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EDP Fuzzy Comprehensive Evaluation Model based on AHP-NBM

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ABSTRACT. *In recent years, many island countries are in danger of disappearance due to sea-level rise. Therefore, many Environmental Displaced Persons (EDPs) have emerged. To help better understand and effectively solve the problem, we set up AHP-NBM-fuzzy comprehensive evaluation model to evaluate the severity of EDP.Then, AHP-NBM-fuzzy comprehensive evaluation model is established to evaluate the severity of EDP using the AHP and the natural power cut method.Finally, we discuss our model in detail and propose the required policy support. We also analyzed the impact of exogenous events. At the same time, we stated the scalability of the model, and we believe that our model can solve most problems.*

KEYWORDS: *EDP, AHP-NBM*

1. Introductions

In recent years, many island countries are in danger of disappearance due to sea-level rise. Therefore, many Environmental Displaced Persons (EDPs) have emerged. To help better understand and effectively solve the problem, we set up AHP-NBM-fuzzy comprehensive evaluation model to evaluate the severity of EDP.

We need establish a complete index system, considering the impact of the disappearance of island countries on the number of people at risk and cultural loss,then Put forward policy suggestions to solve the problems of vulnerable groups from two aspects: human rights (being able to resettle and fully participation the new family life) and cultural protection.

2. The Model preparation

We need to analyze how to accommodate the environmentally displaced. First, we define the environmental displaced and the cultural heritage. Then, since the generation of environmental displaced persons is closely related to the deterioration

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of climate, we analyzed the possible impact of climate change, that is, the causes of the generation of environmental displaced persons. Then, the impact of climate change on each country and the population capacity of each country are analyzed, and the climate change is closely linked to national development to obtain national vulnerability index. Finally, the settlement cost is analyzed.

2.1 The impact of climate change

Climate change is mainly manifested in three aspects: global warming, acid deposition and ozone depletion. The main effects are as follows.

2.1.1 Destruction of the ecosystems

Global warming in many parts of the world's natural ecosystems have effects, such as lake, glacier retreat, and lake levels drop, the water reduction, early frost melt, river (lake) in early and late melting and melt, and the extension of northern ice age, therefore, is the expansion of animal and plant distribution to the polar and high altitude, the number of animals and plants reduce, and the flowering of certain plants. As the frequency and extent of climate change increase, the number of damaged natural ecosystems will increase and their geographical scope will expand.

2.1.2 Natural disasters

Extreme weather, melting glaciers, melting permafrost, coral reef death, rising sea levels, changing ecosystems, increased droughts and floods, deadly heat waves, etc. Climate warming will lead to changes in surface runoff, frequency of drought and flood disasters and water quality in some areas. The most common and immediate threat to climate change is flooding and landslides in river basins and coastal lowlands, as well as in rapidly growing towns. Environmental problems such as water and energy shortages, waste disposal and transportation, which are currently faced by human settlements, may also be exacerbated by high temperatures and heavy rain. The spread of climate-sensitive infectious diseases such as malaria and dengue fever is likely to increase; Increased illness and mortality associated with heat waves.

2.1.3 National economy

The impact of climate change on national economies: agriculture may be one of the most sensitive sectors to trade with. Changes in diet will add to the instability of agricultural production in the region. Environmental problems, the thawing of permafrost, have increased the livelihoods of local residents and the difficulty of road works. In addition, water and energy shortages, for example, have reduced food production and caused millions to starve to death.

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2.2 Net cost of dealing with problems brought by EDPs

The social comprehensive asset index Social Comprehensive Capital, abbreviated SCC)refers to the sum of all the national property and natural resources accumulated in a country or a region for many years. The decrease in SCC caused by the placement of EDPs is considered as its net cost.

2.2.1 Economic cost

The cost of damage and reconstruction of tangible production materials, including housing, etc.Loss of the value of public goods and personal property

2.2.2 Environmental cost

The income of some industries caused by climate deterioration, such as drought and high temperature, declined .Loss of intangible production assets and consumption data .Natural resources,including land, forests, minerals, water resources, and so on, and the ecological environment formed by these resources, are destroyed

2.2.3 Resettlement cost

It takes a lot of cost and energy to resettle EDPs.The EDPs themselves, the immigrating countries and the United Nations all need to make efforts to solve this problem

EDPs themselves need to make plans and choices for their own future ,actively cooperate with the work of the government, and compromise their own will to a certain extent. The human rights of EDPs, including personal freedom, the right to work and government assistance, will undoubtedly cost a lot of money and political resources. The United Nations needs to coordinate the communication between various countries and EDPs,and provide timely intervention and help for the resettlement of EDPs.

2.2.4 Cultural cost

The damage of material cultural heritage is hard to recover. The environmental displaced persons caused by climate change are forced to move to other countries. The difference of living environment and lifestyle will inevitably lead to the difficulty of inheriting intangible cultural heritage.

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3. Grade assessment of the severity of EDP

We need to analyze the climate background of EDPS, and then analyzethe possibility of EDPS caused by the impact of climate change in onecountry, as well as the acceptability of other countries for environmentalglass lost persons

First of all, in order to measure the impact of a countrys post-harvest change, we analyze the relationship between climate change and national vulnerability indicators from the perspective of national vulnerability, and provide a complete indicator system. Then, from the two aspects of the number of EDPS and the risk of cultural heritage loss. we analyze the relevant indicators of the severity of ED Ps, and integrate them into a complete indicator system corresponding to the national vulnerability indicators.

Finally, a fuzzy comprehensive evaluation model based on AHP-NBM is established to evaluate the severity of EDPS.

3.1 Fragile States index.

Table 1 The national 4 primary indexes, 12 secondary indexes and 42 sub-indexes

Primary index	Secondary index	Sub-index
Cohesion	C1:Security Apparatus	Monopoly on the Use of Force. Political Violence. Force. Arms.
	C2:Factionalized Elites	Representative Leadership. Identity. Resource Distribution. Equality and Equity. Law
	C3: Group Grievance	Post-Conflict Response. Equality. Divisions. Communal Violence.
Economic	E1: Economic Decline	Public Finances. Economic Climate. Economic Diversification.
	E2:Uneven Economic Development	Economic Equality. Economic Opportunity. Ghettos or Slums.
	E3: Human Flight and Brain Drain	Retention of Technical and Intellectual Capital .Economics
Political	P1: State Legitimacy	Confidence in the Political Process. Political Opposition. Transparency Openness and Fairness of the Political Process. Political Violence.
	P2: Public Services	General Provision. Health Education. Shelter. Infrastructure
	P3: Human Rights and Rule of Law	Civil and Political Rights. Civil and Political Freedoms. Violation o Rights. Openness. Justice. Equality.
Social	S1: Demographic Pressures	Population. Public Health Food and Nutrition. Environment Resources. .
	S2: Refugees and EDPs	Refugees. Environmental Displaced Persons. Response Displacement.
	S3:External Intervention	Political Intervention Force Intervention. Economic Intervention.

Many of the national vulnerability are analyzed, in order to analyze the effect or climate change on the vulnerability of the country , can first determine the accurate

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quantitative measure of the vulnerability or the national 4 primary indexes, 12 secondary indexes and 42 sub-indexes .Display them in the following table.

3.2 Building a hybrid index system - climate change and fragile states index

We corresponded the above two index systems, marking their corresponding functional relations, specifically reflecting the direct or indirect impacts of climate change on national vulnerability. Draw the chart of the index system as follows.

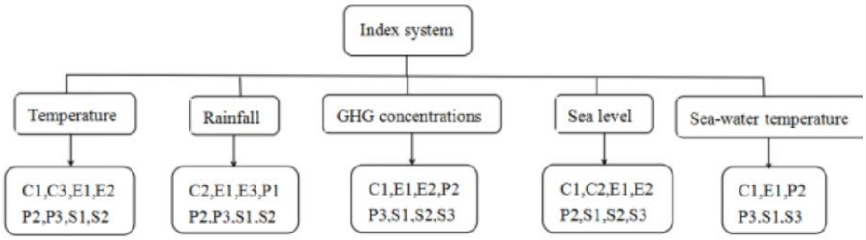

Figure. 1 Draw the chart of the index system

3.3 Building a hybrid index system - the severity of EDPs

We have mapped the above three index systems, marked their corresponding functional relationships, and specifically reflected the requirements of EDPS for national vulnerability, that is, the impact of national vulnerability on EDPs resettlement. As shown in the table below.

Table 2 The timpact of national vulnerability on EDPs resettlement

Index	Description	Correspond national vulnerability indicators
N	Affordable immigration	C1,E1,E2,E3,P1,S1,S2
δ	Cultural environment similarity	C2,E1,P2,P3,S3
S	National comprehensive strength	C1,E1,E2,P1,P2,P3,S1,S2

3.4 The Establishment of AHP -NBM- Fuzzy Comprehensive Evaluation Model (ANFCE)

3.4.1 Analytic hierarchy process (AHP) - scientifically determining the weight of evaluation index

The analytic hierarchy process of mathematical thinking of complex system, human subjective judgment based quantitative analysis, the differences between the various factors determine the numerical value, help people to maintain the consistency of the thinking process is suitable for fuzzy comprehensive evaluation

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of complex system, is currently one of the most widely used to determine weight method. The use of analytic hierarchy process (AHP) to determine the weight of the index can be carried out according to the following steps.

Step 1:Establishing hierarchical structure of vulnerability assessment system

A clear classification index system is established to analyze the N indexes in the established index system. The index set is represented as the first class index set V = {V_1 , V_2 , V_N ,} and sub-index set V = {V_{i1} , V_{i2} , V_{ik} ,} , V_i represents the first level index, N is the number of index, and the set of these indexes is a simple sort by numbered.

Step2:Determine the comparison matrix between the two

The 1-9 proportions scale method is used to qualitatively describe the relative importance of each level's evaluation index and quantify it with accurate numbers, and then determine the discriminant matrix .

Table 3 The meaning table of discriminant matrix and scale

Scale	Meaning
1	It is of the same importance that the two elements are compared.
3	One element is slightly more important than the other.
5	One element is more important than the other.
7	One element is intensely more important than the other.
9	One element is extremely more important than the other.

2, 4, 6, 8 are the median of the adjacent judgments, and if the index a and B are compared to a_{ij} , then the index B and a are compared to 1/ a_{ij}. The first level index concentrates each index relative to the total evaluation goal. The comparison matrix between the two is as follows.

$$A=\begin{bmatrix} 1 & V_{12} & \cdots & V_{1N} \\ V_{21} & 1 & \cdots & V_{2N} \\ \cdots & \cdots & \cdots & \cdots \\ V_{N1} & V_{N2} & \cdots & 1 \end{bmatrix}=(V_{ij})_{N\times N} \qquad (V_{ij}=\frac{1}{V_{ji}})$$

Among them, for the total evaluation target, the value of the relative importance of elements is characterized by the diagonal elements of 1, that is, the importance of each index relative to itself is1. In terms of the indexes of the sub index concentration, the comparison matrix between the two is follows.

$$B_i=\begin{Bmatrix} v_1 \\ v_2 \\ \cdots \\ v_k \end{Bmatrix}\begin{bmatrix} 1 & f_{12}^i & \cdots & f_{1k}^i \\ f_{21}^i & 1 & \cdots & f_{2k}^i \\ \cdots & f_{12}^i & \cdots & \cdots \\ f_{k1}^i & f_{k2}^i & \cdots & 1 \end{bmatrix}=f_{k\times k}^i \quad (i=1,2,\cdots N)\,(f_{ij}^i=\frac{1}{f_{ji}^i})$$

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Step 3: The application and product method are used to solve the discriminant matrix, and the relative weight of the index one by one is obtained under a single criterion.

First, the elements in the matrix are normalized by column normalization. Then the matrices that are processed are added in line respectively Then the row vectors are normalized to get the weight vectors of each comparison element under a single criterion. Finally, the unique maximum eigenvalue is calculated according to the following formula. λ_{max} , $\lambda_{\max} = \sum_{i=1}^{n} \frac{(A\omega)_i}{n\omega_i}$ (The other discriminant matrix is equal to the same.)

Step 4: Hierarchy-a matrix that calculates the combination weight of the same level index (H_1, H_2, H_m)

Step 5: Consistency test

First, the consistency index CI is calculated, CI= λ -n/n-1. N is the order of the discriminant matrix. Finding the average random consistency index R.I. Computing conformance ratio CR=CI/RI. When CR<0.1, it is generally accepted that the consistency of discriminant matrix is acceptable The smaller the value of C.R is, the smaller the value of discriminant matrix deviates from the actual situation, the closer it is to the reality. Therefore, from the above we can see that the weight using the analytic hierarchy process to solve the various evaluation index, a qualitative evaluation is given only to the relative importance of each evaluation personnel elements 22 description, and then through the AHP method can accurately calculate the weight of each evaluation element, which are based on strict scientific theory as a basis, greatly enhance the scientific and effective evaluation process.

4. Model solution

4.1 Data processing

Collect data from each website, normalize all the data, and use the mean replacement method to process the missing data, and integrate the data.

The partial least squares regression method is used to determine the weight, and the Matlab software is used to solve it Taking the precipitation in Kampuchea as an example, multiple linear regression analysis of its 1991-2015 year precipitation is made, and image is made, and its multiple linear regression equation is given.

Its regression equation is: y=0.0002x6 -0.0099x5+0.1581x4-1.3007x3+5.6472x2 -10.826x+30.635.R2=0.9879. As a result, the correlation coefficientis0.9879>0.75, which can be used for prediction. This equation is applied to the following neural network prediction.

Taking Cambodia as an example, make the fitting of neural network to it, and using the results of Matlab software for time series prediction. Procedures see Appendix 4, the results of the program are as follows.

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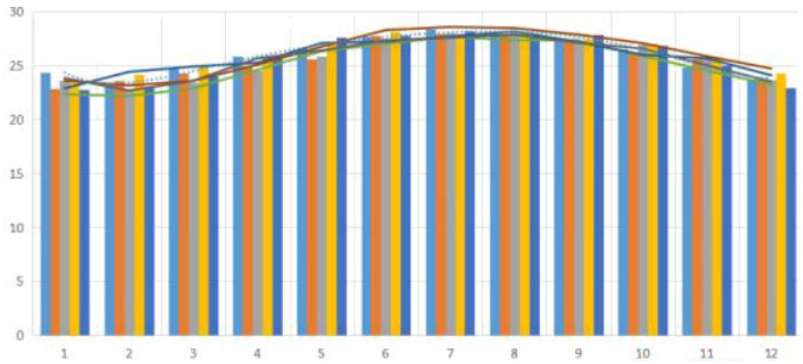

Figure. 2 Cluster columnar diagram of precipitation change

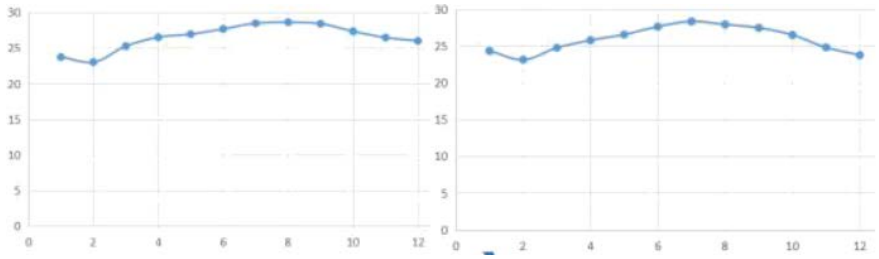

Figure. 3 Multiple linear regression

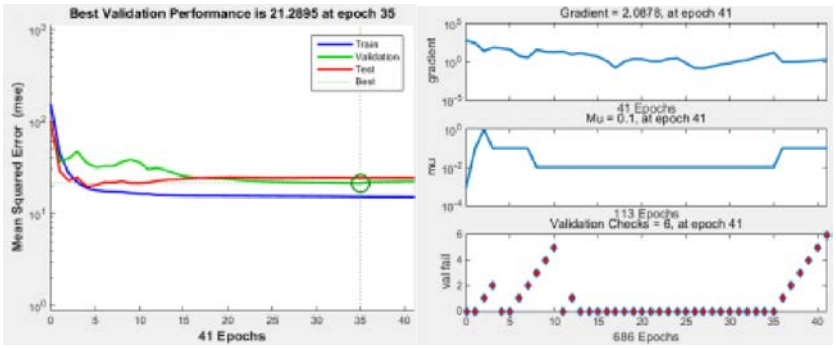

Figure. 4 Results of Analysis

The result show that the fitting results are good, the error is concentrated in the small part, and it can be used to continue to predict.

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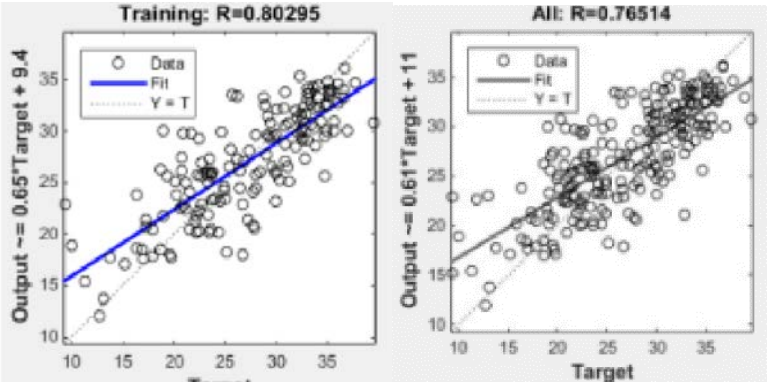

Figure. 5 Correlation Coefficient

It can be concluded that Kampuchea will reach the first critical point of the national vulnerability index in2042, and will arrive at the second critical point of the national vulnerability index in 2063.

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