sustainability

MDPI

Article

What Affects Chinese Residents' Perceptions of Climate Change?

Jinjia Wu [1], Jiansheng Qu [1,2,*], Hengji Li [2], Li Xu [1], Hongfen Zhang [1], Suman Aryal [3,4], Jingjing Zeng [2], Yujie Fan [1], Qin Wei [1] and Xiafei Liu [1]

1 Key Laboratory of Western China's Environmental Systems (Ministry of Education), College of Earth and Environmental Sciences, Lanzhou University, Lanzhou 730000, China; zsjinjia@yeah.net (J.W.); lxu16@lzu.edu.cn (L.X.); hfzhang16@lzu.edu.cn (H.Z.); fanyj17@lzu.edu.cn (Y.F); weiqin-js@sino-carbon.cn (Q.W.); liuxf2015@lzu.edu.cn (X.L.)
2 Lanzhou Information Center/Information Center for Global Change Studies, Chinese Academy of Sciences, Lanzhou 730030, China; lihengji@llas.ac.cn (H.L.); zengjj@llas.ac.cn (J.Z.)
3 Institute for Agriculture and the Environment, University of Southern Queensland, Toowoomba, QLD 4350, Australia; aaryalsuman@gmail.com
4 International Institute for Research, Education and Consultancy (iiREC), Toowoomba, QLD 4350, Australia
* Correspondence: jsqu@lzb.ac.cn; Tel.: +86-139-9319-3793

Received: 14 October 2018; Accepted: 7 December 2018; Published: 11 December 2018

Abstract: The theme of global sustainable development has changed from environmental management to climate governance, and relevant policies on climate governance urgently need to be implemented by the public. The public understanding of climate change has become the prerequisite and basis for implementing various climate change policies. In order to explore the affected factors of climate change perception among Chinese residents, this study was conducted across 31 provinces and regions of China through field household surveys and interviews. Combined with the residents' perception of climate change with the possible affected factors, the related factors affecting Chinese residents' perception of climate change were explored. The results show that the perceptive level of climate change of Chinese residents is related to the education level and the household size of residents. Improving public awareness of climate change risk in the context of climate change through multiple channels will also help to improve residents' awareness of climate change. On the premise of improving the level of national education, improving education on climate change in school education and raising awareness of climate change risk among dependents will help to improve the level of Chinese residents' awareness of climate change, which could be instrumental in promoting public participation in climate change mitigation and adaptation actions.

Keywords: climate change; perception; correlation analysis; regression analysis; China

1. Introduction

The Intergovernmental Panel on Climate Change (IPCC) has published Climate Change Assessment Reports five times, comprehensively explaining the scientific evidence and attributions of climate change, the impact and risk, mitigation and adaptation, and policy and negotiation. These reports have not only promoted the scientific understanding of global climate change, but have also provided the guidance for adaptation and mitigation. Climate change has evolved as a social issue, as its impacts are becoming more apparent and evident from peoples' observation and from scientific research. Many of the previously discussed possible consequences of climate change have had real impacts on societies all over the word [1–3]. At present, every country has launched or participated in climate change action to a varying degree. A scientific understanding of climate change within

the public plays an important role in implementing mitigation and adaptation actions. Moreover, the perceptions of local people towards climate change are important, as they largely determined the ways local people respond to the impacts of climate change. Here, 'perceptions' refers to the way people identify and interpret observations and concepts related to climate change.

Empirical evidence has shown that residents' perception of climate change is positively correlated with adaptive behavior [4]. Raising public awareness of the threats of climate change has become a common commitment to global action [5]. Unlike other natural disasters, uncertainty, future events, damage, and relativity are the major features of climate change risk, which makes it difficult for the public to distinguish climate change from natural variability. The uncertainty in climate change and its impacts has been accepted by the scientific community, but the public has its own understanding [6,7]. The grave consequences of climate change still pose a major threat to the values and interests of the public, despite the uncertainties, indirectness, and time lag [8]. Decision makers frequently weaken the uncertainty of climate change (to prove the rationality of their decision), and ignore the uncertainty of residents' awareness in the formulation of climate change policies, whose misconceptions will diminish the satisfaction and reception of decision-making [9,10]. Residents' perception plays the key, basic role in mitigation and adaption [11]. Therefore, understanding perceptions of climate change and its driving forces plays a significant role in promoting resident participation in the implementation of relevant policies. Yet, although some research on climate change perception has been done [12], at present, we lack even a rudimentary understanding of the factors shaping residents' climate change perception awareness nationally, owing to the unavailability of past data.

Due to the uncertainty of climate change, the regional climate response to extreme climate events also varies greatly, which leads to significant differences in the public perception of climate change and its influencing factors in different regions. Alam et al. [13] showed that residents' perception of climate change was highly correlated with extreme events caused by climate in Bangladesh. However, British scientists [14] reported that the individual risk perception level was not high. In contrast, the German scientists represented by Frondel found that personal risk perception under climate change was positively correlated with disaster experience, including high temperatures and heat waves [15,16]. Similar research has also demonstrated that variables related to the socio-economy, the production system, and the social capital of the respondents can also affect their understanding of climate change [17], indicating that understanding the public's perception of climate change and its influencing factors is a prerequisite for the formulation of climate change mitigation and adaptation policies. Therefore, this study takes the status of perception of climate change of Chinese residents as its research object in order to explore influencing factors for the public's perception of climate change that can provide theoretical references for the formulation of climate change policies and promotion of public awareness.

2. Data Sources and Methods

China is situated in the eastern part of Eurasia, facing the Pacific Ocean. The geographical features of the land in the west are higher than those in the east, and have typical monsoon characteristics. China has become one of the countries that is most adversely affected by climate change [18]; its impacts are mainly evident in forests and natural ecosystems, water resourcess and coastal zones. Agriculture production and animal husbandry can feel a far-reaching impact, bringing huge losses to the national economy, and there can be enormous economic and social costs as a consequence of climate change [19–21]. In order to improve Chinese residents' awareness of climate change, and to promote public participation in climate change mitigation and adaptation actions, this study conducted random investigations in target cities and rural areas. Based on the Chinese Household Carbon Emissions Survey (CRECS) research project, which is represented by 31 medium-sized cities in 31 provinces and regions of China, a total of 930 samples were investigated nationwide. The data were collected by combining household questionnaire surveys and interviews conducted from October 2016 to December 2017. Supplementary samples are added in time in order to ensure the validity of each sample.

Psychological research suggests that the residents' perception of climate change not only includes the direct stimulation of climate change, but also involves the stimulation of information exchange and communication via social networks and the media. The questionnaire for the survey was designed from an ethics examination based on previous work. The investigation mainly includes the basic status of residents, such as people's perception of climate change (climate perception and climate information awareness), gender, age, family scale, education level, income, and so on (Table 1). The long-term changes of some climate indexes, such as temperature and precipitation, have a direct effect on residents, and play an important role in residents' perception of climate change [22]. The meteorological data about survey cities (local level) are from China meteorological information center (http://data.cma.cn/), and cities for which meteorology stations are absent are replaced by nearby sites. More than 70 per cent of natural disasters in China have been linked to extreme weather and climate events [23]. The disasters and losses caused by climate change have a direct impact on residents, particularly within agriculture and livestock production. Therefore, we choose the data of natural disaster acreage, affected population, and economic loss in each province as research variables. These data come from Yearbook of Meteorological Disasters in China. Variable description shows in Table 1.

Table 1. Variable Description.

Variable	Value	Mean Value	Standard Deviation
Perception	Incomprehension 1, Comprehension 2	1.5109	0.2295
Gender	Male 1, Female 2	1.5485	0.1605
Educational background	Illiteracy 0, primary 1, junior 2, senior 3, college 4, graduate 5	1.9789	0.5817
Age	Min–max std	53	6.7527
Family size	Min–max std	3.8	0.8804
Income	Min–max std	57233	39870.51
Damage area	Min–max std	69.79	61.9788
Affected population	Min–max std	595.56	435.5160
Economical loss	Min–max std	80.3	70.0107

3. Data Analysis

Table 1 presents the variables and related factors obtained from the research. The low values of standard deviation of the residents' basic situation, such as gender, education level, and family size, indicate that the correlation variables are less discrete. The standard deviation of age is relatively high, indicating that the coverage is relatively extensive in the research. The standard deviation of family income and disaster degree are relatively large, indicating that the correlation indexes are significant in different provinces. To sum up, this research is extensive, and the samples have quite high representativeness.

3.1. Perception Level

According to the assignment in Table 1, the perceived level of Chinese residents is shown in Figure 1. Based on the investigation data, we averaged the perception level of each province, then divided the data into three equal grades. So, the perception of Chinese residents may be broadly divided into three regions: the northern of China, the coastal area, and the inland provinces. The perception levels in the northern regions (Xinjiang, Qinghai, Gansu, Ningxia, Inner Mongolia Shaanxi, Shanxi, Hebei, Tianjin, Beijing, Liaoning, Jilin, and Heilongjiang) and coastal areas (Shandong, Jiangsu, Shanghai, Zhejiang, Fujian, Guangdong, and Hainan.) are higher than in other inland provinces (Tibet, Sichuan, Yunnan, Guizhou, Guangxi, Hunan, Hubei, Jiangxi, Anhui, and Henan).

Due to the significant difference in socio-economic level and the natural environment between regions, the perceptive level of northern regions is generally higher than that of the central and eastern regions. Therefore, the perceptive level may be less affected by the level of economic development, or likely plays at least some other role. Based on the analysis above, perception may be affected by multi-factors.

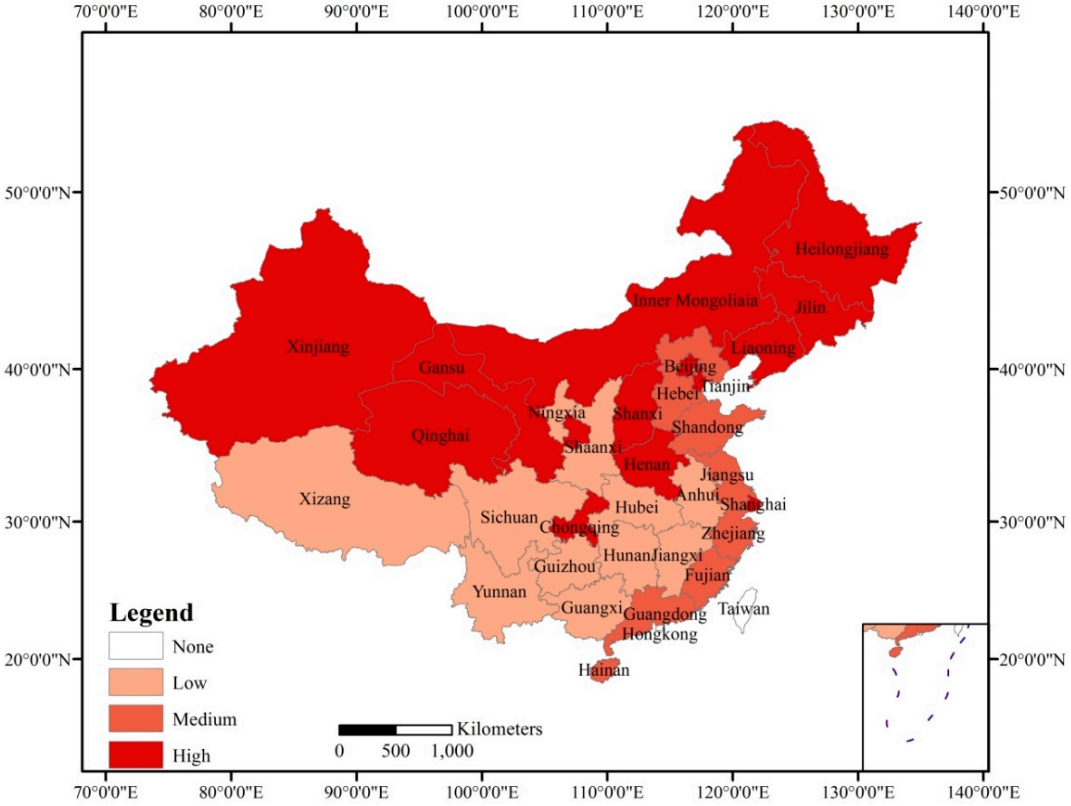

Figure 1. Perception level of Chinese residents.

3.2. Meteorological Data

Climate change is an issue of potentially huge significance across the globe. Research shows that public concern for global warming is widespread [24]. So, we collected climate data to understand Chinese residents' perception on climate change. From Figures 2 and 3, annual mean temperature departure is in an upward trend, and precipitation anomalies are in a downward trend over the past fifty years, which coincides with global climatic changes.

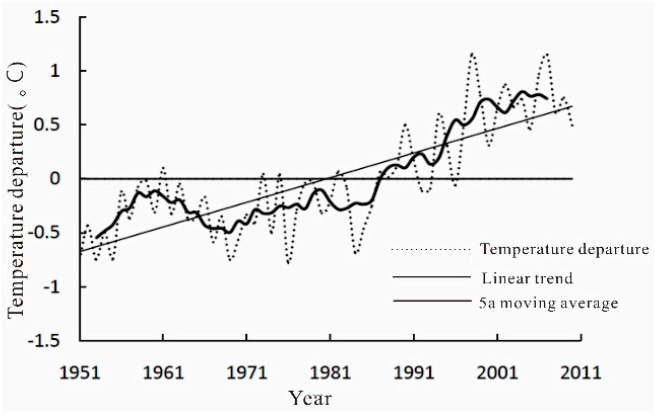

Figure 2. Temperature departure over the past 50 Years in China.

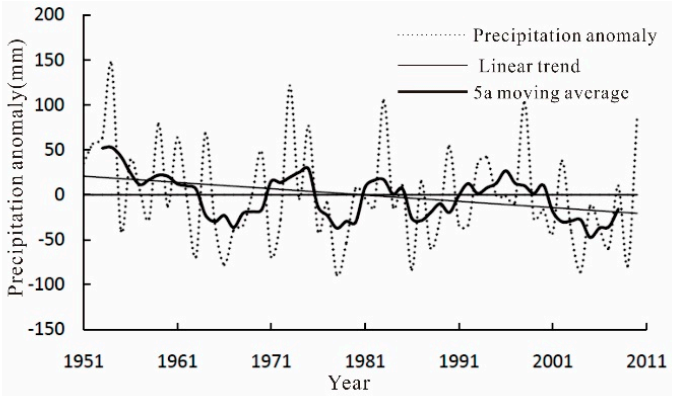

Figure 3. Precipitation anomaly over the Past 50 Years in China.

In our research, the meteorological data of various provinces and regions in 2015 were collected (Figure 4) in order to study the external stimulus factors of residents' perception of climatic change. The data of temperature and precipitation show that the average temperature of China in 2015 is 0.9 °C higher than that of the normal year, and precipitation is more than 19.5 mm, but the variation of temperature and precipitation presents significant regional differences. The temperature anomaly range between 0.3 and 1.1 °C; the highest temperature anomaly is 1.1 °C in Ningxia province, and the lowest temperature anomaly is 0.3 °C in Anhui Province. Generally, the provinces with higher levels of warming are mostly distributed in the northern region [25], such as Ningxia, Xinjiang, Tianjin, Qinghai, Inner Mongolia, Heilongjiang, and other provinces, which is in accordance with the perceive level of residents distribution. The range of precipitation anomaly is between −924.6 and 861.4 mm, Anhui is the largest (861.4 mm), and the negative distance of precipitation in Tibet is the largest (−924.6 mm). Distribution of precipitation variability does not exist in the North higher than the south, probably because of the contingency of factors affecting precipitation, such as the arrival of warm and wet airflows and the conditions of cloud-induced rain. For the whole meteorological data set, there is no regularity between temperature anomalies and precipitation anomalies in each province. There are provinces with synchronous changes, such as Tianjin, Inner Mongolia, Heilongjiang, Shanxi, and Hebei, as well as provinces with different changes, such as Hainan, Guizhou, Sichuan, and Henan. The results show that with global warming, the temperature of China's provinces is generally on the rise, but that precipitation is more complicated [26].

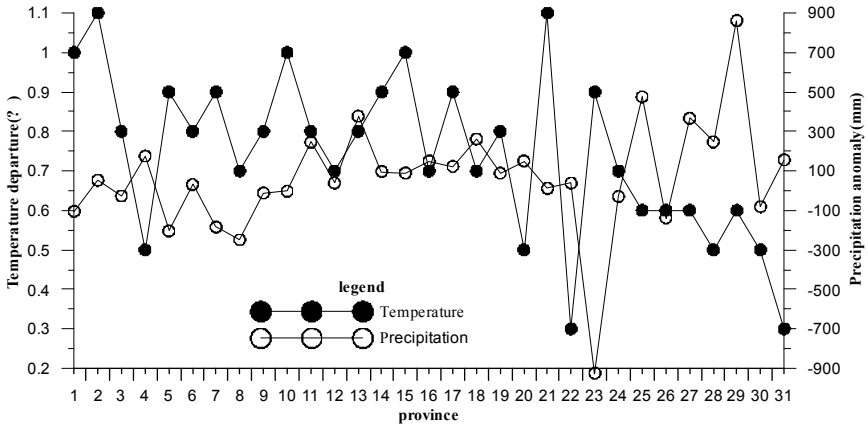

Figure 4. Temperature and precipitation anomaly in the past 5 years. Notes: Number 1–31 represents (1) Xizang, (2) Ningxia, (3) Guangxi, (4) Chongqing, (5) Guizhou, (6) Yunnan, (7) Sichuan, (8) Shaanxi, (9) Gansu, (10) Qinghai, (11) Jilin, (12) Shandong, (13) Hebei, (14) Heilongjiang, (15) Tianjin, (16) Beijing, (17) Inner Mongolia, (18) Liaoning, (19) Shanxi, (20) Henan, (21) Xinjiang, (22) Hubei, (23) Hainan, (24) Guangdong, (25) Jiangxi, (26) Hunan, (27) Shanghai, (28) Zhejiang, (29) Fujian, (30) Jiangsu, (31) Anhui.

3.3. Meteorological Disaster Data

According to the relevant data from the Yearbook of Meteorological Disasters in China [27], an average of about 26.56 million hectares of crops were affected, and direct economic losses have reached RMB 332.45 billion, affecting 30.2 million people by meteorological disasters and derivatives disasters in the past five years. Rainstorms caused the highest direct economic losses, followed by tropical cyclones, and then droughts. In terms of the affected people, rainstorms and floods accounted for the highest proportion. In terms of the affected area of crops, drought accounts for the highest proportion (Figure 5). Research has shown that under global warming, the frequency and intensity of extreme storms and droughts have increased [28]. Heat stress and water anomalies dominate the global 40% of wheat yield changes [29]. Therefore, with global warming, the impact of China's meteorological disasters will also show an increasing trend [30,31]. Increasing climatic disasters will not only lead to increased losses for residents, but will also affect residents' perception of climate change.

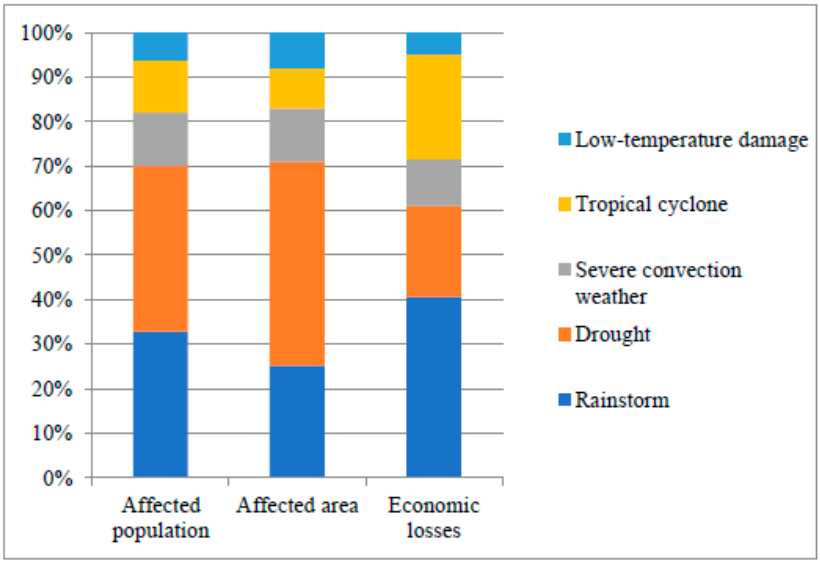

Figure 5. Portion of meteorological disasters in the past five years [27].

4. Results

Due to the fact that gender indices and perceptive levels are discontinuous variables, spearman correlation analysis was adopted for analyses of correlations with perceptive level, education level, age, precipitation anomaly, temperature departure, the average family income, gender index, the affected area, the affected population, and direct economic loss, in order to investigate the main influencing factors of Chinese residents' perception of climate change. The results are shown in Table 2.

The results showed that residents' perception of climate change was mainly related to education level, gender, household size, affected people, and economic losses, among which education level was significantly correlated at 0.01 level, while other factors were significantly correlated at 0.05 level; therefore, respondents' perceptions of climate change may be related to education degree, gender, family population, number of people affected by disasters, and economic losses caused by natural disasters. Roco et al. [17] used the econometric model to show that education level has an important effect on the acquisition of climate information, and better educated and means of production owners can better recognize the potential impact of climate change. Some studies have shown that an excellent correlation was obtained between the experience of natural disasters and residents' participation in climate change [6,32]. However, their reliability has been contested in different regions. In this study, affected people and economic losses due to natural disasters were negatively correlated with perception; however, whether these factors account for the level of perception still needs to be determined.

In order to further explore the influencing factors of Chinese residents' perception, Regression analysis was performed on the perceptive factors that passed the correlation test (which had a linear relationship with perceptive level, such as education level, gender, household size, affected people, and economic losses) for further analysis of the various affected factors and the true relationship between residents' perception. The results are shown in Table 3.

The result of Regression Analysis reveals that there was a correlation between perception level and educational level and household size. In contrast, gender, number of people affected by disasters, and economic losses caused by natural disasters are not correlated with residents' perception, and they were eliminated from the model. After quadratic regression, this model after quadratic regression gives effective results, demonstrated that education level (correlation coefficient 0.714) and household size (−0.414) respectively, reached significant levels. The total model had an adjusted R^2 of 0.712, suggesting that the majority of variation in perception could be explained by the included parameters at 71.2%.

The ANOVA table (Table 4) of recession analysis shows that F-statistics is 34.645 ($p < 0.01$), and has statistically significant association (F = 34.645 > Fa(k, n − k − 1) = 3.304817) by computing; this means that the explanatory variables education level and household size have a significant effect on the residents' perception of climate change.

To further verify the rationality of the regression model, a histogram of standardized residuals (Figure 6) can intuitively show that the standardized residuals follow a normal distribution with an average value of 1.20×10^{-15} approximately 0, and a standard deviation of 0.966. Meanwhile, normal P-P plot of regression standardized residual (Figure 7) clearly showed the scatter distributed around the first quadrant, so the residuals obey normal distribution. Therefore, regression equation is reliable. It can be concluded that perception level of Chinese residents is mainly affected by education and household size.

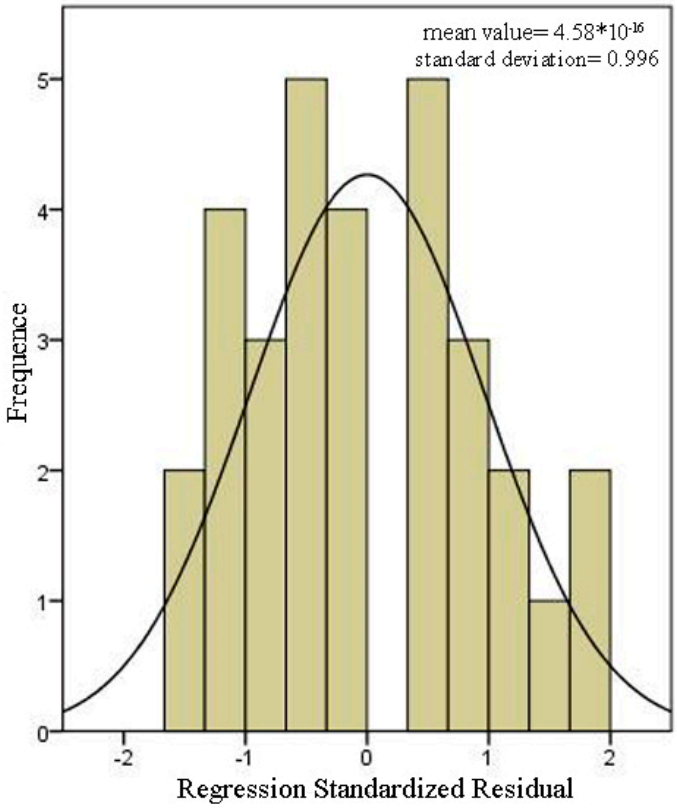

Figure 6. Standardized Residual histogram.

Table 2. Correlation analysis for perception factors.

	Income	**Education**	**Age**	**Gender**	**Household Size**	**Affected People**	**Affected Area**	**Economic Losses**	**Temperature Anomaly**	**Precipitation Anomaly**
Perception	0.166	0.712 **	−0.140	−0.444 *	−0.407 *	−0.415 *	−0.093	−0.459 *	−0.206	0.303
Income		0.461 **	−0.411	−0.130	0.250	−0.029	−0.164	−0.060	−0.295	0.007
Education			−0.470 **	−0.499 **	0.027	−0.232	−0.025	−0.323	−0.110	0.121
Age				0.331	−0.674 **	0.007	0.099	0.214	−0.014	0.241
Gender					−0.108	0.187	0.028	0.121	−0.426 *	0.344
Household size						0.467 **	0.167	0.229	−0.112	−0.511 *
Affected People							0.671 **	0.776 **	−0.369 *	−0.233
Affected area								0.702 **	−0.115	−0.055
Economic losses									−0.201	−0.159
Precipitation anomaly										−0.371 *

** Significant correlation on the 0.01 level (bilateral). * Significant correlation on the 0.05 level (bilateral).

Table 3. Regression coefficients for perception factors.

Model		Unstandardized Coefficients		Standardized Coefficient	Sig.	Model Summary		
		B	Std Error	Trial Version		R	R^2	Adjust R^2
1	(Constant)	0.932	0.101		0.000	0.742	0.550	0.535
	Education	0.293	0.049	0.742	0.000			
2	(Constant)	1.353	0.134		0.000	0.844	0.712	0.692
	Education	0.282	0.040	0.714	0.000			
	Household size	−0.105	0.026	−0.404	0.000			

Table 4. Anova for regression analysis.

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	0.870	1	0.870	35.467	0.000 a
	Residual	0.711	29	0.025		
	Total	1.581	30			
2	Regression	1.126	2	0.563	34.645	0.000 b
	Residual	0.455	28	0.016		
	Total	1.581	30			

a. Predictor: (Constant), Education level. b. Predictor: (Constant), Education level, household size.

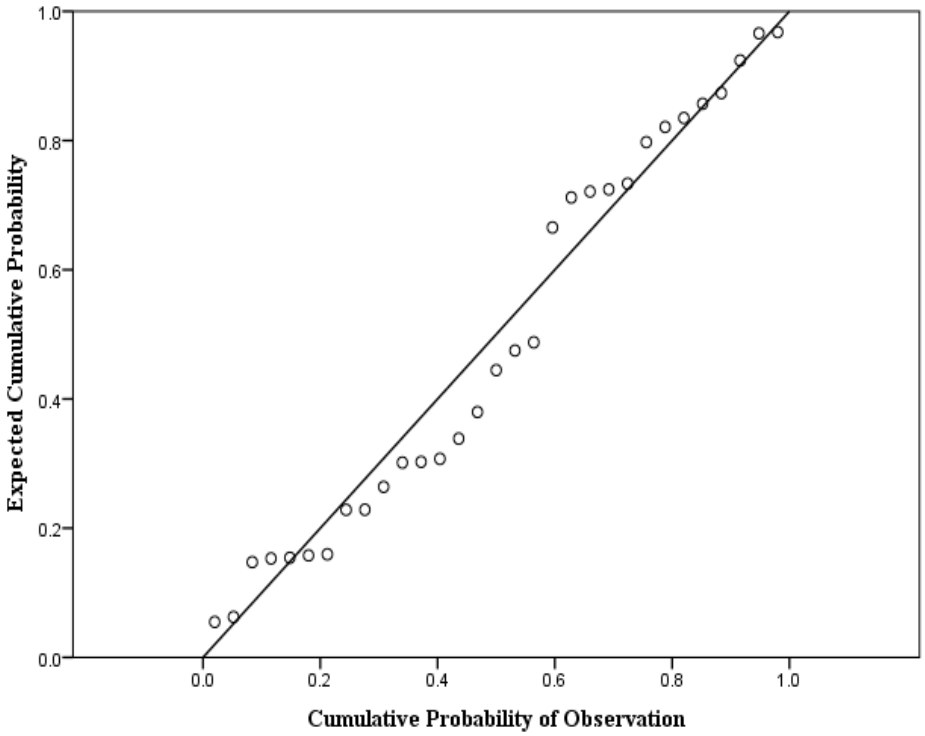

Figure 7. Normal P-P Plot of Regression Standardized Residual.

5. Discussions

With the increase in impacts from climate change and other global environmental problems, global sustainable development shifts from environmental management to climate governance [33]. The uncertainty of climate change impacts makes the traditional top-down governance model ill-suited to dealing with the current climate crisis. Therefore, policymakers need to take the public interest into account to frame long-term mitigation and adaptation plans [33]. Public awareness of climate change is a prerequisite for responding to the relevant policies. Enhancing residents' awareness

and understanding of climate change causes and impacts promotes active participation at all levels. The process of human response to climate change involves many aspects, including how they appraise and understand risks, how they feel about situations, and how they behave and respond to threats. The climate perception of an individual is based on a process of extracting and receiving information from a series of processes caused by climate change. Climate perception is formed through the process of identifying, understanding, and processing the environment in which we live. Climate change coping behaviors are choices and actions based on perception. From scientific research to public view, climate change has evolved into a social issue, and becomes a process in which all social subjects participate in the construction [34].

Stevenson [35] suggests that females have a stronger perception than males through their study of the risk perception of climate change in North Carolina. In general, females seem to be a little more sensitive to external stimuli, and therefore, have a deeper perception of climate change. This research suggests that males rank more highly than females in terms of education level, and Table 2 suggests that there is significantly correlation between education level and gender, i.e., 0.01 level. Chinese women are the main body of domestic labor services, especially in the vast rural areas. Compared with men, women have less time and opportunities to acquire knowledge in the fields. Chinese society is in a period of rapid development and transformation, where women pay more attention to matters that are closely related to their lives and may ignore changes in climate indicators such as temperature and precipitation. Therefore, Chinese women's perception has not demonstrated attention to climate change. This is accorded with the results in a recent article [36].

Personal perception depends on the social-natural environment, and residents get climate change information by perceiving the changes in climatic variables and communicating with society. Although natural disasters have a direct impact on people's lives, the questionnaire investigation are carried randomly. Natural disasters and the research object may be difference or out of phase, which does not involve the vital interests of the research object. In addition, followed by the residents' quality of life, to a certain extent, residents' perception of climate change may reduce gradually. Hagen et al. [37] showed that individuals' perception has been greatly reduced with time lapse and spatial extension. In addition, some residents' perception of climate is intermixed with human-induced climate change, and they may not see climate change as a severe threat. Brechin et al. [38] suggested that the climate change impacts perceived so far are less significant at this time to raise the public's level of concern above general environmental concerns. Therefore, the relationship between perception and natural disasters needs to be further explored.

Education is a matter of personal vision, since residents have a higher level of education which determines their abilities to obtain information. In the world as a whole, education level is the most powerful factor influencing residents' perception [39]. Residents with higher education levels have grater advantages in obtaining and identifying climate change information [17,40]. The mechanism by which Chinese residents' education levels affect perception level of climate change may be the same. However, considering that China is the biggest developing country in the world, with a large population and relatively low level of education, that leads to a relatively low level perception.

Correlation analysis and regression analysis shows that household size is negatively correlated to residents' perception. This is contrary to the fact that larger household sizes indicate larger networks and less social distance [41], because people often rely on climate experts and social media outlets to form judgments about global climate change phenomenon [6]. As a result of birth control policy, China has already entered a low birth level country ranking. According to statistics, by 2015, the Chinese dependency ratio to the total population of 37%, children's dependency ratio is 22.6%, elderly dependency ratio of 14.3%. The average age for subjects was 53 years. Children and other dependents have not experienced long periods of climate change, so they are out of the discussion to some extent; however, all were counted in household size statistics. Therefore, the perception of the whole family on climate change is represented by the research object, and caused negative correlation between the household size and perception. It is still necessary to investigate this further, because of a

lack of available data, such as children and other dependents' perception of climate change. With the increasing perception levels of children and other dependents, the perception of larger households will be greatly improved accordingly, and will boost efforts to address climate change [39].

In conclusion, residents' education level and household size are the main factors that affect the perception of climate change. Factors such as the gender may be errors in the integration process or just the data have correlations and no obvious causal relationships between them. Because of the absence of reliable information, not everyone has equal access to climate change information, and perceptions of climate change may vary among people [42]. So, further studies are needed to address this individual uncertainty.

6. Chinese Residents' Perception and Some Suggestions

In this paper, the perceptive data and possible influencing factors of climate change of Chinese residents collected by household surveys were used to explore the possible influencing factors of residents' perceptions of climate change. Although imperfect, the level of geospatiality of the data used in the study improves considerably on existing measures.

The assessment of temperature anomalies and precipitation anomalies based on climate change showed that the overall temperature in China has increased, and that the precipitation changes are relatively complex. The differences between provinces and regions are statistically significant.

The correlation analysis results show that there is a correlation between education, gender, household size, affected people, economic losses, and residents' perception of climate change. Although there is a negative correlation between gender, affected people, economic losses, and residents' perception of climate change, the regression analysis results show that there is no relationship between these three factors and perception level, which may be due to research noise or to the fact that relevant losses did not play an important role in residents' daily lives. Therefore, Chinese residents' perception of climate change is mainly determined by residents' education level and their household size.

Understanding perception has become a prerequisite for reducing the negative effects of climate change. Perceptive ability is a multidimensional and complex concept. In order to improve perceptive ability, it is necessary to identify various factors that determine perceptive ability, especially the hidden factors. It is necessary to further clarify the key factors influencing residents' perception of climate change, explore the role of these factors in the formation of perception of climate change, and reveal the perceptive formation mechanisms of residents' perception of climate change.

Finally, our policy recommendations based on our conclusions are as follows: the perception of climate change among Chinese residents is mainly affected by education level and household size. At present, the relatively high family dependency ratio in China leads to households becoming burdened with climatic changes. Therefore, under the auspices of making further improvements, it is helpful to infiltrate climate change in school education and to educate the residents about climate change and promote school education for climate change. In order to improve perception level of climate change among Chinese residents, residents will further form the basis for residents' participation in climate change actions. In addition, when formulating relevant climate change policies, it is necessary to comprehensively integrate the actual conditions of the region, to fully consider the needs of the residents, and to publicize the consequences of climate change in a manner that is well-received by the residents' to increase their awareness.

Social communication is also one of the key factors affecting climate change perception, which requires the establishment of dialogue mechanisms between different groups. Establishing a platform which is conducive to residents' access to information on climate change can make full use of social networks and norms in a way that is easily accepted by residents. This will also help to clarify the severe consequences of climate change, increase residents' awareness of the risks, and enable residents to obtain reliable, effective and available climate change information. Climate change impact varies according to the socioeconomic, geographical, political, world view, and other conditions of

individuals. Transdisciplinary approach (for example, anthropology, psychology, sociology, geography) and other factors need further study.

Author Contributions: J.W., J.Q., and J.Z. conceived and designed the experiments; J.W., J.Q., H.L., L.X., H.Z., Y.F., Q.W., and X.L. performed the experiments; J.W. analyzed the data; and J.W., J.Q. and S.A. wrote the paper. All authors read and approved the final manuscript.

Funding: This work was founded by the National key R&D program of China (No. 2018YFC1509007) and the National Natural Science Foundation of China (No. 41671535).

Acknowledgments: We thank the editor and reviewers for their constructive comments and suggestions on the manuscript.

Conflicts of Interest: The authors declare no conflict of interest.

References

1. Dai, A. Increasing drought under global warming in observations and models. *Nat. Clim. Chang.* **2013**, *3*, 52–58. [CrossRef]
2. Watts, N.; Adger, W.N.; Agnolucci, P.; Blackstock, J.; Byass, P.; Cai, W.; Chaytor, S.; Colbourn, T.; Collins, M.; Cooper, A.; et al. Health and climate change: Policy responses to protect public health. *Lancet* **2015**, *386*, 1861–1914. [CrossRef]
3. Scheffers, B.R.; De, M.L.; Bridge, T.C.; Hoffmann, A.A.; Pandolfi, J.M.; Corlett, R.T.; Butchart, S.H.M.; Pearce-Kelly, P.; Kovacs, K.M.; Dudgeon, D.; et al. The broad footprint of climate change from genes to biomes to people. *Science* **2016**, *354*, 6313. [CrossRef] [PubMed]
4. Woods, B.A.; Nielsen, H.Ø.; Pedersen, A.B.; Kristofersson, D. Farmers' perceptions of climate change and their likely responses in Danish agriculture. *Land Use Policy* **2017**, *65*, 109–120. [CrossRef]
5. Hitayezu, P.; Wale, E.; Ortmann, G. Assessing farmers' perceptions about climate change: A double-hurdle approach. *Clim. Risk Manag.* **2017**, *17*, 123–138. [CrossRef]
6. Weber, E.U. What shapes perceptions of climate change? *WIREs Clim Chang.* **2010**, *1*, 332–342. [CrossRef]
7. Burnham, M.; Ma, Z. Climate change adaptation: Factors influencing Chinese smallholder farmers' perceived self-efficacy and adaptation intent. *Reg. Environ. Chang.* **2016**, *17*, 1–16. [CrossRef]
8. Pahl, S.; Sheppard, S.; Boomsma, C.; Groves, C. Perceptions of time in relation to climate change. *WIREs Clim. Chang.* **2015**, *6*, 375–388. [CrossRef]
9. Poortinga, W.; Spence, A.; Whitmarsh, L.; Capstick, S.; Pidgeon, N.F. Uncertain climate: An investigation into public scepticism about anthropogenic climate change. *Glob. Environ. Chang.* **2011**, *21*, 1015–1024. [CrossRef]
10. Whitmarsh, L. Scepticism and uncertainty about climate change: Dimensions, determinants and change over time. *Glob. Environ. Chang.* **2011**, *21*, 690–700. [CrossRef]
11. Silvestri, S.; Bryan, E.; Ringler, C.; Herrero, M.; Okoba, B. Climate change perception and adaptation of agro-pastoral communities in Kenya. *Reg. Environ. Chang.* **2012**, *12*, 791–802. [CrossRef]
12. Li, J. Does the Chinese Public Care about Climate Change? Available online: https://www.chinadialogue.net/article/show/single/en/10831-Does-the-Chinese-public-care-about-climate-change- (accessed on 26 November 2018).
13. Alam, G.M.; Alam, K.; Mushtaq, S. Climate change perceptions and local adaptation strategies of hazard-prone rural households in Bangladesh. *Clim. Risk Manag.* **2017**, 52–63. [CrossRef]
14. Botzen, W.J.W.; Michel-Kerjan, E.; Kunreuther, H.; Moel, H.D.; Aerts, J.C.J.H. Political affiliation affects adaptation to climate risks: Evidence from New York City. *Clim. Chang.* **2016**, *138*, 1–8. [CrossRef]
15. Li, Y.; Johnson, E.J.; Zaval, L. Local warming: Daily temperature change influences belief in global warming. *Psychol. Sci.* **2011**, *22*, 454. [CrossRef] [PubMed]
16. Frondel, M.; Simora, M.; Sommer, S. Risk perception of climate change: Empirical evidence for Germany. *Ecol. Econ.* **2017**, *137*, 173–183. [CrossRef]
17. Roco, L.; Engler, A.; Bravo-Ureta, B.E.; Jara-Rojas, R. Farmers' perception of climate change in mediterranean Chile. *Reg. Environ. Chang.* **2014**, *15*, 1–13. [CrossRef]

18. Ding, Y.; Ren, G.; Shi, G.; Peng, G.; Zheng, X.; Zhai, P.; De' er, Z.; Zhao, Z.C.; Wang, S.; Wang, H.; et al. China's National Assessment Report on Climate Change (I): Climate change in China and the future trend. *Adv. Clim. Chang. Res.* **2007**, *3*, 1–5.
19. Qin, D.; Huang, J.; Luo, Y. Climate change in China and China's policies and actions for addressing climate change. *EDP Sci.* **2010**, *9*, 131–135. [CrossRef]
20. Piao, S.; Ciais, P.; Huang, Y.; Fang, J.Y. The impacts of climate change on water resources and agriculture in China. *Nature* **2010**, *467*, 43–51. [CrossRef]
21. Wang, J.X.; Mendelsohn, R.; Dinar, A.; Zhang, L.J. The impact of climate change on China's agriculture. *Agric. Econ.* **2010**, *40*, 323–337. [CrossRef]
22. Taylor, A.; Bruine, D.B.W.; Dessai, S. Climate change beliefs and perceptions of weather-related changes in the United Kingdom. *Risk Anal.* **2014**, *34*, 1995. [CrossRef] [PubMed]
23. Third National Assessment Committee on Climate Change. *The Third National Assessment Report on Climate Change*; Science Press: Beijing, China, 2015; ISBN 9787030454812.
24. Kvaløy, B.; Finseraas, H.; Listhaug, O. The publics' concern for global warming: A cross-national study of 47 countries. *J. Peace Res.* **2012**, *49*, 11–22. [CrossRef]
25. Lin, J.J.; Zhang, Q. Characteristics of Temperature and Precipitation Climate State Change in the South and the North of China and Its Influence of Climate Monitoring. *Progressus Inquisitiones De Mutatione Climatis* **2015**, *317*, 141–177. [CrossRef]
26. Hu, Y.J.; Zhu, Y.M.; Zhong, Z.; Zhang, H.J. Estimation of Precipitation in Two Climate Change Scenarios in China Using a Statistical Downscaling Approach. *Plateau Meteorol.* **2013**, *32*, 778–786. [CrossRef]
27. Song, C.L. *China Meteorological Disaster Yearbook 2010–2015*; China Meteorological Press: Beijing, China, 2011–2016.
28. Diffenbaugh, N.S.; Singh, D.; Mankin, J.S.; Horton, D.E.; Swain, D.L.; Touma, D.; Charland, A.; Liu, Y.; Haugen, M.; Tsiang, M.; et al. Quantifying the influence of global warming on unprecedented extreme climate events. *Proc. Natl. Acad. Sci. USA* **2017**, *114*, 4881–4886. [CrossRef] [PubMed]
29. Zampieri, M.; Ceglar, A.; Dentener, F.; Toreti, A. Wheat yield loss attributable to heat waves, drought and water excess at the global, national and subnational scales. *Environ. Res. Lett.* **2017**, *12*, 064008. [CrossRef]
30. Wu, J.D.; Fu, J.; Zhang, J.; Li, N. Meteorological Disaster Trend Analysis in China: 1949–2013. *J. Nat. Resour.* **2014**, *29*, 1520–1530. [CrossRef]
31. Li, D.H.; Zhou, L.W.; Zhou, T.J. Changes of extreme indices over China in response to 1.5 °C global warming projected by a regional climate model. *Adv. Earth Sci.* **2017**, *32*, 446–457. [CrossRef]
32. Shi, X. Research Progress in Public Perception and Adaption Behavior of Climate Change. *Bull. Soil Water Conserv.* **2016**, *36*, 258–264, 271. [CrossRef]
33. Chou, K.T. The public perception of climate change in Taiwan and its paradigm shift. *Energy Policy* **2013**, *61*, 1252–1260. [CrossRef]
34. Hong, D.Y. Coping with Climate Change: China's Efforts and Their Sociological Significance. *Sociol. Rev. China* **2017**, *5*, 3–11.
35. Stevenson, K.T.; Peterson, M.N.; Bondell, H.D.; Moore, S.E.; Carrier, S.J. Overcoming skepticism with education: Interacting influences of worldview and climate change knowledge on perceived climate change risk among adolescents. *Clim. Chang.* **2014**, *126*, 293–304. [CrossRef]
36. Ai, W.X.; Wang, C.K.; Lv, M.H.; Zhao, L. Gender differences in perceptions of climate change and meteorological disasters in China. *Clim. Chang. Res.* **2018**, *14*, 318–324. [CrossRef]
37. Hagen, B.; Middel, A.; Pijawka, D. European climate change perceptions: Public support for mitigation and adaptation policies. *Environ. Policy Gov.* **2016**, *26*, 170–183. [CrossRef]
38. Brechin, S.R.; Bhandari, M. Perceptions of climate change worldwide. *WIREs Clim. Chang.* **2011**, *2*, 871–885. [CrossRef]
39. Lee, T.M.; Markowitz, E.M.; Howe, P.D.; Ko, C.Y.; Leiserowitz, A.A. Predictors of public climate change awareness and risk perception around the world. *Nat. Clim. Chang.* **2015**, *5*, 1014–1020. [CrossRef]
40. Akompab, D.A.; Bi, P.; Williams, S.; Augoustinos, M. Heat Waves and Climate Change: Applying the Health Belief Model to Identify Predictors of Risk Perception and Adaptive Behaviours in Adelaide, Australia. *Int. J. Environ. Res. Public Health* **2013**, *10*, 2164–2184. [CrossRef]

41. Zhao, H.J.; Fan, Y.B.; Jia, G.; Business, S. Charitable Contribution, Enterprise Performance and Financing Constraints. *Econ. Probl.* **2016**, 73–78. [CrossRef]
42. Akerlof, K.; Maibach, E.W.; Fitzgerald, D.; Cedeno, A.Y.; Neuman, A. Do people "personally experience" global warming, and if so how, and does it matter? *Glob. Environ. Chang.* **2013**, *23*, 81–91. [CrossRef]