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An inclusive future: disabled populations in the context of climate and environmental change

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Climate and environmental change impacts are projected to increase, constituting a significant challenge for meeting the Sustainable Development Goals (SDGs) while disproportionately affecting disabled populations. However, current research lacks knowledge on context-specific impacts of climate and environmental change on disabled populations. We use the environmental justice perspective that emphasises distributional, recognitional, and procedural dimensions regarding disabled populations to understand impacts and adaptation concerns and their implications for achieving the SDGs.

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Introduction

Global environmental change and anthropogenic climate change are causing unprecedented biodiversity loss, jeopardising the provision of nature's contributions to people (NCP), that are 'all the contributions, both positive and negative, of living nature (diversity of organisms, ecosystems and their associated ecological and evolutionary processes) to people's quality of life' [1–5]. The assessments of the Intergovernmental Panel on Climate Change (IPCC) and the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) demonstrate that the impacts of climate change, biodiversity loss and environmental degradation are unevenly distributed across different social groups. In fact, the impacts from these changes disproportionately affect the wellbeing of vulnerable and marginalised communities, such as the poor, women, elderly and Indigenous Peoples [3,6]. Despite efforts to include marginalised communities, both intergovernmental bodies did not specifically consider another highly vulnerable subgroup of society — disabled populations [7–9]. It is important to note that often disabled populations are also a part of other marginalised groups, such as poor people, Black, Indigenous People and People of Colour (BIPOC) or women, inter-binary, trans-binary or non-binary people. Therefore, there is an urgent need to address the challenges of climate and environmental change for the world's disabled populations from an intersectionality lens in order to effectively foster sustainable inclusive and just futures. More specifically, it is necessary to understand the interconnections between the context-specific impacts of climate and environmental change for disabled populations (intersecting with other marginalised social groups as mentioned above) and environmental justice [10,11]. Transforming our societies towards sustainability requires the consideration of environmental justice [12] and all marginalised groups, including disabled populations.

Progress in addressing the interconnections between the context-specific impacts of climate and environmental change on disabled populations within the environmental justice framework is still meagre. The paradigm of environmental justice comprises three dimensions: distributional, recognitional and procedural. Distributional justice refers to how impacts, costs, benefits and non-benefits of climate and environmental change are allocated among actors. Recognitional justice refers to the acknowledgement of whose voices and knowledge are heard, respected and listened to. Procedural justice refers to how decisions are made and by whom [13].

This paper critically evaluates current evidence of climate and environmental change impacts on disabled populations in mainstream academic publishing. To assess to what extent the scientific literature on climate and environmental change has considered disabled populations, we reviewed the literature with a perspective on the three dimensions of environmental justice: distributional, recognitional and procedural [12,13]. To assess the

impact of environmental change, we specifically considered changes of NCP [2]. We aimed to answer the following questions: 1) How do climate and NCP changes impact disabled populations? (distributional dimension); 2) Are 'people with disabilities'[6] recognised in the research and policy of climate change and NCP? (recognitional); 3) To what extent are disabled populations included in decision-making and policy-making regarding climate change and environmental change? (procedural).

Conceptual background: environmental justice to understand disabled populations

Disabled populations are the largest marginalised group. This group consists of approximately 15% of the global population. If care providers — parents, children and relatives caring for a disabled family member are accounted for, the percentage would be much higher [14]. Almost everyone in their lifetime is likely to temporarily or permanently experience disability. The percentage of people with disabilities in the population is expected to increase with demographic trends of ageing and the prevalence of chronic health conditions associated with disability (e.g. diabetes, cardiovascular diseases, sensory diseases/impairment, and mental illness) [14]. Multidimensional barriers towards inclusion and participation in decision-making are often historical and result in reduced access to education, health services, employment, and thus, poverty and lower levels of information and resources [11,15,16].

While the environmental justice framework has been extensively applied to answer the question of whether the most vulnerable members of society are most likely to be at high risk from natural hazards [17,18] and suffer from a lack of access to NCP [19,20]; it has rarely investigated the specific impacts on disabled populations [19]. Considerations of disability rights are neither widespread in climate change research [21] nor environmental change and often the analysis lacks of recognizing intersectionality (i.e. disabled populations that are part of other marginalised groups) [19].

Methods

Our review draws on the systematic review methodology [22] in order to transparently, comprehensively, and critically assess the current state of knowledge on the impacts of climate and environmental change on disabled populations. Based on the results of a scoping review including IPCC and IBPES reports, we defined a search string comprising keywords and related search terms for the elements of interest — climate change, environmental change, and disabled populations. We used the final search string in three literature databases (Web of Science Core Collection, Scopus, and PubMed) that represent the most relevant body of academic literature in the context of research on climate and environmental change (see Supplementary Material for the full search strings). We searched for English language literature, with no limitation regarding year of publication.

All articles found in the databases were screened in a two-step approach with the online platform Sysrev [23], including a combined title and abstract screening and subsequent full text screening by three independent researchers. Conflicting screening decisions were resolved in discussion among the researchers. Inclusion criteria for articles to be considered in the review were primary research studies that provide empirical evidence on observed climate or environmental change impacts on disabled populations. Review articles and meta-analyses were excluded during the screening stages.

Included articles were systematically coded in Sysrev according to a set of codes on a) metadata, describing the publication, b) location of the study, to analyse regional patterns and potential bias, and c) themes, describing the climate and environmental change impacts on disabled populations and dimensions of environmental justice addressed.

Results

The full review includes 21 articles (see Supplementary material for a list of all articles included). Some of these articles dealt only with climate change or environmental change, while some dealt with both. Figure 1 shows a breakdown of these articles per study location.

The following sections provide a narrative synthesis of the main findings of climate change (Section 'Climate change and disabled populations') and environmental change (Section 'Environmental change and disabled populations') impacts on disabled populations, representing the general coverage of empirical research on these key concerns in academic literature.

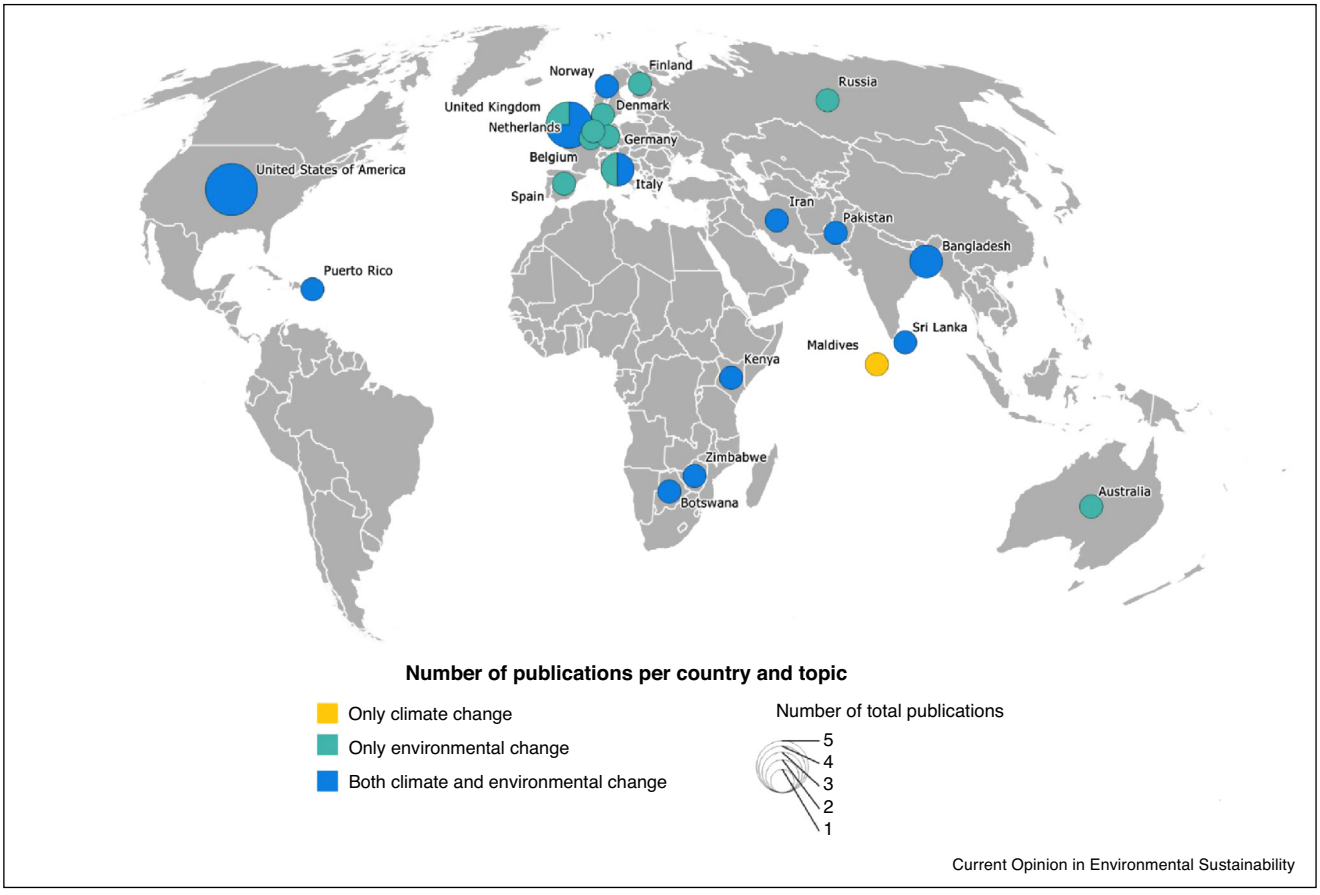
Climate change and disabled populations

Only a few studies in the mainstream scientific literature analyse climate change impacts with regard to disabled populations [see also Ref. 7]. These studies are predominantly located in North America, Europe and Asia, with a low number of studies in regions in which climate change impacts are projected to be highest (e.g. Mediterranean, Latin America, Africa, Small Island States) (Figure 1).

The reviewed literature relating to distributional justice shows that disabled populations are disproportionately affected by climate change at three different stages: a) before the disaster (e.g. access to urgent information, early warning systems); b) during the disaster (e.g.

[6] Here we use the term 'people with disabilities' instead of 'disabled people' as we want to emphasize the person and not their disability. Although it is an inseparable part, disability does not define the holder.

Figure 1



Geographical distributions of peer-reviewed publications including evidence on the impacts of climate change and environmental change (which was assessed through changes in Nature's Contributions to People) on disabled populations.

evacuation, transport and shelters); and c) after the disaster (e.g. housing, food, water, medical care, education) [7,24–27] (Figure 2). For example, Hurricane Katrina impacted 155 000 people with a range of disabilities (e.g. people who were blind or deaf; people who used wheelchairs, canes, walkers or crutches; people with service animals; and people with mental health needs) in all of the three stages [28]. Before the disaster, people with disabilities, particularly those with sensory disabilities, were unaware of the magnitude of the storm and evacuation or shelter opportunities [29]. There was a lack of fully accessible emergency information (e.g. no sign language interpreter on the news or loss of power or cell phone signals) as well as access to evacuation transport. This situation is not isolated to the Hurricane Katrina event: evacuation and access to transportation are among the major problems for people with disabilities during disasters [28]. In some cases, people with disabilities have limited access to shelters due to losing their mobility equipment or being rejected because of lacking adequate equipment (e.g. suitable beds or accessible bathrooms) [27,30]. When in shelters, women with disabilities have a higher probability of experiencing sexual violence [26,31]. After Hurricane Katrina, 12% of children that had disabilities were left homeless [26]. Generally, the reconstruction of 'the previous life' is often challenging for people with disabilities in terms of accessible housing, food shortage, water supply, health care, education, employment and economic welfare. After climate change-related extreme events, people with disabilities are also faced with increased vulnerability towards vector or water-borne diseases (e.g. Malaria, Ebola virus EVD4, Zika, MERS, SARS or COVID-19) and mental health problems such as post-traumatic stress disorder. These other conditions may exacerbate underlying conditions and lead to higher morbidity and mortality rates [11,32–35].

Heatwaves are another extreme climatic event that disabled populations are also particularly susceptible to. Heatwaves are extreme climatic events and one of the leading causes of weather-related deaths worldwide

Figure 2

An illustration of the disproportionate vulnerability towards climate-related hazards, such as flooding, of people with disabilities (source: Asad, 2017).

[36,37]. Yet, their impact depends on many factors, such as the type of disability. For example, while exposure to heat might not exacerbate the condition of someone with hearing impairment (sensory disability), it might worsen the symptoms of someone with multiple sclerosis (physical disability) [38,39]. Hence, from the perspective of distributional justice, we need to better understand how climate change impacts different types of disabilities (e.g. mental, intellectual, sensory, physical). In addition, the extent of the impact of heatwaves also depends on the specific context. For example, while urban heat islands can further amplify the 'heatwave effect'; people with disabilities in rural areas are likely to be significantly affected due to lower levels of education, economic status and physical isolation [40]. Therefore, long-term studies to understand the direct and indirect impacts of extreme climatic events on the livelihoods and wellbeing of disabled populations in different geographical contexts is urgently needed [33,41,42].

Regarding distributional justice, disabled populations also face stigma and discrimination [43,44]. Climate change is escalating these inequalities, placing disabled populations in even more socially and economically disadvantaged positions (e.g. loss of housing and employment, forced migration) [45]. Many studies have indicated that the most vulnerable people are those disabled that belong to other marginalised groups, such as Indigenous Peoples, women, children or the elderly [7,46–48]. For example, children with disabilities are more susceptible to water-borne diseases due to underlying conditions, weaker immune systems and the lack of disability-specific services (e.g. access to medication, health services, assistive devices, food and clean water).

Most current research focuses on recognitional justice, investigating, for example, the impacts of extreme events on disabled populations, particularly those with physical disabilities. Yet, most studies dealing with climate change and disabled populations acknowledge the necessity for applying an intersectionality lens to study the relationships between the complex vulnerabilities of disabled populations in order to uncover 'hidden discriminations' [11,25,43,49]. For example, residential care and education facilities for young children in the Maldives are often not adequately equipped to provide care to children with disabilities, leading to further marginalization and generating unique situations of vulnerability [49]. Although this study does not refer particularly to climate change, it shows what could happen 'after the disaster' when children are displaced to new care facilities and schools that are not properly equipped to cater for the unique needs of children with disabilities. Intersections of disability with other vulnerabilities (e.g. gender, age, ethnicity or race) might lead to overlooking 'hidden discriminations' and fuel ableism.

As climate change impacts on disabled populations are associated with high mortality rates of this group and long-term impacts on their wellbeing, it is important to act quickly to incorporate disability issues into procedural justice. Previous research highlights the need for different sets of knowledge in order to be able to: a) include disabled advocates and researchers into decision-making; b) increase education opportunities for disabled populations; c) empower and informing disabled populations about their rights; and d) explore the effects of climate change on disabled populations [9,11,16]. For example, Shah *et al.* [50] demonstrated that education is the best tool for successful mitigation, adaptation and risk reduction for people with disabilities.

Environmental change and disabled populations

While scientific knowledge on the effects of environmental change on NCP has exponentially increased in the past two decades [2,51–53], the consideration of environmental justice in NCP research is still in its infancy [13,20,54], especially with regards to disabled populations. The few research on NCP and disabled populations have been located in the global north (especially in the United States and the United Kingdom) (Figure 1) with a clear focus on distributional and recognitional justice. In particular, the reviewed literature shows the effects of environmental change on NCP and the negative impact on the wellbeing of disabled populations [55]. However, research on environmental justice and the effects of environmental change on NCP is not evenly distributed among NCP categories (Figure 3). In terms of regulating NCP, regulation of hazard and extreme events, climate and air quality are the most represented categories. Among the material NCP, the provision of medicinal, biochemical and genetic resources, as well as materials and assistance, are the most represented. Among the non-material NCP, research on environmental justice and NCP has mainly focused on physical and psychological experiences, followed by learning and inspiration and supporting identities (see Supplementary Material for the definitions and examples of the NCP categories).

Regarding recognitional justice, research shows that the degradation and loss of NCP can affect the wellbeing of disabled populations in many ways. For example, Akerlof *et al.* [41] stressed that the impact of climate change on regulating and material NCP has adverse effects on the wellbeing of disabled (and elderly) populations. Regarding non-material NCP, the aesthetic experience provided by nature is likely to be different when the person is visually impaired than when the person is non-visually impaired. Moreover, accessibility often determines the capacity of physically impaired persons to enjoy recreational, aesthetic and learning experiences in nature [56].

Regarding distributional justice, Gallis *et al.* [57] emphasised the role of different types of disabilities (i.e. sensory, learning and physical impairments) in the access to NCP. Moreover, to deeply understand the effect of loss and degradation of NCP on the wellbeing of disabled populations requires intersectional approaches by which differences in cultural, political, and socioeconomic status are considered [43,49]. For example, disabled members of impoverished communities are more dependent on material and regulating NCP [42,58,59]. In addition, children with disabilities are at the highest risk of malnutrition in the context of scarce food (material NCP) in many Indigenous communities due to their inability to compete with their healthy siblings over the family dinner table [48,60,61].

Regarding procedural justice, only a few studies suggest that disabled populations should be part of the decision-making and policy-making [18,32,43,62]. For example, Jayasiri *et al.* [63] suggested that awareness campaigns and social media that foster learning and inspiration (non-material NCP) and target people with disabilities can contribute towards better risk management and build community resilience.

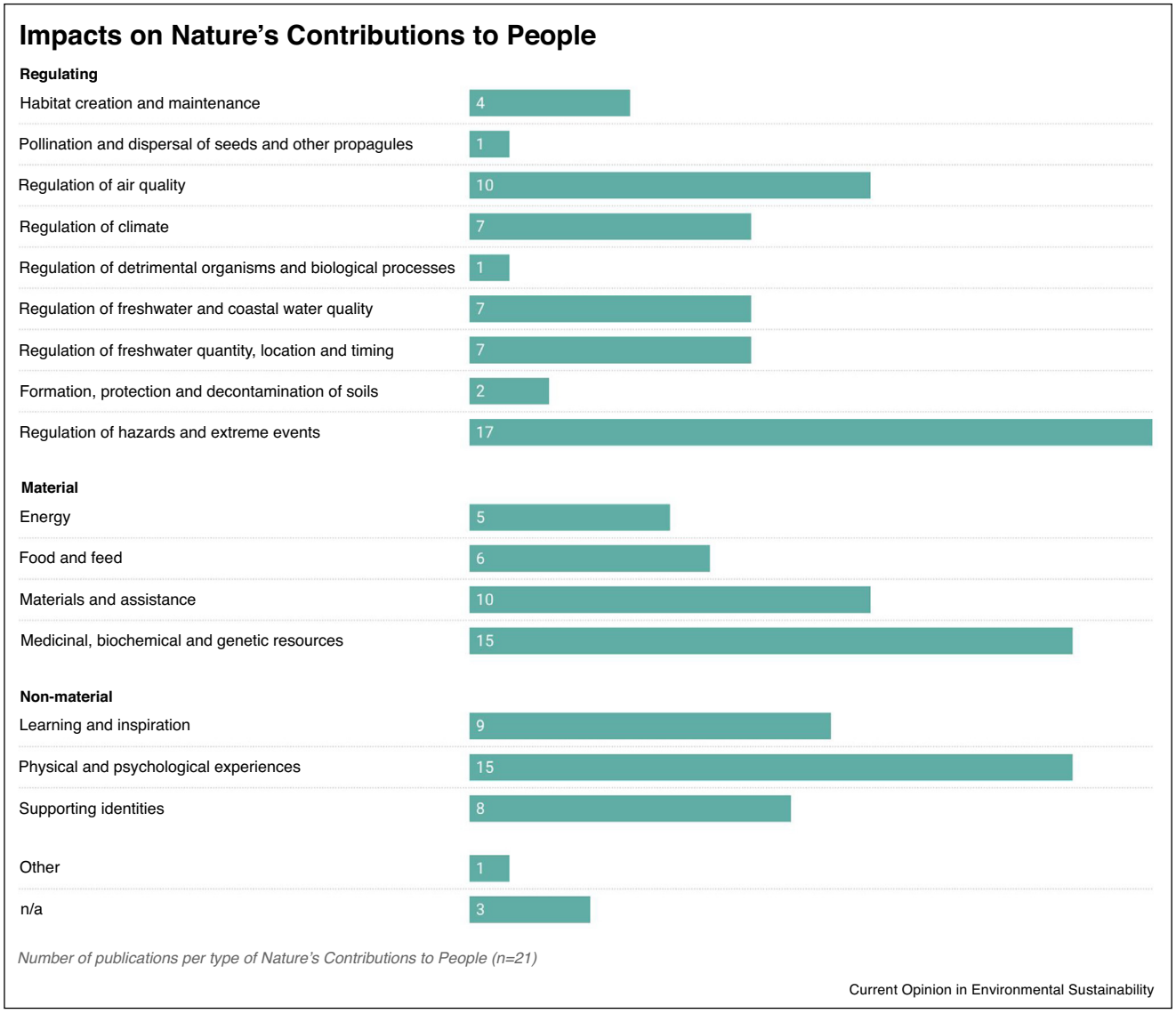
Discussion and conclusions

Considering disabled populations to build sustainable futures

Although the scientific literature has not widely considered disabled populations as an essential stakeholder group when researching climate and environmental change, there are relevant advancements in global sustainability policies. In 2016, the World Economic and Social Survey identified that one of the main challenges in achieving the UN Agenda 2030 for Sustainable Development is to recognise that climate change is likely to 'have a differential impact on people and communities', distinguished by geographical region, ethnicity, disability and other socioeconomic attributes [25]. The recent *UN Flagship Report on Disability and Sustainable Development Goals* has also stressed that the UN Agenda 2030 can be achieved only with the 'full participation of everyone, including persons with disabilities' [11]. Hence, any success in achieving the SDGs requires an integrative and inclusive approach guided by environmental justice [58,59].

As illustrated in the section 'Climate change and disabled populations', achieving SDG 13 Climate Action requires the consideration of disabled populations in several ways, including the climatic stressor, event phase, disability type and the intersectionality with gender, age, ethnicity or other social categories. The SDG target 13b acknowledges that to mitigate climate change equitably, it is necessary to take action based on human rights and to continue 'combating climate change through enhancing capacities for effective climate change related planning and management with a focus on marginalised communities' [64]. Actions have been already developed in this

Figure 3



Number of publications including evidence of impacts of environmental change on different categories of Nature's Contributions to People (NCP) for disabled populations (see Supplementary material for the definitions and examples of each NCP).

regard. For example, the UN Office for Disaster Risk Reduction has advocated for developing inclusive safety pre-disaster planning. Moreover, the Sendai Framework for Disaster Risk Reduction 2015–2030 has called for inclusive and effective disaster risk management that can be accomplished through three steps: a) data collection on emerging trends regarding disabled populations; b) engagement and promotion of people with disabilities in research; and c) incorporation of existing knowledge of different disabled groups (including science-based and Indigenous and local knowledge) into risk management [16].

The successfully achievement of one SDG with the consideration of disabled populations might foster the achievement of other SDGs (Figure 4). Although previous research has shown the synergies and trade-offs among SDGs [11,65–67] (Figure 4), these relationships have not been assessed yet from the perspective of disabled populations. For example, people with disabilities are on average three times more likely not to receive medical assistance when needed (SDG 3), which can be essential for saving lives during and after climate-related disasters (SDG 13) [9,11,24,27]. Disabled populations are also more likely to remain in poverty (SDG 1) due to displacement and a lack of adequate long-term assistance

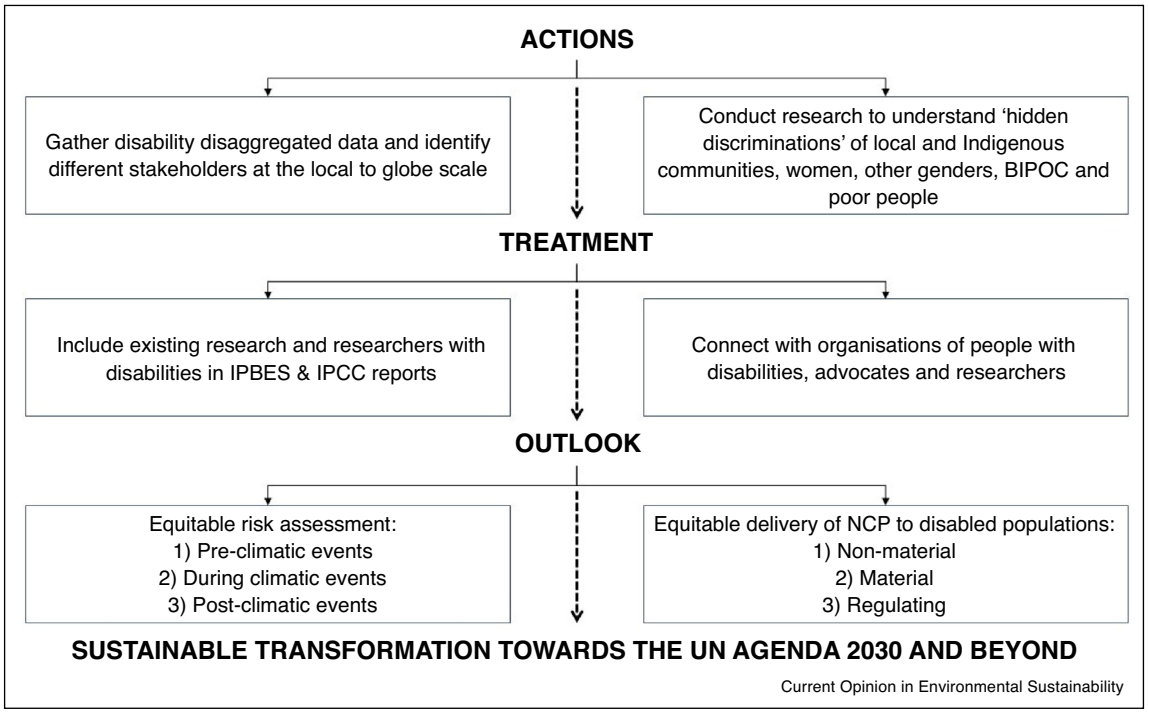
Figure 4

Importance of the inclusion of disabled populations in the SDGs 13, 14, and 15 for achieving other SDGs. Guidelines for promoting a more sustainable and equitable future.

after climatic disasters (SDG 13), limiting their access to education (SDG 4) [33]. Female gender is one of the factors amplifying the impact of climate change on people with disabilities [41]. Yet, the experience of women and girls with disabilities can be crucial for developing strategies to combat climate and environmental change (SDG 5) [68,69]. Moreover, Indigenous women (including disabled girls) play a central role in combating climate change (SDG 13) by preserving their local ecological knowledge (SDGs 5 and 16) and translating it into action [69]. Furthermore, access to mainstream education might allow girls and women with disabilities better understanding of the impacts of climate and environmental change and lead to increase their participation in the community decision-making (SDGs 5 and 17).

Impacts on marine and terrestrial biodiversity jeopardise not only the achievement of SDGs 14 Life Below Water

Figure 5



Framework for fostering action towards inclusive, sustainable futures for disabled populations.

and 15 Life on Land but also affect other SDGs through the impact on NCP [65,70–73]. For example, environmental change negatively affects coastal communities (SDG 14) through jeopardising the provision of several NCP, such as material NCP (e.g. fisheries and other sources of seafood); non-material NCP (e.g. nature-based tourism, spiritual and aesthetic experiences); and regulating NCP (e.g. erosion prevention, and mitigation of extreme events) [74,75]. Vegetation in urban areas (SDG 11) and forests (SDG 15) contribute to people's health (SDG 3) in many ways, disproportionally affecting people with disabilities. For example, vegetation improves the mental health of disabled populations and green spaces in urban areas reduce the heat island effect, mitigating the impacts of extreme climate events on disabled populations (SDGs 3 and 13) [76].

Meeting Sustainable Development Goal 17 (Partnership for the Goals) can lead to better visibility and inclusion of disabled populations by increasing the availability of disaggregated data by disability (target 17.18)' intersecting with poverty (SDG 1), education level (SDG 4) or gender (SDG 5). Finally, reducing inequalities (SDG 10) enables further opportunities for sustainable development across different stakeholders, including those people with disabilities.

A research agenda for more inclusive and just sustainable futures

This review shows that disabled populations are not fully considered in the sustainability research agenda and that this blind spot can jeopardise moving towards sustainable and just futures. The inclusion of disabled populations as a stakeholder group in the sustainability research agenda can contribute towards providing evidence on (a) adaptation processes that align with the needs of disabled populations during climate change events, (b) how regulating, material and non-material NCP support the wellbeing of disabled populations; and (c) how climate and environmental change affect the wellbeing of disabled populations. We, therefore, plea for a future agenda that includes disabled populations in climate and environmental change research (Figure 5).

One element of this future research agenda is the application of an intersectional approach that considers different disabilities, genders, education levels, socioeconomic status or cultural background. A disability rights approach [21] needs to pay specific attention to disabled populations that also belong to other marginalised groups, such as other genders than men, children and elderly people, or BIPOC (Figure 5). A second crucial element is the collection of data disaggregated by type of disability (Figure 5). In fact, a disability rights approach necessarily

requires the inclusion of disabled populations representing different disabilities.

A third crucial element is the disaggregation of information according to type of climate event, phase of climate change event or NCP category (Figure 5). A framework for action that promotes the resilience of disabled populations requires the consideration of disability rights during the three stages of disasters, including long-term assistance for recovery [33]. Likewise, it needs to considerate the differential access to non-material, material and regulating NCP according to different disabilities and intersecting with ethnicity, gender, age, or other factors (Figure 5). Intergovernmental bodies, such as IPCC and IPBES, can play a central role in connecting the science-based evidence concerning disability, climate change and environmental change with internationally agreed goals in order to foster inclusive and just sustainable futures.

This paper also shows the urgent need to better represent disabled populations in climate change and global environmental change decision-making (Figure 5). To do so, we do not only need the assessment of the impacts of climate change and loss of NCP on the wellbeing of disabled populations but the active engagement of the disabled community in the research and science-policy interface processes.

The active engagement of 'disability specialists', that is, scientists with disabilities and expertise in climate and environmental change, persons with disabilities having experience in both research and science-policy interface platforms can help to consider disabled populations as a relevant stakeholder group. In addition, it is essential to consider intersectionality and engage people with disabilities that belong to other minorities, such as those created by gender or race. The consideration of intersectionality when addressing disabled populations in decision-making might contribute to overcoming current unequal power dynamics in sustainability decision-making [21,77].

International sustainability research programs, such as Future Earth, and science-policy interface platforms that foster sustainability, such as IPBES and IPCC, should ensure that disabled communities are actively engaged in their programs. Only with the inclusion and engagement of disabled populations as relevant stakeholders, we will be able to develop inclusive risk management and adaptation strategies, inclusive conservation policies, and sustainable just futures. Disability equality needs to become a key component of sustainability to make Agenda 2030 a reality.

Conflict of interest statement

Nothing declared.

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CRediT authorship contribution statement

Aleksandra Kosanic: Conceptualization, Methodology, Investigation, Writing – original draft, Writing – review & editing, Visualization. **Jan Petzold:** Methodology, Formal analysis, Data curation, Writing – original draft, Writing – review & editing, Visualization. **Berta Martín-López:** Conceptualization, Writing – review & editing, Supervision. **Mialy Razanajatovo:** Writing – original draft, Writing – review & editing, Visualization.

Appendix A. Supplementary data

Supplementary material related to this article can be found, in the online version, at doi:https://doi.org/10.1016/j.cosust.2022.101159.

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