Perceptions About Climate Change in the Brazilian Civil Defense Sector

Victor Marchezini1,2,3 · Luciana Resende Londe1,3 · Eloisa Beling Loose4 · Silvia Midori Saito1,5 · José A. Marengo1,3

Accepted: 12 September 2022 / Published online: 27 September 2022 © The Author(s) 2022, corrected publication 2022

Abstract Few studies have analyzed climate change perceptions in the disaster risk management sector. This research aimed to understand how civil defense experts are dealing with the climate change topic: what they learn and think about. An online survey was conducted between October and December 2021 with 1,063 participants from civil defense agencies in Brazil. The findings indicate: (1) most (80.6%) civil defense officers completely agreed that climate change will cause additional challenges to disaster risk management, while 10.1% stated that they are prepared to deal with it; (2) one quarter of the respondents (26.3%) completely agreed that they easily understand the information about climate change, but trust in the sources of information is a challenge—52.4% completely agreed and 40.5% partially agreed with information provided by scientists, but the levels of trust were reduced when referring to governments and press; and (3) about 30% of the respondents thought that civil defense work is associated with the Sustainable Development Goals (SDGs), despite SDGs 11 and 13 being related to disasters and climate change. The identification of civil defense’ perceptions on climate change is an important step in seeking pathways for increasing capacity building to achieve disaster risk reduction and climate change adaptation.

Keywords Brazil · Capacity building · Disaster risk management · Emergency management · Risk governance · Risk perception

1 Introduction

Social sciences are essential to understanding how people and societies perceive, comprehend, produce, and cope with environmental changes. However, this field of science has had a marginal role in carrying out research on climate change and in influencing climate change adaptation policy agenda (Victor 2015; Koehrsen et al. 2020; O’Reilly et al. 2020; Acselrad 2022), as is exemplified by recent literature reviews (Billi et al. 2019; Salmi and Fleury 2022; Zhong et al. 2022).

Social sciences refer to different fields of knowledge, such as history, cultural studies, political science, sociology, anthropology, and so on. Sociologists have used different approaches to study climate change, such as the sociology of loss (Elliott 2018), the drivers of climate change at macro-, meso-, and micro-scale levels and the implications for social justice (Dietz et al. 2020), environmental sociology (Lockie 2022), and sociology of social problems (Acselrad 2022). They have also been involved in multi- and interdisciplinary research through three main approaches: (1) coupled human-natural systems, such as sustainability science; (2)
individual-level analysis; and (3) post-political framing of climate change (Weaver et al. 2014; Brulle and Dunlap 2015).

The coupled human-natural systems (CHANS) approaches study the characteristics of interactions between nature and society. Neither CHANS in general nor sustainability science in particular have questioned the power imbalances between natural and social sciences to define the research questions, as well as systems theory’s centrality in framing societies as consensual and adaptive.

Individual-level analysis focuses on how individuals think and feel about climate change, the potential psychosocial impacts of climate change on their lives, their consumption behaviors, and the drivers that influence their perceptions and reactions to climate change. This approach usually neglects societal and cultural perspectives, as well as institutional aspects, by ignoring that “people’s perceptions and knowledge systems are framed by cultural contexts with which they ascribe meaning and value to what they see and know” (Roncoli et al. 2009, p. 96).

Another main contemporary approach is called post-political critique, and also applies to individual-level analysis and both CHANS and sustainability approaches (Brulle and Dunlap 2015). These approaches shed light on the role of a collection of anonymous individuals producing greenhouse gas (GHG) emissions, without questioning the role of power imbalances and conflicts, and the inequalities of access to resources. It is called post-political critique because it depoliticized the social-political-economic status quo (Swyngedouw 2011), neglecting the fact that climate change affects nations and people very differently, placing the most vulnerable people at a cumulative disadvantage. It also ignores the debate about intersectionality, in which multiple discriminations as a result of gender identity, age, race, ethnicity, sexual orientation, and so on can lead to additional exposure to climate change risks and impacts (Dietz et al. 2020).

One approach to develop interdisciplinary social research—such as conducted by the research team of this article—consists of characterizing the perception of social groups about a specific theme. The basis of the discussion of risk perception is the fact that risk is a socially constructed concept (Sun and Faas 2018). Although risk is related to hazard and vulnerability, risk estimation is always a value-dependent social process: “these inherent social values determine which risks are selected for assessment and which metrics are selected to measure them” (Etkin and Ho 2007, p. 627). Risk perception refers to the subjective assessment of the degree of potential threat of a given event by non-specialist groups, based on experiences, representations, beliefs, and values (Pidgeon et al. 1992; Lima 1995). It involves a complex and combined set of factors, such as degree of exposure, knowledge, socioeconomic status, ideological, political, and religious views, among others (Slovic 1987; Renn and Rohrmann 2000; Covello and Sandman 2011).

Research on climate risk perception has helped to understand how individuals, groups, or countries, for example, assess risks, enabling effective communication strategies to promote a better response to risk. Slovic (1987) claimed that such studies have several implications related to educating people about risk and, consequently, collaborate in its management. Most studies on perception of climate change have been carried out in developed countries, but there is a lack of knowledge about climate change perception in developing countries (Capstick et al. 2015; Lee et al. 2015). In Brazil, this type of study, focused on climate risk, is scarce (Pedrini et al. 2016).

There are some efforts already focused on themes, delimited geographic spaces, or specific groups, such as the case of what Brazilian leaders think about climate change (ISER 2008), how family farmers perceive climate variability (Eiró and Lindoso 2014), the risk perception of actors involved in the climate change news circuit, such as journalists, sources of information, and readers (Loose 2020), and climate change perception of high and elementary school teachers (Marchezini and Londe 2020). In 2021, 2,600 civil society participants in all Brazilian states and the Federal District responded to a survey on perceptions of climate change (ITS 2021). This survey revealed that 92% of respondents recognize that global warming is happening and 77% blame humanity for this process. The analysis identified lower income (compared to rich people) and politically left-wing individuals as more sensitive to the issue. The second edition of this survey (ITS 2022) states that Brazilians continue to consider global warming important and to be concerned about the issue, but only 25% consider that they know enough about this subject.

Civil society’s perceptions about climate change are important to guide public policies, but usually the perceptions of public officers are not considered in those studies (Márquez 2015; Terorotua et al. 2020), despite their views being a key to identifying pathways of implementing public policies, such as those related to disaster risk management (DRM), which includes climate change adaptation (CCA) (Kelman 2015; Kelman et al. 2020). There are also few studies focused on the civil defense sector (Valencio 2009; Alexander 2015; Londe et al. 2015; Bonelli et al. 2022), and we did not find any previous work addressing the civil defense profession’s perception about climate change in Brazil.

This study aimed to understand how civil defense experts are dealing with the topic of climate change: what they have learned and think about it. Civil defense experts are assigned to carry out DRM activities, which requires knowledge about climate-related hazards (heavy rains, floods, droughts, and so on), as well as vulnerabilities, capacities, and risk mitigation measures (Wisner et al. 2012). This type of social research is important for developing countries such as Brazil, where the social research on climate change is emergent (Fleury et al. 2019; Taddei 2020; Lahsen and Ribot 2021; Salmi and Fleury 2022).
The article is structured as follows: Sect. 2 describes the methods employed; Sect. 3 assesses the main findings related to the case study in Brazil. Subsequently, we highlight some recommendations for policy making in climate change adaptation.

2 Methods

Between 2013 and 2020, Brazil had 211 million people affected in disasters in 4,912 (86%) of 5,570 municipalities (Brazil 2021). The country experienced recent and diversified disasters from landslides in Recife (2022), flash floods in Petrópolis (2022), oil spills along the northeastern coast (2019), dam bursts in Mariana (2015) and Brumadinho (2019), drought and wildfire episodes throughout the states, and many other events with impacts to both society and environment. Climate change is among the hazard drivers associated with disasters, either directly or indirectly. For instance, changes in rainfall patterns may worsen landslides, floods, and flash floods (Debortoli et al. 2017); droughts and wildfires may be seriously aggravated by changes both in temperature and in rainfall (Marengo et al. 2021).

The Ministry of Environmental Affairs published in 2015 an updated version of the National Adaptation Plan to Climate Change, proposing a number of measures in several sectors, including the civil defense and protection area (Brazil 2015). Interestingly, the National Adaptation Plan mentioned four times the need for studies focusing on “risk perception,” which was usually associated with those “communities at risk,” but not with the public services sector administrators, such as those from civil defense and protection agencies.

Brazil’s civil defense system was created in the Second World War, based on a command-and-control approach. The National Civil Defense System (SINPDEC) is structured in three main levels—federal, state, and municipal—supported by the National Secretariat for Civil Defense and Protection (SEDEC), under the Regional Development Ministry, as follows:

- Municipal civil defense and protection bodies and their respective regional bodies responsible for the articulation, coordination, and execution of the SINPDEC at the municipal level;
- Sectoral bodies from the three levels of government covering the bodies involved in civil defense and protection actions, such as the public health system, social protection system, Armed Forces, and so on.

This study focused on perceptions of officers working at state and municipal civil defense and protection bodies. According to the Brazilian Institute of Geography and Statistics (IBGE 2021), 4,236 (76%) of 5,570 cities have civil defense units. It is not possible to have statistics about the number of civil defense officers because they are not included in the Brazilian Occupational Classification (CBO) system (Bonelli et al. 2022).

The SEDEC authorized our survey proposal, after considering its academic goals and ethical and logistical procedures. The online survey was planned by all the authors—two sociologists, one geographer, one journalist, and one climatologist—and a test was conducted with civil defense volunteers. The final version of the online survey was created on the Survey Monkey platform, and a link and a QR code were generated to facilitate dissemination by institutional emails, profiles of civil defense at Instagram, and WhatsApp groups of civil defense personnel.

The survey was distributed in October 2021 to the 26 state civil defense units. The SEDEC and the National Center for Monitoring and Early Warning of Natural Disasters (Cemaden) also gave their support to the spread of the invitations for participation in the survey. Authors sent an official letter inviting civil defense officers to respond to the survey and to forward it to their coworkers at state and municipal civil defense units. In the letters it was explained that all answers would be anonymously registered and that participants should agree to have their data anonymously published. In the online form for the survey, all the explanations and instructions were reinforced, assuring the participants the possibility to quit at any time. The survey had 1,063 participants across the five regions of Brazil.

The original questionnaire was written and applied in Brazilian Portuguese, which is the language spoken by the participants. The authors translated it to English for publication, to assure the exact translation of scientific jargon and the best semantic adjustments. The survey had 25 questions, which were related to two main dimensions: (1) What do civil defense experts learn/know about climate change? and (2) What do they think about climate change? The multiple-choice questions used a 5-point Likert scale from strongly agree to strongly disagree. Some questions allowed participants to select one or several options from a list. A free text-field was available. This allowed respondents to include.
complementary information related to their answer. The average time to complete the questionnaire was 9 minutes and 20 seconds, according to the Survey Monkey estimate. The data collected were analyzed with descriptive statistics by the research team considering three main issues: (1) perceptions about climate change; (2) sources of information and levels of trust in relation to these sources; and (3) perceptions about the roles and responsibilities of civil defense to cope with disaster risks, climate change, and sustainable development goals. The research team also analyzed the data according to gender, age, and levels of education in order to identify possible correlations.

3 Results

This section discusses the main findings according to three main topics: (1) perceptions about climate change; (2) sources of information and trust; and (3) civil protection in an era of climate change.

3.1 Perceptions about Climate Change

Perceptions about the social world, and its problems, challenges, and situations, may be the basis to define issues that will be prioritized in the public policy agenda setting, either in the short or long term. Most of the civil defense officers who participated in the survey (77.6%) totally agreed that climate change is happening, while 17.8% partially agreed. This finding was similar to other studies conducted with the general public: respondents in Costa Rica (94%), Brazil, and Spain (both 92%) were the most likely to think that climate change is happening, while people in Indonesia (78%), Egypt, and Saudi Arabia (both 79%) were the least likely (Leiserowitz et al. 2021).

Among the participants, 69.7% identified themselves as men, 29.7% as women, 0.5% as LGBTQIA, and 0.1% preferred not to inform. Most participants were aged between 41 and 60 years old (52.1%), 40.2% aged between 20 and 40, and 7.7% above 60 years old. When considering the gender dimensions in the civil defense sector, very high percentage of females (84.2%) and LGBTQIA1 (100%) strongly agreed that “climate change is happening.” This response is higher than in the male group (74.6%), confirming previous studies that showed similar findings when analyzing civil society participants (Finucane et al. 2000; ITS 2022). This pattern based on gender was also observed among those who strongly agreed with the statement “I am concerned about how climate change is already intensifying extreme events, which triggers disasters where I work” (Table 1). However, there are interesting differences in the findings of these two questions. The percentages of those who strongly agreed that “climate change is happening” is on average 18.6% higher than those who were “concerned about how climate change is already intensifying extreme events” (Table 1), and the percentage differences between the two questions are higher in the LGBTQIA (20%) and female (19.7%) groups (Table 1). The percentages of those groups who “strongly disagree” and “partially disagree” are similar (Table 1), while those who have “no opinion” more than doubled from the first question to the later. It is important to emphasize that this survey was applied to the civil defense sector, which is responsible for managing disaster risks and emergencies, and to monitor hazards and weather-related extreme events. The formal education levels of respondents were a variable that influenced the research findings about climate change.

| Table 1 | Perceptions about climate change and extreme events according to the gender of civil defense officers |
|---------|------------------------------------------------------------------------------------------------------------------|
| | In which extension do you agree with the statement “climate change is happening”? | In which extension do you agree with the statement “I am concerned about how climate change is already intensifying extreme events, which trigger disasters where I work”? |
|          | Female (%) | Male (%) | LGBTQIA (%) | Female (%) | Male (%) | LGBTQIA (%) |
|-------------------|-----------|---------|-------------|-----------|---------|-------------|
| Strongly agree     | 84.3      | 74.6    | 100        | 64.6      | 58.4    | 80          |
| Partially agree    | 11.7      | 20.8    | 0          | 27.8      | 33.2    | 0           |
| Partially disagree | 1.3       | 2.0     | 0          | 1.9       | 2.4     | 0           |
| Strongly disagree  | 0.6       | 1.9     | 0          | 0.6       | 1.1     | 0           |
| No opinion         | 2.2       | 1.5     | 0          | 5.1       | 4.9     | 20          |
| Total              | 100       | 100     | 100        | 100       | 100     | 100         |

LGBTQIA, lesbian, gay, bisexual, transgender, queer/questioning (one’s sexual or gender identity), intersex, and asexual/aromantic/agender

---

1 Lesbian, gay, bisexual, transgender, queer/questioning (one’s sexual or gender identity), intersex, and asexual/aromantic/agender (Merriam-Webster 2022).
change perception, as reported by some other studies. For instance, a survey with 2,600 civil society participants in Brazil (ITS 2022) indicates that those with a graduate degree have more knowledge about climate change than those with a high school degree.

In our survey with the civil defense sector, an expressive group of respondents (36.3%) hold a graduate degree, while 31.4% hold a postgraduate degree. A significant portion of the interviewees (28.7%) completed the high school stage, while 3.6% achieved only the elementary school stage of formal education.

More than a half (62.4%) of the interviewees thought that climate change is triggered by a combination of human and natural factors, while 34.8% considered that it is completely anthropogenic. A small proportion believed that climate change is exclusively a natural phenomenon (1.1%), others (1.2%) stressed that the causes are unknown, while 0.5% stated that “I don’t believe that climate change is happening.” When asked about human influence, 75.3% completely agreed with the affirmation “Human influence has been contributing to change the planet’s climate with uneven intensity in the last 100 years.”

Regarding the question “Do you believe you can do something to reduce climate change?”, a small proportion of the respondents (8.8%) replied “no,” a larger group (28.7%) stated they “don’t know,” while 62.5% chose “yes.” The participants considered that their main contribution to the reduction of climate change effects is working on awareness campaigns directed toward the general population. The words “information” and “seminars” were quoted very often by the respondents in the open text field of the form. They also mentioned that “education” is essential for the protection of the environment as well as the adoption of sustainable behaviors by society. The respondents emphasized that tackling climate change is a collective task and everyone plays a major role as a citizen. This perception of municipal civil defense officers contradicts the priority of the National Secretariat for Civil Defense, since its budget has been allocated for disaster relief and response, and less than 5% of its funding was invested in disaster prevention (Brazil 2021). The National Survey on Municipal Civil Defense (Brazil 2021) also identified that 78% of 1,993 municipal civil defense respondents did not have the budget to carry out DRM tasks.

3.2 Sources of Information and Trust

People can have unequal access to information, depending on factors such as income, gender, age, race, ethnicity, type of impairment, and so on. They can also obtain information from different sources, such as social media (Facebook, Instagram, Twitter, TikTok), media vehicles (television, newspaper, radio), WhatsApp groups, and in-person meetings, among others. In our survey, the participants had to identify the main channel through which they receive information about climate change. The results show a diversification of sources of information, some of them formal (media vehicles) and others informal (social media and WhatsApp groups). Media vehicles were the main source of information for 37.2%, followed by social media (23.9%), WhatsApp groups (17.9%), lectures and workshops (13.7%), and other sources (7.8%). Our findings are different in relation to other studies. For instance, the 2022 survey program jointly sponsored by the ITS (Instituto de Tecnologia & Sociedade do Rio), the Yale Program on Climate Change Communication, and the IBOPE (Brazilian Institute of Public Opinion and Statistics) was undertaken with civil society participants whose responses indicated that media vehicles are less accessed than websites, WhatsApp groups, and social media. The vast majority (87%) of the respondents stated that they keep up to date based on conversations with their relatives, friends, and coworkers. These findings show us the importance of thinking about climate change communication initiatives using both formal and informal channels, including the public sectors that cope with weather-related extreme events, such as civil defense.

Most of the research participants (51.7%) partially agreed that the climate change information they received is sufficient for the civil protection actions that were part of their responsibilities, while 25.9% stated that such information is not enough. Interestingly, the participants stated that they are able to understand most of the information disseminated: 26.3% completely agreed with the affirmation “I easily understand the climate change information received,” while 55.6% partially agreed.

Another aspect that stands out from data is the degree of reliability of different actors. It is a consensus that climate change is happening (77.6% agreed on that), but who provides the information makes a real difference. The respondents place trust first in the scientists (40.5% partially and 52.4% totally), then in the government (53.3% partially and 21.4% totally), and last in the press (65.5% partially and 14.6% totally)—this trend was also identified when analyzing data by age groups. Scientists are the only category in which more than a half of the respondents completely trust. These findings confirm other studies about public trust in news and media. In 2021, the Reuters Institute and University of Oxford (Toff et al. 2021) carried out a study in Brazil, the United States, the United Kingdom, and India on public trust in news and media. The results showed that, of all the countries surveyed, Brazil has one of the highest levels of distrust in relation to the press. The context of intense disinformation and attacks
against journalists contribute to this result according to Toff and his colleagues (2021).

### 3.3 Civil Protection in the Era of Climate Change

Usually, people performing duties as civil defense officers can be hired in different ways: municipal public tests based on merit (57%), political preference of mayors (37%), or other reasons (6%) (Brazil 2021). The survey participants had unequal years of experience in civil defense and protection: 54.4% had up to four years of experience, while 27% had less than one year, a further 12.3% had only between one and two years, and 15.1% had more than two but less than four years. At the other extreme, 31.7% had between four and 12 years of experience, whereas 13.9% had more than 12 years.

The participants agreed (80.6% totally and 16.8% partially) that climate change will trigger additional challenges to DRM, demanding new strategies to act on civil protection and defense issues. When questioned whether the civil defense sector is prepared to cope with more disasters intensified by climate change, most respondents (49.2%) partially agreed that the sector is prepared, while 10.1% considered they are prepared. The percentage of those who disagreed comprised 32.2% (partially = 20.1%; totally = 12.1%), while those who had no opinion—neither agreed nor disagreed—represented 8.6%. Although 60.2% had not received capacity building training in climate change topics, a similar proportion of the respondents (59.3%) believed that they are totally or partially prepared to cope with extreme events. A significant portion of the respondents (60.7% of participants with more than two years of experience on this issue) believed that experience in civil protection will be sufficient to cope with disasters intensified by climate change.

We were also interested in knowing what topics the participants considered important enough to increase their capacity building on climate change issues. The respondents could choose several options for this question. The participants claimed that more information was needed related to mitigation and climate change adaptation (CCA) strategies (74.6%), basic notions about meteorology (68.1%), workshops about perceptions on extreme events risks (67%), social and environmental vulnerability analysis (61.3%), interpretation of technical information and weather forecasting (61%), and DRM for coastal areas (34.2%). Other suggestions, which attracted limited support among participants (8%), included specific adaptation measures according to the biomes and multiple hazards encountered locally, especially fires and droughts; risk communication and educational strategies for citizens; communication between governmental agencies in different government levels, and exchange of information through the same monitoring platforms; basic notions about hydrology and watershed modeling; detailed climate change impacts for regional and municipal scales where civil protection actions happened; exchange of knowledge between municipalities that have implemented mitigation and CCA measures; improving knowledge about environmental law; increasing accessibility to technologies and software that can support DRM actions; information about financial mechanisms for mitigation and CCA; and nature-based solutions to reduce disaster risks.

For the 59.3% of the respondents who believed that they are totally or partially prepared to cope with extreme events, the survey asked them to identify what the civil defense bodies could do to respond to climate change. The participants could select more than one option and suggest others. Most respondents thought that they can mobilize policymakers to consider: climate change in urban planning (75.2%); contributing to awareness campaigns to disseminate information about climate change (72.1%); promoting capacity building activities with communities to improve their adaptation measures to climate change impacts (70%); and sharing initiatives to mitigate impacts through nature-based solutions (64.2%). A small proportion of the participants (2.8%) indicated that responses to climate change are not included in the mission of civil protection, while others (1.3%) did not know what to do. The participants also proposed to include civil defense on environmental agendas at the national and international levels, to articulate educational, social protection, and health sectors with a climate change agenda to face the future impacts on society, and increase the partnerships with NGOs and universities working on these issues. The respondents stated the need to strengthen both institutional capacities and human and financial resources to assist mitigation and CCA actions.

Two research questions were related to other global agendas, such as the Sustainable Development Goals (SDG), the Sendai Framework for Disaster Risk Reduction (SFDRR), the Paris Agreement, the New Urban Agenda Habitat III, and the Resilient Cities Campaign. When asked about which agenda(s) are related to climate change, the Resilient Cities campaign was cited by 58% of respondents, followed by the Sustainable Development Goals (SDGs) (47.6%), the Paris Agreement (42.5%), the SFDRR (42%), and the New Urban Agenda (20.4%). However, 21.9% replied that they did not know about this debate, which reinforces the need to promote information campaigns in the civil protection sector. Although the Resilient Cities campaign has been disseminated in the civil defense sector—Brazil had 300 cities inscribed in this campaign in October 2021—other agendas still need to be promoted. The second question about global agendas was focused on the SDGs. When asked if the SDGs are related to the works carried out by civil defense, 47.7%
partially agreed, while 29.9% completely agreed. There was a significant portion of respondents (14.4%) who did not agree or disagree (Table 2).

### 4 Discussion

In February 2020, the United Nations Development Program (UNDP) and partners launched the Peoples’ Climate Vote—the largest survey of public opinion on climate change ever conducted. With 1.2 million respondents, the results span 50 countries covering 56% of the world’s population (UNDP and University of Oxford 2021). The survey aimed to provide the policymakers with reliable information on whether people considered climate change an emergency, and how they would like their countries to respond. The research findings indicate that 64% of people consider climate change an emergency, and there were slight differences across regions of the world: in Western Europe and North America (72%), Eastern Europe and Central Asia (65%), Arab States (64%), Latin America and the Caribbean (63%), Asia and Pacific (63%), and Sub-Saharan Africa (61%). These findings confirm part of the conclusions of Bord et al. (1998), who stated that concern about global warming tended to be highest in Canada, most of Europe, and South America—in the survey of the UNDP and University of Oxford (2021), South America was not among the most concerned with climate change. Interestingly, the findings of the People’s Climate Vote are similar with other studies carried out recently, such as Fletcher et al. (2021), who indicated that 74% of 1,071 Americans, surveyed in October 2016, were concerned about climate change.

The Peoples’ Climate Vote highlighted the expectation that future versions of the survey “may offer opportunities to look more closely at specific sectors” (UNDP and University of Oxford 2021, p. 10). Our interpretation of this recommendation led us to shed light on the perception of public sectors about climate change.

There are few studies that investigate the perception of public authorities about climate change. Terorotua et al. (2020), for instance, interviewed public authorities and assessed their perceptions on climate change in French Polynesia. Although the respondents did not identify climate change as a major current issue, they were concerned about climate-related problems, such as sea-level rise. As an outcome, they recommended the development of coastal climate services. Interestingly, a survey conducted with 252 public authorities in the state of Campeche, Mexico, identified the fact that they did not consider climate change as a major issue—similar to what Terorotua et al. (2020) identified in French Polynesia—but, in the Campeche case, public authorities did not consider sea-level rise and coastal erosion as problems related to climate change (Márquez 2016). Márquez’s study, conducted in Campeche, showed

### Table 2  Perceptions about climate change by the civil defense sector

| Statements                                                                 | Strongly disagree (%) | Partially disagree (%) | Neutral (%) | Partially agree (%) | Completely agree (%) |
|---------------------------------------------------------------------------|-----------------------|------------------------|-------------|---------------------|----------------------|
| Climate change is happening                                              | 0.9                   | 1.8                    | 1.7         | 18.0                | 77.6                 |
| Information provided by press is reliable                                 | 2.6                   | 10.6                   | 6.7         | 65.5                | 14.6                 |
| Information provided by the government is reliable                        | 5.5                   | 12.1                   | 7.7         | 53.3                | 21.4                 |
| Information provided by scientists is reliable                            | 0.6                   | 2.5                    | 4.1         | 40.5                | 52.4                 |
| I am concerned about how climate change is already intensifying extreme events, which trigger disasters where I work | 0.9                   | 2.3                    | 5.0         | 31.4                | 60.4                 |
| Human influence has been contributing to raise temperature in the planet with an uneven intensity during the last 100 years | 1.2                   | 2.4                    | 1.9         | 19.3                | 75.3                 |
| Climate change is going to increase the intensity and frequency of climatic extremes, amplifying risks and disasters associated with floods, landslides, droughts, and forest fires | 0.7                   | 1.3                    | 2.2         | 25.4                | 70.5                 |
| Climate change is going to increase the challenges of disaster risk management and demand new strategies of action in the sector of protection and civil defense | 0.7                   | 0.5                    | 1.4         | 16.8                | 80.6                 |
| The sector of protection and civil defense is prepared to deal with more disasters that are intensified by climate change | 12.0                  | 20.1                   | 8.6         | 49.2                | 10.1                 |
| The pieces of information on climate change which I receive are enough to develop my work | 10.2                  | 15.7                   | 10.2        | 51.7                | 12.3                 |
| I can easily understand the information about climate change              | 2.1                   | 8.8                    | 7.3         | 55.6                | 26.3                 |
| There are global agendas, such as the Sustainable Development Goals, which are directly associated with the civil defense work | 2.6                   | 5.4                    | 14.4        | 47.7                | 29.9                 |
that public authorities have a basic knowledge about climate change, obtaining information from informal channels such as the television (71%), Internet (42%), and radio (25%).

Our study looked at a specific public sector: civil protection. Civil protection has an important role in emergency management, DRM, the promotion of climate change awareness, and the civil society’s preparedness to weather-related extreme events. The lack of public policies on civil protection can influence social preparedness to extreme events. For instance, a survey conducted with 5,184 adults in the Philippines, between March and April 2017, “examined the association between perceptions of climate change and actions taken to prepare for disasters” (Bollettino et al. 2020, p. 2). Most respondents (59.9%) had not heard of, and did not feel well informed about, climate change and their awareness about it varied regionally. The study indicated that the levels of disaster preparedness vary widely by region, showing that only a third of Filipinos undertake measures to prepare for disasters (Bollettino et al. 2020). Those who believe they have been directly impacted by climate-related changes are also more likely to take planning actions, such as dwelling improvements. “Membership in an association, wealth, exposure to previous disasters, risk perception, and the perceived impact of climate change on the household were all significantly associated with participants’ self-reported general engagement in disaster preparedness” (Bollettino et al. 2020, p. 8). Based on their research findings, the authors recommended “a more unified intervention framework that links climate change adaptation and disaster preparedness” (Bollettino et al. 2020, p. 13).

One important strategy to find pathways for this unified intervention framework between CCA and disaster preparedness is to understand the perceptions of the civil protection sector about climate change. Civil protection in Latin America and the Caribbean (LAC) is usually occupied by those who considered themselves as “male.” Of the 1,063 respondents in our Brazilian study, 69.7% were male; another study about climate change perception in the civil protection of Campeche State, Mexico, showed that 95% of the positions were held by males (Márquez 2015).

Our survey in Brazil revealed that most civil defense officers thought that climate change is happening. Perceptions about this issue according to gender were also an important variable. The percentage of females and LGBTQIA persons who strongly agreed that “climate change is happening” was higher than that of the male group, confirming previous research that showed similar findings when analyzing civil society participants. The People’s Climate Vote, for instance, pointed out that there was much “stronger belief in the climate emergency among women and girls than men and boys (by more than 10 percentage points) in Australia, Canada, and the United States. But it was the other way around in other countries such as Vietnam and Nigeria where men and boys were more receptive to the idea” (UNDP and University of Oxford 2021, p. 9).

The findings of the Peoples’ Climate Vote were analyzed not only according to gender, but also considered the participants’ level of education. “There were consistently very high levels of demand for climate action among people with post-secondary education in all countries, ranging from LDCs [Least Developed Countries], such as Bhutan and the Democratic Republic of the Congo (both 82%), to wealthy countries like France (87%) and Japan (82%)” (UNDP and University of Oxford, 2021, p. 9). In our survey with the civil defense sector in Brazil, an expressive group of respondents (36.3%) hold a graduate degree, while 31.4% hold a postgraduate degree. A significant portion of the interviewees (28.7%) had completed high school, while 3.6% only achieved the elementary school stage of formal education. Despite this level of education, there are other circumstances that influence the institutional capacity of civil protection to cope with climate change.

Márquez (2015) pointed out that the experience time of civil protection officers in Mexico is about six years, suffering a massive turnover during municipal elections, which causes institutional vulnerabilities such as the loss of investments in capacity building of their human resources. The Brazilian context is similar: 54.4% of the survey respondents had up to four years of experience in civil protection and, as reported by the National Survey on Municipal Civil Defense (Brazil 2021), their job security depends on the political preference of Mayors (37%) or other reasons (6%). Usually, the civil defense system promoted capacity building activities for DRM actions, but the staff often are changed after municipal elections. These factors of institutional vulnerabilities were also observed by the study of Terorotua et al. (2020), who highlighted this rupture in the continuity of decisions, but also cited other issues such as corruption of individuals leading the territory, and the lack of political will dedicated to the topic of climate change. According to these authors, the low level of concern among the institutional actors of French Polynesia with respect to climate change is not related to the absence of knowledge of the phenomenon and/or its impacts. In Brazil, the lack of political will to address the climate change agenda is also manifested in the number of municipalities that had CCA plans: less than 20% of cities have municipal CCA and DRR plans (IBGE 2021).

Most municipal civil protection officers in Brazil completely agreed that climate change will cause additional challenges to their DRM activities. Yet they felt unprepared to deal with it, and most did not receive any capacity building training on this topic. The need for these capacity building activities about climate change was also recommended by Márquez (2016) after studying the climate change perception of civil protection in Campeche, Mexico. It is important to consider that capacity building is not synonymous
with having access to information. Data literacy to analyze graphs and maps, skills to access software and tools, training courses to communicate disaster risks on social media, participatory methods to engage general public in formulation and implementation of CCA and DRR plans, and media training are some of civil defense needs of capacitation (Brazil 2021).

Some studies about public trust in news and media indicated that “gaps in trust in news align with deficits in social and interpersonal trust as well as dissatisfaction with democracy (...)” [there is] a strong correlation between levels of trust in news, the degree to which people are bonded to other individuals and specific groups in society, and how satisfied people are about the way democracy is working (...) trusting attitudes towards news are in part driven by factors external to the news itself” (Toff et al. 2021, p. 8). Our survey did not ask questions about political aspects (political orientation, for instance), as carried out by Poortinga et al. (2019) and Levi (2021). Future studies about perception of civil protection should include these political dimensions, as well as investigate how climate change perception changes over time, especially in current circumstances of “infodemic,” where the activism of the climate change denial movement seems only to increase, influencing policy making, religion, the private market, and so on (Dunlap and McCright 2015).

5 Conclusion and Recommendations

Few studies have investigated the climate change perception of public sector personnel. This article shared some findings held by the civil protection sector that contribute to closing that gap, based on a survey with 1,063 civil defense respondents in Brazil. The aim was to understand what civil protection officers learn and think about climate change.

The percentage of those who strongly agreed that “climate change is happening” (77.6%) is on average 18.6% higher than those who are “concerned about how climate change is already intensifying extreme events.” This suggests that a significant portion of civil protection officers do not perceive the association between climate change and the intensification of extreme events. They believe that climate change will cause additional obstacles to DRM, but they face challenges to identify indicators that the changes are happening. Some research projects around the world have worked to identify local indicators of climate change impacts using citizen science techniques. Future action research projects should involve local civil defense officers in this type of initiative, considering that their staff are usually composed of one or two persons. Research approaches based on ethnography would also be useful to understand the everyday challenges that civil defense officers face to deal with data and information about disaster risks and climate change.

Receiving climate change information is not synonymous with capacity building. A small portion of civil protection officers feel prepared to deal with climate change—let alone being required to institute capacity building activities about mitigation and CCA, as well as basic notions about meteorology, social and environmental vulnerability analysis, and implementation of nature-based solutions, among others. The Ministry of Environmental Affairs, SEDEC, and Cemaden in Brazil need to bridge DRR and CCA by creating a joint national plan to continuously strengthen institutional capacities at the municipal level. Only by increasing local capabilities will it be possible to formulate and implement municipal plans that address these issues together, including methodologies to engage civil society and press to combat misinformation. The institutionalization of DRM and CCA in a public policy-making agenda can catalyze this integrated effort.

It is important to highlight that about one quarter of the respondents think that civil defense efforts are associated with the Sustainable Development Goals (SDGs), showing the need for cross-sectoral dissemination and implementation at the municipal level. When asked what agenda(s) are related to climate change, the Resilient Cities campaign was most cited, followed by the SDGs, the Paris Agreement, the SFDRR, and the New Urban Agenda. One quarter of the respondents replied that they did not know about these agendas, which reinforces the need for promoting information campaigns in the civil protection sector.

Acknowledgments The authors acknowledge the state and municipal civil defense personnel in Brazil. Victor Marchezini acknowledges the São Paulo Research Foundation—Fapesp (Grant Number 2018/06093-4). José A. Marengo thanks the support of the National Institute of Science and Technology for Climate Change Phase 2 under CNPq Grant 465501/2014-1; FAPESP Grants 2014/50848-9, and the National Coordination for Higher Education and Training (CAPES) Grant 88887.136402-00/INCT.

Open Access This article is licensed under a Creative Commons Attribution 4.0 International License, which permits use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons licence, and indicate if changes were made. The images or other third party material in this article are included in the article’s Creative Commons licence, unless indicated otherwise in a credit line to the material. If material is not included in the article’s Creative Commons licence and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder. To view a copy of this licence, visit http://creativecommons.org/licenses/by/4.0/.

References

Acselrad, H. 2022. The “social” in the climate change (O “social” nas mudanças climáticas). Liinc Em Revista 18(1): Article e5930 (in Portuguese).
Alexander, D.E. 2015. Evaluation of civil protection programmes, with a case study from Mexico. *Disaster Prevention and Management* 24(2): 263–283.

Billi, M., G. Blanco, and A. Urquiza. 2019. What is the “social” in climate change research? A case study on scientific representations from Chile. *Minerva* 57(3): 293–315.

Bollettino, V., T. Alcayna-Stevens, M. Sharma, P. Dy, P. Pham, and P. Vinck. 2020. Public perception of climate change and disaster preparedness: Evidence from the Philippines. *Climate Risk Management* 30: Article 100250.

Bonelli, M.d.G., F. Damacena, A. Silveira Viana, A.D. Gambardella, V. Bollettino, V., T. Alcayna-Stevens, M. Sharma, P. Dy, P. Pham, and P. Vinck. 2020. Public perception of climate change and disaster preparedness: Evidence from the Philippines. *Climate Risk Management* 30: Article 100250.

Bord, R.J., A. Fisher, and R.E. O’Connor. 1998. Public perceptions of global warming: United States and international perspectives. *Climate Research* 11(1): 75–84.

Brazil. Ministry of the Environment. Executive Group of the Interministerial Committee on Climate Change (GEx-CIM). 2015. National Plan on Climate Change Adaptation (*Plano Nacional de Adaptação à Mudança do Clima*). Brasilia, DF: Ministry of the Environment. https://www.mds.gov.br/webarquivos/arquivo/seguranca_alimentar/cais/MinasGerais/PlanoNacionalPlanoNacionalAdaptacaoMudancasClimaticas2015.pdf. Accessed 10 Oct 2021 (in Portuguese).

Brazil. Ministry of Regional Development. National Secretariat of Civil Defense and Protection. 2021. Assessment on capacities and needs of municipal civil defense units in Brazil (*Diagnóstico de capacidades e necessidades municipais em proteção e defesa civil. Project coordination by Victor Marchezini*). Brasilia, DF: Ministry of Regional Development (in Portuguese).

Brulle, R.J., and R.E. Dunlap. 2015. Sociology and global climate change. In *Climate change and society: Sociological perspectives*, ed. R.E. Dunlap, and R.J. Brulle, 1–31. New York: Oxford University Press.

Capstick, S., L. Whitmarsh, W. Poortinga, N. Pidgeon, and P. Upham. 2015. International trends in public perceptions of climate change over the past quarter century. *WIREs Climate Change* 6(1): 35–61.

Covello, V., and P. Sandman. 2001. Risk communication: Evolution and revolution. In *Solutions to an environment in peril*, ed. A. Wolbarst, 164–178. Baltimore, Maryland: John Hopkins University Press.

Debortoli, N., P.I. Camarinha, J.A. Marengo, and R. Rodrigues. 2017. An index of Brazil’s vulnerability to expected increases in natural flash flooding and landslide disaster in the context of climate change. *Natural Hazards* 86(2): 557–582.

Dietz, T., R.L. Shwom, and C.T. Whitley. 2020. Climate change and society. *Annual Review of Sociology* 46(1): 135–158.

Dunlap, R.E., and A.M. McCright. 2015. Challenging climate change: The denial countermovement. In *Climate change and society: Sociological perspectives*, ed. R.E. Dunlap, and R.J. Brulle, 300–332. New York: Oxford University Press.

Eiró, F., and D. Lindoso. 2014. Climate change, risk perception and inaction in the Brazilian semiarid region: How smallholder farmers perceive climate variability in the Sertão do São Francisco (*Mudança climática, percepção de risco e inação no semiárido brasileiro: como produtores rurais familiares percebem a variabilidade climática no sertão do São Francisco – Bahia*). *Revista Econômica do Nordeste* 45(4): 137–150 (in Portuguese).

Elliott, R. 2018. The sociology of climate change as a sociology of loss. *European Journal of Sociology* 59(3): 301–337.

Etkin, D., and E. Ho. 2007. Climate change: Perceptions and discourses of risk. *Journal of Risk Research* 10(5): 623–641.

Finucane, M.L., P. Slovic, C.K. Mertz, J. Flynn, and T.A. Satterfield. 2000. Gender, race, and perceived risk: The “white male” effect. *Health, Risk & Society* 2(2): 159–172.

Fletcher, J., J. Higham, and N. Longnecker. 2021. Climate change risk perception in the USA and alignment with sustainable travel behaviours. *PLoS ONE* 16(2): Article e0244554.

Fleury, L.C., J.C.H. Miguel, and R. Taddei. 2019. Climate change, science and society (*Mudanças climáticas, ciência e sociedade*). *Sociologias* 21(51): 18–42 (in Portuguese).

IBGE (Brazilian Institute of Geography and Statistics). 2021. Survey on municipal basic information (*Pesquisa de Informações Básicas Municipais*). https://www.ibge.gov.br/estatisticas/sociais/saude/10586-pesquisa-de-informacoes-basicas-municipais.html?&t=resultados. Accessed 1 Jan 2022 (in Portuguese).

ISER (Instituto de Estudos da Religião). 2008. What Brazilian leaders think about climate change and the country engagement (O que as lideranças brasileiras pensam sobre mudanças climáticas e o engajamento do Brasil). https://silto.tips/download/o-que-as-lider-anas-brasileiras-pensam. Accessed 1 Jan 2022 (in Portuguese).

ITS (Instituto de Tecnologia & Sociedade do Rio). Yale Program on Climate Change Communication, and IBOPE (Brazilian Institute of Public Opinion and Statistics). 2021. Survey on Brazilian people perceptions about climate change (*Pesquisa Mudanças Climáticas no Percepção dos Brasileiros*). https://itsrio.org/wp-content/uploads/2021/02/AdaptacaoDoClima_Junho2015.pdf. Accessed 10 Jan 2022 (in Portuguese).

ITS (Instituto de Tecnologia & Sociedade do Rio). Yale Program on Climate Change Communication, and IBOPE (Brazilian Institute of Public Opinion and Statistics). 2022. Climate change in the perception of Brazilians (*Mudanças climáticas na percepção dos brasileiros*). 2nd edn. https://itsrio.org/wp-content/uploads/2022/03/IBOPE_Final.pdf. Accessed 15 Sept 2022 (in Portuguese).

Kelman, I. 2015. Climate change and the Sendai framework for disaster risk reduction. *International Journal of Disaster Risk Science* 6(2): 117–127.

Kelman, I., J. Mercer, and J.C. Gaillard. 2020. *The Routledge handbook of disaster risk reduction including climate change adaptation*. Abingdon, UK: Routledge.

Koehrsen, J., S. Dickel, T. Pfister, S. Rödder, S. Böschen, B. Wendt, K. Block, and A. Henkel. 2020. Climate change in sociology: Still silent or resonating?. *Current Sociology* 68(6): 738–760.

Lahsen, M., and J. Ribot. 2021. Politics of attributing extreme events and disasters to climate change. *Wires Climate Change* 13(1): Article e750.

Lee, T., T. Markowitz, P. Howe, C.-Y. Ko, and A.A. Leiserowitz. 2015. Predictors of public climate change awareness and risk perception around the world. *Nature Climate Change* 5: 1014–1020.

Leiserowitz, A., J. Carman, N. Buttermore, X. Wang, S. Rosenthal, J. Marlon, and K. Mulcahy. 2021. International public opinion on climate change. New Haven, CT: Yale Program on Climate Change Communication and Facebook Data for Good.

Levi, S. 2021. Country-level conditions like prosperity, democracy, and regulatory culture predict individual climate change belief. *Communications Earth and Environment* 2: Article 51.

Lima, M.L. 1995. Living with risk: A socio-ecological psychology approach (*Viver com o risco: abordagem da psicologia social*). 2nd edn. https://itsrio.org/wp-content/uploads/2022/03/IBOPE_Final.pdf. Accessed 15 Sept 2022 (in Portuguese).

Lima, M.L. 1995. Living with risk: A socio-ecological psychology approach (*Viver com o risco: abordagem da psicologia social*). 2nd edn. https://itsrio.org/wp-content/uploads/2022/03/IBOPE_Final.pdf. Accessed 15 Sept 2022 (in Portuguese).

Loose, E.B. 2020. Journalism and climate risks: Perceptions and understandings of journalists, sources and readers (*Jornalismo e riscos climáticos: Percepções e entendimentos de jornalistas,*
Salmi, F., and L.C. Fleury. 2022. Mudanças Climáticas e Ciências Sociais.

Roncoli, C., T. Crane, and B. Orlove. 2009. Fielding climate change in cultural anthropology. In Anthopology & climate change: From encounters to actions, ed. S.A. Crate, and M. Nutall, 87–115. Walnut Creek: Left Coast Press.

Salmi, F., and L.C. Fleury. 2022. Mudanças Climáticas e Ciências Sociais: análise bibliométrica do campo (2011–2021). BIB – Revista Brasileira De Informação Bibliográfica Em Ciências Sociais 1(97): 1–19.

Pidgeon, N. et al. 1992. Risk perception. In Encyclopedia of Environmental Science and Pollution Research International, ed. R. Swyngedouw, E. Swyngedouw, 3(5): 8 (in Spanish).

Marchezini, V., and L.R. Londe. 2020. Looking to future perceptions about climate change in Brazil: What children’s teachers think, learn and teach about?. Natural Hazards 104(3): 2325–2337.

Márquez, R.I. 2015. Climate change and civil protection: Knowledge and perceptions of government officials (Cambio climático y protección civil: conocimientos y percepciones de funcionarios gubernamentales). Revista Iberoamericana de Producción Académica y Gestión Educativa 2(3): 11 (in Spanish).

Márquez, R.I. 2016. Knowledge and perceptions about climate change in personnel of the municipal public administration of the state of Campeche (Conocimientos y percepciones sobre el cambio climático en personal de la administración pública municipal del estado de Campeche). Revista Iberoamericana de Producción Académica y Gestión Educativa 3(5): 8 (in Spanish).

Merriam-Webster. 2022. LGBTQIA. Merriam-Webster.com Dictionary. https://www.merriam-webster.com/dictionary/LGBTQIA. Accessed 12 Sept 2022.

O’Reilly, J., C. Isenhour, P. McElwee, and B. Orlove. 2020. Climate change: Expanding anthropological possibilities. Annual Review of Anthropology 49(1): 13–29.

Pedrini, A.G., D.S. Brotto, T.V. Santos, L. Lima, and R.M. Nunes. 2016. Environmental perception on global climate change in a public square in the city of Rio de Janeiro (RI, Brazil) (Percepção ambiental sobre as mudanças climáticas globais numa praça pública na cidade do Rio de Janeiro (RI, Brasil). Ciência & Educação 22(4): 1027–1044 (in Portuguese).

Pidgeon, N. et al. 1992. Risk perception. In Risk: Analysis, perception and management, ed. The Royal Society Study Group, 89–134. London: The Royal Society.

Poortinga, W., L. Whitmarsh, L. Steg, G. Böhm, and S. Fisher. 2019. Climate change perceptions and their individual-level determinants: A cross-European analysis. Global Environmental Change 55: 25–35.

Renn, O., and B. Rohrmann. 2000. Cross-cultural risk perception research: State and challenges. In Cross-cultural risk research: A survey of empirical studies, ed. O. Renn, and B. Rohrmann, 211–233. Dordrecht: Kluwer Academic Publishers.

Roncoli, C., T. Crane, and B. Orlove. 2009. Fielding climate change in cultural anthropology. In Anthropology & climate change: From encounters to actions, ed. S.A. Crate, and M. Nutall, 87–115. Walnut Creek: Left Coast Press.

Salmi, F., and L.C. Fleury. 2022. Mudanças Climáticas e Ciências Sociais: análise bibliométrica do campo (2011–2021). BIB – Revista Brasileira De Informação Bibliográfica Em Ciências Sociais 1(97): 1–19.

Slovic, P. 1987. Perception of risk. Science 236(4799): 280–285.

Sun, L., and A.J. Faas. 2018. Social production of disasters and disaster social constructs: An exercise in disambiguation and reframing. Disaster Prevention and Management 27(5): 623–635.

Swyngedouw, E. 2011. Depoliticized environments: The end of nature, climate change and the post-political condition. Royal Institute of Philosophy Supplement 69: 253–274.

Taddei, R. 2020. Anthropology and the pragmatics of climate knowledge in Brazil. American Anthropologist 122(4): 944–947.

Terorotua, H., V.K.E Duvat, A. Maspataud, and J. Ouriquia. 2020. Assessing perception of climate change by representatives of public authorities and designing coastal climate services: Lessons learnt from French Polynesia. Frontiers in Marine Science 7: Article 160.

Toff, B., S. Badrinathan, C. Mont’Alverne, A.R. Arguedas, R. Fletcher, and R.K. Nielsen. 2021. Overcoming indifference: What attitudes towards news tell us about building trust. Oxford, UK: Reuters Institute of the University of Oxford. https://reutersinstitute.politics.ox.ac.uk/sites/default/files/2021-09/Toff%20et%20al%20-%20Overcoming%20Indifference%20FINAL.pdf. Accessed 5 Feb 2022.

UNDP (United Nations Development Programme), and the University of Oxford. 2021. People’s climate vote. https://www.undp.org/publications/peoples-climate-vote. Accessed 5 Feb 2022.

Valencio, N. 2009. The National Civil Defense System and climate change: Challenges and institutional structural limitations (O Sistema Nacional de Defesa Civil (SINDEC) diante das mudanças climáticas: desafios e limitações da estrutura e dinâmica institucional). In Sociology of disasters: Construction, interfaces and perspectives in Brazil (Sociologia dos Desastres: construção, interfaces e perspectivas no Brasil), ed. N. Valencio, M. Siena, V. Marchezini, and J.C. Gonçalves, 19–33. São Carlos: RiMa (in Portuguese).

Victor, D.G. 2015. Embed the social sciences in climate policy. Nature 520(7545): 27–29.

Weaver, C., S. Mooney, D. Allen, N. Beller-Simms, T. Fish, A.E. Grambsch, W. Hohenstein, and K. Jacobs et al. 2014. From global change science to action with social sciences. Nature Climate Change 4: 656–659.

Wisner, B., J.C. Gaillard, and I. Kelman. 2012. Framing disaster: Theories and stories seeking to understand hazards, vulnerability and risk. In The Routledge handbook of hazards and disaster risk reduction, ed. B. Wisner, J.C. Gaillard, and I. Kelman, 18–34. London: Routledge.

Zhong, F., W. Cheng, A. Guo, X. Song, Q. Cheng, A. Ullah, and Y. Song. 2022. Are Chinese social scientists concerned about climate change? A bibliometric analysis and literature review. Environmental Science and Pollution Research International 29(9): 12911–12932.