Measurement of Environmental Population Capacity Based on Island Environment--A Case Study of Hainan Island and Ireland Island in China

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Abstract: In this paper, the influencing factors of environmental population capacity are categorized into three types: strict constraints, elastic constraints and non-constraints, and the systematic relationship among the three types of factors is explored, from single-factor environmental population capacity model to multi-factor environmental population capacity model, and finally to obtain the regional environmental population capacity model. In this paper, we choose to take Hainan Island in China and the island of Ireland, which have similar natural conditions (area, population, etc.), as examples to measure the environmental population capacity based on the island. From the perspective of environmental capacity, this paper explores how to make the global distribution of population settlements more in line with the distribution of environment and resources, and then puts forward more effective and reliable suggestions for the coordinated development of population and economic and social resources and environment.

1 INTRODUCTION

In recent years, population, resources, environment and development have become the biggest global issues facing the world today. Figure 1 shows a crowded earth. How to utilize regional resources more effectively to maximize efficiency is an important issue that every government is considering. Reasonable and effective utilization of regional resources to bring out the best benefits can make the regional economy, environment and population in a more perfect balance. [1] UNESCO defines environmental population capacity as "the environmental population capacity of a country or region is the number of people that the country or region can sustainably support over a foreseeable period of time, utilizing local and other resources, intelligence, technology, etc., and ensuring a material standard of living in accordance with socio-cultural norms". Unlike environmental carrying capacity, which emphasizes the number of people that the environment can sustainably support. So population size is an important indicator of environmental carrying capacity. The environmental carrying capacity of one or more resources is often used as the environmental population capacity in the actual estimation of the environmental population capacity of a region, a country, or even the entire planet. [6]

The research on environmental population capacity can be started from the point of view of carrying capacity firstly proposed by Malthus in 1798 in his Principles of Population. Until now, various environmental population capacity models have been proposed: system dynamics, hierarchical analysis, entropy weighting method, etc. have constructed the P-E-R model[6], DPSIR evaluation model[6], etc., all of which provide solutions for environmental capacity.[6] Until now, most of the environmental population capacity models seldom consider the following two challenges: Challenge 1: How do the factors of environmental population capacity influence the mechanism? Challenge 2: Does the selection of the area for environmental population capacity measurement consider the influence of external factors? In response to challenge one, through our analysis of the factors, it is not difficult to see that the intensity of the influence of each factor of environmental population capacity itself varies, and different factors are considered with different priorities. For example, we can roughly categorize the environmental population capacity factors into water, food, environment, living space, etc. Water and food as the determining factors for survival and production often occupy a decisive position in the environmental population capacity, which leads us to the fact that we should deal with the factors with different priorities separately when measuring the environmental population capacity of a region. In this paper, we analyze the factors affecting the environmental population capacity into three levels, strict constraints, elastic constraints, and non-constraints, and adopt a qualitative and then quantitative approach to measure the environmental population capacity.[6] Challenge 2: In the process of measuring environmental population capacity, we usually select the area we need to measure (e.g., Fujian Province, Fuzhou City, Minhou County, etc.) and collect the relevant data of the area. However, in reality, we have to consider whether...
the environmental population capacity of a region is affected by external factors, such as a large amount of foreign food input or fresh water input, and so on. In cities such as Hong Kong and Shanghai, with large populations and small per capita areas, the environmental population capacity calculated solely on the basis of local resources is much lower than the actual population, but in practice, these densely populated areas are not overloaded with population, and the people's minimum living standards cannot be guaranteed, which is due to the large amount of foreign input of essential materials for living. Therefore, when we calculate the environmental population capacity, we should carefully assess the measured environmental resources, whether they are strongly influenced by external factors, and the paths through which external factors affect the local environmental population capacity. From the perspective of the ecosystem, materials can be recycled, and by isolating an area to calculate the environmental population capacity of that area, we are actually calculating the environmental population capacity that can be carried by the material cycle of that area. This paper is also therefore proposed based on the island environment of the environmental population capacity measurement, the island environment is a more special environment, in this environment, most of the external environmental factors affecting the survival of human beings is blocked, can't be effectively transmitted, so we in the measurement of the environmental population capacity of the island environment, consider the local resources can be. In this paper, we have chosen Hainan Island and the island of Ireland in China as examples, and used the framework we created for measuring the environmental population capacity of island environments to evaluate the carrying capacity of regional resources and the environment, and to make constructive suggestions for local development.

In this paper, our innovations are three main points:

First, A framework for measuring environmental population capacity was constructed. We constructed the framework based on mechanism analysis and hierarchical analysis. The framework categorizes the influencing factors of environmental population capacity into strict constraints, elastic constraints, and non-constraints, and further reveals the influencing mechanism of each factor of environmental population capacity.

Second, This paper proposes an effective framework for the measurement of environmental population capacity model. The framework is based on the measurement of the island environment, with accurate results and more comprehensive considerations.

Thirdly, This paper tests the model by using a large amount of realistic data. It reveals the relevance and validity of the environmental population capacity measurement framework by using the environmental population capacity measurements of Hainan Island and the island of Ireland in China.

2 RESEARCH METHODS AND DATA DESCRIPTION

2.1 Overview of the study area

Through the collection and organization of global data, based on the validity of the data, the representativeness of the region, and the distribution of the region by sea and land, we finally selected two regions, Hainan Island and Ireland Island in China, which are also islands, to be measured through the framework of environmental population capacity measurement proposed in this paper. The following is a description of the basic situation of the two study areas:

2.1.1 Basic Overview of Hainan Island, China.

Hainan Island, China, 108°37 ' -111 ° 03' east longitude, 18°10 ' -20 ° 10' north latitude. The terrain of Hainan Island is high in the middle and low on all sides, which belongs to the tropical monsoon maritime climate. The four seasons are not distinct, there is no extreme heat in summer and no severe cold in winter. The annual temperature difference is small, and the annual average temperature is high. The dry season and rainy season are obvious, the winter and spring are dry, the summer and autumn are rainy, and there are many tropical cyclones. Light, heat, water resources are abundant, wind, drought, cold and other climatic disasters are frequent. The average annual temperature is 22.5-25.6°C, the annual sunshine duration is 1780-2600 hours, the total solar radiation is 4500-5800 MJ/m2, and the annual precipitation is 1500-2500 mm (about 1000 mm on the western coast).

As a tropical island with a relatively closed geographical environment, Hainan Island of China mainly uses sea transportation and air transportation to transport materials with the mainland, and there is no cross-sea bridge or tunnel, so the area is relatively closed. The regional statistical data are in line with the estimation conditions of the environmental population capacity model framework based on islands proposed by the local government.

2.2.2 Basic Overview of the Island of Ireland.

The island of Ireland, latitude 50°30 ' -55°30' north, longitude 5°30 ' -10°30' west in the North Atlantic Ocean.
The terrain is high in north and south and low in the middle. The island is surrounded by mountains with low edges and is covered with dense forests, the highest point being Mount Carantuel in the southwest, at 1,041 m above sea level. The central plain covers a wide area with green land. Rivers criss-cross the island, a dense network of rivers, lakes as many as the stars. The main rivers are the Shannon River, the Slaney River, the Noel River, the Blackwater River and so on. The coastline is meandering, with many bays deep inland along the Atlantic coast. The island has a temperate maritime climate, warm and humid, with little snow in winter.

The island of Ireland, as a temperate island, is in contrast to the Chinese island of Hainan in terms of geography, with goods mainly transported by sea and air to and from the mainland, no bridges or tunnels across the sea, and a relatively closed area. Its statistical data meets the conditions of the locally proposed island-based environmental population capacity modeling framework.

2.2 Data sources
The data for the environmental and demographic capacity of Hainan Island in this paper mainly come from the China Statistical Yearbook, the Statistical Yearbook of each city and county in Hainan Province, and the China County Statistical Yearbook. In this paper, the data on the environmental population capacity of the island of Ireland are mainly from the World Bank database, the United Nations database, ISSDA (Irish Social Science Data Archive), etc. Some of the indicators are obtained by further analysis. Some of the indicators are obtained by further processing of the data. For missing data, the difference-in-differences method is used to fill in the gaps. This paper uses 2019 data to measure the environmental population capacity.[11]

2.3 Modeling
In order to measure the environmental population capacity, this paper adopts the method of qualitative analysis first and then quantitative analysis. First of all, the influencing factors of environmental population capacity are analyzed qualitatively according to the importance degree and influence mode of the influencing factors, which can be roughly classified into three categories according to the mechanism analysis: strict constraints, elastic constraints and non-constraint factors. Figure 2 shows the classification of three different factors. Strict constraints refer to the factors that have a large degree of influence and high intensity of constraints on the capacity of environmental population, and their influence on the capacity of environmental population is usually decision-making, including water resources and food production; elastic constraints refer to the influencing factors that have a certain degree of influence on the capacity of environmental population but have a certain influence on the capacity of environmental population, including environmental resources and living space; non-constraints refer to factors whose factors have no decision-making influence on environmental population capacity, but have some influence on environmental population capacity, and some of the factors have indirect influence on environmental population capacity.

Secondly, on the basis of qualitative analysis, we would like to quantify the environmental population capacity. In this paper, we construct a single-factor environmental population capacity model, to a multi-factor environmental population capacity model, and finally a new generation of environmental population capacity model. For the single-factor environmental population capacity model, this paper uses mechanistic analysis to obtain the single-factor environmental population capacity model as follows:

\[
SinglePopulation = \frac{\sum_{i=1}^{n} \frac{Resource_i}{Parameter_i} \cdot k_i}{\sum_{i=1}^{n} k_i}
\]

where "SinglePopulation" represents the environmental population capacity that the area can bear by a single factor; "Resource" represents the total environmental resources of different types of areas for a
single factor; "Per " represents the per capita occupancy of different types of factors; "k" is the weight of each indicator, reflecting the importance of each indicator.

This one-factor environmental population capacity model needs to be based on the actual situation of the region, data completeness, and the degree of data refinement will determine the accuracy. The influence of the non-constraint factor on the environmental population capacity is indirect, and the change of this factor may have a geometric effect on the environmental population capacity, affecting other factors. Therefore, the non-constraint factor can be expressed as a multiplication factor: "T"

For the multifactor environmental population capacity, this paper considers that at a certain level of strict constraints, each factor interacts with each other on the environmental population capacity and all of them have an impact. The multifactor environmental population capacity model we obtained is as follows:

\[
\text{MultiPopulation} = \frac{\sum_{j=1}^{n} \text{SinglePopulation}_j k_j}{\sum_{j=1}^{n} k_j}
\]  \hspace{1cm} (2)

where "MultiPopulation" represents the multi-factor environmental population capacity of the area; "SinglePopulation,") is the single-factor environmental population capacity; "k" is the weight of each single-factor environmental population capacity, reflecting the importance of each indicator.

The environmental population capacity can be considered as the interaction of factors on the environmental population capacity to a certain extent when the strict constraints reach a certain level. However, the environmental population capacity will be reflected by the lowest of the strict constraints on its constraints on the environmental population capacity. The model of environmental population capacity we obtained is as follows:

\[
\text{Population} = \min\{\text{MultiPopulation, Population}_{\text{water}}, \text{Population}_{\text{nutrition}}, \ldots\}
\]  \hspace{1cm} (3)

Where, "Population" represents the environmental population capacity of the area, and the environmental population capacity of the area to be measured is finally obtained by referring to the parameters of strict constraints and multi-factor environmental population capacity.

Finally, in order to determine the relative importance indicators among the factors, this paper adopts the hierarchical analysis method (AHP) to determine the environmental population capacity to avoid the subjectivity of direct assignment. Hierarchical analysis method is to take a complex multi-objective decision-making problem as a system, decompose the objectives into multiple goals or criteria, and then decompose them into a number of levels of multi-indicators, and calculate the hierarchical single ranking and total ranking through the fuzzy quantitative method of qualitative indicators. This paper uses the Delphi method (expert survey method) to collect weighting factors. In order to use hierarchical analysis to measure the weight of each factor of environmental population capacity, we need to construct a hierarchical diagram first, with the top layer as the objective layer, the middle layer as the criterion layer, and the bottom layer as the indicator layer.

In the modeling, the correlation degree between the evaluation criterion level and the final decision level is evaluated first, and then the scheme level is further discussed. The relative importance of each factor is quantified by referring to numbers 1-9 and reciprocal as the scale.

In order make the comparison of relative importance between factors to avoid subjectivity, this paper quantitatively measures the importance based on the principle of the impact of factors on the population capacity of the environment, and the impact on the survival of human beings, and obtains the relative importance between two factors.

In turn, the intra-scale transformation, the establishment of the judgment matrix, after the resulting matrix of different orders of magnitude, then lead to different decision-making levels can not be compared, so the use of MATLAB will be normalized matrix processing, the matrix value will be organized to the [0,1] range, the original measure of the value of the transformation of the value of the measure of no outline measure of the value of the result of the weights. The MATLAB operations were used to derive the weight vectors for each matrix.

Pass the conformance test (process described below):

1. From the formula of consistency test, we get the matrix consistency index "CI", which is calculated by the following formula:

\[
\text{RI} = \frac{\lambda_{\text{max}} - n}{n - 1}
\]  \hspace{1cm} (4)

2. Given by Saaty for n=1,.. The value of RI at 9. The RI The values are constructed from 500 sample matrices by a randomized method: randomly taking numbers from 1-9 and their reciprocals to construct a positive reciprocal inverse matrix, and finding the average of the largest characteristic roots "\lambda_{\text{max}}" with the following formula:

\[
\text{CR} = \frac{\text{CI}}{\text{RI}}
\]  \hspace{1cm} (5)

When CR < 0.10 when, that is, the decision matrix passes the consistency test, otherwise it does not have satisfactory consistency. When it is within the permissible range of error, it means that the above calculated values of weights for the environmental population capacity under the control of a single limiting factor are suitable for the model.

In Table 1, several island regions are selected to test the environmental population capacity, and the test results are consistent with the feedback of the local actual situation, indicating that the environmental population capacity measurement framework constructed in this paper is effective. Figure 3 shows the environmental population capacity measurement framework built in this paper, and it is also hoped to further improve the accuracy by further improving the parameter measurement methods in the future.
Table 1. Environmental population capacity testing framework

<table>
<thead>
<tr>
<th>Population(10,000 people)</th>
<th>Environmental Population Capacity(10,000 people)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Xiamen Island</td>
<td>115.2</td>
</tr>
<tr>
<td>Kinmen Island</td>
<td>10.54</td>
</tr>
<tr>
<td>Pingtan Island</td>
<td>54.70</td>
</tr>
<tr>
<td>Taiwan Island</td>
<td>2341</td>
</tr>
<tr>
<td>Hokkaido Island</td>
<td>544.00</td>
</tr>
<tr>
<td>Tahiti</td>
<td>9.6</td>
</tr>
<tr>
<td>Iceland</td>
<td>39.7</td>
</tr>
</tbody>
</table>

Figure 3. Framework for calculating environmental population capacity. The framework shows that among the environmental population capacity factors for a given area, we mainly consider the environmental population capacity that can be carried by the circulation within the area, but at the same time we need to consider the environmental population capacity influencing factors outside the circulation and include them in the calculation.  

3 ANALYSIS

3.1 Screening of regional environmental and demographic capacity indicator system

The purpose of variable selection in the factors of environmental population capacity is to determine the regional environmental population capacity, and this paper analyzes certain factors from five factors, namely, water resources, food production, environmental resources, socio-economic conditions, and energy levels, and draws conclusions. Its variable selection needs to comply with the following principles:

Objectivity. The selection of variables should comply with the principle of objectivity, avoiding the subjectivity of the selected factors and making the measurement results accurate and valid.

Representativeness. Indicators should be chosen to represent characteristics that are representative of the overall characteristics of the factor, and a variable that has its own specific characteristics that obscure the overall characteristics of the factor should not be selected for inclusion in the indicator list.

Operability. The selected variables should be able to be effectively brought into the model for measurement, so the selected variables should be selected from statistical yearbooks and other authoritative databases as much as possible, and attention should be paid to whether the statistical caliber of the selected variables is the same.

Sustainability. The selected indicators should be sustainable, and the environmental population capacity measured by the sustainability indicators is the environmental population capacity that can be sustainably carried by the region.

3.2 Analysis of results

3.2.1 Environmental-population capacity of Hainan Island, China.

Hainan Island is the most typical tropical island region in China, which is less affected by external factors, and we only need to consider the regional internal circulation factors when calculating the environmental population capacity of the region. When calculating the regional environmental population capacity, we determined the minimum per capita standard of each indicator through preliminary data collection. Some per capita standards were calculated by referring to the per capita income standard of low-income countries. In Table 2, these 15 indicators were calculated by five factors: water resources, food production, environmental resources, energy level and socio-economic conditions. We got the environmental population capacity of Hainan Island.
Table 2. Table of factors for measuring the environmental population capacity of Hainan Island

<table>
<thead>
<tr>
<th>Target level</th>
<th>Standardized layer</th>
<th>Indicator layer</th>
<th>Unit (of measure)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hainan Island Environmental Population Capacity</td>
<td>Water resources</td>
<td>Total water resources</td>
<td>Billion cubic meters</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Per Capita Integrated Water Use</td>
<td>Cubic Meter (Unit Of Volume)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Total Water Supply</td>
<td>Billion Cubic Meters</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Total Water Supply For Production</td>
<td>Billion Cubic Meters</td>
</tr>
<tr>
<td></td>
<td>Grain production</td>
<td>Grain production</td>
<td>Tons</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Food Consumption</td>
<td>Tons</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Carbon dioxide emissions</td>
<td>Tons</td>
</tr>
<tr>
<td>Environmental resources</td>
<td>Forest Area</td>
<td>Thousand Square Meters</td>
<td></td>
</tr>
<tr>
<td>Energy level</td>
<td>Electricity Generation Per Capita</td>
<td>Kilowatt-Hour (Kwh)</td>
<td></td>
</tr>
<tr>
<td>Socio-economic conditions</td>
<td>GDP</td>
<td>Billions</td>
<td></td>
</tr>
<tr>
<td></td>
<td>GNP</td>
<td>Billions</td>
<td></td>
</tr>
</tbody>
</table>

Table 3. Environmental population capacity of Hainan Island

<table>
<thead>
<tr>
<th>Sports Event</th>
<th>Weights</th>
<th>Environmental Population Capacity (10,000 People)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Environmental Population Capacity Under Water Resource Control</td>
<td>0.47462</td>
<td>11157.36</td>
</tr>
<tr>
<td>Environmental Population Capacity Under Food Production Control</td>
<td>0.29839</td>
<td>362.4</td>
</tr>
<tr>
<td>Environmental Population Capacity Under Control Of Environmental Resources</td>
<td>0.12870</td>
<td>10168.94</td>
</tr>
<tr>
<td>Environmental Population Capacity Under Energy Level Control</td>
<td>0.06115</td>
<td>16078.13</td>
</tr>
<tr>
<td>Environmental Population Capacity Controlled By Socio-Economic Conditions</td>
<td>0.3714</td>
<td>1023.67</td>
</tr>
<tr>
<td>Multi-Factor Environmental Population Capacity</td>
<td></td>
<td>8075.75</td>
</tr>
<tr>
<td>Environmental Population Capacity</td>
<td></td>
<td>362.4</td>
</tr>
</tbody>
</table>

As shown in Table 3, the current total population of Hainan Island is 9.25 million, and the measured environmental population capacity is 3.624 million. The environmental population capacity of Hainan Island in China is significantly affected by food production. In this paper, the discussion of Hainan's grain production mainly focuses on rice.

The limiting reasons for grain production on Hainan Island come mainly from natural conditions, with a hot climate, rugged terrain, and a low replanting index being the main causes of low grain production. In addition, the socio-economic conditions of China's Hainan Province currently have low data, but it has the potential for development that has now received a high degree of national attention. In conclusion, in order to enhance the regional environmental and demographic capacity, it is of great significance to enhance the production of grain to cope with regional emergencies.

3.2.2 Environmental Population Capacity of the Island of Ireland.

In the calculation of the island of Ireland, due to its latitude, the climate is very different, and the factors and possible causes affecting the environmental population capacity are also different. In Table 4, 18 factors are selected for measurement.

Table 4. Table of factors for measuring environmental population capacity on the island of Ireland

<table>
<thead>
<tr>
<th>Target level</th>
<th>Standardized layer</th>
<th>Indicator layer</th>
<th>Unit (of measure)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Renewable inland freshwater resources per capita</td>
<td>Annual freshwater abstraction (industrial water)</td>
<td>Tons</td>
<td></td>
</tr>
<tr>
<td>Water resources</td>
<td>Annual freshwater abstraction (Agriculture)</td>
<td>Tons</td>
<td></td>
</tr>
<tr>
<td>Environmental Population Capacity of the Island of Ireland</td>
<td>Annual freshwater abstraction (domestic water)</td>
<td>Billion cubic meters</td>
<td></td>
</tr>
<tr>
<td>Grain production</td>
<td>Cereal production</td>
<td>Kilograms per hectare</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total Cereal production</td>
<td>Kilograms per hectare</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Carbon dioxide emissions</td>
<td>Ton (loanword)</td>
<td></td>
</tr>
<tr>
<td>Environmental resources</td>
<td>Agricultural land</td>
<td>Square kilometer</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Forest area</td>
<td>Square kilometer</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Land area</td>
<td>Square kilometer</td>
<td></td>
</tr>
<tr>
<td>Renewable energy generation, excluding hydropower</td>
<td>Electricity consumption</td>
<td>Billion kilowatt hours</td>
<td></td>
</tr>
<tr>
<td>Energy level</td>
<td>Crude oil production</td>
<td>Tons</td>
<td></td>
</tr>
</tbody>
</table>
significant. The influence on the environmental population capacity is of socio-economic conditions is high, and the latter's comparing with the food production and the development of socio-economic conditions is high. The environmental population capacity of the region low. The same time, low human redevelopment, which makes the protection of environmental resources in the region, and at the same time, low human redevelopment, which makes the region affective. Comparing with the environmental population capacity controlled by multiple factors, the environmental population capacity controlled by water resources is low, comparing with the food production and the development of socio-economic conditions is high, and the latter's influence on the environmental population capacity is significant.

<table>
<thead>
<tr>
<th>Environment factor</th>
<th>Weights</th>
<th>Environmental population capacity (10,000 people)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Environmental population capacity under water resource control</td>
<td>0.47462</td>
<td>111864.43</td>
</tr>
<tr>
<td>Environmental population capacity under food production control</td>
<td>0.29839</td>
<td>566.975</td>
</tr>
<tr>
<td>Environmental population capacity under control of environmental resources</td>
<td>0.12870</td>
<td>3600.083</td>
</tr>
<tr>
<td>Environmental population capacity under energy level control</td>
<td>0.06115</td>
<td>13016.72</td>
</tr>
<tr>
<td>Environmental population capacity controlled by socio-economic conditions</td>
<td>0.3714</td>
<td>52177.86</td>
</tr>
<tr>
<td>Multi-factor environmental population capacity</td>
<td>73900.436</td>
<td></td>
</tr>
<tr>
<td>Environmental population capacity</td>
<td>566.975</td>
<td></td>
</tr>
</tbody>
</table>

Table 5. Environmental population capacity on the island of Ireland

As shown in Table 5, the main factors affecting the environmental population capacity of the island of Ireland are environmental factors, low industrialization, better protection of environmental resources in the region, and at the same time, low human redevelopment, which makes the region affective. Comparing with the environmental population capacity controlled by multiple factors, the environmental population capacity controlled by water resources is low, comparing with the food production and the development of socio-economic conditions is high, and the latter's influence on the environmental population capacity is significant.

4 CONCLUSION

This paper proposes a framework for measuring environmental population capacity by using the hierarchical analysis method and mechanism analysis, the framework adopts a qualitative and then quantitative approach, will be based on the degree of influence of the factors on the environmental population capacity and the influence of the mechanism is divided into qualitatively divided into strict constraints, elasticity constraints and non-constraints of the factors of three categories, through the construction of a single-factor environmental population capacity model to the multi-factor environmental population capacity model and finally constructed a quantitative analysis of the environmental population capacity model measurement framework. Finally, the quantitative analysis of the environmental population capacity modeling framework is constructed. The framework reveals the way to measure the environmental population capacity in the island environment, and the results can be applied in various fields such as environment and nature to provide data support for governmental departments and regional environmental protection workers.

Through the investigation of information and data collection, through the selection of Hainan Island and the island of Ireland as a framework for the measurement, using water resources, food production, environmental resources, energy levels, socio-economic conditions of the five major single factors for the measurement, the results found that the two regions of food production are lower is more serious impact on regional development factors, followed by socio-economic conditions of China's Hainan Island region has a certain impact on environmental resources on the island of Ireland has a certain impact on the island of China. Resources have a certain impact on the island of Ireland. In the future, in order to further strengthen the environmental and demographic capacity of both regions to maintain the stability of regional environmental development and the ability to cope with unexpected natural conditions, the regions need to pay attention to food reserves.

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