# The influence of climate change on vulnerability about fragile and stable

Tian Runda
Chengdu University of Technology
Chengdu 610059,China
e-mail: 461655857@qq.com

Zhang Shesheng
Wuahn University of Technology
Wuhan 430063, China
Email :sheshengz@qq.com

*Abstract*—**Manufacturing unsustainable environmental practices, migrations, and resource shortages that prevail in developing countries may worsen countries with weak governance.Many experts have also conducted research on this, although environmental pressure does not necessarily lead to violent conflicts in itself. When it is combined with weak governance and social division, it will lead to violent conflicts that can aggravate the spiral of violence, usually It is latent ethnic and political disagreements.**

*Keywords-Climate change, Fragile, Stable, Entropy weight method*

## I. INTRODUCTION *(HEADING 1)*

AIn recent years, global or regional environmental problems directly or indirectly caused by climate change have attracted wide attention of the international community[1]. A large number of evidence suggests that the global average temperature has increased by 0.8 degrees since 1900 due to the increase in the content of CO2 and other greenhouse gases in the atmosphere[2]. From 1880 to now, the world's hottest 12 years are all concentrated in the between 1990 and 2005[3]. The Intergovernmental Panel on climate change (Intergovernmental Panel On Climate Change, abbreviated as IPCC) clearly pointed out in the fourth "climate change assessment report" that climate change will have a profound impact on the earth's resources and the ecological environment, food production and human security[4].. When the global warming is more than 1.5 ~2.5 C, the risk of 20%~30%'s biological species extinction will be greatly increased; the structure and function of the ecosystem of 25%~40% will greatly change at more than 2 ~3 C[5]..
The Intergovernmental Panel on climate change(Intergovernmental Panel on Climate Change) said that the net damages the costs of climate change can be significant[6].. These effects will change the human way of life, may lead to weakening the structure of society and government and collapse[7].. Therefore, we need to establish the index system to evaluate the vulnerability, and the climate factors into consideration, is to determine the direct or indirect way to influence vulnerability[8]

## II. MODELING

Firstly, select the indicators to represent the national vulnerability. As with the national relevant vulnerability index number a lot, so we use the method of principal component analysis to reduce the main index. Based on previous experience, we use PCA methods to reduce the number of indicators [2] and get the final required indicators. Different contribution evaluation index for critical weighted model. Therefore, this section uses two models to calculate the weight of the weight vector.

### 2.1. Weighted model based on entropy weight method（EWM）

In information theory, entropy is a measure of uncertainty, according to the characteristics of entropy, entropy can be calculated to determine the randomness and disorder of an event, but also the entropy can be used to determine the discrete degree of an index, the greater the degree of dispersion index, the index of comprehensive evaluation Influence(weight) more[3]. It is a kind of objective weighting method, because its dispersion depends only on the data itself.

The measuring unit of the indicators are not uniform, so in the calculation of comprehensive index with them before, must first normalized absolute value that index into relative value. In addition, positive indexes and negative indexes values represent different meanings (positive index value is good and negative index values as low as possible), therefore, for the positive and negative indicators need to use different algorithms for data standardization:

positive index：

$$x'_{ij} = \frac{x_{ij} - \min\left\{x_{1j}, \cdots, x_{nj}\right\}}{\max\left\{x_{1j}, \cdots, x_{nj}\right\} - \min\left\{x_{1j}, \cdots, x_{nj}\right\}} \tag{1}$$

negative index：

$$x'_{ij} = \frac{\max\left\{x_{1j}, \cdots, x_{nj}\right\} - x_{ij}}{\max\left\{x_{1j}, \cdots, x_{nj}\right\} - \min\left\{x_{1j}, \cdots, x_{nj}\right\}} \tag{2}$$

For convenience, the normalized data xij' till represents as xij ;
Calculate the index j under the proportion of the indicator of sample i

$$p_{ij} = \frac{x_{ij}}{\sum_{i=1}^{n} x_{ij}}, i = 1, \cdots, n, j = 1, \cdots, m \tag{3}$$

Calculate the entropy of the index j

$$, e_j = -k \sum_{i=1}^{n} p_{ij} \ln(p_{ij}), j = 1, \cdots, m \quad (4)$$

$$(k = \frac{1}{\ln(n)} > 0, e_j \geq 0)$$

Among them,

$$k = \frac{1}{ln(n)} > 0$$

.Satisfy ej>0;
Calculate the information entropy redundancy :
$$d_j = 1 - e_j, j = 1, \cdots, m$$
Calculate the weight of each indicator:

$$w_j = \frac{d_j}{\sum_{j=1}^{m} d_j}, j = 1, \cdots, m \quad (5)$$

2.2. AHP-based weight model

In order to make the indicators more comprehensive, we use the consistency judgment matrix to weigh each indicator, and we obtain the complementary judgment matrix by experts scoring each index according to experience.

We can solve the feature vector matrix to obtain the weight. According to the method of group decision-making, the final weight can be obtained by combining the weight of experts and the weight of judgment matrix. The weight of each index is as follows:

The reliability of the weighted process can be checked in the following values: Consistency index value CI =0.0786,Consistency ratio value CR= CI/RI=0.0527,Through the above method, we can finally calculate the weight of each indicator.

The six dimensions of national assessment of vulnerability based, we identified a set of comprehensive indicators and the reasonable weights, including infrastructure, human resources, education resources, military resources, political authority and social stability, public diplomacy, economic system, image image, brand image ten index.

2.3. Impact of climate change on the weighting model

The impact of climate change on vulnerability can be divided into direct and indirect effects[4]. We incorporate climate into the 11th weight indicator and reconstruct the weighting model, and calculate the weight of each component shown in picture as follows:
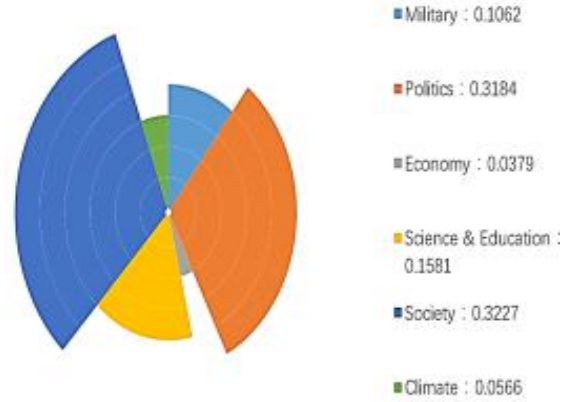


- Military : 0.1062
- Politics : 0.3184
- Economy : 0.0379
- Science & Education : 0.1581
- Society : 0.3227
- Climate : 0.0566

Figure 1.    The Nightingale diagram of the proportion of weight

III.    THE PERFORMANCE OF THE FRAGILE STATES IN THE MODEL

.Based on the fragile state index given in the title, we chose Yemen among the ten most vulnerable countries as an example to test the accuracy of the model and to use a weighting model to observe the impact of climate change on national vulnerabilities. Yemen is one of the most chaotic countries in the whole Middle East chaos and is full of geographical differences, sectarian conflicts and tribal conflicts. Yemen has a land area of       527,970 square kilometers and a permanent population of 27.58 million (2016)



Figure 2.    The satellite map of Yemen

According to the indicator system and the proposed standard, the indicators of vulnerability reflecting the seven dimensions of the country are calculated and the results are shown in the Figure.3
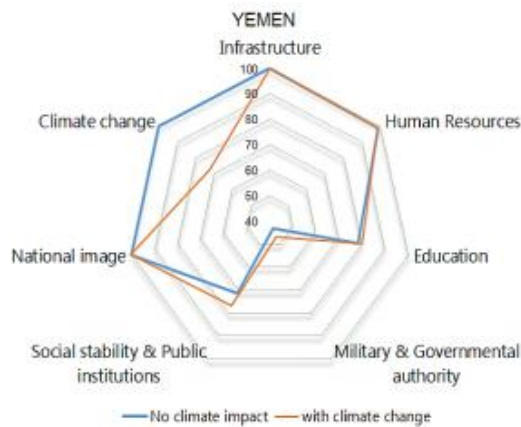
Figure 3.   The index value of Yemen

introduced relevant protection policies in time, resulting in extremely uneven distribution of resources and significant social inequities, which exacerbated the impact of climate change on national vulnerabilities
.

## IV.   CONCLUSION

The weight by entropy method and AHP to determine the index, making the results more convincing, to avoid accidental. To complete the task of predicting the use of comprehensive prediction models, for different models may have limitations and vulnerabilities, makes the results more reliable. In some of the steps we use an index instead of the two indicators of evaluation, this may lead to errors or error evaluation.

### 3.2. Current vulnerability analysis

Based on the overall situation in Yemen and the assessment in section 3.1, we can conduct a detailed analysis of the current situation of vulnerability in Yemen.

Specifically, the frequent war in Yemen has prevented it from effectively gathering its national strength to improve the living environment and social conditions of its residents. At the same time, it is unable to develop its economy and leads to a relatively low overall national strength. Although the Yemeni government has formulated a domestic development plan, it is still not perfect. Development plans include economic development, education for all, etc., but do not address the governance and improvement of the domestic social environment. This has led to the higher vulnerability of Yemen.

At the same time, it can be seen that the impact of climate change is also more prominent. As a result of perennial drought, the level of agricultural development in Yemen lags behind and the government has not

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