Climate change in the Chinese mind: An overview of public perceptions at macro and micro levels

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Abstract
This paper summarizes the current literature on public responses to climate change in China. The paper first provides a “macro view” by reviewing what we know about public climate change knowledge, risk perceptions, policy preferences, and behaviors based on large-scale survey research. The paper also examines what sociodemographic, psychological, and cultural variables – such as age, gender, rural/urban status, and income – can best predict public understanding and responses to climate change. Second, it provides a “micro view” by presenting findings from place-based and contextualized research projects in China. The review concludes by suggesting next steps to advance the understanding of public engagement with climate change in China.

This article is categorized under:
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KEYWORDS
China, climate actions, climate change, low-carbon transition, public perceptions

1 INTRODUCTION

As the world’s largest greenhouse gas emitter that accounts for roughly 30% of the global emissions, China has been playing a driving role in global climate governance. To reach consensus on an international agreement in Paris during the 2015 United Nations Climate Change Conference (COP 21), China made a lot of efforts together with France and the United States in pushing the international community to work out the historical Paris Agreement. In the Paris Agreement, China vows to peak its carbon emissions around 2030, and at the same time cut its carbon intensity by 60–65% from the 2005 level and increase the share of nonfossil energy sources to around 20% in its energy mix. Besides, China promised to enhance South–South climate cooperation and provide solid technology transfer and financial support to poor developing countries. Since the United States declared its intention to withdraw from the Paris Agreement, China has apparently become one of the most important players in the process of global climate governance. To ensure that its Nationally Determined Contributions (NDCs) can be timely reached, China’s central government has launched a coal-cap policy, setting strict limits on coal use, initially in the most polluted regions, then over much greater geographical areas, and eventually across the whole country. The amount of electric power generated from renewable...
sources has tripled. In particular, the wind and solar power capacity grew 25 times in China in the decade from 2008 to 2018. Currently, 30% of the country’s electricity comes from nonfossil fuels and the carbon intensity was cut by 45.8% between 2005 and 2018. Furthermore, the air quality has improved dramatically as the result of its synergy with climate change governance. The concentrations of fine particular matter (PM2.5) in the Beijing-Tianjin-Hebei region has been cut by 40% and carbon intensity by 15–28% from 2013 to 2017.1

However, China’s reputation regarding climate change was not always so promising. For example, a Guardian article published on December 22, 2009 accused China of “wrecking” the Copenhagen Deal.2 How did China transform from a follower to a “torch-bearer” between 2009 and 2015? (Chao, 2017)

Before and even in 2009, the Chinese central government did not place climate change on the priority list of its work. Correspondingly, few media covered this topic, leading to little influence on the general public. In 2009, the United Nation’s Fifteenth session of the Conference of the Parties (COP15) witnessed an explosive growth in the Chinese media coverage on climate issues because the conference was almost unanimously described as the last chance for human beings to save the earth. Though COP15 ended in failure, the attention to and debates around climate change percolated back in China, therewith the change of narratives. The central government realized that the country should shift its developmental model from the traditional, high-emission one to the more sustainable, low-emission one. Naturally, the central government started to emphasize the importance of addressing climate change with major policy initiatives, followed by a nation-wide, systematic low carbon transition plan and wide coverage by mainstream mass media (Wang, 2018).

In this paper, we systematically review how Chinese people understand and respond to climate change in various contexts. Though China arguably has different political contexts to countries that are typically surveyed for public opinions, we think the study has strong practical importance because the government tends to design and implement climate policies with references to public opinions. These opinions can be gathered and communicated in the form of internal reference reports (“Neican”), and/or seminars and conferences organized by the government, government-affiliated institutions and third parties. The importance and benefits of guaranteeing such bottom-up support has been highlighted in policymaking process in various occasions. For example, the 19th National Congress Report issued in 2017 required the government to adhere to the “people-oriented policy.”3 In the field of climate change, in particular, civil society organizations have been invited to have regular dialogues with the government since 2010. In addition, the State Council executive meeting on September 19, 2012 announced to set up a yearly National Low-Carbon Day, which marked the first national public campaign initiated by the central government in the aspect of climate issues. The annual campaign, facilitating extensive discussions, not only helps the public understand climate change and relevant policies, but also calls for actions by multistakeholders.4

Beyond the sheer size of China’s emissions, this topic is instructive for scholars and policymakers to better understand attitudes and actions towards climate change.

Our review draws mostly from peer-reviewed academic literature, but also includes the “gray literature” from Non Governmental Organizations (NGOs), think tanks, survey institutions and governments. The review has two parts. In the first half, we will focus on the large-scale surveys on the public opinions on environment and climate change and explain the corresponding background and context of China when these surveys were conducted. In the second half, we will look into surveys and studies that focus on particular regions or specific populations (e.g., government officials, college students, farmers). By bringing together the “macro” and the “micro” perspectives, we can obtain a comprehensive view on how Chinese people understand climate change.

2 | THE MACRO VIEW: EVIDENCE FROM LARGE-SCALE ENVIRONMENTAL PUBLIC OPINION SURVEYS

Since the late 1990s, many scholars and research institutions have used surveys to gauge public opinions on environmental issues, including climate change in China. The GlobeScan (Environics) International Environmental Monitor 1998 survey on public perceptions and engagement around climate change is one of the earliest polls of this kind conducted, in which respondents from 30 countries including China were asked whether they believed poor countries should act on human impacts on climate. Three quarters of the respondents in that survey thought poorer countries should be required to take significant actions either along with or after the richer countries, and only 5% otherwise.5 By 2007, while less than a half of the Chinese thought that global warming was a serious and pressing problem, more than 75% still believed the problem should be addressed, either immediately with significant costs or gradually “by taking steps that are low costs.” In this section, we
| Research institution | Title | Sample size (n) | Main questions | Research method |
|----------------------|-------|----------------|---------------|-----------------|
| Beijing Institute of Technology (Yu, Wang, Zhang, Wang, & Wei, 2013) | Public perception of climate change in China: Results from the questionnaire survey | 509 (21 provinces, 4 autonomous regions and 4 municipality cities, and 237 samples were collected in Beijing) | 1. Sensibility and concern about climate change 2. Perception of causes of climate change 3. Perceptions of the impact of climate change 4. Attitudes towards government credibility and policy influence in response to climate change. | Online investigation and field survey |
| China Center for Climate Change Communication (2012) | Public climate change awareness and climate change communication in China | 4,169 | Climate change beliefs, perception of climate change impacts, responding to climate change, support for environmental policies, climate change communication | Phone interview (Computer Assisted Telephone Interviewing System [CATI]) |
| China Center for Climate Change Communication (2017) | Climate change in the Chinese mind | 4,025 | Climate change beliefs, climate change impacts, responding to climate change, support for climate policies, enforcement of climate actions, climate change communication | Phone interview (CATI) |
| Schwirplies (2018) | Citizens’ acceptance of climate change adaptation and mitigation: A survey in China, Germany, and the U.S. | 1,430 | 1. The respondents’ general personal beliefs regarding climate change, 2. Adaptation and climate-friendly activities 3. Specific attitudes Towards international climate policy and negotiations 4. Their world view And values, 5. Socio-economic and socio-demographic in-Formation | Identical website-based surveys |
| Chen, Cheng, and Urpelainen (2016) | Support for renewable energy | 2,086 internet users | The perceptions of renewable energy among the Chinese public | Online survey |
| Jamelske, Boulter, Jang, Miller, and Han (2017) | Support for an international climate change treaty among American and Chinese adults | 2,047 | 1. Awareness and understanding of climate change. 2. Media exposure 3. Support for an international climate treaty | Random face-to-face surveys |
| GfK SE (Gesellschaft für Konsumforschung) (Schleich, Dütschke, Schwirplies, & Ziegler, 2014) | A public opinion survey on international climate policies in Germany, China and the US | 1,430 | 1. Personal assessments of climate change 2. Attitudes to international climate policies and negotiations 3. Individual engagement in climate-friendly behavior and CO2 offsetting. | Face-to-face interview in conducted in centrally located test studios |
| GlobalScan (1998) | Global poll | Respondents from 30 countries | How serious is climate change? | N/A |

(Continues)
| Research institution | Title | Sample size (n) | Main questions | Research method |
|----------------------|-------|----------------|----------------|----------------|
| GlobalScan/ Lightspeed (Climate Confidence Monitor, 2009) | 2009 global poll | 1,000 | Whether the country should play a leadership role in international COP conferences? | Internet-based survey |
| GlobalScan (Wealthy Countries Less Concerned about Climate Change: Global Poll, 2015) | 2015 21 country poll | 1,000 | 1. How serious is climate change? 2. Whether the country should play a leadership role in international COP conferences? | Telephone survey |
| Horizon Consulting (2009) | Public opinion survey on climate change | 3,785 | 1. Environmental issues that the public believes are most urgently needed to be addressed? 2. What is the Kyoto protocol and if China has joined it? 3. Willingness of actions to improve the environment and climate? 4. Who should take the leadership of climate actions? Government, nonprofit organizations, companies or individuals? | Household survey/face-to-face interview |
| HSBC, Lightspeed Research (2007) | HSBC Climate Confidence Index | 1,000 | 1. People’s concern, confidence, commitment and optimism about climate change 2. Do you have anything to add with regards to this topic? | Internet-based survey |
| HSBC Climate Partnership, Lightspeed Research (2008) | Climate confidence monitor | 1,000 | People’s concern, confidence, commitment and optimism about climate change | Internet-based survey |
| HSBC Climate Partnership, Lightspeed Research (2009) | Climate confidence monitor | 1,000 | People’s concern, confidence, commitment and optimism about climate change | Internet-based survey |
| HSBC Climate Partnership, Lightspeed Research (2010) | Climate confidence monitor | 1,000 | People’s concern, confidence, commitment and optimism about climate change | Internet-based survey |
| Winden, Jamelske and Tvinneime (2018) | A survey comparing citizen’s willingness to pay for climate change mitigation in China and the United States | N/A | A double-bounded dichotomous choice contingent valuation survey to estimate American and Chinese citizens’ willingness to pay (WTP) for climate change actions. | Online and intercept surveys |
| National Survey Research Center, Renmin University of China (Hong, & Fan, 2013) | Chinese general social survey | 3,716 | 1. Which are the top environmental problems in your country? (including climate change) 2. The cause of climate change 3. Implications of climate change to individuals and families 4. How serious is the global temperature rise caused by climate change? 5. The public’s actions on climate change. | Household survey, face-to-face interview |
review similar studies claiming to study the Chinese general public. As we will note later, these surveys rarely collected representative samples, thus one should be careful in interpreting their results. These surveys (see Table 1), nonetheless, offered us valuable insights to consider the public opinions in China as a whole, and a benchmark to compare China with other countries in this aspect.

We noticed that many general attitude surveys are part of larger cross-national projects. They are almost all conducted by multinational organizations such as GlobalScan, Pew Research Center, Gallup, BBC, and HSBC, especially in the years immediately before and after 2010. These general attitude surveys often focused on a variety of international issues. Questions pertaining to climate typically inquire about the awareness, seriousness, and perceived causes, and effects of climate change/global warming. On the other hand, in recent years, Chinese scholars and researchers have also developed and implemented several national public surveys on climate change. For instance, researchers from the Center for Energy and Environmental Policy Research and Beijing Institute of Technology (CEEP-BIT) conducted a small-scale random sampling survey, which collected 509 valid questionnaires from 21 provinces, 4 autonomous regions and 4 municipality cities in China (Yu et al., 2013). The China Center for Climate Change Communication (China4C) carried out nationally representative surveys in 2012 and 2012 (Wang, Shen, & Jin, 2017), respectively. In the following sections, we will summarize the main results from these large-scale survey projects.

### 2.1 Climate change beliefs and impacts

1. China has seen a relatively high awareness among the public of climate change in the last decade, and the majority of the public understand that the issue was human caused.

Climate change constitutes a complex phenomenon drawing upon multidisciplinary knowledge—science, economics, society, politics, and ethics—and therefore the awareness of climate change is also multifaceted. Basic climate knowledge can be divided into several general and sometimes overlapping categories: knowledge about how the climate system works; specific knowledge about the causes, consequences, and potential solutions to global warming;
contextual knowledge placing human-caused global warming in historical and geographic perspective; and practical knowledge that enables individual and collective actions (Leiserowitz, Smith, & Marlon, 2011). Two of the most used questions gauging the climate knowledge in public surveys and related analysis are “is climate change happening?” and “is it caused by human activities?”

When Gallup conducted its first comprehensive opinion survey on climate change globally during 2007–2008, about 62% of Chinese respondents said they “know something or great deal about climate change,” which was “falling roughly at about the world's average” (Pugliese & Ray, 2009). While the data from the 2012 Climate Asia Survey conducted by BBC Media Action showed that 78% of Chinese respondents thought climate change were happening (Copsey, Hoijtink, Shi, & Whitehead, 2013). Besides China, the survey covered the other six Asia countries. Regards the same question, the highest percentage was obtained by Myanmar (94%), while the awareness level in China was higher than that in Bangladesh (77%), India (58%), Indonesia (74%), Nepal (65%), Pakistan (38%), and Vietnam (74%). When China4C conducted its first national public survey on climate perception in 2012 (China4C, 2012), 93% of the all 4,169 respondents thought that climate change were happening. The latest China4C survey in 2017 showed that 94.4% of the 4,250 respondents thought climate change were happening.

In the China4C’s survey in 2012, half of the respondents (55%) knew that climate change were mostly caused by human activities. In the CEEP-BIT’s survey in 2013, 85% fairly or strongly agreed that it was human activities caused climate change. In 2017, over two thirds (66%) of them knew it was caused “mostly by human activities.”

The Chinese public's climate perceptions from 2007 to 2012 were generally of high accuracy, and the awareness level after 2009 has even been higher as shown by various surveys.

2. More Chinese seriously worry about climate change and one of the related findings is that many have experienced some negative climate impact personally.

Questions inquiring Chinese' perceptions of climate risks, such as the immediacy of climate change, the intensity of their concerns, personal tolls of climate change, the most concerned consequence of climate change, were also commonly covered in these surveys.

According to the Pew Research Center’s survey in the spring of 2015, the majority said climate change were a serious problem in all 40 surveyed nations, and “a global median of 54%” believed it was very serious. Regarding to the Chinese public, results from several surveys are generally consistent that they seemed to be well aware of the urgency and seriousness of climate change.

GlobalScan has tracked the public perceptions on the “seriousness of climate change” since 1998, which found that Americans’ sense of seriousness has “rebounded after steadily declining in the aftermath of the 2007–2008 financial crisis” and “the trend is mirrored” in China. Specifically, in the GlobalScan Global 2015 21 Country Poll, respondents were surveyed for questions including “How serious is the climate change or global warming, due to the greenhouse effect?” and “What, if anything, do you think is the major cause of these extreme weather patterns?.” This survey revealed that 77% of the Chinese respondents thought that climate change is at least “somewhat serious,” and 33% thought it was “very serious.” The 2012 China4C survey showed that 78% of the 4,169 respondents were either very or somewhat worried about climate change, and 69% said that people in China were already being harmed by climate change. The percentage of those who are either very or somewhat worried slightly increased to 79.8% in the China4C’s 2017 national survey, which polled 4,025 respondents residing in 332 prefecture-level administrative units. Respondents who believed that they had already experienced impacts of climate change also increased by 60–75%.

The 2017 survey also challenged the respondents by asking them “what is the first thing that comes to minds when hearing climate change.” The most frequently mentioned words included “hot (7.9%),” “haze (6.3%),” and “global warming (6.0%).” Though the answers to this open-ended question varied from person to person, many Chinese respondents tended to associate climate change with the warming environment or air pollution, while others seemed to be confused between climate and weather. However, 80% of those who responded to this question associated a “negative” connotation towards the word/phrase, further demonstrating that the Chinese public not only has high awareness, but also accurately understands that its impacts can be undesirable, which is in line with many people's daily experiences in connection with air pollution and extreme weather disasters in particular.

3. Climate change is one of the major concerns of the Chinese public.
Compared with other environmental and social problems, climate change does not seem to be the priority concern in the United States according to the surveys from Yale Program for Climate Change Communication (YPCCC). The situation was similar in China a few years ago. For example, the Chinese General Social Survey (CGSS) in 2010 showed that the Chinese public neither thought climate change was as significant as air, water or waste pollution, nor envisioned the former's implications to individuals and families were as severe as others', though 76.6% of respondents believed the rising temperature caused by climate change was at least somewhat harmful (Hong & Fan, 2013).

However, the Chinese became more concerned about climate change in recent years. In the Pew Research Center's Global Attitude Survey conducted in the spring of 2015, 3,649 Chinese respondents were asked whether they consider “global climate change” as a “major threat” to their country from a list of seven international headline topics, including “Global economic instability, ISIS, Iran's nuclear program, Cyber-attacks, Tension with Russia and Territorial disputes with China.” The majority of them said climate change was at least “a somewhat serious problem.” The 2017 China4C’s survey also revealed that over 70% of the Chinese respondents thought the central government should pay particular attention to eight key issues, including air pollution, water pollution, ecosystem protection, health care, climate change, education, economic development, and anti-terrorism. Specifically, on a scale of 1–4, four being the most concerned, the respondents on average regarded the issue of air pollution as being the most important (3.42), followed by water pollution (3.36), ecosystem protection (3.31), healthcare (3.28), and climate change (3.25). What is interesting is that Chinese respondents worried about climate change more than education, economic development and anti-terrorism.

### 2.2 Individual actions on climate change

Overall, both international and domestic public perception surveys often ask how Chinese respondents will subsequently act on climate change in two behavior categories: people's willingness to pay more for environmental and climate-friendly products and the potential adjustment of lifestyles.

1. The willingness of most of the Chinese public to pay more for climate-friendly products is clear.

   The high climate awareness somehow correlates with the Chinese public's willingness to bear costs associated with policy change and to change their lifestyle. About 68% of the Chinese respondents said they were willing to pay 1% of the country's Gross Domestic Product (GDP) on climate actions (The World Bank, 2010). The 2012 China4C national survey showed that 87% of the respondents were willing to pay more for energy-efficient and environment-friendly products, among which 17% were willing to pay over 30% more than the market price. In the China4C’s 2017 follow-up survey, 73.7% of the respondents were willing to pay more for climate-friendly products. The lower willingness level was generated possibly due to the questions' wording difference, as the awareness of "environmental problems" (2012) was arguably higher than "climate issues" (2017) and the definition of the latter is usually part of the former. A 2018 survey concluded that “Chinese adult's and college students' willingness to pay is over two times larger than that of their US counterparts” (Winden et al., 2018).

2. Most of the Chinese public have realized the importance to adapt to a less carbon intensive lifestyle, but the understanding level varies.

   According to the 2010 CGSS data, 55.5% of the Chinese respondents at least sometimes purposely sorted glass bottles, aluminum cans, plastics or newspapers for recycling, and 73.1% at least sometimes intentionally reduced the consumption of household energy and fuel, such as oil, gas and electricity for environmental protection (Hong & Fan, 2013). In the China4C's 2012 survey, it was found that the respondents implemented different countermeasures at a relatively high rate. 37.1% “always” turned off electronic products when not in use, and 50.5% “often” turned off lights when not in use. However, the frequency of waste classification was relatively low. 12.1% of the respondents “always” classified waste and only 21.8% “often” classified waste, together totaling only one third of the all respondents. The 2015 Pew Research Center survey showed that 58% of the Chinese respondents thought “lifestyle changes are necessary to reduce effects of climate change,” rather than solely relying on technology to “solve the problem.”

   One low carbon lifestyle measure, shared bike, has gained increasing popularity in China. For example, 46.7% of the respondents had used shared bikes and 92.6% supported “using it as a way of travel.” In terms of lifestyle adjustment, in the 2008 HSBC survey questioning whether “respondents already had changed their lifestyle in response to climate change,” China scores the highest (56%) among 12 countries and regions, Australia, Canada, France, Germany, the United Kingdom,
United States, Brazil, China, the Hong Kong SAR, India, Malaysia, and Mexico. In the last 3 years, the Chinese government encouraged households to install rooftop solar photovoltaic panels by allowing electricity generated from solar panels to be sold to the State Grid. It is a relatively new policy which may directly induce lifestyle change of the general public. According to China4C’s 2017 survey, 55.6% of the respondents said that they were aware of this policy already that the surplus electricity generated by solar PV can be sold to the State Grid after household/business consumption.

2.3 | Attitude to climate policies

1. The Chinese public strongly supports their government to take more responsibility on tackling climate change.

Many scholars have explored the Chinese’ support to their government aiming to address climate change. According to the 2009 World Bank Survey, around 60% of the respondents residing in developing countries felt their government should give climate change a higher priority and the vast majority of the citizens also held their own government was accountable for addressing climate change. Some other surveys indicated that a high percentage of Chinese respondents believed that China should act to address climate change despite also believing that “rich countries should do more.” Surveys further showed that 98% of the Chinese thought their country had “a responsibility to deal with climate change” (Kim & Wolinsky-Nahmias, 2014). In CEEP-BIT’s survey in 2013, 93% of the respondents agreed that in China, the government should play a leading role in response to climate change. In China4C’s 2017 surveys, among the government, environmental NGOs, enterprises/business organizations, the public and the media, respondents generally believed the government should shoulder relatively more responsibilities.

2. The Chinese public strongly supports domestic climate policies.

Regarding domestic policies, a 2016 online survey among 2,086 Chinese internet users showed that the public’s support was high for renewable energy, as roughly half the surveyed (51%) preferred alternative energy sources, such as wind, solar, hydrogen, as a way to fulfill the country’s future energy demand, while only 24% preferred fossil fuels (Chen et al., 2016). The preference for alternative energy sources is in line with that in other emerging economies, including Brazil, India, South Africa, and Russia (Chen et al., 2016). China4C’s 2017 public survey showed that around 90% of the respondents supported China’s climate mitigation and adaptation policies. Specifically, 86% either “supported” or “strongly supported” the country in establishing a national carbon emission trading market, and 98.5% supported increasing “the use of clean energy like solar power and wind power.” Other policies all enjoy almost unanimous public support, including promoting low-carbon lifestyles, improving energy efficiency, reducing coal consumption, and raising public awareness.

3. The Chinese public strongly supports the international climate cooperation.

Survey reports showed that the Chinese public also highly supported international cooperation on making adaptation and mitigation efforts (Stokes, Wike, & Carle, 2015; Jamelske, Boulter, Jang, Miller, & Han, 2017; Schwirplies, 2018). The GfK SE 2013 survey showed that 54% of the Chinese respondents perceived “previous international agreements to be rather successful or very successful in combating climate change.” The percentage was much higher than that in the United States (22%) or Germany (8%). Chinese respondents also tended to believe future international agreements are important and beneficial to all countries (Schleich, Dütschke, Schwirplies, & Ziegler, 2014). After the historic Paris Agreement was signed, the Chinese public seemed to have even greater faith in international climate agreements. According to the China4C's 2017 survey, 96.3% of the respondents either somewhat supported or strongly supported China’s participation in the Paris Agreement and 94% thought that China should stay in the Paris Agreement to honor the commitment even if the U.S. announced that it would withdraw from the Paris Agreement. 96.8% said they supported China’s effort to promote international cooperation in addressing climate change.

2.4 | Potential predictors that shape the Chinese public perceptions on climate change

Anthropology, sociology, cultural psychology, and behavior decision research in the past three decades often suggested the correlation between human perceptions and the power of individual, social and cultural forces (Weber, 2010).
Recent surveys have further sought to understand the reasons behind disparate public perceptions of climate change between these demographical and social–economical predictors. The results often differed from each other due to their different survey time, methodologies, variable selection, and therefore failed to prove universally applicable correlations in most cases. However, these surveys and analysis still revealed valuable information about how the Chinese public’s climate perceptions might vary due to age, gender, cultural values, education, income and rural/urban differences, and they set a starting point and stratified social groups for raising the acceptance of international climate policies.

- **Age and gender**

  Age and gender are usually believed to be strong predictors of the public’s climate perceptions. For example, a report analyzed data collected from an online survey conducted in 2013, which recruited 516 complete cases in China argued that age is a significant predictor of perceptions of environmental and climate risk to humans because people who were older were more likely to believe that risks to humans were higher than before (Wang, 2017). In contrast, Schwirplies’s research in the same year found that in China, age and gender had almost no significant impact on the support of national and international adaptation and mitigation measures. The analysis was drawn from a 2013 survey based on 1,430 respondents in China, who were recruited by employees of GfK China in 11 core regions and invited to participate in the survey in the centrally located test studios. The analysis, however, showed that older Chinese respondents were more likely to be climate change deniers (Schwirplies, 2018).

  Many studies include gender only as one of, rather than a primary controlled variable. A 2012 study based on the 2003 CGSS with the Environment Module took a deeper dive to model the interrelated effects of gender, employment status and parental roles with people’s environmental knowledge. The results revealed that “in urban China, men in general, regardless of their employment status or parental roles, tended to perceive various environmental issues as modestly more serious than women” (Xiao & Hong, 2012). A more recent article from the same authors, claimed that according to the data in the 2010 Chinese General Social Survey, “in contemporary China women generally are no longer less concerned about the environment than Chinese men, even though women’s lower environmental knowledge somewhat hinders their overall levels of environmental concern” (Xiao & Hong, 2017a, 2017b). Similar to the result commonly found in the west, if with equal environmental knowledge, “Chinese women are slightly more concerned” (Xiao & Hong, 2017a, 2017b). However, a latest analysis illustrated that men were more inclined to buy climate-friendly products than women (Wang & Gu, 2019).

  An analysis concluded that Chinese adults and students had similar likelihoods of acknowledging that climate change is happening. The two age groups’ concerns and belief that the environment is the most important issue facing society, and willingness to support and join international climate change agreements were all identical (Winden et al., 2018). The analysis referred to a series of online and random face-to-face surveys conducted in 2013, covering 2,294 adult participants split evenly between residents of Beijing, Chengdu, Guangzhou, and Xi’an and additional 2,404 students located in Guangzhou (37.8%), Beijing (17.5%), Xi’an (17.4%), Chengdu (17.4%), and Shanghai (11.5%). Neither of the two sample populations were randomly selected instead being arranged through researchers’ mutual contacts. Different from many other studies, these survey results showed that variables such as income, age, education and gender were strong predictors of climate change opinions (Carlsson et al., 2012; Duan, Lü, & Li, 2014; Li, Mu, Schiller, & Zheng, 2016; Yang, Zou, Lin, Wu, & Wang, 2014).

- **Cultural values**

  Culture values represent the implicitly or explicitly shared abstract ideas about what is good, right and desirable in a society (Williams, 1970), while worldview is the culturally structured set of assumptions underlying how people perceive and respond to reality (Kraft, 1999). Climate change and its impacts have become a reality to human society for long and undoubtedly, unique social motivation and cultural values can foster different perceptions on it.

  A 2016 study probing the impacts of cultural world views argued that “certain cultural worldviews are significantly associated with climate change risk perception, support for climate-friendly policies and climate change mitigation behavior” (Xue, Hine, Marks, Phillips, & Zhao, 2016). The study sample consisting of 515 Mandarin-speaking residents in Beijing, accurately represented the city’s gender ratio but overrepresented the population group with university education. The study indicated that “in China, with its long history of top-down regulation and one-party rule, beliefs about individualism and hierarchy appear to be less relevant to environmental risk perceptions. Many accept strict government controls as a given, and do not view environmental problems as a serious threat to the one-party system” (Xue...
et al., 2016). Similarly, a 2017 study concluded that “communitarian worldview (vs. individualistic)” was positively associated with perceived risks to humans, risks to environment, and stronger policy support (Wang, 2017). A smaller survey comparing U.S.-China college students’ motivations in sharing climate change information stated that “psychological collectivism” was a major incentive for Chinese students to spread the word (Yang, Kahlor, & Griffin, 2014).

Additionally, a study pointed out fatalistic beliefs deeply rooted in traditional Chinese culture might also shape people’s risk responses, as “If fatalists do not believe that they have much control over environmental threats like climate change, they may attempt to downplay the risk to manage their anxiety” (Xue et al., 2016). Other cultural worldviews, such as egalitarian (vs. hierarchical), a stronger future orientation, and more liberal political philosophy can also positively predict the public perceived climate change risks to humans and environment, and attract more support for climate policies (Wang, 2017).

- Education

A 2015 study showed that education level and beliefs about the cause of climate change were frequently the top-ranked predictors of climate change risk perceptions globally, and in China the top predictor was education (Lee, Markowitz, Howe, Ko, & Leiserowitz, 2015). This study, using the data from the 2007 and 2008 Gallup World Poll that surveyed 119 countries on the “relative influence of socio-demographic characteristics, geography, perceived well-being, and beliefs on public climate change awareness and risk perceptions at national scales.” The results showed that in China, “education has an independent additional effect on awareness,” as basic awareness of climate change increased with the rise in level of education, emblematic of the urban/rural difference (Pugliese & Ray, 2009). A 2013 analysis report, based on the 5,073 respondents from the 2003 CGSS data and its Environment Module, also confirmed that education is “a powerful predictor of environmental concern among the Chinese” (Xiao, Dunlap, & Hong, 2013). Chinese people with a higher education level is not only less likely to be climate deniers, but also seem to show more “acceptance of international mitigation measures” (Schwirplies, 2018).

However, the higher awareness of and concerns for climate change do not necessarily turn into greater willingness to pay for climate change mitigation. As the aforementioned survey showed, Chinese adults and college students had similar willingness after controlling for income and other variables, despite students appear “to be more environmentally conscious/concerned than previous generations” (Wind et al., 2018).

- Income

Unsurprisingly, income disparity plays a major role, particularly in determining whether the Chinese public are willing to pay for climate mitigation measures as mentioned in various survey and analysis reports (Carlsson et al., 2012; Duan & Hu, 2014; Kotchen, Boyle, & Leiserowitz, 2013; Li et al., 2016; Yang, Kahlor, & Griffin, 2014). The study on the willingness of Chinese adults and students showed the similar positive effect of income, but “modest in magnitude.” An additional CNY 1,000 of household income could raise the willingness to pay by approximately CNY 0.18 and CNY 0.24 for Chinese adults and students per month respectively (Wind et al., 2018). Higher income was also associated with a higher willingness to adapt to climate change (Schwirplies, 2018). Perception-wise individuals with high household income and exposed to more ecological degradation were more likely to have a pro-environmental attitude, according to a 2014 study also using the 2003 CGSS data and its environment module (Hao, 2014).

- Urban/rural

Many studies acknowledged the urban/rural difference in environmental and/or climate perceptions while trying to uncover the underlying reasons that cause such perception gaps. The 2012 China4C survey discovered that personal experiences in a specific region were likely to determine perceptions on climate change risks and policy support between urban and rural respondents.

However, an analysis based on the data collected from the 2010 CGSS argued that the difference in awareness of environmental issues between rural and urban residents might be caused more by varied information contents and channels, rather than distinctive occupations or personal experiences (Fan & Hong, 2015). Thus, “the methods of effective climate communication need be discussed in light of rural and urban residents’ belief and characteristics” (Li, 2015a, 2015b).
Limited education and a lack of access to environmental information in rural regions of China may explain why rural Chinese tend to focus on problems directly relevant to agricultural production and are less concerned about general environmental issues such as “pollution, nature conservation, and global environmental degradation” (Yu, 2014).

- Media use

Results from a recent consumer survey show that access to media contents related to climate and environment (e.g., news and other information) had a positive correlation to climate policy support, while personal experience contributed more to the awareness of risks to humans and the environment (Wang, 2017). A 2012 survey conducted by China4C showed a positive correlation between the number of channels from which respondents can get climate change information, and the level of self-reported climate awareness. Though traditional mass media, especially television, remains the predominant channel of climate change communication in China as shown in the center’s 2017 survey, the social media WeChat is the second major source now. This channel shift might lead to the change in the Chinese public’s most reliable information source on climate change from research institutions to the government over the past 5 years, as the latter has a greater traditional and social media presence.

In general, macroscale literature gauging the Chinese public perceptions on climate change sheds light on how the issue was understood in the Chinese minds, and what demographic, social–economic and cultural variables might affect their opinions. International survey agencies are pioneers in this field and domestic study groups have been catching up in recent years as well.

3 | THE MICRO VIEW: EVIDENCE FROM PLACE-BASED AND CONTEXTUALIZED STUDIES

In recent years, there is a growing number of studies that examined perceptions of climate change using the methodology of qualitative, small-sized surveys, and case studies. These in-depth studies often focus on a population, a place, or a media platform. Due to their specificity, they can often bring about contextualized understanding—one that difficult to obtain through large-scale surveys—on how people make sense of climate change in their social environments. In this section, we will review the key studies in four areas, that is, government officials, college students, peripheral China, and media, as well as a few studies that are difficult to categorize.

3.1 | Local government officials

There were two surveys which specifically aimed to examine the understanding of climate change among China’s provincial government officials. These officials, working in different provincial governments, have taken the responsibility for implementing policies on the ground. In China’s top-down political system, provincial-level officials are the vital middle actors to ensure the policies issued by the central government can be carried out locally.

The first paper surveyed 314 officials in the Centre for Disease Control and Prevention (CDC) in Shanxi province. About two-third of the respondents believed that climate change had happened at both global and local levels. While about 75% of the respondents correctly chose greenhouse gas effect as a reason for climate change, their knowledge was rather incomplete (Wei et al., 2014). The majority are willing to change their behaviors to protect the climate, yet there is a visible gap between their perceptions and actions.

The other paper focused more specifically on the perception and knowledge of climate change adaptation. The study surveyed 85 officials responsible for climate change adaptation planning in five provinces. The results showed that over 60% of the respondents indicated that warmer temperatures and drought were the most significant forms of impact from climate change (X. Liu & Mu, 2016). The results also indicated that over half the respondents had knowledge of climate change adaptation measures, but the extent of the understanding varied widely by regions and aspects. These decision-making officials expressed their interests in obtaining more knowledge regarding climate change, but the main barrier was a lack of training and learning materials.

The above two studies provided us a glimpse of how Chinese government officials at provincial level view on climate change—they are, to a certain extent, quite similar to the average citizens. Yet, these respondents are representative by no means for their size of a few hundreds. We thus need to interpret the results with caution.
3.2 | **College students**

College students are among the better studied groups in terms of understanding of climate change. Scholars tend to use a comparative framework to contrast students’ knowledge in the United States and China. Jamelske and his colleagues (Jamelske et al., 2017) conducted two waves of similar climate change opinion surveys to college students in 2011 and 2013. Both studies showed that, compared to their American counterparts, Chinese college students’ held views more similar to the scientific consensus than USA college students. A higher proportion of Chinese students thought climate change was happening and caused by human activities. They were also more personally concerned about the issue. The same research also found that male students were more proactive than females when responding to the message. Besides basic understanding of climate change, Jamelske et al. (2017) investigated the relevant information sharing behaviors among college students in the United States and China. The findings suggested that Chinese students were often driven by social motivation and information seeking activities, less by negative emotions or epistemic motivation.

3.3 | **Minority groups in China**

About 91% of the population in China belongs to the Han group, while the remaining 55 officially recognized minority groups only account for less than 10% of the population, who dominate in the vast areas in western China. In this regard, a number of studies used small-scale surveys to study perception on climate change in the non-Han Chinese communities in Tibet (Bai et al., 2013; Li, Tang, Luo, Di, & Zhang, 2013), Yunnan (Wang & Cao, 2015; Zheng & Byg, 2014), and Xinjiang (Deng, Qin, & Zhang, 2012). As these places are prone to experience the impacts of climate change, the respondents reported their seeing higher temperature (Wei et al., 2014) and increasing occurrence of hailstorm and drought (Jamelske et al., 2013), and extended growing seasons (J. C. E. Liu, 2015; Jamelske et al., 2015). The perception tended to agree with the objective climate records (Jamelske, et al., 2015; Haggard, Yao, & Cai, 2014). Some studies also documented that these communities had already taken steps—such as changing farming patterns or shifting to off-farm work—to adapt to the change they witnessed (T. Liu et al., 2016, Jamelske et al., 2015). This is generally consistent with one other study conducted in Han-majority rural areas in Anhui and Jiangsu.

Among the studies focusing on the minority groups in China, one is especially worthy of attention. The study showed that Tibetan villagers viewed climate change as a moral and spiritual issue (Byg & Salick, 2009). When their research was carried out in 2009, the villagers were not aware of the global climate change phenomenon. Instead, they interpreted the change through frameworks based on local cultural and religious beliefs. Some villagers viewed the changing climate as the signs of God’s anger to human misconduct, such as intrusion to sacred mountains; others worried that climate change harmed deities’ power to protect humans. Research such as this reminded us that the importance to treat climate change not only as a physical phenomenon, but also social, cultural, and even moral and spiritual. Despite of the global nature of climate change, people’s perceptions and responses must be understood in the local contexts.

Overall, there are still rare in-depth studies on public understanding of climate change in China. While there is some literature in the areas we covered, some studies already seem to be outdated due to the rapidly changing contemporary China. Many other areas—coastal areas, for example, or populations, such as farmers, teachers, and business communities, seem to be left out from these literatures. We also noticed that most studies were still based on smaller scale surveys. While surveys have multiple strength, we feel qualitative methods such as in-depth interviews and ethnography may help to interpret how climate change is felt, discussed, or even ignored in the Chinese society.

3.4 | **Conclusions and relative analysis**

1. As the various public surveys focusing on Chinese perceptions on climate change have shown, the respondents are in general highly aware of climate change along with its causes and implications on both macro and micro levels. Climate change has been the priority of the central government of China particularly starting from 2009, after COP15. As a result of lessons learned in Copenhagen that year and real demands of sustainable development domestically, the Chinese government has paid more attention to climate issues. For instance, the 12th Five Year Plan (2011–2015) of China encourages the development of energy saving products and the 13th Five Year Plan (2016–2020) highlights the importance of building an ecological civilization, which means a combined goal of environmental protection and addressing climate change nationwide. Afterwards, several rigid regulations were released
to regulate emission-intensive industries at different levels around China. During this process, the mass media also helped to communicate related policies and information about climate change to the general public. On the other hand, the Chinese public are experiencing extreme climate events more frequently in recent years, including drought, flood, and heatwave. Thus, we conclude that it is the increasing political priorities, greater media coverage and more frequent personal experiences of extreme weather disasters that jointly contributed to the higher awareness and more accurate understanding of the climate facts in China.

2. On the macro level, climate change constitute one of the major concerns of Chinese public, even prior to education, economic development and anti-terrorism. The year 2018 was the 40th anniversary of China’s Reform and Opening Up Policy. The policy has benefited the country in many aspects, such as a higher education level, stable economic development, and fewer terrorist attacks. However, severe environmental pollution was, at the same time, resulted from rapid development that solely valued GDP growth and heavily relied on fossil fuel. As the Chinese started to conscientiously reflect upon the unsustainable development model, the central government kept up by kicking off national campaigns to address environmental problems, particularly air pollution. The nationwide “Blue-Sky Protection Campaign” in 2018, for example, was initiated by Premier Keqiang Li pledging to “make the sky blue again.” Meanwhile, the government highlighted the synergetic value between emission mitigation and environmental protection domestically. In early 2018, the Department of Climate Change was transferred from the National Development and Reforming Committee to the Ministry of Ecology and Environment, indicating that the government is determined to deal with both environmental pollution and climate change challenges in a more coordinated manner.

3. Both international and domestic public perception surveys on the macro level showed that Chinese people had relatively high willingness to pay more for environmental and climate-friendly products and the adjustment potential of lifestyles is huge. People started to care about the real cost once they realized that addressing climate change is more than just a slogan but requires concrete actions with everyone’s participation. In the last 2 years, the Chinese public were blessed with more opportunities to change lifestyle and act on climate. For example, shared bikes became very popular in cities which encourage more low-carbon transportation utilization. Another example is that more people chose to install the rooftop solar photovoltaic system because the surplus electricity is allowed to be sold to the State Grid and residents can therefore earn some money, which is an effective financial incentive for people to adjust their lifestyle. If in future, the government and business sectors can work together to help the public better understand their carbon footprints and provide more options conducive to cutting emissions of their daily activities, we believe the public would be incentivized to do so.

4. On the macro level, the Chinese public in general strongly support their government to take more responsibility for tackling climate change. Majority of them strongly support domestic policies and international cooperation on various climate adaptation and mitigation measurements. The strong support from the public, in return, facilitated the government to show more leadership in the process of the global climate governance. In particular, after 2015, a bottom-up momentum has emerged among the nonstate actors, for example, private sector, NGOs, and the general public, who have been making efforts to transform the society to a low carbon future together with governments. For example, during the 2016 COP 22 in Marrakesh, a Chinese philanthropist pledged to donate USD 15 million to address climate change. It is the first private donation of this kind worldwide after the Paris Agreement entered into force. Several Chinese philanthropists quickly followed the suit and announced the launch of the Global Climate Change Action initiative during the Climate Action Summit in California in September 2018 to provide even more financial fund to support innovative climate actions.

5. Researchers have identified that age, gender, income, education, media use, personal experiences and sociodemographic characteristics are major drivers for the public in forming specific climate change perceptions. It is clear that social media is playing an increasingly important role to shape the climate change perceptions. There are various opinions about the predictability of these indicators and some results are blurred or even conflict with each other when we go deeper to the segmentation research. For instance, one said elder people supported climate policies, and while another survey found that the elder tended to be climate deniers. It is interesting to find that the methodologies of these surveys are often similar, while most of them did not adopt random sampling at the national scale but just covered a few of big cities, such as Beijing, Shanghai, Guangzhou, Wuhan and Chengdu. Another survey admitted that the survey relies on the researchers’ mutual contacts.

6. Last but not least, compared with the macro level survey, the micro-scale ones tended to test the climate change perceptions of small targeted groups. Their sampling size is much smaller than the macro-scaled surveys, but they usually get more useful and accurate findings.
3.5 Suggestions and implications for the future studies

From the reviews and analysis above, we can draw the conclusion that both Chinese government and the Chinese public agree that climate change is a priority, which may explain why China is actively becoming a global leader in this field. This final section will try to answer the question: how can we improve the future studies of public climate perceptions in China?

We must bear in mind that the methodologies utilized in many macrolevel public surveys in China are problematic, as they fail to construct representative samplings either by demographically skewing in favor of the urban population, or by nonrandom selection of respondents due to resource and capacity limits. These survey results and the data analysis findings based on them need to be treated with great caution. For example, in the Pew 2006 Survey, the 2,180 probability samples were disproportionately taken in six cities and surrounding rural areas. A decade later, though the Pew 2015 study expanded to 77 Primary Sampling Units of districts, county-level cities and counties in China, the survey data collected from 3,649 interviewees was still disproportionately urban and therefore required weighting to reflect the actual urban/rural distribution in China. On the other hand, due to limited capacity and resources, many domestic surveys relied on the outdated China General Society Survey Data for national scale public perception analysis, which focused more on general environmental issues instead of climate change specifically. Other methodological problems, such as purely relying on the internet-based surveys and convenient sampling approaches, made the results more representative of urban “mass affluent” in China, particularly in years before 2010 when the percentage of internet users was less than 35% of the population.

To date, the methodology of China4C’s survey, advised by YPCCC, is more scientific because it better represents the public perceptions on a national scale. Considering the high popularity rate of fixed-line and mobile phones in Mainland China, the survey was a computer-aided phone survey (CATI). Specifically, samples were drawn from 15.4% of the fixed-line phones and 84.6% of the mobile phones. The sampling plan is that in light of the 332 prefecture-level administrative units (including 291 prefecture-level cities, 8 regions, 30 autonomous prefectures, and 3 leagues) and 4 municipalities directly under the central government in China, the total population was divided into 336 levels. The sample numbers were assigned to such levels in proportion to population, contributing to proportional sampling. Besides, the proportions of age groups, gender groups, residencies (rural or urban areas), and the ownership of landline and mobile phones are considered to guarantee the samples to be representative. Concretely, the phone numbers of residents were drawn at random by the tail number, and the sampling of landline telephone respondents was supplemented by random selection as well. In total, the number of samples was 4,025 respondents and the confidence level 95% (the margin of error of ±2%).

The perception of climate change is the foundation for making related policies to address climate change and mobilize the whole society to participate in related actions. Hence, the public perception surveys should be conducted regularly at different scale in China. Considering the logistical and other difficulties, it is challenging for international organizations to conduct such nation-wide surveys in China directly. International organizations may either focus on microscale surveys targeting specific groups or cooperate with local organizations for constructing and implementing nationally representative surveys.

The cooperation between China4C and YPCCC is a good example. YPCCC provided sampling and survey methodology to China4C and China4C, as the local think tank in China, implemented the survey at the country level. Afterwards, the two organizations worked together on the U.S.-China comparative research and co-hosted side events at COP18 in Doha, 2012 and COP23 in Bonn, 2017 to release the key findings. The data and findings were quoted by UNFCCC and therefore reached a broader range of international audience.

In future, if scientifically designed surveys on both macro and micro levels in this field can be carried out on a regular basis, researchers will be able to track how Chinese climate change opinions evolve overtime more accurately. While macroscale public surveys provide much valuable insight, their questions are often too broad and findings highly generic. Thus, more in-depth qualitative studies on focus groups are necessary to help researchers better understand how the issue is perceived and how perceptions can evolve over time in China.

Different strategies fit different contexts and purposes at the macro level. For instance, YPCCC conducted national surveys four times a year to test the voters’ perception of climate change. The findings were different each time and correlated to the domestic political situations. The China4C used to conduct a macro-scale survey every 5 years in line with the national 5-year planning because the perceptions of climate reality, causes, experiences and policies in China are heavily influenced by the national plan, and the data gathered from the surveys can advise the government on the implementation of the plan.
On the micro level, China needs more in-depth subdivided surveys to learn the perceptions of selected groups of audience. For example, at the city level, the characteristics of the economic development, culture background, and history, and so on. Cities are greatly different in the east, west, middle, north, south and northeast areas of China. Moreover, there are around 40% of Chinese population live in the rural area, but those groups used to be neglected by most of the surveys conducted by international organizations. It is difficult for international organizations to reach these areas, creating opportunities for local researchers. Considering the rapid development of the Chinese society, more regular microscale surveys are necessary to reflect the latest development of climate change perceptions in the Chinese minds.

Last but not least, public perception surveys are one of the strategic approaches for addressing climate change. When designing a survey, researchers need to have a clear understanding of the purpose and the potential role the survey may play in national and global climate policy making and governance. Combating global climate change requires the public to take practical actions. It has become a top priority to mobilize public participation in tackling climate change. To sustain this momentum, further research to bridge the gap between growing public awareness of climate change in China and people’s participation in climate actions will assist the country’s efforts to honor its commitments under the Paris Agreement and facilitate its transition to a more sustainable future. However, a common challenge for all countries, including China, is how to mobilize public participation, especially to increase the willingness to pay for the climate-friendly products. From the perspective of the public as a consumer, changing the consumption pattern can directly contribute to the realization of the 2°C target laid out by the Paris Agreement. Thus, how to proactively and effectively change public consumption patterns, especially their attitude towards buying climate-friendly products, requires further study.

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