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People and Nature

PERSPECTIVE

Disabling barriers—Coping with accessibility of nature in Biosphere Reserves

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Abstract

1. Biosphere Reserves have the mandate to foster the relationship between people and nature, which can benefit people in a variety of ways, including both physical and mental health. With about 16% of the global population, people with disabilities are a significant group of people who, so far, have received limited attention for their needs in research and in discussions about how people relate to nature.
2. We have reviewed accessibility measures in 167 Biosphere Reserves in 18 countries in Europe and North America.
3. We find that accessibility is considered in 58% of cases with at least one measure. However, measures are mainly focused on accessibility for physical disabilities by providing access through infrastructures.
4. We highlight a variety of measures that have been implemented and tested already today in the Biosphere Reserve to serve different needs of a variety of disabilities.
5. In this perspective piece, we aim to illustrate challenges, but also the possibilities that we find to make nature more accessible. Thus, it is necessary to highlight the multi-dimensionality of disabilities and the need for plural measures to foster just access to protected areas. With this piece, we ultimately aim to start a conversation in the research field of sustainability science that considers a marginalized group that most people will join (temporarily) at some point in their lives: people with disabilities.

KEYWORDS
accessibility, Biosphere Reserves, disability, environmental justice, nature benefits, people with disabilities, well-being

1 | INTRODUCTION

Nature contributes to human well-being in many ways (Díaz et al., 2018). Over the last three decades, a vast body of scientific literature has studied these contributions as ecosystem services and nature's contributions to people, with the effect that now there are political processes to assess these on a variety of political levels, such as the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES), the European Mapping and Assessing of Ecosystem Services (MAES) or the Canadian Census of

the Environment (CoE). Despite different frameworks, definitions, and classifications existing (e.g., Kadykalo et al., 2019), all of them acknowledge contributions that are non-material in type, such as recreation, mental health, identity, and heritage. While other contributions can be transported to humans (e.g., food) or can benefit people without having people present in the concrete location (e.g., carbon sequestration), non-material contributions mostly require direct interaction of humans with nature (Hill et al., 2021).

Access to nature and green spaces is beneficial for people's physical and mental health including pregnancy outcomes, brain development in children, cognitive function in adults, and reduction in chronic diseases and chronic pain, as well as premature mortality (Dadvand & Nieuwenhuijsen, 2019). Not only mental illness seems to be reduced by access to nature, it also fosters general psychological well-being (e.g., happiness, finding meaning in life) (Bratman et al., 2019). Especially for urban areas, variables such as socioeconomic status, gender, and age have been identified to influence the mental health that derives from experiencing nature (Astell-Burt et al., 2013). During the global Covid-19 pandemic, people turned more to green spaces for exercise but also for therapeutic psychological experiences, leading to increases of up to almost 300% of normal use (Venter et al., 2020). Furthermore, human-nature connectedness increases people's interest towards nature and their knowledge about nature while simultaneously fostering biodiversity conservation (Martin Lopez, 2022; Soga & Gaston, 2023). In contrast, when people lose or feel less connected with nature, a phenomenon particularly visible in children, their mental health and general child development can be hampered ("Ming" Kuo, 2013; Louv, 2008; Rigolon et al., 2018; Soga & Gaston, 2016).

Despite access to nature having an extensive impact on people's quality of life, access to nature is not evenly distributed among different societal groups. Over the last decade, social–ecological research has increasingly paid attention to justice (Loos et al., 2023; Pascual & Howe, 2018) and has emphasized the role of governance as a mediating factor that articulates access to nature (Isaac et al., 2022; Nunan et al., 2021). In addition, sustainability science has promoted co-production of knowledge as a way to address challenges in the context of nature and people. In co-production approaches, different societal groups are involved with their distinctive perspectives, worldviews, and values during the research process (Chambers et al., 2022). Nevertheless, marginalized groups in society (i.e. women, other non-binary genders, Black, Indigenous, and People of Colour (BIPOC)) are often not included in studies. Another group hardly considered in discourses around nature and sustainability is people with disabilities[1] (Kosanic et al., 2022; Kosanic & Petzold, 2020; McGill Centre for Human Rights and Legal Pluralism et al., 2022).

About 16% of the global population (1.3 billion people) have a significant disability according to the World Health Organization (World Health Organization, 2022a). Within the field of disability studies, two models are often dichotomously presented: the medical model focuses on the individual and their medical conditions, and the social model centres around structural and societal barriers (Oliver, 1990). The dichotomy is likely to overlook the complex web of interactions between medical, social, cultural, political, and other aspects that shape disabilities. In this perspective paper, we follow a relational understanding of disability focusing on the interactions between individuals and their surroundings (Bygdell, 2024; Tøssebro, 2004). In general, people with disabilities live in poorer health, die earlier, and experience limitations in everyday life (World Health Organization, 2022a). The UN Convention on the Rights of People with Disabilities (United Nations, 2008) requires States Parties to ensure that people with disabilities can enjoy all human rights and fundamental freedoms (Article 1) and to enable people with disabilities to participate in outdoor activities (Article 30). In Europe and North America, all countries have signed and ratified the Convention, except for the United States of America and Liechtenstein, which have only signed the Convention but not ratified it. Furthermore, 156 out of 193 United Nations Member States have already recognized the human right to a healthy environment, which includes people with disabilities. Lastly, the Sustainable Development Goals, especially SDG10 on inequalities, highlight the importance of making today's society accessible to become sustainable societies (United Nations, 2018). Nevertheless, factors such as socio-economic status, lifestyle, accessibility, and policies hinder that everyone can benefit from healthy environments (Soga & Gaston, 2023).

Biosphere Reserves function as model areas for the sustainable development of humans and nature (Ruoss, 2013). They aim to balance sustainable natural resource use, ecosystem services provision, and nature conservation (Palliwoda et al., 2021). These goals are pursued in the Biosphere Reserves' three main zones: (1) core area—protected conservation area; (2) buffer zone—surrounding or adjacent to core areas used for activities with ecological practices and research, education, and training; (3) transition area—zone fostering socio-culturally and ecologically human activities (UNESCO, 2021a). The majority of areas in Biosphere Reserves are typically classified as the transition zone, while core areas are often protected areas such as National Parks (Ishwaran et al., 2008). The United Nations Educational, Scientific and Cultural Organization (UNESCO) confers the Biosphere Reserve title with the aim to preserve both ecological and cultural values in areas with special relationships between people and landscapes (UNESCO, 1996). As part of the recognition of these relationships, Biosphere Reserves are mandated to follow a participatory, multistakeholder governance approach in order to include as many perspectives represented in society as possible (Price, 2017; Reed et al., 2017), including those from marginalized groups such as people with disabilities.

With our perspective piece, we want to start a conversation on the accessibility of nature for people with disabilities. Only if nature is accessible for people can they fully benefit from it (e.g., health benefits) but also build relationships with it. We have chosen to focus on UNESCO Biosphere Reserves as they have a mandate to promote people and nature together and have the mandate of multistakeholder governance. Our objective is to illustrate challenges but also the possibilities that we found to make nature more accessible in order to reduce barriers to nature's benefits.

[1]Many terms used in the context of disability are debated and alternatives exist. In general, we tried to follow a people-first and non-discriminatory language. However, as time will pass, certain terms we use today might change as communities agree on new terms that are more inclusive or less burdened with negative associations.

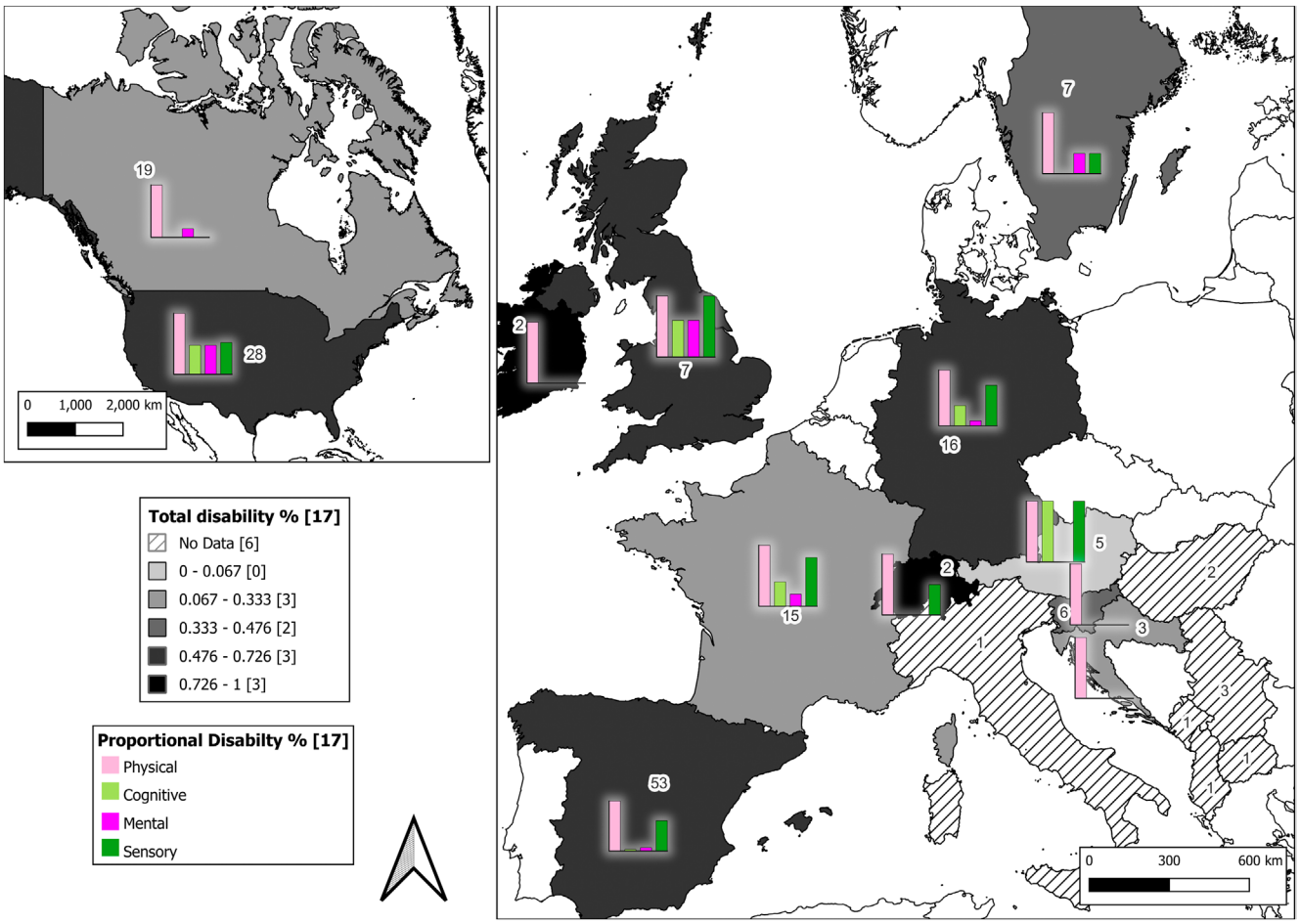

FIGURE 1 Maps of countries included in the study. Numbers in each country represent how many Biosphere Reserves we researched in each country. Shading of countries shows the percentage of Biosphere Reserves of a country that had measures for people with disabilities—the darker the shading, the higher the percentage. Bar plots show for each country which of the four types of disabilities were addressed by the measures found in the Biosphere Reserves of the respective country.

2 | METHODS

We searched on the internet in 2022 and 2024 on disability measures in 167 UNESCO Biosphere Reserves in 18 countries in the UNESCO regional group "Europe & North America" (UNESCO, 2021b) (Figure 1). We included in our search those countries and Biosphere Reserves because at least one member of our author team could speak the language of the country where the Biosphere Reserve was located. Our search represents 50.5% of the Biosphere Reserves in the group, but just 40.0% of the countries. We searched for information on measures for people with disabilities in the Biosphere Reserve both on the website of the respective Biosphere Reserve and via Google. For the Google search, we used the name of the Biosphere Reserve and the word "disability" in the local language and English. We decided on an online search because this is a common way for people living in and outside Biosphere Reserves to find information to plan visits. Achieving inclusion and recognitional justice also means that people with disabilities could use the same ways to find information about accessing and enjoying a Biosphere Reserve as anyone else. For this reason, we opted to use for our data collection an online search rather than interviews or contact requests to Biosphere Reserve administrations or advocacy groups in the respective areas.

We collected information on the existence of measures for people with disabilities through reading texts and watching videos if provided. If this was the case, we investigated further if the measures were provided by the administration of the Biosphere Reserve or another organization, what kind of disabilities were considered (physical, cognitive, mental, sensory), and if the measure was permanent or temporary in type. In addition, we took notes on the measure(s) to gain a deeper knowledge of how Biosphere Reserves foster accessibility for people with disabilities (Annex 1, sheet "data collection"—column R).

For the purpose of our paper, we used four types of disability (World Health Organization & World Bank, 2011):

- Physical disabilitiesaffect people's bodies and mobility, most of the time visible and of permanent or temporary type.
- Cognitive disabilities: intellectual and developmental disabilities, often with limitations in communication (i.e. language

disorders), self-care, social skills, safety, and self-direction (Federal Communications Commission, 2024).

- Mental disabilities: disturbances in thinking, emotional regulation, and behaviour (World Health Organization, 2022b).
- Sensory disabilities: at least one of people's senses (hearing, sight, speaking, smell, touch) not at the level of other people (Lee, 2022).

While we tried to be as inclusive as possible with those four types of disabilities, we acknowledge that people with certain conditions (e.g., chronic health conditions) might not feel represented in any of the four types. In addition, we want to highlight that the same type of disability might require different measures and that one measure might be beneficial for people with different disabilities. For example, someone with Cerebral Palsy (i.e. umbrella term for disability caused by brain damage) might need multiple measures and some of these measures could be beneficial for someone with a learning disability, neurodiversity, or multiple sclerosis. While the four types come with a series of shortcomings, we decided to use them for analytical purposes and to help guide readers through our work.

2.1 | Positionality statement

We are three women of European ethnicity who have lived in various countries in Europe and North America and who enjoy the outdoors. Two of us live with different types of disabilities and have experienced, to a different extent, how predominant decision-making systems disable us even more as a result of disregarding disabilities. As researchers, we understand ourselves as sustainability scientists coming to the field with additional, academic backgrounds in environmental sciences, ecological economics, political ecology, and geography. Our research programmes explore the interface between people and nature. This means that our research and lived experience have allowed us to identify the research topic of people with disabilities and their access to nature as a topic that has gained hardly any attention in research. We acknowledge that our perspectives come from a position of privilege (higher than average education, high income, whiteness, ability (KJW)). From this position, we try to pursue a broad understanding of disability but do not claim that we can adequately represent all disabilities in our research. We hope to shed (research) light on people with disabilities and initiate thinking about other underrepresented groups when researching, promoting, and considering the relationship (building) between people and nature.

3 | FINDINGS

We identify at least one accessibility measure for 96 (57.5% of Biosphere Reserves) of the total of 167 Biosphere Reserves. The administrations of Biosphere Reserves provide the measure in four out of every five Biosphere Reserves with measures (80.2%). In terms of considered disability types, physical disabilities are considered by far the most (91.7% of Biosphere Reserves with measures), followed by sensory disabilities (49.0%), cognitive disabilities (21.9%), and mental disabilities (19.8%).

In two thirds of the countries ($n = 12$), there is at least one Biosphere Reserve that has at least one measure (Figure 1). In those 12 countries, the share of Biosphere Reserves with measures ranges between 20.0% and 100.0% (median 50.0%). More than three-quarters of American, German, Irish, and Swiss Biosphere Reserves have measures implemented.

When looking at different types of disabilities on a country level, we find that all 12 countries with Biosphere Reserves with measures for disabilities targeted physical disabilities, 8 countries have Biosphere Reserves with measures for sensory disabilities, 7 countries for mental disabilities, and 6 for cognitive disabilities (Figure 1). However, the share of Biosphere Reserves in each country that considers each of the four types of disabilities varies (physical median 100.0%; cognitive median 2.9%; mental median 8.3%; sensory median 50.0%). For example, Spain has at least one Biosphere Reserve considering each of the four types of disabilities. By disability type, the picture changes as 28 of the 34 Spanish Biosphere Reserves with measures provide measures for physical disabilities while only one has a measure for cognitive disabilities (Figure 1). This indicates that there is knowledge on accommodating a variety of disabilities in all studied countries; however, the depth and familiarity of different accessibility measures seems to vary a lot depending on the type of disability.

The vast majority of Biosphere Reserves with measures for people with disabilities (91.7%) had permanent measures that can be divided into a series of groups (Table 1). The first group comprises measures concerning permanent structures in Biosphere Reserves, such as information panels or visitor centres accessible to people with (mainly physical) disabilities. Measures for wheelchair accessibility (43.8%) are the most common measure intending to offer access to people with physical disabilities. These measures include, among others, adapted parking spots, ramps, level spaces, elevators, adapted restrooms, picnic areas, and benches. Another type of infrastructural adaptation that we found in 11 Biosphere Reserves (11.5%) is the accommodation provided for other disability types, such as hearing loops, adjustable lighting, and calm rooms. Further, 10 Biosphere Reserves (10.4%) provide information in their information centres for people with disabilities by, for example, using braille, simple language, or videos in sign language and with subtitles. In some cases, the videos include footage of parts of the Biosphere Reserve that are not accessible to people with reduced mobility.

The second group of permanent measures is connected with outdoor activities. Almost half of the Biosphere Reserve (47.9%) has adapted trails. The large majority of those trails are adapted for physical disabilities; however, some adaptations (especially in Spain) are also for people with visual impairments.[2] For example, the *Biosphere Reserve of Monfragüe* uses a digital technology called Blind

[2]Person with visual impairment is currently still the most commonly used terminology while just the word impairment is not favoured in the context of people with disability. Blind is often considered too narrow as many people have partial vision and there is a negative connotation of blind in the sense of "blind spot". Visually diverse is in discussion as an alternative to visual impairment but is not yet widely used by the community.

TABLE 1 Overview of different groups of permanent and temporary measures identified.

Measure group	Share of BR	Description	Examples
Infrastructure related to built structures	91.5%	Allow people with disabilities to access Biosphere Reserves and their information when physically present. Often connected to built structures such as information centers.	• Adapted parking spots, ramps/level spaces/elevators, restrooms, picnic areas, benches • Hearing loops (Biosffer Dyfi, UK) • Calm rooms (e.g. in Kristianstad Vattenrike, Sweden)
Outdoor activities	63.5%	Measures to allow access to the outdoors for people with different disabilities. Mostly for people with a physical disability, but also with sensory disabilities	• Adapted trails • App to guide people with visual impairment (e.g. Monfragüe, Spain) • Information in braille (e.g., Glacier Bay and Admiralty Island, USA)
Sustainability activities	15.6%	Activities connected to the broader task of Biosphere Reserves to promote understanding of sustainable use of the environment	• Community Garden (e.g. Georgian Bay, Canada) • Woodworking workshop (e.g. *Real Sitio de San Ildefonso-El Espinar, Spain*)
Adapted mobility devices	14.6%	Biosphere Reserves possess adapted mobility devices for people with disability to access nature.	• Hiking chairs for different trails (e.g., Cévennes, France) • Water devices like kayaks (e.g., Congaree, USA) and boats (e.g., Pfälzerwald, Germany)
Temporary	19.8%	1. Events accessible for people with disabilities while targeting a broad audience 2. Events specifically for people with disabilities 3. Training for volunteers to support people with disabilities 4. Events by people with disabilities for a broad audience	

Explorer to help people with visual impairments explore the outdoors. About 15% of Biosphere Reserves ensure accessibility for people with physical disabilities to a specific point of interest, like a section of a beach or a viewpoint. Almost every sixth Biosphere Reserve has information about trails or points of interest in non-traditional manners such as in braille or in audio form in apps. A similar share of Biosphere Reserves offers tours with or without rangers that consider one or multiple disabilities.

We identify only a few examples of permanent measures considering disability that were not directly connected to nature conservation and its recreational enjoyment despite the mandate of Biosphere Reserves to promote a broader understanding of the sustainable use of nature. Three Biosphere Reserves have measures to use nature, for example, in the form of community gardens that include people with disabilities. The Canadian *Georgian Bay Biosphere Reserve* is affiliated with a social service organization that creates community gardens together with adults with mental disabilities. Other measures go beyond promoting accessibility to recreational activities and relate to employment and training. For example, a partner organization of the German Biosphere Reserve *Flusslandschaft Elbe* employs solely people with disabilities and a local association of the Spanish Biosphere Reserve *Real Sitio de San Ildefonso-El Espinar* offers a regular course for people with disabilities on working and restoring wood.

The fourth group of permanent measures relates to adapted mobility devices. Almost every sixth Biosphere Reserve offers such devices so that people with (mainly physical) disabilities can more easily access nature. For example, Biosphere Reserves provide adapted wheelchairs for hiking or trekking in the mountains (e.g. one-wheeled Joëlette chair) or offer special rowing boats, kayaks, or beach equipment. Since these adapted mobility devices are often specially manufactured, their purchase is connected to high costs and therefore, when a Biosphere Reserve provides them, more people can use them without having to pay the purchase cost. Among the permanent measures, two Biosphere Reserves (i.e. *Urdaibai—Spain; Carmargue/Delta du Rhone—France*) have staff specially trained to help people with disabilities.

For about a fifth of Biosphere Reserves with measures, we identify temporary measures. Temporary measures are mainly events that happened over a certain time frame and for which we could not find any information that they happened on a regular, recurring basis. Given that we did the majority of the review after 2 years of the Covid-19 pandemic and the temporal character of temporary measures, we are cautious with the interpretation of the results as we assume that, like in any other realm of society, temporary activities were probably limited during the pandemic. We identified four groups of temporary measures: (1) events that were made accessible for people with certain disabilities while targeting a broader audience, (2) events that were targeting specifically people with disabilities, (3) training for volunteers to support people with disabilities during activities in the Biosphere Reserve, and (4) events by people with disabilities for an audience of people with and without disabilities.

4 | DISCUSSION AND CONCLUSION

People with disabilities comprise a large group of marginalized people in society, whose possibility to build relationships with nature is often hampered by the lack of measures implemented by protected

areas and green spaces. In our perspective piece, we illustrate how disabilities are considered in Biosphere Reserves in Europe and North America with the aim to start a conversation within the scientific community about the relevance of considering the accessibility challenges to nature of people with disabilities. A conversation that is very much needed since people with disabilities are the least considered group among marginalized groups when it comes to research of people and nature (Kosanic et al., 2022).

At the moment, the outdoors and environmentalism are dominated by an ableist discourse that connects the outdoors with wilderness, physically fit (white) bodies, loneliness, and the idea of adventure (Ray et al., 2017). In the spirit of environmental justice, it is crucial to open up the narratives around people and nature and the outdoors, what people with disabilities can do, and where they might need assistance. As disabilities come in so many forms and shapes, we need to reconsider ideas of disability and what it means for accessing nature. Although we are aware that the grouping of disabilities into physical, cognitive, mental, and sensory does not do justice to the diversity of disabilities, we believe that our typology allows us to broaden the discussion around measures that go beyond infrastructure measures for people with physical disabilities like adapted parking and restrooms. Considering the diversity of disabilities can contribute to implementing a variety of measures in Biosphere Reserves: while some people might need flat trails, others might need trained guides or clear markings on the trails to find their way. For example, the French mountain Biosphere Reserve *Cévennes* has an 80 km long trail for the visually impaired and the German Biosphere Reserve *Schwäbische Alb* once offered people the opportunity to join a group on their hike to avoid being alone in nature. Yet, measures can target multiple disabilities. Trained staff can help to highlight the needs of people with various disabilities or the involvement of representatives with disabilities in the management or governance of the Biosphere Reserve can help to broaden the understanding of what measures are needed and possible. Hardly any measure alters the experience for people in abled bodies, but rather can help to broaden their experience. The provision of information in a standardized form on a website like that of UNESCO on Biosphere Reserves could increase the accessibility of information and force administrations to think about it when filling (or leaving empty) the text box.

We found that the consideration of people with disabilities in European and North American Biosphere Reserves is not evenly distributed among countries and among types of disabilities. For more than 40% of the Biosphere Reserves we reviewed, we could not identify a single measure to make the area accessible for people with disabilities. About half of all reviewed Biosphere Reserves have measures in place for people with physical disabilities, and about a quarter of the ones reviewed have measures for people with sensory disabilities. Our findings allow us to conclude that distributional justice is not achieved either from an equality (the same for everyone) or an equity (depending on need) perspective. Moreover, the fact that most measures targeted physical disabilities does not correspond with the reality of intersecting disabilities.

Access to nature for people with disabilities should be a priority. People who have disabilities often have multiple types of disabilities. For example, in Canada, more than two thirds of all people with disabilities have at least two diagnosed, permanent disabilities (Statistics Canada, 2022). In many cases, one of the disabilities is a mental disability, such as depression or anxiety (Ko et al., 2011; World Health Organization, 2022a), which is the type of disability with the lowest number of measures identified in our review. Our findings stand in stark contrast to other scientific findings that spending time in nature is beneficial for mental health, which leads us to think that people with mental disabilities should be a priority group in the management of recreation and tourism in protected areas.

Aside from potential mental health benefits, access to nature also allows people to benefit from other contributions of nature such as connectivity to nature, shaping of identity and traditions, and education and learning (Pearson et al., 2024; Russell et al., 2013). By making Biosphere Reserves more accessible to people with disabilities, we are promoting a more just distribution of these benefits in society. In this sense, we identified measures to disable barriers to distributional justice. Many of the permanent measurements in Biosphere Reserves address questions of distributional justice, such as those related to infrastructure (e.g. ramps, parking, adaptation of trails and provided information) or mobility devices (e.g. Joëlette chair or digital technology for visually impaired people).

Having accessibility measures in a Biosphere Reserve is a contribution to recognitional justice. However, recognition can be realized in different forms. We find an emphasis on measures for people with physical disabilities and on measures in and around built infrastructure often close to nature but not necessarily in nature (e.g., in visitor centers). This indicates that specific disabilities are more recognized than others. Beyond, it allows for speculations on how far decision-makers recognize the increased need of people with disabilities to have opportunities to access and build relationships with nature. In addition, we should not ignore that for more than 40% of the reviewed Biosphere Reserves we could not identify any information on measures for people with disabilities. One could assume that we just did not look at the right spots and that we might have gained more information by contacting Biosphere Reserve administrations and advocacy groups. However, information about accessibility measures should be as accessible as information for any other visitors of Biosphere Reserves when thinking in terms of recognitional justice. If Biosphere Reserves really have not taken any measures to accommodate people with disabilities, we can say that fundamental recognitional justice is missing as they lack the recognition that those measures are needed for just access.

In addition, Biosphere Reserves can promote procedural justice for people with disabilities by fostering their engagement in decision-making and management (Kosanic et al., 2023). Broad people-led governance should be of special interest for Biosphere Reserves since they have the mandate to follow a multistakeholder-focused governance approach (Price, 2017; Reed et al., 2017). We found one Biosphere Reserve (i.e. the Spanish Biosphere Reserve *Babia*) that has an easily findable management plan that outlines the

participation of people with disabilities to create a special plan for accessibility. Therefore, the creation and public reporting of steering committees or advisory councils representing marginalized or underrepresented groups, such as people with disabilities, could improve diversity in decision-making in Biosphere Reserves and promote the implementation of new measures that disable barriers.

AUTHOR CONTRIBUTIONS

This manuscript is the product of intensive discussions between the three authors. Klara J. Winkler, Aleksandra Kosanic, and Berta Martín-López conceived the ideas for the research. The three authors contributed to data collection. Klara J. Winkler conducted data analysis and coordinated the writing and editing of the manuscript. Aleksandra Kosanic and Berta Martín-López contributed to writing the drafts and the final version of the article.

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CONFLICT OF INTEREST STATEMENT

The authors declare that they have no conflict of interest.

DATA AVAILABILITY STATEMENT

All data used for this manuscript is accessible through Appendix S1 in Supporting Information 1 and can be found in the institutional repository PubData of Leuphana University of Lueneburg with the https://pubdata.leuphana.de/entities/publication/fd66bbc0-c0b3-4a62-86f3-3adb465fff54.

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