



# (In)visibilities About the Vulnerabilities of People with Visual Impairments to Disasters and Climate Change: A Case Study in Cuiabá, Brazil

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**Abstract** People with visual impairments (PwVI) represent a heterogeneous social group who often experience significant disabling barriers in exercising their rights throughout their life course. Understanding dimensions of vulnerability of PwVI to disasters and climate change is an important issue to reduce the culture of neglected disasters. To date, few studies have analyzed visual impairment and disaster risk reduction (DRR) in the countries of Latin America and the Caribbean. This exploratory qualitative research project analyzed how to include PwVI in the DRR policies of Brazil. The research question is: how can we include PwVI in the discussion of DRR and climate change? The response to this question is part of a joint effort that involved a university, a hazard monitoring agency, and three institutions that work with PwVI. The three main results of the project are: (1) a mapping method to identify the exposure of PwVI to landslides and floods, and to create tactile risk maps tailored to them; (2) incorporating the voices of PwVI regarding their vulnerabilities

and capacities with respect to disasters and climate change, achieved through shared interaction during 15 face to face interviews and one workshop attended by 100 people; and (3) an initiative of inclusive education to reduce some of the disabling barriers that intensify vulnerability.

**Keywords** Brazil · Climate injustice · Disaster risk · Environmental education · Inclusive education · Sight impairment

## 1 Introduction

One of the social groups severely impacted by disasters is people with impairments. There are medical and social approaches to understanding impairments. The medical model considers “disability” to be the result of an individual medical or biological condition in which people are treated as “objects” of medical treatment. In the social model, disability is perceived “...as resulting not from the impairments of individuals, but from the way societies are organized, as reflected in negative attitudes, inaccessible physical structures, discriminatory policies, and a lack of support” (Jodoin et al. 2020, p. 77). A third dynamic approach views “...disability as either a product of an impaired body *or* a result of ableist social attitudes” that focus on how people become dis/abled in and through their everyday experiences at particular times and locations (Bell et al. 2019, p. 273).

The United Nations Convention on the Rights of Persons with Disabilities (UNCRPD 2006) defines people with disabilities as those who have long-term physical, mental, intellectual, or sensory impairments who, in interaction with various barriers, may have their full and effective participation in society on an equal basis hindered.

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According to the Disability and Development Report of the United Nations (2019), 1 billion people live with some type of impairment. It is important to note that the impaired population is not a homogeneous group (Smith, Simard et al. 2017; Bennett 2020): 46% of people over the age of 60 years live with some type of disability; one in every five women is likely to experience disability in her life; one in every 10 children lives with a disability (United Nations 2020). Experiences of disability are becoming more widespread, but 80% of people with impairments live in low and middle income countries, and it is very likely that they will face even more disadvantages related to climate change and disasters (United Nations 2019). The intersection of experiencing an impairment and multiple discrimination as a result of gender identity, age, race, ethnicity, sexual orientation, and so on can lead to additional exposure to risk (Smith, Simard et al. 2017; Jodoin et al. 2020).

Practices of climate change adaptation (CCA) can be considered as a subset of disaster risk reduction (DRR) strategies (Kelman 2015). The Sendai Framework for Disaster Risk Reduction 2015–2030 (SFDRR) has two guiding principles that explicitly mention “persons with disabilities” (UNISDR 2015), while the Glasgow Climate Pact has only one reference to disability. However, there are several gaps in the means of implementation of DRR (Smith, Simard et al. 2017; Gutnik and Roth 2018; Bennett 2020; Jodoin et al. 2020).

Smith, Simard et al. (2017) conducted a literature review that identified the lack of disability-inclusive approaches across the CCA and DRR sectors. In the DRR sector, there are four main barriers (Smith, Jolly et al. 2012; Smith, Simard et al. 2017; Gutnik and Roth 2018): (1) lack of data, information, and knowledge of people with disabilities; (2) exclusion from all stages of disaster risk management (DRM); (3) inaccessible disaster preparedness measures, warnings, and facilities; and (4) stigma and discrimination.

There also is a lack of studies that address these barriers in CCA (Abbott and Porter 2013; Gutnik and Roth 2018; Jodoin et al. 2020) and DRR (Wolbring 2009; Stough and Kang 2015; Ronoh et al. 2017; Smith, Simard et al. 2017). According to Jodoin et al. (2020, p. 76), “none of the articles, monographs, edited books, or special issues that have been published on human rights and climate change tackles how the rights of persons with disabilities might be affected by climate change.” A further limitation, identified by several studies, is that people with impairments are treated as a homogenous group (Smith, Simard et al. 2017; Bennett 2020; Jodoin et al. 2020).

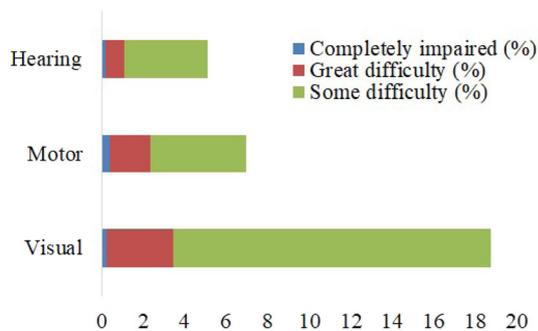
In this article we address the issue of disasters and people with visual impairments. The terminology of people with disabilities and people with impairments is contested from one country to another and even among people in the same country. For example, in Brazil people are

accustomed to say “*pessoas com deficiência visual*” (people with visual disability) for those who have partial sight or no sight, and recently also those with monocular vision have been classified as visually impaired, which is provoking a strong debate (Brasil 2021). In this article we use the term “people with visual impairment,” recognizing the importance of respecting the language that each individual feels most comfortable with, promoting the “human rights model of disability...[that]...recognizes impairments as part of human diversity and that people with disabilities may require support not only due to socially constructed barriers, but also because of an underlying physiological impairment” (Jodoin et al. 2020, p. 78).

Understanding dimensions of vulnerability among people with visual impairments (PwVI) in the face of disasters and climate change is an important issue not only for academia, but also to inform policy making and to drive change (Abbott and Porter 2013; Smith, Simard et al. 2017; Gutnik and Roth 2018). However, few studies have analyzed PwVI and disasters (Good 2016; Good et al. 2016; Kharade et al. 2017; Park et al. 2019; Sherman-Morris et al. 2020), especially in Latin America. According to Bell et al. (2019, p. 280), “future research [can examine] how people living with sight impairment...within different geographical contexts connect to and negotiate the weather on a routine basis..., we could gain important and novel insights into how and why different people and communities are able to build intricate somatic skills, knowledge and awareness.”

The goal of this article is to fill part of this gap in understanding vulnerabilities and capacities of people with visual impairments (PwVI) to weather-related hazards and climate change in Latin America. The research question is: how can we include PwVI in the discussion of DRR and climate change? The response to this question is part of an exploratory study conducted in Cuiabá, Mato Grosso state, Brazil. It involved a PhD dissertation in the Postgraduate Program on Education at the Federal University of Mato Grosso, the Brazilian National Center for Monitoring and Early Warning of Natural Disasters (CEMADEN), the Municipal Civil Defense of Cuiabá (NUPDEC/Cuiabá), the Institute of the Blind of the State of Mato Grosso (ICE-MAT), and the Association for the Blind of Mato Grosso (AMC). Three main findings will be shared: (1) a mapping method to identify the exposure of PwVI to landslides and floods; (2) the voices of PwVI regarding their vulnerabilities and capacities to disasters and climate change; and (3) an initiative of inclusive education to reduce existing barriers for PwVI in DRR.

Section 2 provides a brief context about people with visual impairments in Brazil and their vulnerability situation, while Sect. 3 presents the research methods used in our study. Then, in Sect. 4, the disabling barriers and the



**Fig. 1** Percentage of population by type and degree of difficulty and impairment. The same person may have more than one impairment. The percentage of people with mental/intellectual impairment was 1.37%. Source Developed by the authors based on data from IBGE (2010)

dimensions of vulnerability present among PwVI are discussed, and the roles of education as a way of overcoming some of the disabling barriers are included. Finally, we point out some ways to bolster public policies for DRR and PwVI in Brazil.

Considering that imagery information is not transmitted to PwVI, the first figure presented in this article is accessible through an example audio description, inserted in an alternative text box, which could be read by a sighted reader. In a properly equipped digital mode the image can be interpreted by the screen reader, informing the visually impaired user of the description.

## 2 Disasters and People with Impairments in Brazil

In Brazil, about 23.9% of the population—45.6 million people—has some degree of mental/intellectual impairment and/or difficulty in seeing, hearing, walking, or climbing stairs, even with the aid of contact lenses, hearing aids, and walking aids (IBGE 2010) (Fig. 1). These numbers will change as soon as the Brazilian Institute of Geography and Statistics (IBGE) has revised the data about people with impairments (PwI) based on the 2010 demographic census to incorporate the criteria recommended by the Washington Group of Disability Statistics.<sup>1</sup>

Among the Brazilian population with impairments, 6.5 million people are visually impaired—more than 528,000 have no sight and 6 million have partial vision. In the state of Mato Grosso, 96,680 out of 3 million inhabitants are visually impaired. In Cuiabá, there are 17,349 PwVI: 1460 of them (0.26%) are unable to see—no sight; and, 15,889 (2.88%) have great difficulty seeing (Table 1) (IBGE 2010).

<sup>1</sup> <https://www.washingtongroup-disability.com/about/conceptual-framework/>

Audio description: The table is composed of four columns and four lines, in alternating dark gray and light gray colors, with two brief definitions at the bottom. The first line contains the header of each column: PwVI (Identification); Brazil, Population 190,755,766; Mato Grosso, Population 3,035,122; Cuiabá, Population 551,098. In the first column, the identification Visual Impairment (cannot see at all), Visual Impairment (great difficulty), and Total. In the second column, 528,624 (0.28%), 6,056,684 (3.18%), and 6,585,308 (3.4%). In the third column, 5276 (0.17%), 91,404 (3.01%), and 96,680 (3.18%). In the fourth column, 1460 (0.26%), 15,889 (2.88%), and 17,349 (3.14%). [[Beneath the table, the two categories of visual impairment for which data are provided are described: no sight (when there is a total loss of vision) and partial vision (where low vision or only residual vision exists).]] End of audio description.

Any effort to categorize and define the magnitude of visual impairment is a complex task. An alteration of vision irremediably affects the ability to perceive color, size, distance, shape, position, or movement in a more or less comprehensive field, which may occur from birth (congenital blindness), or later (adventitious blindness, usually known as acquired) due to organic or accidental causes. The Braille system is an important tactile reading and writing medium system for no sight people, in addition to the digital technologies widely used by these people today. The definition is complicated depending upon the variety and intensity of impaired visual functions. It is characterized by impaired visual functioning of the eyes, even after treatment or correction, and may present 30% or less of vision in the best eye, after all clinical and surgical procedures and correction with ordinary glasses. People with low vision can read printed texts, enlarged or with the use of special optical resources, and have difficulties to see details on a daily basis. For instance, they see people but do not recognize their features; children may see the blackboard, but do not identify the words, nor do they recognize the signs at the bus stop, among other examples (Dorina Nowill Foundation n.d.; Sá et al. 2007).

People with visual impairments are the majority population among people with impairments in Brazil (Fig. 1), but this was not the principal motivation that led us to consider them in this research. The motivation was the lack of studies on this topic (Geraldi 2009; Smith, Jolley et al. 2012; Abbott and Porter 2013; Godd 2016; Godd et al. 2016; Smith, Simard et al. 2017; Bennett 2020). Our hope is to grant them an audience, overcoming what they experience as “... a ‘world of silence and darkness’, a ‘no place’ in life, in poetry, in passion” (Sousa 2015, p. 2).

It is essential to understand the situations of vulnerability among PwVI to find pathways to overcome the barriers that create the vulnerabilities for this group. One

**Table 1** People with visual impairment (PwVI) in Brazil, Mato Grosso, and Cuiabá

PwVI (Identification)	Brazil Population: 190,755,766	Mato Grosso Population: 3,035,122	Cuiabá Population: 551,098
Visual impairment (cannot see at all) <sup>a</sup>	528,624 0.28%	5276 0.17%	1460 0.26%
Visual impairment (great difficulty seeing) <sup>b</sup>	6,056,684 3.18%	91,404 3.01%	15,889 2.88%
Total	6,585,308 3.46%	96,680 3.18%	17,349 3.14%

<sup>a</sup>No sight: When there is total loss of vision or very little ability to see

<sup>b</sup>Partial vision: When the impaired person suffers from lazy eye (amblyopia), low vision, or residual vision

Source: Developed by the authors based on data from IBGE (2010)

important aspect is to break down the stigmatization of people with impairments, including attitudinal barriers that impede their participation in society (Abbott and Porter 2013; Bennett 2020; Jodoin et al. 2020). Regarding the vulnerability of PwVI, "... it is not the individual limit that determines the disability, but the existing barriers in spaces, in the physical environment, transportation, information, communication and in public services" (Brasil 2012b, p. 9). A significant barrier in policy making is the lack of a national strategy to include people with impairments in the national plan of CCA (Brasil 2008) and DRR—Article 12 of the National Policy on Civil Defense and Protection (PNPDEC) mentions the need to develop strategies that include people with impairments (Brasil 2012a). Regarding risk knowledge, for instance, the Geological Survey of Brazil (CPRM) maps flood- and landslide-prone areas and estimates the number of houses and people living in these zones. But CPRM does not identify aspects related to exposure, vulnerabilities, and capacities of people, including people with impairments. The efforts of the Brazilian Early Warning Center (CEMADEN) and IBGE to add layers of vulnerability to the hazard maps of CPRM (Assis Dias et al. 2018) also did not take impairment into account by providing disaggregated data on people with impairments. This study contributes to filling in some of these gaps.

### 3 Methods

This section introduces the research site context, the types of natural hazards and vulnerabilities in Cuiabá, the institutions and our research partners, as well as the research methods employed.

#### 3.1 Research Site

Located in the geodesic center of South America, Cuiabá is the capital of Mato Grosso (MT), with an area of 3292 km<sup>2</sup>. In 2010, the population was 551,098 people; in 2021, the population is estimated to be 623,614 (IBGE 2022).

Cuiabá has infrastructure problems, which are reflections of historical urban sprawl into environmentally protected areas. Most areas subject to flooding are on the banks of the Cuiabá River and its tributaries. The dense informal settlements in these floodplains, the inefficiency of public policies for the preservation of the water basin, lack of investments in sanitation and garbage collection, and so on cause frequent episodes of urban flooding especially in these riverbank neighborhoods, where a large part of the low-income population resides (Zamparoni 2012). During our initial visit to the Center for Civil Defense and Protection of Cuiabá (NUPDEC/Cuiabá) in 2017, the civil defense officers showed us a "risk" map that they had created—demonstrating the flood-prone areas. This "risk" map, however, did not take into account aspects related to exposure and/or vulnerability and capacities of the inhabitants.

#### 3.2 Mapping Risk Areas and Visually Impaired People

Starting with the map developed by NUPDEC, the first author sought information on exposure and/or vulnerability by requesting additional information from CEMADEN. One of the co-authors of this article, who is a researcher at CEMADEN, provided the report Sectorization of Risk Areas at High and Very High Geological Risk in the Urban Area of the Municipality of Cuiabá as well as the shapefile archive of the mapped areas, prepared in 2014 by the



**Fig. 2** ICEMAT student returning home. Photograph by Giselly Gomes, 18 March 2018. Note: A woman researcher accompanying an ICEMAT student above the age of 60 and his daughter to his home in the periphery of the metropolitan area of Cuiabá. The trip home took two hours by school bus. The neighborhood of Mr. Nicolau has dirt roads. The ground in front of his home is uneven and strewn with small rocks and he is using a long white cane to navigate from the bus to his front door

Geological Survey of Brazil (CPRM).<sup>2</sup> The report gathers data obtained from eight sectors of the city, related to landslides/rockfalls, erosion, riverine flooding, and urban flooding. But the report is strictly limited to physical hazard potential, and does not consider aspects of people's vulnerability to disaster (Cabral and Peixoto 2014).

Based on information from NUPDEC/Cuiabá and CPRM, we sought to find out if PwVI were living in those mapped areas. Three local institutions that work with PwVI were contacted in 2016: the Help and Support Center for the Inclusion of Special Education (CASIES),<sup>3</sup> the Institute of the Blind of the State of Mato Grosso (ICEMAT),<sup>4</sup> and the Association for the Blind of Mato Grosso (AMC).<sup>5</sup> The aim of the study was explained to these institutions and with their consent, the research proposal was submitted to the Research Ethics Committee (CEP) of the Federal University of Mato Grosso, which recognized that the project complied with the norms related to research ethics.

<sup>2</sup> Hazard maps of Brazilian Geological Survey (CPRM) are available at: <http://www.cprm.gov.br/publique/Gestao-Territorial/Prevencao-de-Desastres/Produtos-por-Estado-Setorizacao-de-Risco-Geologico-5390.html>

<sup>3</sup> The training center offers a multifunctional resource room and specialized professionals, in addition to producing educational materials and equipment for accessibility to the visually impaired people. It is an organization linked to the Mato Grosso State Secretariat of Education (SEDUC/MT).

<sup>4</sup> Founded on 25 April 1979, ICEMAT is a school that teaches literacy in Braille and in the Soroban System (Japanese abacus). Once they become literate, visually impaired people are referred to regular schools, but continue with the support of ICEMAT.

<sup>5</sup> AMC is a nonprofit association whose purpose is to promote and integrate visually impaired people into mainstream society, without any distinction.

During our initial visits to CASIES, ICEMAT, and AMC, we explained the research project to their PwVI clients. In 2017–2018, after receiving their permission, we georeferenced the residences of 21 people who attended these institutions. For this procedure, we scanned their addresses and, using a mobile application of the My GPS Coordinates, obtained the locational data (latitude, longitude), which were incorporated into the map provided by NUPDEC/Cuiabá.

The georeferencing of the ICEMAT students' homes was authorized by the institution's leaders, allowing the first author of this article to accompany the students to their homes via school transport that provides services to the institute. On that occasion, we added into the mapping program the location of seven new students who live in the municipality of Várzea Grande adjacent to Cuiabá's western boundary, even though this location was not the primary areal focus of interest for this study—this is because we were interested in mapping the different places where students can be exposed to disaster risks (at home and/or at school) (Fig. 2).

### 3.3 Dialogues at the Research Site

The identification of PwVI living in flood and landslide-prone areas is not sufficient to understand their vulnerabilities. Due to this lack of information, we adopted an exploratory case study approach to allow for broad and detailed knowledge (Gil 2009) of their living conditions. The focal group/population was those PwVI that work and/or study in three institutions located in Cuiabá: CASIES, ICEMAT, and the AMC. From April 2016 to August 2018, the first author visited these three institutions and conducted: (1) participatory observations in the institutions; (2) informal conversations in the institutions when accompanying ICEMAT students to their homes via school transport; (3) 15 interviews; and (4) informal conversations and participatory observation during a workshop that shared the preliminary findings of this research with 100 people (60 of whom were PwVI).

These informal conversations and participant observations were conducted in the three institutions where these people work. It was possible to accompany some of the ICEMAT students to their homes via school transport and to initiate informal conversations with them. Then, with the consent of the Research Ethics Committee (CEP), the first author conducted 15 semistructured interviews with adult PwVI at ICEMAT, lasting one to two hours.

In the semistructured interview script, we asked questions about climate change, disaster risk, vulnerability, and the role of education. The questions were: Have you ever heard about climate change? What comes to your mind when you hear about this subject? Do you consider that

disasters are natural? Have you ever imagined yourself being the victim of a disaster? What would you do in a situation like this? Do you consider yourself vulnerable? Why? In the face of a disaster, would your vulnerability increase? How?

The interviews were recorded through audio recordings, and notes were taken in a field diary. In compliance with the rules established by the research ethics committee involving human beings, the interviewees are identified in all records (field notes, interview transcripts, and so on) by codenames chosen by the interviewees themselves, as well as by their age, and their varied forms of visual impairment.

This article shares the experiences of six interviewees (using fictional names), aged between 33 and 50 years, three men and three women, who worked at the AMC. They experience varied forms of visual impairment: one of them has no sight and the others have partial sight. Four are married and have children. Regarding their level of education, five of them had higher education in areas such as education (pedagogy and music), social communication (radio broadcasting), and information technology (analysis and systems development).

Additionally, the research project shared preliminary findings and promoted the topic by organizing a workshop on Environmental Education, Climate Justice, and Visually Impaired People, which brought together 100 participants, including civil defense workers, university students and faculty, ICEMAT and AMC officers and staff, and 60 PwVI who discussed the topic of PwVI in DRR and CCA. This workshop was also used to gather information and insights that are being presented as results and findings in this article.

The verbatim transcripts were manually coded and analyzed using thematic analysis as advocated by Braun and Clarke (2006), according to three main topics: (1) what PwVI know about disaster and climate change; (2) whether PwVI consider themselves to be vulnerable persons, and, if so, why; and (3) what is discussed about climate change at AMC and/or ICEMAT and the potential ability of education to address the topic.

#### 4 Preliminary Results of a Case Study in Cuiabá-MT

This section shares preliminary findings on PwVI's exposure to flooding and their vulnerabilities and capacities to face disaster risks and climate change. We also identified narratives that represent hope as synonymous with battling (Freire 1992), in order to point out ways to face climate change injustice. The interpretations presented here, as well as the concepts and conclusions, do not deny other

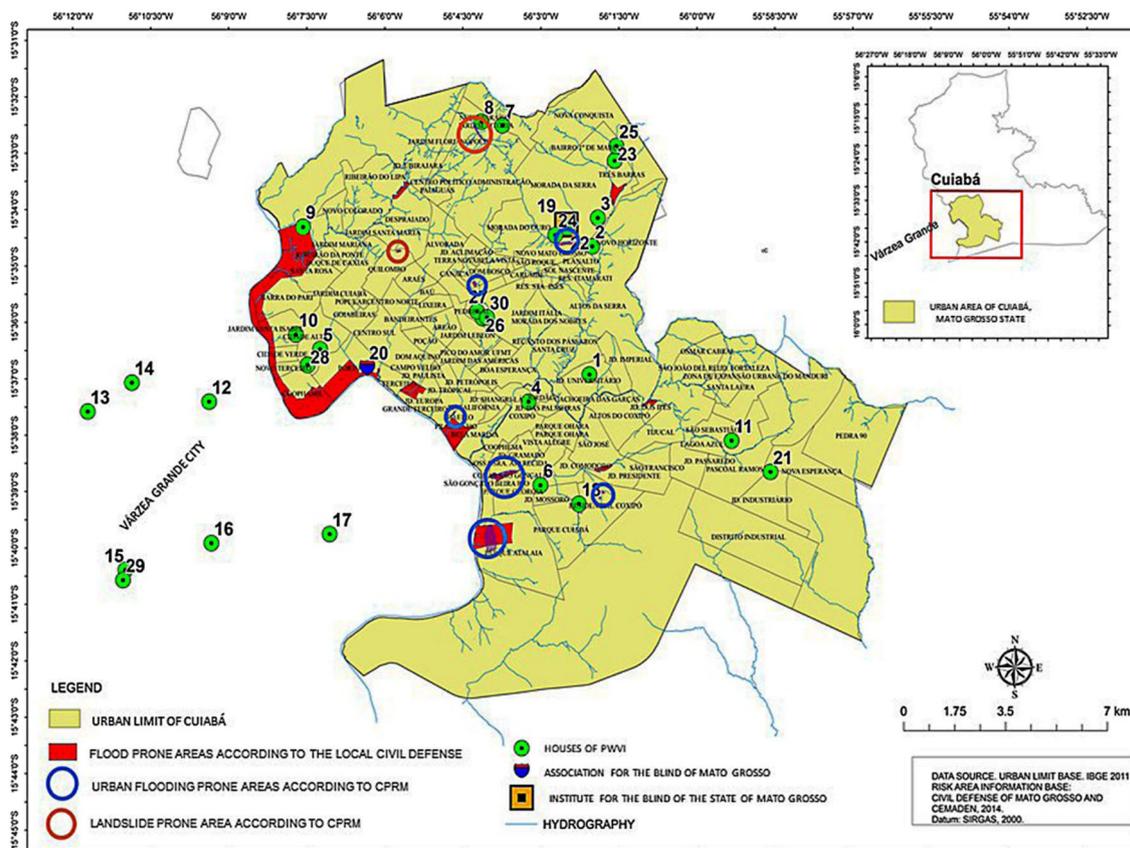
forms of understanding, but invite further contributions, since science is an inconclusive field, which is always subject to transmutation (Sato et al. 2013).

#### 4.1 Exposure to Floods and Landslides

In Brazil, there are 45.6 million people with disabilities, the majority of whom are those with visual impairments (IBGE 2010) and, in general, there are no risk maps that include people with impairments (PwI) or display their exposure to hazards. The National Policy on Civil Defense and Protection (PNPDEC) (Brasil 2012a) mentions the need for strategies to include people with “disabilities” in DRR. However, disaggregated data and hazard maps—basic elements for DRR policy making—are still lacking. This study proposed a method to merge hazard maps—provided by NUPDEC/Cuiabá and CPRM—and georeference data from 28 PwVI residences and two institutions collected in the field in partnership with the ICEMAT (Fig. 3). The geomapping case study applied in Cuiabá can be replicated in other municipalities that are required by law to follow the National Policy on Civil Defense and Protection (Brasil 2012a).

In Cuiabá, some of the PwVI—whose homes are identified in numbers 1 to 30—reside in the vicinity of areas subject to flooding (for example, subject no. 9). Institutions that provide services to these people are also exposed to this hazard, including the headquarters of Institute of the Blind of the State of Mato Grosso (ICEMAT, no. 19) and the Association for the Blind of Mato Grosso (AMC, no. 20), located in the traditional neighborhood of Porto, an area that was flooded in 1942, 1974, 1995, and 2001 (Zamparoni 2012). The problems related to urban mobility are increased during flooding, and create additional barriers to people who live in and/or circulate in these zones, including PwVI who go to AMC. This is not an isolated case. A similar situation was reported by Good et al. (2016) after the 2010 and 2011 earthquakes in Christchurch, New Zealand: the national organization that provided services to PwVI was located in one of the most severely damaged parts of the city and safety barriers had been set up that did not take into account the needs of PwVI.

The varied forms of visual impairment can be important to define the vulnerability of PwVI, but we also need to take into account their capacities and the potential of ICEMAT and AMC to codevelop DRR education strategies. There are necessary skills that can be used in self-protection strategies in the face of social and environmental risks (Abbott and Porter 2013; Bell et al. 2019). For example, skills in social communication (radio broadcasting) and information technology can help to create campaign initiatives (Good 2016; Good et al. 2016) and to discuss disaster prevention with civil defense, urban



**Fig. 3** Georeferencing of some people with visual impairments (PwVI) associated with AMC (Association for the Blind of Mato Grosso) and ICEMAT (Institute of the Blind of the State of Mato Grosso), as well as flood- and landslide-prone areas in the

metropolitan region of Cuiabá. *Source* Created by the authors, based on data collected in the field and obtained from Brazilian Geological Survey (CPRM) (Cabral and Peixoto 2014) and NUPDEC/Cuiabá (Center for Civil Defense and Protection) of Cuiabá (2017)

planners, and people with impairments. To support these and other initiatives on the topic, it is important to listen to and interpret what people have to say about climate change, vulnerability, disaster risks, and education. In the words of the international disability rights movement—Nothing About Us Without Us—it is essential that these people participate and collaborate in the debate. In the next sections, we discuss these topics.

#### 4.2 Visually Impaired People, Disaster Risks, and Climate Change

Stating that some social groups are in a situation of vulnerability to climate change also implies that this condition can change, in both positive and negative ways. One positive way to reduce the vulnerability is to increase the personal capacities of PwI and social protection mechanisms of institutions responsible for disaster risk management (Wisner et al. 2012). In the case of PwVI, it is urgent to listen to and involve them in the formulation of DRR plans (Abbott and Porter 2013).

Our understanding of vulnerability considers the conceptual complexity of the term and the fact that it involves many characteristics of people that are circumscribed by socioenvironmental and economic conditions that unequally expose them to hazards. This exposure limits their ability to anticipate, deal with, and recover from disaster impacts. In the case of the Latin America / Caribbean region, it is essential to understand the social, economic, environmental, political, technical, and institutional dimensions that make people vulnerable, as well as how they change in different space-time scales (Wilches-Chaux 1993).

Even though we have made considerable advances in relation to the rights of PwI in the Brazilian context, these disabling barriers persist in the National Plan on Climate Change, last updated in 2007 (Brasil 2008) and the National Policy on Civil Defense and Protection, last updated in 2012 (Brasil 2012a), as well in the cities that particularly need to implement them. Additionally, the situation of vulnerability can worsen. Reports of cases of violence against people with impairments show a worrying scenario of social vulnerability. A survey by the Notifiable



**Fig. 4** Tactile risk map created to include people with visual impairments (PwVI) in DRR education. Photograph by Giselly Gomes, 25 October 2018

Diseases Information System (SINAN), based in the Ministry of Health, shows that in 5 years, the number of people with impairments who experienced and reported instances of rape almost doubled in Brazil, from 941 in 2011 to 1803 in 2016. These cases represent almost 8% of the rapes attended by health services, which totalled 22,991 in 2017 (Collucci 2017).

This situation of the vulnerability of PwVI is strongly impacted by disabling barriers, defined by the World Report on Disability (WHO 2011, pp. 262–263) as environmental factors that restrict the participation of this group in society:

1. **Inadequate policies and standards** that do not always consider the needs of people with impairments, and/or are not met. For example, the lack of a clear inclusive education policy, the lack of accessibility standards in physical environments, and the low priority given to rehabilitation for those people that manifest no sight or partial sight during their life course;
2. **Negative attitudes**, such as beliefs, prejudices, and stigmas; also problems related to the lack of services;
3. **Inadequate financing**, for example, strategic studies on poverty reduction that mention impairment, but do not consider the issue of financing policies for people with impairments (Bennett 2020);
4. **Lack of access** in public facilities and transport systems, which are often inaccessible;

5. **Lack of access** to information in an accessible format and to communication directly tailored to their needs;
6. **Lack of consultation and involvement** in decision making on issues that directly affect their lives; and
7. **Lack of rigorous and comparable data** on disability, and about programs that work.

During the interviews and the workshop, many participants shared their experiences with the environment and impressions of climate change. They recognized global warming, deforestation, and fires as agents that cause climate change, identifying human action as its main cause.

The culprit for climate change is society's own demand. It is the price of progress... The issue of deforestation, inappropriate waste disposal in the environment, contamination by pesticides... (Marconi, 50 years old, partial sight).

Visual impairment was not viewed as a disability to comprehend that disasters are not natural. They stated that the lack of access to scientific knowledge is a barrier to “taking the naturalness out of natural disasters” (O’Keefe et al. 1976):

We often know of some kind of disaster, which makes it subtle to realize that it is the result of human action. But as we do not have all this scientific knowledge to perceive it clearly, sometimes it is perceived as a consequence of nature itself. For example, an unusual storm, or another phenomenon of unusual nature... in a way, it is not noticed by most people who understand it as a nature event only (Murdock, 33 years old, no sight).

In general, there is an understanding regarding the causes of disasters from the aspect of natural phenomena, when blaming, for example, the rain. Hence the understanding of “natural” disasters. At the same time, the people interviewed also identified technological hazards that can be associated with how the media framed the dam collapses that occurred in Brazil in Minas Gerais State in 2015. Examples include the failure of the Fundão Dam at the Germano unit in Mariana, Brazil, and the construction of the Manso Power Plant in Mato Grosso State. One interviewee said: “if nature designed it to support a certain weight, and they go there and build it, it will tumble. So it is a natural disaster, and at the same time, it is not” (“Son of the moon,” 37 years old, partial vision man). Another participant added: “if the barrier of the Manso Dam breaks, they say Cuiabá could be flooded” (Marconi, 50 years old, partial vision).

It is interesting to note the importance of social memory about disasters. Some interviewees recalled the devastating flood that occurred in 1974 in Cuiabá, which affected

neighborhoods located on the banks of the river, including the traditional neighborhood of Porto, where AMC is located. They discussed the future disaster risks and the barriers they face such as the possibility of further flooding and the lack of accessibility on the streets, especially on rainy days, and the lack of access to information and communication about disaster risks.

Considering a rainfall scenario, regardless of its volume, all people may be exposed to it, but may have different conditions for coping with the situation, as well as experiencing disorientation, similar to what Bell and colleagues (2019) identified in the UK. The visually impaired population, who already face a series of daily barriers, more frequently encounter difficult situations, and may need special help, especially from civil defense professionals and the Fire Department, among others. The interviewees detailed the effect of some disabling barriers related to the **lack of public policies** and the **lack of access** to information in an accessible format and communication tailored to their needs. According to Murdock:

Vulnerability is a weak point that does not depend on my control, or that is often not under my control. And this control would have to be done by other areas that will close these points of vulnerability... regardless of whether a given location is susceptible to disaster risks, at least the knowledge about it is fundamental to all people with impairments, in the same way that it is essential for the civil defense technical team, for example, to be prepared to assist a person with an impairment... And it should be mandatory for all institutions to have a sector of study focused on disability in general (Murdock, 33 years old, no sight).

The narrative sheds light on the importance of social participation of PwVI, who can contribute to the policy-makers and DRR researchers (Abbott and Porter 2013; Smith, Simard et al. 2017; Bennett 2020; Jodoin et al. 2020). Regarding the demands identified in the narrative, we are reminded of the dimensions of vulnerability enunciated by Wilches-Chaux (1993): **educational vulnerability**, defined as the absence of educational programs on the subject—“the knowledge about it [location susceptible to disaster risks] is fundamental to all people with impairments”, the **degree of preparedness** of the population to face disaster situations—“it is essential the civil defense technical team (...) to be prepared to assist a person with impairment”; and **institutional vulnerability**, as reflected in the obsolescence and rigidity of institutions, in the prevalence of political decisions without technical-scientific criteria, in the predominance of personalist criteria in decision making. One of the interviewees who named himself Murdock said “it should be mandatory for

all institutions to have a sector of study focused on disability in general”.

In general, civil defense units in Brazil are not yet prepared to include PwVI in DRR policies, mainly because civil defense activity is not recognized as a career, and positions are politically nominated and generally change every election (Marchezini et al. 2017). To face this institutional vulnerability, it is necessary that other governmental and social sectors, including those that have actions in the field of education, social assistance, and urban planning, be involved with DRR including CCA. Interviewees reported risk situations that they experienced, by emphasizing the architectural barriers that increase the risk of accidents, especially during rainfall: “I speak for myself, me who has already fallen on the street several times after rain... the sidewalks littered with holes in my neighborhood are filled with puddles of water, and it causes falls” (Smiling, 35 years old, partial vision).

During the interviews, we realized that the notion of disaster risk prevention is conceived as something inevitable in their lives, especially because they already face a series of disabling barriers on a daily basis, similar to what Abbott and Porter (2013) and Bell et al (2019) reported in their studies. This statement is aligned with recommendations of scholars to use education to increase awareness about the need for reducing the underlying causes that produce disaster risks, such as those related to permanent processes, that is, urban sprawl and the lack of accessibility in cities (Sulaiman and Aledo 2016). To cope with these everyday risks that PwVI face in cities—where regular rainfall associated with weather variability can be “extreme,” our participants always tried to be with other people or temporarily avoid some of the disabling barriers. PwVI need to be involved in contingency planning, drills, and evacuation exercises to increase preparedness, especially those who have children:

When my children are not with me, and they go to their father’s house, I don’t even leave the house (Chanô, 48 years old, partial sight woman).  
[...]Whether during the day or at night, we always try to be with other people... If a disaster occurs, most people will be at work, at school, with other people... In my case, for example, if something happens during the day, I will be here at AMC... If there is a fire, the alarm will be activated and we will go outside, next to each other... I do not see how to create something specific for us visually impaired, but hopefully it has (Marconi, 50 years old, partial sight).

If the current situation already poses a series of disabling barriers, intensified by the chance of rainfall, the increase in extreme weather events implies new challenges, perhaps greater than those experienced in the 1974 flood in Cuiabá.

Another hazard is heat waves (Pallotta 2018). The average temperature in Mato Grosso is 35 °C, but projections indicate there will be a future increase of between 3° to 6 °C (Marengo 2009). During the interviews, two participants talked about their perceptions of climate variability—increased temperature—in Mato Grosso and the implications for their health:

I was born in the state of Paraná, and I lived there until I was 14 years old... When I came to Mato Grosso, it is much warmer here, the doctors in Paraná said that the Mato Grosso weather would harm me a lot. And really, I lost my vision much faster... Because glaucoma, eye pressure, goes up a lot with the heat (Orange Blossom, 36 years old, no sight woman).

I cannot stand the sun's glare, even wearing photochromic glasses. My eyes are very sensitive. In addition to being very red, the sun's rays can increase inflammation in my eyes, causing burning, headache, irritability... I avoid exposure to the sun, because I feel these effects more strongly and I know they harm me!... I don't even do physical activities in the morning anymore (Smiling, 35 years old, woman with no sight).

These challenges require critical understanding of the problem, and education is considered fundamental in this process, to transform the institutions and to bring them together with people that need to be more prepared for DRR including CCA.

#### **4.3 The Role of Environmental Education in Disaster Risk Reduction Including Climate Change Adaptation: Subsidies from the Perspective of Inclusive Education**

In Brazil, there is a legislative mandate to provide compulsory teaching of DRR including CCA in the school curriculum. It is important to guarantee an audience for PwI and PwVI students (Good 2016) in DRR, including CCA, recognizing and understanding that PwI are not a homogeneous group. There is a need to tailor data and information according to the diversity of PwI, as well as to codevelop methods to include them in DRR strategies (Abbott and Porter 2013; Smith, Simard et al 2017; Bennett 2020). Inclusive education can be instrumental in finding means of implementation.

The narratives from the workshop confirm the unquestionable contribution of education, and highlight the relevance of DRR efforts that include CCA in the primary and high school curricula. Participants—including PwVI who are teachers—considered that access to information is important and schools and media can contribute. These

participants also stated that information is not enough, because information also needs to be analyzed and critiqued by universities and environmental education courses, as well as by disability rights movements:

As a teacher, I consider that schools work very superficially on weather and climate change... The information is transmitted, but it needs to be analyzed and critiqued. Universities also have this role. But when I graduated, I had only one environmental education module during the four years of the pedagogy course... I believe that it is a subject that should be more emphasized in universities (Smiling, 35 years old, partial sight woman).

It is important for people with visual impairments to be included in the discussion of the field on climate change and disaster risks, with the school and the mass media being important spaces for bringing information... Subjects such as environmental education and sustainability must be more present in schools and associations (Murdock, 33 years old, no sight man).

When we think about the school curriculum, we can promote initiatives that will become inclusive pedagogical practices, but above all, which demonstrate an ethical curriculum from the point of view of respect and care for people and other forms of life, as recommended by the *Earth Charter*<sup>6</sup> and the *Treaty on Environmental Education for Sustainable Societies and Global Responsibilities*.<sup>7</sup>

The Workshop on Environmental Education, Climate Justice, and the Visually Impaired was a way of bringing together 100 participants, including 60 PwVI, representatives of universities and institutions (ICEMAT, AMC, CASIES, and civil defense) for an important dialogue on climate change, disaster risks, and, mainly, to hear the understanding of the PwVI about their vulnerability to disasters in Cuiabá. The workshop was an opportunity to share preliminary findings of this research using science communication strategies that took into account the needs of PwVI. One of the interesting results of the workshop was the proposal to create an app tailored to PwVI's needs of information. Another was the creation of a tactile risk map, co-produced with one teacher and two technicians from CASIES and revised by two of its experts in the braille system, to promote dialogue about disaster risks, as well as to gather information and insights about how to develop methods to promote DRR education with PwVI, such as the use of tactile risk map (Fig. 4).

<sup>6</sup> [https://earthcharter.org/wp-content/uploads/2020/03/earthcharter\\_english.pdf?x79755](https://earthcharter.org/wp-content/uploads/2020/03/earthcharter_english.pdf?x79755)

<sup>7</sup> <http://rio20.net/en/documentos/treaty-on-environmental-education-for-sustainable-societies-and-global-responsibility/>

While the educational system must include diversity as a right for all people (MATO GROSSO 2010; Brasil 2013; Hardoim et al. 2013), it is also relevant to think about diversity from the perspective of the role of civil defense and disaster response, especially considering that people with impairments are not a homogeneous group (Abbott and Porter 2013; Smith, Simard et al. 2017; Bennett 2020). According to an interviewee's recommendation:

It shouldn't be an option, but an obligation, that all institutions should have a study sector focused on people with impairments in general... Today I also think a lot about hearing impairment because I live with my daughter who is hearing-impaired... How will a civil defense technician communicate with her if she doesn't know LIBRAS [Brazilian sign language]? How will this technician explain to her what is going on? Training aimed at assisting people with impairments in general should already be taking place in institutions such as Civil Defense (Murdock, 33 years old, no sight man).

The need for dialogue between civil defense and public schools is found in Law no. 12.608 (Brasil 2012a), a regulatory framework of the National Policy on Civil Defense and Protection (PNPDEC). The PNPDEC changed Article 26, § 7, of Law no. 9.394 (Law of Guidelines and Bases of National Education) by stating that "the elementary and high school curricula must provide the principles of civil protection and defense and environmental education in an integrated way with the mandatory contents."

We recognize the importance of this initiative. But we agree with Sulaiman and Jacobi (2013) when they emphasize that the technocratic and behaviorist perspective present in the Brazilian policy of disaster prevention is based on an approach to living with risk, instead of questioning the root causes that lead to risks. Critical environmental education can be a key to questioning this behaviorist approach, as advocated by Law no. 9.795, of 27 April 1999, which provides guidelines for the National Environmental Education Policy, as well as the National Curriculum Guidelines for Environmental Education, approved by the National Education Council by Resolution CNE/CP no. 02/2012. The conjunction of inclusive education and critical environmental education can help to reform the technocratic DRR paradigms that persist in Brazil and possibly elsewhere.

## 5 Conclusion and Recommendations

Despite numerous legal advances in favor of the visually impaired, they continue to encounter several barriers, which compromise their social participation in different

spaces, especially in those where decisions are made on issues/themes directly related to their lives. These disabling barriers reinforce their dependent relationships with other people, as well as perpetuating the stigma that labels PwVI as "disabled" or incapable (Smith, Simard et al. 2017; Bennett 2020; Jodoin et al. 2020).

The lack of educational programs and initiatives in Brazil that address the issue of CCA and DRR are reflected in school curricula, indicating that educational vulnerability around these issues is high. In the face of noncompliance with inclusive proposals, it is likely that the situation of PwVI is even more fragile. The lack of data and information on PwVI in agencies such as civil defense and the absence of an action plan aimed at providing adequate care also indicate institutional vulnerability (Wilches-Chaux 1993), and is reported in many cases around the world (Smith, Simard et al. 2017; Bennett 2020). The educational approach to disaster prevention in which environmental education assumes an important role is recognized as fundamental, as long as the curriculum overcomes technocratic and behavioral perspectives and promotes questioning of the status quo.

In the general terms of the proposal of the National Curriculum Guidelines for Environmental Education, environmental education involves the understanding of a critical education, assuming a transformative and emancipatory role in society (Brasil 2013). This approach is consistent with warnings about the importance of questioning the naturalization of "natural disasters," thus breaking with the understanding that natural phenomena themselves are responsible for disasters (Kelman 2020).

Although these educational programs are being created, it is important to ask first how they will be formulated and implemented. People with visual impairments are the ones who best understand their own barriers, and their inclusion in the DRR debate can foster another way of "seeing" and experiencing the world, decolonizing the concepts and the frameworks that are usually created to analyze the vulnerabilities of the visually impaired to disaster and climate change. The motto "Nothing about us without us," which emerged with the disability rights movement in South Africa, communicates the idea that no policy that concerns them should be decided without their full participation, no matter how good the intentions of people without impairments are (Sasaki 2007). Some initiatives are trying to put this motto into practice (Smith, Simard et al. 2017; Bennett 2020), including in the Brazilian context.

Actions such as those taken by the Civil Defense of the State of Rio de Janeiro, in partnership with the National Institute of Deaf Education (INES) and the Roquette Pinto Association of Educational Communication (ACERP), are examples that can inspire public policy in other Brazilian states, and also motivate organizations that serve persons

with impairments to identify inclusive proposals that can be used in their jurisdictions. These initiatives, coordinated by the Civil Defense School (ESDEC), seek to promote a space of mutual support for the dissemination and exchange of knowledge and DRR-inclusive practices. An additional example comes from the São Paulo State Civil Defense, which is developing a calendar of regional workshops for DRR, and is also working on creating a protocol for locating and rescuing people with some type of impairment in hazard-prone areas (Coordenadoria Estadual de Defesa Civil de São Paulo 2018).

More than encouraging the culture of DRR among PwI, we hope that the concerns, motivations, and reflections presented in this article can promote a dialogue between people with and without impairments, public institutions, civil defense managers, and DRR and CCA policymakers. One of the urgent topics of discussion is the processes that lead to situations of vulnerability, especially for those people that face multiple marginalizations, such as PwVI in situations of poverty, who do not have access to a guide dog, nor the resources to be more independent or to benefit from governmental policies of social protection. These are improvements that can inaugurate a more inclusive scenario for the group in DRR, including CCA planning, as well as in academic-scientific fields concerned with climate injustice and neglected disasters.

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