the characteristics of forest resources, thus reflecting the dynamic changes of regional forest resources.

3. Ecological Diversity and Forest Ecological Diversity

3.1. Relationship between Ecological Diversity and Forest Ecological Diversity. Forest is a concept of comprehensive region, which includes woodland and all wild plants and animals in the forest. It is an ecosystem type with the largest land area, the widest distribution, the richest species resources, the most complex composition and structure, and multiple values and functions.

Forest ecological diversity is an important part of ecological diversity, a commonwealth of mankind, and a collection of various life resources on which mankind depends for survival and development. It provides mankind with medicines, foods, and various industrial raw materials necessary for survival and provides a material basis for mankind to improve biological varieties. Ecological diversity includes ecosystem diversity, species diversity, and genetic diversity. From these three levels of ecological diversity, the relationship between forest and ecological diversity is mainly reflected in the following three aspects [21, 22]:

(1) Forests are the areas with the richest species diversity.

(2) The forest contains abundant genetic genes. Forest ecosystem diversity provides a diverse living environment for organisms and is the basis for the continuous evolution of species and the generation of new species, thus ensuring genetic diversity. The destruction of forests will lead to the extinction of species.

(3) Forest is the core of the global ecological environment problem, and the destruction of forest will lead to the overall deterioration of the global ecological environment, such as climate warming, soil erosion, climate imbalance, land desertification, soil erosion, and degradation.

Based on the above definition and according to the research progress of forest ecological diversity, this study only evaluates and measures the change of ecosystem diversity in forest ecological diversity.

3.2. Ecological Diversity and Sustainable Development. Diversity has important use value and nonuse value, which is not only the basis of meeting the needs of human survival and development, but also plays a key role in maintaining ecological balance and protecting the environment, and is an important guarantee for sustainable development.

The reduction of ecological diversity will worsen the living environment of human beings and affect and threaten the survival and development of human beings. Therefore, we should strengthen the protection and management of ecological diversity and coordinate the contradiction between ecological diversity and economic development and finally realize the sustainable development of ecological diversity and economy and society.

4. Research Method

4.1. Forest Management and Assessment System. With the development of big data, remote sensing technology, communication technology, and computer technology, GIS has entered an era of information explosion [23], and the spatial information data such as remote sensing satellite data and GIS data show geometric exponential growth, which provides data support for scientific research in related fields of spatial information, such as forest thematic data management and evaluation simulation and water cycle model simulation research, and greatly promotes scientific research progress in related fields.

Guided by OGC Web service specification and according to a distributed Web service architecture, the system is divided into three layers: data layer, service layer, and application layer, as shown in Figure 1.

Provide forest data management and evaluation services by using a general browser in the application layer. By writing JavaScript functions and following OGC standard interfaces, various functional interfaces of the service layer are called.

The service layer is the core of the system architecture, providing various functional interfaces of the system, which is divided into five types of services: (1) basic GIS operation, (2) forest data management, (3) forest thematic statistics, (4) dynamic data entry, and (5) evaluation simulation.

The data layer is divided into two types according to the data storage mode: one is file storage, including geospatial data and remote sensing data, which is stored in tile files. According to the form of "graphic pyramid," the data should be graded according to the scale level, so as to display different geospatial data and remote sensing data on different scales. The other is database storage, including forest thematic data, corresponding metadata and authority data.

The function of the system is designed according to the requirements of each functional module and its specific functions. Modules are designed according to the service layer of the system architecture diagram and the functions of each module are refined, as shown in Figure 2.

The evaluation module is the core of the whole system. There are two stages as follows: first, the study of the forest fire assessment model. The main basic algorithm of this model is spatial buffer analysis. Through the research and development of the model for the realization and expansion of the spatial buffer algorithm, for example, the fire source is found, the fire change spread range in each time period is obtained according to the quantitative indexes such as wind power and wind direction, and the spatial query is carried out according to the spread area, which is convenient for the safety of transferring people and property.

Second, the algorithm is encapsulated as a service by OGC WPS. The encapsulation of the OGC WPS service is the foundation of distributed sharing model of forest assessment. It is the most important part of the whole system. As shown in Figure 3, it is the framework diagram of the forest fire assessment model process. The left part is the flowchart of WPS encapsulation, and the right part is the way of evaluating the model calling in the distributed model.

4.2. Discrete Dynamic Modeling of Forest Ecological Diversity Change Prediction

4.2.1. Dynamic Prediction Model of Forest Resources. In the theory of the grey system, a model established after generating transformation by using less or inaccurate original data sequences representing the behavior characteristics of the grey system to describe the continuous change process of things in the grey system is called grey model [24], or GM model for short.

Grey system theory is the result of the extension of cybernetics to social and economic fields and also the result of the combination of automatic control science and mathematical methods of operations research.

GM(1,1) model features are as follows:

(1) Grey model is a long-term forecasting model, which treats the random elements in the forecasting system as grey data and finds out the inherent laws of the data. The amount of original data needed for prediction is small, and the prediction accuracy is high, so it is not necessary to have a large amount of data and strong regularity, or to give coefficients by an experience like other prediction methods.

(2) The internal laws of the system with limited external elements that characterize the behavior characteristics of the system are analyzed. Grey system theory adopts the method of generating the behavior characteristic data of the system, processes the behavior characteristic data of the chaotic system, and discovers the internal laws of the system from the chaotic images, which is the unique feature of this method.

(3) Ithas strong applicability. Grey model can be used to predict both periodic and aperiodic system behaviors. It can be used for both macro-long-term prediction and micro-short-term prediction.

Basic principles of GM(1,1) model are as follows.

Set

$$X_0 = \left(x_0(1), x_0(2), \ldots, x_0(n)\right). \tag{1}$$

X_1 is the $1 - AGO$ (i.e., one-time accumulation) sequence of X_0:

$$X_1 = \left(x_1(1), x_1(2), \ldots, x_1(n)\right). \tag{2}$$

Then, $x_0(k) + ax_1(k) = b$ is called the original form of GM(1,1) model.

Set

$$Z_1 = \left(z_1(1), z_1(2), \cdots, z_1(n)\right). \tag{3}$$

Among them, $z_1(k) = 1/2\left(x_1(k) + x_1(k-1)\right), \quad k = 1, 2, \ldots, n$.

Then, $x_0(k) + az_1(k) = b$ is called the basic form of GM(1,1) model.

If $\hat{a} = [a, b]^T$ is the parameter column,

$$Y = \begin{bmatrix} x_0(2) \\ x_0(3) \\ \vdots \\ x_0(n) \end{bmatrix}, BY = \begin{bmatrix} -Z_1(2) & 1 \\ -Z_1(3) & 1 \\ \vdots & \vdots \\ -Z_1(n) & 1 \end{bmatrix}. \tag{4}$$

Then, the least square estimation parameter sequence of GM(1,1) model $x_0(k) + az_1(k) = b$ satisfies

$$\hat{a} = [a, b]^T = \left(B^T B\right)^{-1} B^T Y. \tag{5}$$

4.2.2. Optimal Control of Discrete Singular Systems with Quadratic Performance Index. When conditions permit, the optimal control problem of singular systems can be transformed into the optimal control problem of normal systems. The following generalized system is considered:

$$E\dot{x}(t) = Ax(t) + Bu(t), \tag{6}$$

where $x(t) \in R^*, \quad u(t) \in R^*$ is the state of the system and the input vector, respectively; $E, A \in R^*, \quad B \in R^{n\times m}$ is a

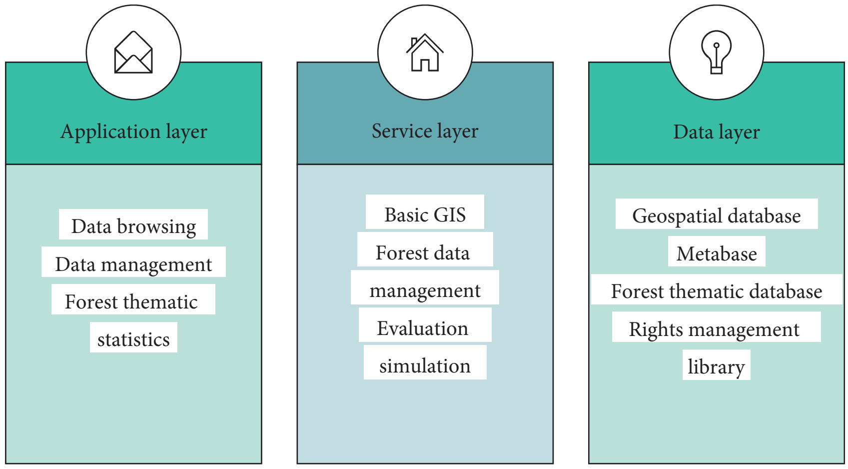

FIGURE 1: Architecture diagram of forest data management and evaluation system.

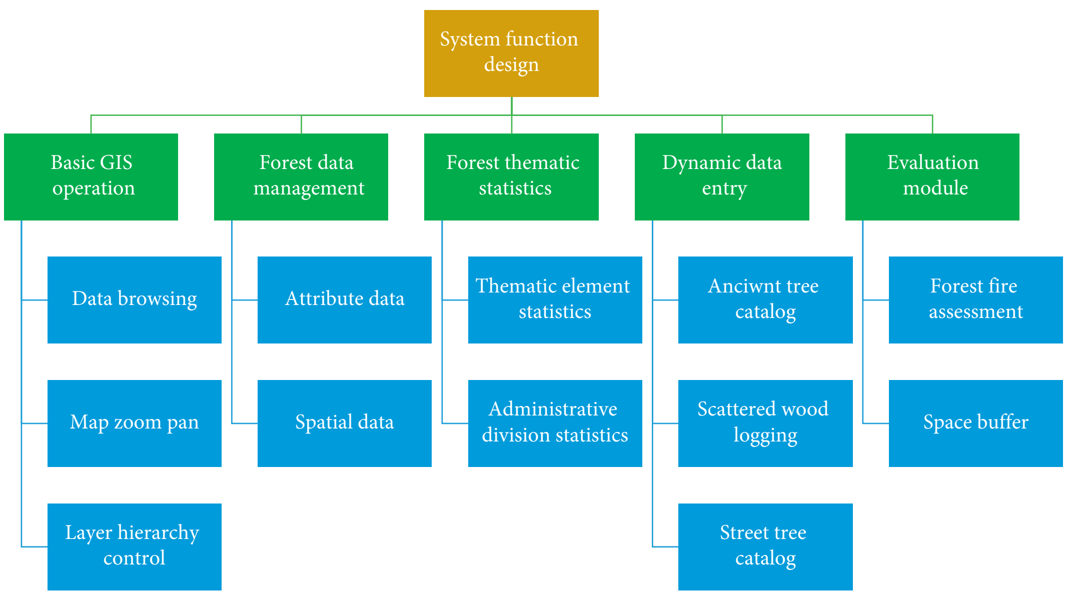

FIGURE 2: Functional design of forest data management and evaluation system.

matrix. Considering the optimal control problem of singular systems under quadratic performance index,

$$J = \frac{1}{2} \int_0^{\infty} \left[\left(x^T(t) F x(t) + u^T(t) G u(t) \right) \right] dt, \tag{7}$$

in which F, G is a symmetric positive definite matrix.

The purpose of expressing forest resources in the form of the mathematical model is to predict and estimate the future, so that forest resources can get the optimal value under certain conditions. Although it cannot be calculated accurately, it can be used as a reference to some extent.

Using the quadratic optimal control problem of the generalized system, a control function $u^*(t)$ is found. When the initial state z_0 is given, the performance index of the system on the corresponding trajectory $z^*(t)$ starting from z_0 satisfies the following formula:

$$J^* = J(u^*(t)) = \min J(u(t)). \tag{8}$$

This control function $u^*(t)$ is called the quadratic optimal control problem of singular systems, in which $z^*(t)$ is the optimal trajectory and $J(u^*(t))$ is the optimal control value [25].

Known:

$$J = J(0) + J(1) + \cdots + J(t),$$
$$J(t) = z^T(T) E^T M E z(T) + \sum_{t=0}^{i=T-1} \left[z^T R z(t) + u^T(t) Q u(t) \right]. \tag{9}$$

If M, R, Q is a positive definite matrix, $\min J$ is the minimum, but if M, R, Q is a negative definite matrix, $\min J$ is the maximum.

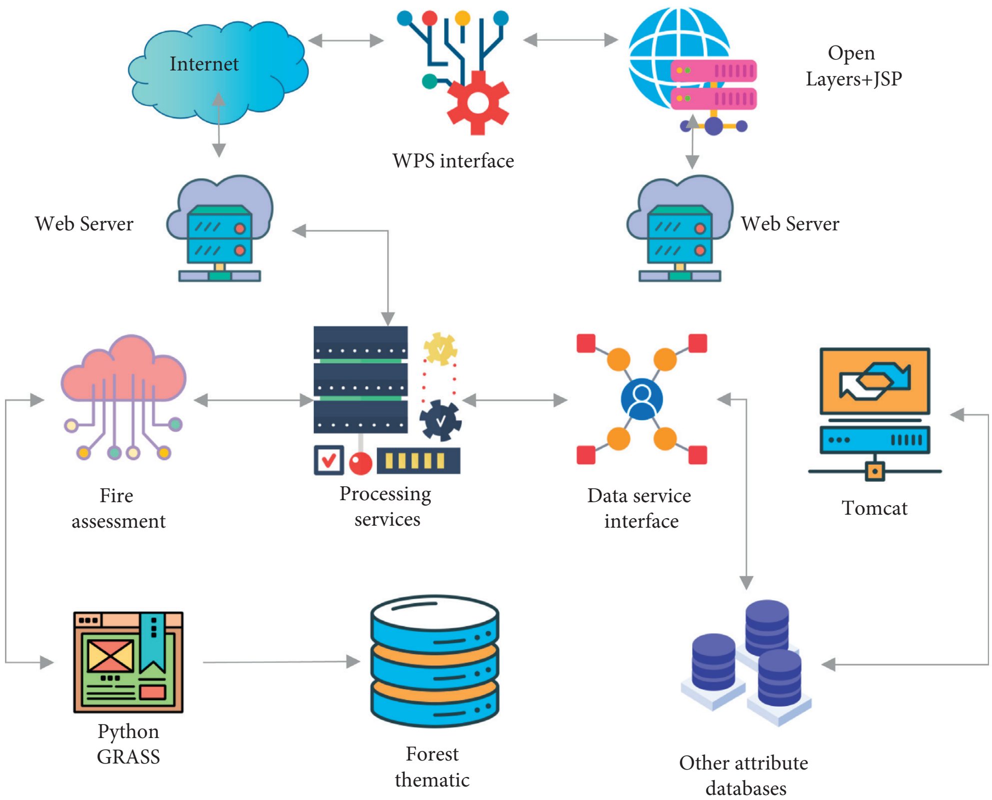

Figure 3: Framework diagram of forest fire assessment model.

$$\begin{cases} \min \quad J = z^T(T)E^T MEz(T) + \sum_{t=0}^{i=T-1} \left[z^T Rz(t) + u^T(t)Qu(t)\right], \\ s.t \quad Ez(t+1) = Az(t) + Bu(t), \end{cases} \tag{10}$$

in which M, R, Q is a negative definite matrix.

Make Lagrange function as follows:

$$L = z^T(T)E^T MEz(T) + \sum_{t=0}^{i=T-1} \left[z^T Rz(t) + u^T(t)Qu(t)\right], + \sum_{t=0}^{T} \lambda^T(t)\left[Az(t) + Bu(t) - Ez(t+1)\right]. \tag{11}$$

In the formula above, the Lagrange multiplier $\lambda^T(t)$ is the line vector:

$$\lambda^T(t) = [\lambda_1(t), \lambda_2(t), \ldots, \lambda_{n+1}(t)]. \tag{12}$$

The L of formula (11) is a scalar multivariate function. Its independent variable is $z(t), u(t), \lambda^T(t), \quad t = 0, \ldots, T$. In order to minimize the target J in formula (11), it is necessary to minimize the target J in three ways, and the necessary conditions for minimizing L are known according to advanced mathematical knowledge, that is, to make L derivative all its independent variables zero:

$$\left.\begin{array}{l} \dfrac{\partial L}{\partial z(t)} = 0 \\ \dfrac{\partial L}{\partial u(t)} = 0, \quad t = 0, 1, \ldots, T \\ \dfrac{\partial L}{\partial \lambda^T(t)} = 0 \end{array}\right\}. \tag{13}$$

In the formula, L is scalar multivariate function, while $z(t), u(t), \lambda^T(t)$ is vector. The derivative of vector by scalar multivariate function is defined as

$$\frac{\partial L}{\partial z(t)} = \begin{bmatrix} \dfrac{\partial L}{\partial z_1(t)} \\ \vdots \\ \dfrac{\partial L}{\partial z_{n+1}(t)} \end{bmatrix}. \tag{14}$$

When the initial state is known, the optimal number of trees at time t can be obtained, which is the optimal number in line with the current situation. From the perspective of forest resource operators, they all hope to plant as many trees as possible when conditions permit.

5. Result Analysis and Discussion

5.1. Analysis of Service Value of Forest Ecological Diversity. The establishment of the realization path of forest ecosystem service value is not only an effective measure to promote the transfer of traditional forestry from modern forestry but also an important means to establish and improve the forest ecosystem service mechanism at this stage. The realization path of forest ecosystem service value and the development of forest ecological benefits complement each other. The establishment of this path not only needs not to be supplemented and improved but also needs to be innovated according to the development trend of the times. Therefore, it is difficult to establish the realization path of forest ecosystem service value. The establishment of the realization path of forest ecosystem service value needs government support. At the same time, it also needs to consider the impact of market development trend on forest ecosystem service value and establish and improve the realization path from the perspective of marketization.

5.1.1. Analysis on the Total Value of Forest Ecological Diversity Services in China. Figure 4 shows the percentage of each function value of China's forest ecosystem to the total value in 2020.

From Figure 4, it can be seen that the value of forest water conservation in China is the largest. After calculation, its value accounts for 47.1% of the total value, which is close to half of the total value. The value of soil conservation, carbon fixation, and oxygen release and ecological diversity protection accounts for more than 10% of the total value, which are 19.2%, 15.8%, and 13.3% of the total value, respectively. The nutrition accumulation value and air environment purification value of the remaining trees are all below 5%, which are 2.4% and 2.2% of the total value, respectively.

According to the calculation results, we can conclude that the order of forest ecological function values in China in 2020 is air environment purification value < forest nutrient accumulation value < ecological diversity protection value < carbon fixation and oxygen release value < soil conservation value < water conservation value.

5.1.2. Simulation and Prediction Analysis of Total Value of Forest Ecological Diversity Services

Scheme 1. Take the annual afforestation area of 20199.5 hm^2 and the average timber harvesting amount of 2310876.1 m^2 which were not implemented in China's forests from 2005 to 2010.

Scheme 2. Take the annual afforestation area of 58617.2 hm^2 and the average timber harvesting amount of 998317.6 m^2 of China's forests from 2015 to 2020.

Scheme 3. Take the average annual afforestation area of the natural forest protection project as 6874.2 hm^2.

The change trend of the total value of forest ecological diversity services in China under different schemes is shown in Figure 5.

It can be seen from Figure 5 that the service value of forest ecological diversity in China under different schemes is increasing with time.

The value of forest ecological diversity services in Scheme 1 increased from 11.03 billion yuan in 2020 to 28.89 billion yuan in 2024.

The value of forest ecological diversity services in Scheme 2 will increase from 11.86 billion yuan in 2020 to 48.17 billion yuan in 2024.

The forest ecological diversity service value of Scheme 3 increased more obviously in 2022, from 11.96 billion yuan in 2020 to 217.4 billion yuan in 2024.

Comparing the future service value of the three schemes, we can see that scheme 3 is the best. That is to say, the scheme of maintaining the annual newly increased afforestation area and adopting the measures of cutting down has the greatest value of forest ecological diversity services, so China's forests should choose this scheme.

5.2. Prediction and Analysis of the Quality of Forest Ecological Diversity Service Functions in China. The western region is the most fragile ecological environment in China, which bears the heavy responsibility of ensuring national ecological security, is the main battlefield of forestry ecological construction, and is also the key area for improving China's forest coverage rate in the future. In the southern region, the forest coverage rate is already high at present. On the premise of actively protecting the ecology, we should give full play to the advantages of regions and policies and mechanisms, strengthen scientific and technological support, improve the quality of development, and accelerate the construction of commercial forest bases such as timber forest, industrial raw material forest, and economic forest.

10% of the total investment in tropical and subtropical regions with relatively high forest coverage is selected and it is increased to the western climatic zones (temperate grassland, temperate desert, and Qinghai-Tibet Plateau) with relatively fragile ecology. The ratio of increased investment among temperate grassland, temperate desert, and Qinghai-Tibet Plateau is the average investment ratio among climatic zones from 2005 to 2020. See Figure 6 for the quality results of forest ecological diversity service functions in China in 2022 and 2024.

Continue to take 20% of the total investment in tropical and subtropical areas with relatively high forest coverage, and increase it to the western climatic zones (temperate grassland, temperate desert, and Qinghai-Tibet Plateau) with relatively fragile ecology. The ratio of increased investment among temperate grassland, temperate desert, and Qinghai-Tibet Plateau is the average investment ratio among climatic zones from 2005 to 2020. See Figure 7 for the quality results of forest ecological diversity service functions in China in 2022 and 2024.

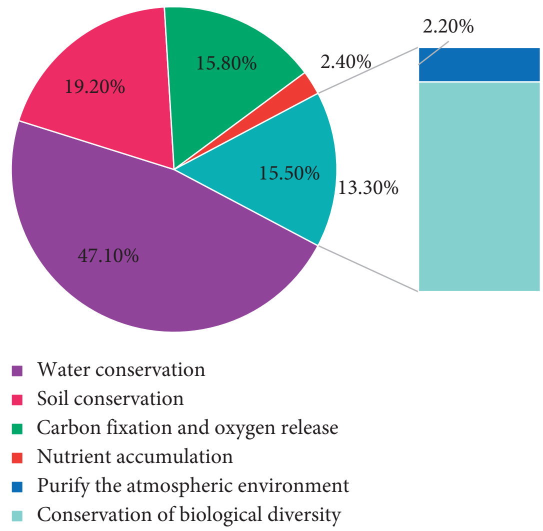

FIGURE 4: Percentage of each function value of China's forest ecosystem in total value in 2020.

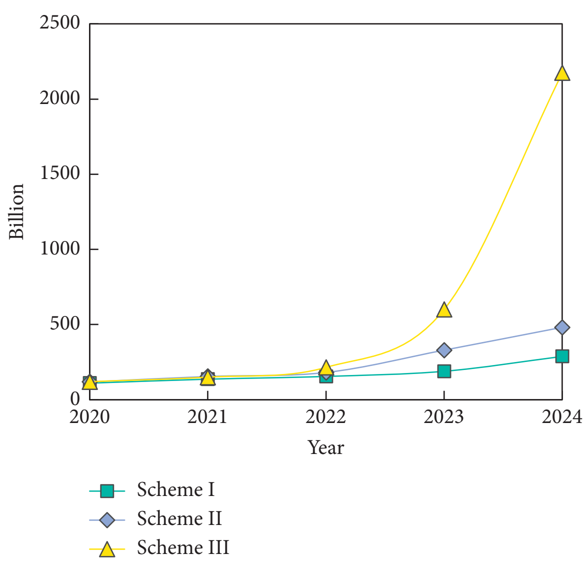

FIGURE 5: Change trend of the total value of forest ecological diversity services in China under different schemes.

5.3. Analysis on the Value of Ecological Diversity Service Function Predicted by Simulation of Various Schemes. Figure 8 shows the changing trend of the value of forest ecological diversity services in China under the three schemes.

It can be seen from Figure 8 that the service value of forest ecological diversity in China has an increasing trend under different schemes.

The value of the first scheme increased from $43{,}798.1 \times 10^8$ yuan in 2021 to $48{,}713.7 \times 10^8$ yuan in 2022 and $55{,}149.3 \times 10^8$ yuan in 2024, increasing by 11.20% and 25.9%, respectively.

The value of the second scheme increased from $44{,}316.8 \times 10^8$ yuan in 2020 to $51{,}207.6 \times 10^8$ yuan in 2022 and $57{,}842.6 \times 10^8$ yuan in 2024, increasing by 15.5% and 30.5%, respectively.

The value of the third scheme increased from $46{,}899.2 \times 10^8$ yuan in 2020 to $53{,}244.9 \times 10^8$ yuan in 2022 and $59{,}901.6 \times 10^8$ yuan in 2024, increasing by 13.5% and 27.7%, respectively.

Although the second and third schemes result in lower growth of the national ecological service function value than the first scheme, the growth of the three climatic zones in the west is obviously increased, which is of great significance to the three climatic zones in the west where the ecology is relatively fragile.

5.4. Forecast Results and Analysis of Forest Resources. Sequence prediction is to predict the future behavior of system variables, and GM(1,1) is a commonly used sequence prediction model. According to the actual situation, on the basis of qualitative analysis, an appropriate operator is defined, and a GM(1,1) model is established for the sequence acted by the operator. Taking forest land area prediction as an example, the prediction results of main indicators of forest resources in China are obtained (Figure 9).

The total forest land area, forested land area, and forest coverage rate are increasing, while the natural forest area changes little. Natural forest protection is mainly implemented to reduce the consumption of natural forests. However, natural forests formed or renewed naturally are difficult and take a long time to grow, resulting in a stable state of natural forests. At present, the state has taken further measures to protect natural forests, improved the natural forest protection system, completely stopped commercial logging of natural forests, and increased forest area and volume.

According to the division of age group structure, the areas of young forest, near-mature forest, and mature forest all showed a downward trend, while the areas of middle-aged forest and over-mature forest showed an upward trend. Referring to the growth rule of trees and the division rule of age promotion, this forecast trend is more in line with the actual situation. According to the

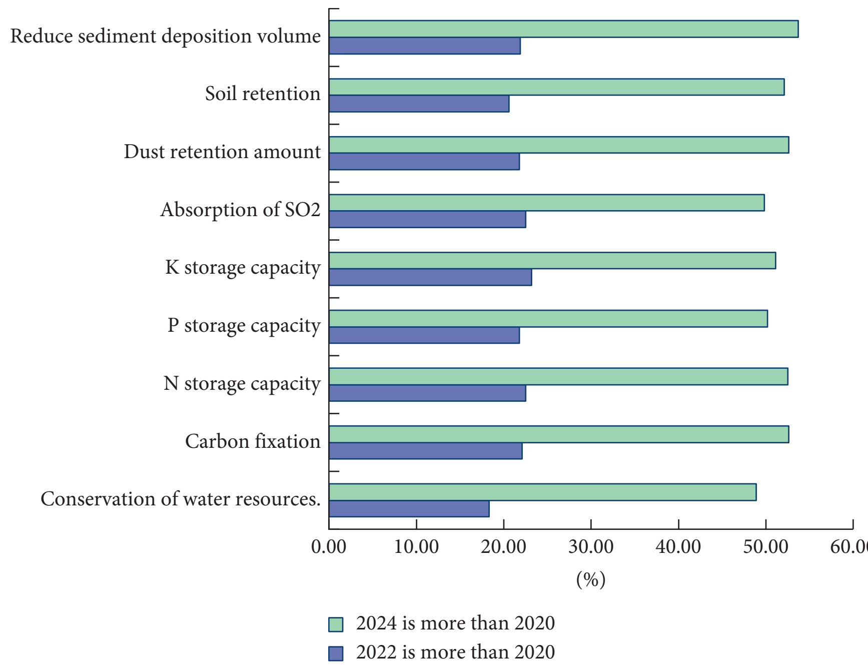

Figure 6: Comparison of the quality growth rate of forest ecological diversity service function in China.

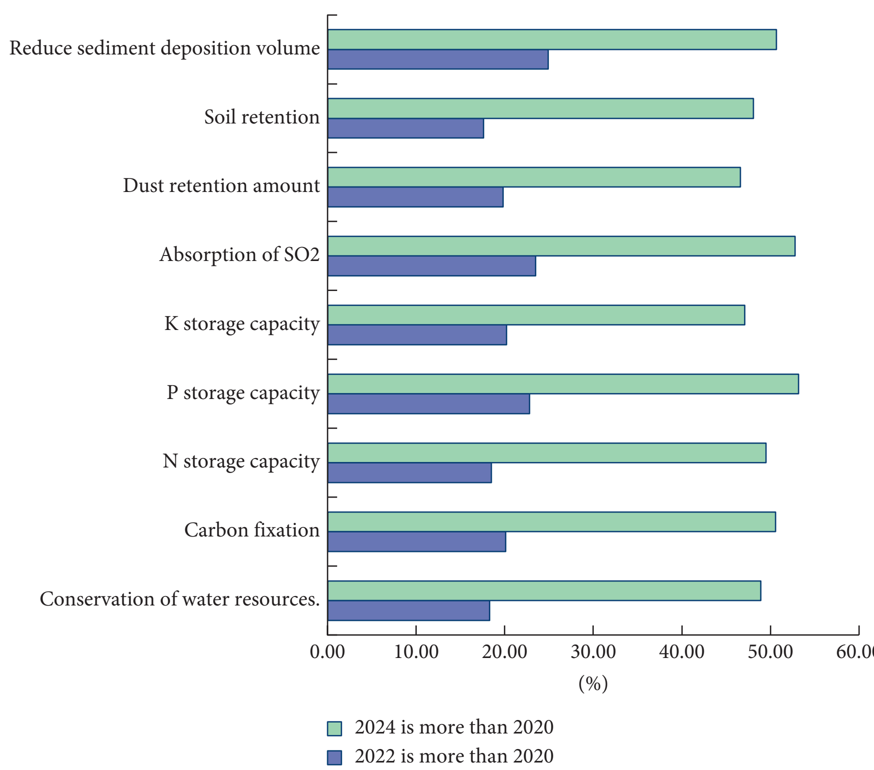

Figure 7: Comparison of the quality growth rate of forest ecological diversity service function in China.

composition of forest age, we should change the forest management strategy appropriately, adjust the inclination of forest cutting to mature forest, and avoid further increase of natural growth loss of trees. The areas of shelter forest and timber forest both show a growing trend. According to China's forest land protection and utilization plan, the main direction of planned forest development is to increase the afforestation area of shelterbelts and timber forests, while the areas of economic forests, firewood forests, and special forests remain unchanged. Therefore, in the prediction model, the situation of double growth of shelter forest and timber

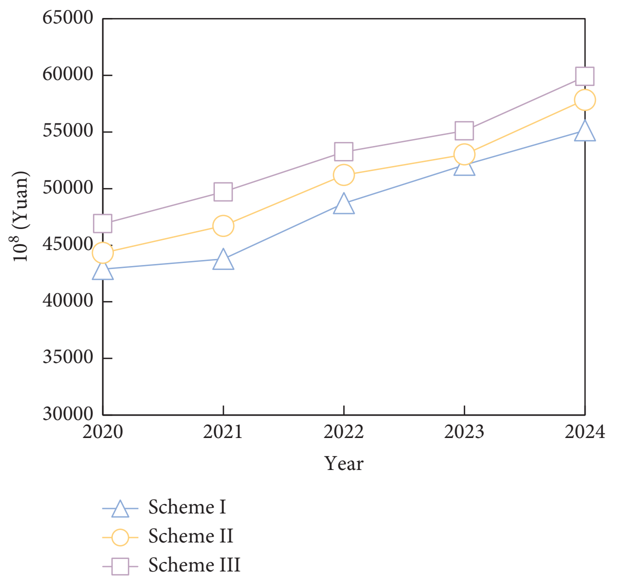

Figure 8: Change trend of value of forest ecological diversity service function in China under different schemes.

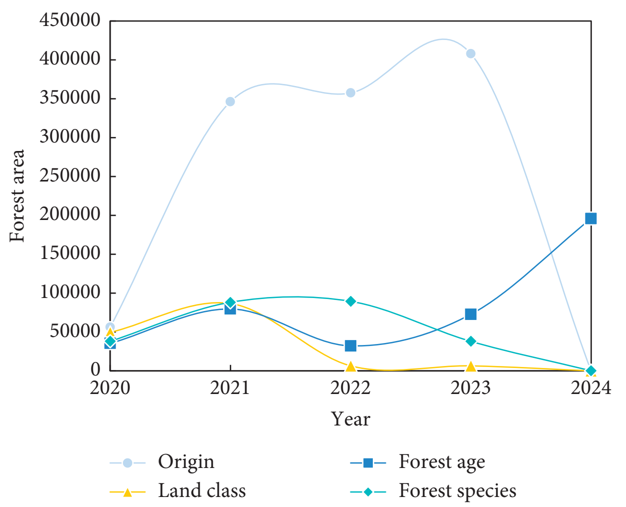

Figure 9: Forecast results of main index area of forest resources from 2020 to 2024.

forest is more in line with the actual situation, and the predicted results are basically achievable.

The time trend forecasting model established by applying the grey system theory will reduce the estimation accuracy with the extension of the forecasting time, so it is necessary to constantly revise the data and adjust the parameters to increase the estimation accuracy and improve the forecasting accuracy.

6. Conclusion

As the main component of ecological diversity, forest ecological diversity not only provides the material basis for human survival and development but also plays an important role in ecological functions such as soil and water conservation, air purification, and greenhouse effect reduction. Based on the analysis of relevant research results at home and abroad, this study comprehensively analyzes the present situation and dynamic changes of China's forest resources by collecting forest resources data over the years and then forecasts the development trend of local forest resources by using grey theory model. The advanced OGC WPS service is used to share the forest assessment model on the Internet. Through the establishment of the discrete dynamic model of forest ecological diversity change prediction, we can find the changes of ecological and economic characteristics in the dynamic process of forest resources and get the quantitative relationship between the changes of ecological and economic characteristics in the dynamic process of forest resources, so as to achieve the goal of ecological and economic development of forest resources. However, this study does not deeply study the dynamic economic model interpretation of sustainable development of forest resources, and it is far from enough to rely on these qualitative discussions or simple quantitative research. In future research, we also need to carry out in-depth qualitative and quantitative research, dynamic analysis of forest resources system harvest, benefit calculation, optimization, and decision-making of sustainable management schemes.

Data Availability

The data used to support the findings of this study are available from the corresponding author upon request.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

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