



Bridging underrepresented disaster scholars and national science foundation-funded resources

Cassandra Jean¹ · Jamie Vickery² · Joseph Wartman² · Jeffrey Berman² · Nicole Errett^{1,2}

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Abstract

The intentional inclusion of various perspectives is critical in disaster and hazard research to advance science and promote equitable resilience in a rapidly changing climate. However, historically underrepresented scholars like Black, Indigenous, and people of color (BIPOC), LGBTQIA2S+ community members, and women are frequently absent from these efforts. Such exclusions exist as disparities in obtaining grant support, the disproportionate validation of their research or skills, limited training or mentorship opportunities, and implicit biases towards faculty members and students. As a result, many of these scholars, who frequently study communities living in precarious conditions, are absent from utilizing equipment or have limited access to resources that can ultimately assist them in their research efforts. This paper examined the experiences of such underrepresented scholars involved in disaster and environmental-related work to understand the needs, barriers, and opportunities to accessing National Science Foundation (NSF) supported resources. Across 13 key informant interviews, participants reported a myriad of structural barriers that directly impact marginalized scholars and others that limit the capacity of institutions where such scholars frequently work. These barriers exist alongside competing demands placed on marginalized scholars that strain ongoing and meaningful engagement and integration in disaster and hazard research. This study revealed considerations and recommendations for intentionally expanding NSF-funded resources to support underrepresented scholars to advance disaster and hazard scholarship through action-orientation approaches and targeted outreach and engagement strategies.

Keywords National Science Foundation · Underrepresented scholars · Intersectionality · Social capital · Disasters

1 Background and introduction

As disaster and environmental scholars work towards addressing the impacts of hazards, including those exacerbated by human-induced climate change, the need for research and researchers representative of communities most at risk of the effects of disasters is imperative (Jacobs 2019a, b; Peek et al. 2020; Morris 2021). While

there has been increased recognition of the importance of inviting and incorporating researchers from diverse backgrounds with similar lived experiences and racial and ethnic concordance with the most at-risk groups (Kendra and Nigg 2014; Pelling and Garschagen 2019), they are still largely absent from these efforts. These scholars with diverse backgrounds and perspectives offer distinct viewpoints on current methodological tools' challenges, successes, and issues (ibid). Such an outlook provides the researcher with greater insight when applying and advocating for their perspectives and that of historically marginalized communities (Whittaker and Montgomery 2014; Zambrana et al. 2015; Pelling and Garschagen 2019). Historically marginalized communities include, but are not limited to, Black, Indigenous, and people of color (BIPOC) and women.

Intentional inclusion of these scholarly perspectives is necessary for research to advance science and ultimately to build resilience to a changing climate equitably. Beyond recognizing the problems faced by communities most at risk of climate-induced impacts, the positionality of underrepresented scholars influences how they access, examine, collect, interpret, and translate data and findings, especially in the disaster and hazard field. While it is not implied that these scholars speak for or represent the needs of all disaster-affected communities, there is a recognition that their positionalities may enable different levels of access, understanding, and approaches to address the issues such impacted communities face. Furthermore, this recognition of the lived reality of historically underrepresented communities assists in actualizing strategic plans inclusive of directly and disproportionately impacted voices ((Masson-Delmotte 2021).

Accordingly, efforts to advance the field of hazards and disaster research, including greater attention to interdisciplinary and convergence research, have been at the forefront of many conversations regarding diversity in the field (Agyeman et al. 2002; Kendra and Nigg 2014; Ali et al. 2021; Shah et al. 2023). Particularly in light of the global resurgence of the Black Lives Matter movement in 2020 following the murders of Breonna Taylor, George Floyd, Ahmaud Arbery, and countless others, universities, companies, non-profit and government organizations were called to interrogate workplace cultures and practices that—intentionally or unintentionally—systematically marginalize and disenfranchise Black and Brown scholars. In recent years, academic institutions and their affiliated organizations, including research funding bodies, have witnessed a surge in the adoption of Diversity, Equity, and Inclusion (DEI) statements and policies (Ezell 2023; Casellas Connors and McCoy 2022; Meikle and Morris 2022). Despite such efforts to incorporate DEI values, microaggressions and systemic disparities in these spaces continue to lead to discrimination, isolation, and exclusion, especially among historically marginalized and underrepresented faculty, staff (including postdoctoral scholars), and students, like BIPOC, women, and individuals in the Lesbian, Gay, Bisexual, Trans, Queer, Intersex, Asexual, and Two-spirited (LGBTQIA2S+) community ((Leath and Chavous 2018; Chee et al. 2019; Menifield et al. 2024). Several years later, following a wave of anti-DEI legislation in various states and the federal repeal of the affirmative action ruling, higher education institutions have likewise begun rescinding their DEI initiatives (Nellums 2023). Such movements have inadvertently added to the discrimination and isolation felt by students, staff, and faculty who represent historically marginalized and underrepresented groups (Heidt 2023). These removals likewise disrupt mentorship opportunities and affect academic and career trajectories for these scholars, ultimately underscoring the need for more intentional inclusion practices and methods.

2 Literature review

Prior research has highlighted the impact of systematically racist policies and practices in proliferating underrepresentation in the academy, likely with cascading impacts on the disaster and hazard research community. For instance, considering grant support, previous studies have highlighted the disparities in awards across sociodemographic groups that favor white and/or male principal investigators by organizations like the National Science Foundation (NSF) and the National Institutes of Health (NIH) (Ginther et al. 2011; National Science Foundation 2012; Erosheva et al. 2020; Lauer et al. 2021; Chen et al. 2022; U.S. Department of Health and Human Services 2023). Even accounting for institutional characteristics and past research accomplishments, Black researchers were half as likely to receive NIH grant funding for their research on health disparities compared to white investigators (Carnethon et al. 2020). Similar results on such disparities by, for example, age, gender, race, and institution have also been reported with NSF-funded research and within academic institutions (Chen et al. 2022). When looking into the grant application process, studies have shown that Indigenous women face disproportionate barriers to receiving funding compared to non-Indigenous investigators conducting research on behalf of the Indigenous population (Gareau 2003; Fredericks 2011). Studies have also found biases towards underrepresented faculty and staff like BIPOC, women, and LGBTQIA2S+ researchers, noting that when they are invited to participate in research proposals, it is in a limited or tokenistic capacity (Turner 2002; Moody 2004). For example, Gareau (2003) and Fredericks (2011) found that while BIPOC, women, and LGBTQIA2S+ researchers are invited to join research teams or other academic endeavors, they are frequently asked to join superficially and are rarely asked to join as an investigators. Additionally, scholars who conduct work aligned with or focused on the racial or ethnic community with which they identify or align with often face scrutiny based on white, often patriarchal, Westernized standards, thus leading to a devaluation of their work (Stanley 2006; Turner and Myers 2000; Griffin et al. 2011). This results in a cyclical pattern where these perceptions impact who gets invited to participate in research and at what level (Harper 2012; Moss-Racusin et al. 2012; Zambrana et al. 2015).

Inequities with retention rates, training, and recruitment likewise pose barriers for underrepresented researchers and academics. Such scholars are disproportionately hired on fixed-term or short-term contracts and often face inordinate academic pressures, such as service requirements; however, speaking out against their concerns and experience may threaten their access to tenure-track or more stable employment (Fredericks 2011; Leboy and Madden 2012; Whittaker and Montgomery 2012, 2014). This dynamic is especially concerning for Black and Indigenous folks, as these scholars make up about 6% of the entire nation's college student population and are more likely to experience disparities such as increased rates of early college departure and more social isolation than their counterparts due to a lack of mentorship, guidance, and implicit and explicit biases (Fredericks 2011; Marroquin 2014; Chee et al. 2019; Wisner and Wisner 2004; Wisner 2006). Specifically, according to fall 2021 statistics by the National Center for Education Statistics, of the 1.5 million faculty at degree-granting postsecondary institutions, 6% of the faculty were Black, 6% were Hispanic or Latino, and American Indian/Alaska Natives and Pacific Islander scholars represented less than 1%, compared to 73% of faculty members being White (NCES, n.d.). While research teams and organizations, often with stronger financial, political, and resource-rich backgrounds, are encouraged to incorporate and involve underrepresented scholars to diversify academic spaces and promote equity, this dynamic

is often superficially implemented and not critically examined (Romero 2004; Carson et al. 2019).

In the context of hazards and disaster research, this perfunctory or inexistent incorporation of diverse scholars can directly impact how communities frequently subjected to ecological, structural, and institutional suffering mitigate and respond to current and upcoming hazards. By gatekeeping researchers, these communities are left without locally relevant research and resultant knowledge that supports their ability to address and mitigate risks. In response, interdisciplinary or convergence research (Reilly et al. 2021; Gharaibeh et al. 2021; Wong-Parodi and Small 2021; DeRouen and Smith 2021; Peek et al. 2020), and mentoring and sustained training support for underrepresented scholars (Anderson, 1990; Andrulis et al. 2007; Dixon and Louis-Charles, 2015; Waugh and Goss 2019), have been identified as ways of addressing professional disparities within the disaster and hazard field. These efforts intend to intentionally include and integrate current and future researchers and practitioners often overshadowed in the field (Carson et al. 2019); however, their long-term impact and effectiveness remain largely unknown.

3 Study context and aims

Since 1950, the U.S. National Science Foundation has served as an independent governmental organization dedicated to promoting the advancement of science, fostering national health, prosperity, and welfare, and securing the national defense (NSF, n.d.), (Trapani, n.d.). In recent decades, NSF has taken steps to fund projects and programs formulated and executed to support the development of students and scholars who represent diverse disciplines, identities, and institutions (Panchanathan, n.d.). For instance, the Research Experiences for Undergraduates (REU) program was created to support and engage undergraduate students with research opportunities that span various disciplines and topics (Waugh and Goss 2019). Other programs include the NSF- Inclusion across the Nation of Communities of Learners of Underrepresented Discoverers in Engineering and Science (INCLUDES) initiative and the NSF-funded Growing Research Access for Nationally Transformative Equity and Diversity (GRANTED) program. Specific to the disaster and hazards research community, in the mid-1990s, disaster scholar Bill Anderson created the NSF-funded ‘Enabling the Next Generation of Hazards and Disasters Researchers’ program, which helped to develop future generations of researchers and “expand the number of historically underrepresented professionals in the fields of hazard and disaster research and practice” (The Bill Anderson Fund, n.d.; Waugh and Goss 2019; Peek et al. 2020).

The Natural Hazards Engineering Research Infrastructure (NHERI) network is another example of NSF’s efforts to support and advance disaster scholarship and build resilience, emphasizing the importance of interdisciplinary and convergent hazards and disaster research (Peek et al. 2020). NHERI operates with support provided by the NSF and is a nationwide, shared-use network of facilities tailored for the natural hazards research community (About DesignSafe-CI, 2023). The RAPID Facility is one of 13 facilities and entities comprising the NHERI network. Headquartered at the University of Washington, the RAPID Facility provides the NHERI community and beyond with access to field equipment required to document complex natural hazard events, supports the unique needs inherent in fast-track multidisciplinary reconnaissance missions, and facilitates the collection of standardized data across events (Peek et al. 2020; Berman et al. 2020); addressing

the identified research needs in natural hazards and disaster reconnaissance (Wartman et al. 2020).

While efforts towards addressing the disparities and gaps found amongst historically underrepresented or marginalized groups have become a priority of many institutions, including NSF, there has still been a gap in understanding the nuances that exist for these groups when it comes to attaining hazards and disaster research and support. For this reason, research needs to explore factors that facilitate or inhibit these scholars from equitably participating and receiving research funding and support. This study aims to address this gap by highlighting current institutional and academic barriers for marginalized and under-represented scholars while highlighting opportunities to address the systemic and institutional gaps they encounter.

This exploratory study is part of a larger initiative aimed at diversifying and broadening the user base of the RAPID Facility. As part of this ongoing effort, we interviewed researchers who represented groups, programs, and project teams engaged in diversifying the field of disaster science to understand barriers to accessing RAPID Facility resources and to capture recommendations to promote diverse, equitable, and inclusive access. Although this work was driven by a need to improve RAPID Facility services, we also asked more broadly about the accessibility of NSF resources and services for hazards and disaster research. The following research questions drove this study:

1. What are the experiences of historically underrepresented or marginalized scholars or institutions engaged in hazards and disaster research?
2. What barriers do historically underrepresented or marginalized scholars face when accessing or using existing NSF-supported hazards and disaster-related services and resources?
3. How can NSF-supported disaster and hazard-related services and resources better support or prioritize the needs of historically underrepresented or marginalized scholars or institutions engaged in hazards and disaster research?

4 Theory

4.1 Social capital theory

Social capital theory is a concept and framework used to analyze the relationship between individuals, the power of their networks (e.g., social support), and the communities they exist and identify with (e.g., by race, occupation, gender) (Dynes 2006; Aldrich and Meyer 2015). Currently categorized into three forms or types—*bonding*, *bridging*, and *linking*—social capital theory considers the outcomes for and experiences of individuals and communities based on the variation and composition of their relationships (Kawachi et al. 2004; Szreter and Woolcock 2004; Aldrich and Meyer 2015; Kyne and Aldrich 2020). Such relationships or connections are often fluid and can be emotionally driven, culturally influenced, academically related, socially tied, economically allied, or a combination of myriad motivations or bonds (ibid). Through social networks, individuals can determine how, for instance, levels of trust, reciprocity, autonomy, sense of belonging, citizen power, and cooperation contribute to their abundance or lack of social capital and their trajectory toward collective action (Kyne and Aldrich 2020).

Adler and Kwon (2002) state that *bonding* social capital focuses on the emotional connection between individuals like friends or family who likely share characteristics, language, ethnicity, or culture, which creates tight bonds and allegiance to a particular group or groups of people. *Bridging* social capital, in contrast, highlights loosely connected relationships, like acquaintances, which span various groups like race, class, gender, and sexuality (Aldrich and Meyer 2015; Kyne and Aldrich 2020). The last network connection, *linking* social capital, bonds citizens to individuals or groups of individuals who yield some form of power, like a graduate student having a relationship with a research director or CEO of an organization (ibid). Social capital emphasizes the strength of inclusion and other aspects of community building, which, research has shown, directly impacts one's ability to prepare and respond to situations, especially in the face of disasters. As Coleman (1994) stated, "Like other forms of capital, social capital is productive, making possible the achievement of certain ends that would not be attainable in its absence." Through these connections, disaster scholars have begun promoting and emphasizing the need to collaborate and incorporate historically underrepresented groups into the disaster management system. During times of crisis or in moments of collective problem-solving, individuals rely on their trusted circle for support and connections (Jia et al. 2020; Monteil et al. 2020). By acknowledging the weight these factors have with building communities and engaging meaningfully with historically underrepresented groups, disaster research can increasingly address difficult questions by integrating various perspectives, viewpoints, and experiences. Accordingly, this study uses this theory to explore the nature of social capital, networks, and resources attributed to accessing NSF-related resources and services for underrepresented and underserved communities, scholars, and students. In understanding the power of social capital and the resources that exist because of it, this study utilizes this theory to examine what forms of social capital exist for underrepresented scholars and how these factors either impact or impede their participation and access to such support.

4.2 Intersectionality theory

Incorporating an intersectional approach when examining the experiences of historically marginalized groups allows scholars to identify, analyze, and critique discriminatory and oppressive practices that disproportionately affect them, especially in the face of hazards and disasters (Jean et al. 2023a, b). Initially coined by Black feminist legal scholar Kimberlé Crenshaw, intersectionality theory calls for understanding how different forms of privilege, power, and oppression interact and compound to create unequal socioeconomic outcomes across individuals and groups of individuals based on their identities (e.g., age, race, ethnicity, sexuality, and gender) and conditions (e.g., first-generation college students, language dynamics, immigration, and marital status) (Collins, 2003; Crenshaw 2013; Davis 2011; Collins 2022).

In the case of underrepresented scholars, an intersectional approach provides the opportunity to holistically examine and evaluate the existence of different forms of oppression or discrimination based on specific and compounding attributes (Vickery, 2018; Jean & McCalla, 2020). For instance, Black and Brown scholars and women have been, and are, continually overshadowed and overlooked for leadership roles within prominent academic spaces (Davis and Brown 2017; Amaechi et al. 2021). White male scholars and predominately white institutions are frequently overrepresented in such roles and spaces (Whittaker et al. 2015; Zambrana et al. 2015). Racism, sexism, classism, colonialism, and ethnocentrism are often perpetrators or underlying

causes, for example, through gatekeeping opportunities and resources, the devaluation of one's research according to Western standards, and discriminatory microaggressions in the workplace (Davis and Brown 2017; Zambrana et al. 2021). Additionally, the lack of robust social networks within the field of disaster science decreases the chance for these scholars to be acknowledged, brought in, or validated within these spaces and the discipline overall.

As a theory that draws its approaches from antiracist, feminist, and decolonial work, intersectionality provides scholars with the tools to conceptualize how to intentionally diversify these spaces. This theory calls for research to examine the nuances of one's experience and what it means with their interaction with different institutions. For instance, to examine how microaggressions prevent the retention of underrepresented scholars, a narrative exploring the underlying contributors of where discrimination exists helps to explore this phenomenon. Using an intersectional lens, we can consider questions that focus on how socially created inequalities linked to attributes like race, gender, and sexuality compound in a way that affects or prevents one's participation in the field (Weber et al., 2012). Disaster and hazard-related studies have utilized intersectionality in various ways, including as a framework to shape methods, as guiding analysis in interpreting data, and as a tool for social justice by interrogating spaces of discrimination within current practices (Campbell 2019; Every et al. 2019; Andharia 2020; Kuran et al. 2020). An intersectional lens also allows for the identification of equity-oriented solutions through its call to acknowledge and break down the historical and contemporary barriers that contribute to discriminatory practices. As such, taking an intersectional approach to research promotes and validates a variety of epistemologies in the production and dissemination of knowledge (Collins 2019).

Intersectionality theory, thus, helps us to examine how privilege (i.e., white supremacy, patriarchy, and speaking English) and oppression (i.e., racism, sexism, homophobia, xenophobia) within knowledge-producing institutions breed discrimination (i.e., lack of representation, access to resources, and grant support for women and BIPOC+), both separately and concurrently, depending on the individual or group of individuals. Through its integration of intersectionality and social capital theory, this study aims to examine how the identities and conditions of diverse scholars affect their social capital within the hazards and disaster research field and, ultimately, their ability to access NSF-supported resources. Additionally, this study employed these theories to guide the interview protocols, data collection, and analysis processes.

5 Methods

The goal of this study is to identify barriers experienced by historically underrepresented scholars in accessing NSF-supported hazards and disaster research infrastructure, resources, and support, as well as opportunities to dismantle barriers. To achieve this goal, this study employed qualitative, semi-structured interviews with disaster scholars with expertise in or lived experiences in diversifying the disaster and hazards research field. This study was reviewed by the University of Washington Human Subjects Division, which determined it to be human subjects research that qualified for exempt status (Category 2) (STUDY00014599).

5.1 Research sample

This study used a purposive sampling approach, where we initially constructed a list of potential interviewees that meet our inclusion criteria of being a researcher with expertise or lived experience related to diversifying the disaster and hazards research field. Based on these criteria, an initial list of potential interviewees was created by two research team members (CJ and JV) and shared with RAPID Facility leadership to identify additional names or organizations that should be considered for participation. After reviewing the list against the inclusion criteria, we ultimately contacted 19 individuals. Of these, three declined to participate based on their limited availability and bandwidth. Three others indicated a willingness to participate, but we could not schedule interviews despite follow-up attempts.

5.2 Data collection

We emailed potential participants to provide an overview of the study and to request their participation at a convenient time via video conference. The interviewees were contacted and invited up to three times. Interviews were conducted from March to May 2021, and each interview took between 40 and 60 min. We used a semi-structured interview guide (Jean et al. 2023a, b), which included inquiries into the interviewees' prior knowledge of the RAPID Facility, their experience accessing NSF-supported disaster and hazards-related products, including barriers to access, and recommendations for how to diversify the field of NSF-supported hazard and disaster researchers. Participants were offered a \$50 virtual gift card, or if they preferred, the equivalent in book(s) of their choosing for providing their time and expertise. All interviews were recorded and transcribed using a professional transcription service. Following manual transcript cleaning, we created brief 2–3 page summaries for each interview that we sent to participants to confirm the accuracy of our interpretations of their responses related to our study goals and research questions.

5.3 Data analysis

As an initial step in our data analysis process, we conducted a rapid qualitative analysis of the summaries to identify preliminary themes within the data. This technique, frequently used in health services and evaluation research, is often employed as an action-oriented or 'telescoped' approach to describe a situation or environment that needs implementation (Watkins 2017). The qualitative rapid analysis approach provides many benefits as it is flexible and efficient when time and funding are limited. It provides a 'closer approximation' to the participants' lived experiences. This technique calls for the summarization of the interviews through a template of domains that are then turned into summary matrices (ibid). This analytic approach and the interview guide informed the development of an inductive coding scheme (Jean et al. 2023a, b; Elo et al. 2014; Gale et al., 2013) that we applied to the interview transcripts using NVivo14 qualitative analysis software. The transcripts were coded at the paragraph level to ensure context, which included overlapping codes. Two research team members (CJ and JV) co-coded the first six transcripts to ensure the consistency of code application and to refine code definitions. Discrepancies were discussed and adjudicated, and responsive revisions were made to the codebook to clarify

code definitions and instructions for when to apply codes. One member of the team (JV) coded the remaining seven transcripts. Coded text was synthesized to identify emergent themes and summarized in analytic memos.

6 Results

The research participants in this study included 13 BIPOC and women scholars who work in public and private institutions and organizations and who are invested in disaster and hazard-related research. Postdoctoral scholars and students were not included to center the focus on individuals with substantial experience (i.e., professor or principal investigator) in navigating, obtaining, or receiving federally-funded disaster and hazard-related resources and funds. Geographically, interviewees spanned the contiguous U.S. and off-shore insular areas, including Puerto Rico and the U.S. Virgin Islands. The participants represented 14 organizations (one participant held dual appointments) from HBCUs ($n=2$), MSIs ($n=3$), HSIs ($n=1$), and predominately white institutions (PWIs) ($n=8$). Ten of all participants worked for Research 1 institutions, while the other three worked at Research 2 institutions. Each participant has received federal funding through scholarships, fellowships, and collaborative research projects. While all participants have worked on NSF-funded projects, only about half have had projects awarded through NSF as a Principal Investigator. Positions included management roles (directorship roles, those involved in DEI committees) and professorships. While most interviewees held academic positions, two held positions in organizations outside university settings, including an emergency management and non-profit organization.

Below, we present results in alignment with each of our research questions, summarized in Table 1: (1) Experiences with NSF funding and resources; (2) Barriers to accessing NSF funding and resources; and (3) Opportunities for Diversifying the use of and improving access to NSF funding and resources.

6.1 Experiences with NSF funding and resources

Participants highlighted two primary ways they initially accessed NSF resources and services: (1) NSF-funded fellowships and scholarships, and (2) Networking and engagement opportunities.

NSF-funded fellowships and scholarships While most interviewees were aware of NSF-related resources and support, only a few directly interacted with or received them. The same few were the only ones to have stated that they had received awards as PIs, unlike the rest of the participants who interacted with NSF by either being invited into a project, participating on a committee, or being made aware of requests for proposals. Some participants stated that NSF-funded mentors or faculty members introduced them during their undergraduate or graduate studies through NSF-funded fellowship or scholarship opportunities. For example, Participant 2 shared:

“Even just becoming a disaster researcher was a fluke on my part. I had an advisor as an undergrad who kind of forced me to apply for an NSF research for undergraduates experience where I went to the University of Delaware, [and] learned about the disaster research field. And I was not inclined to even apply for it because I worked full-time[to] put myself through school. So, for me, the idea of applying for some kind of

Table 1 Challenges and recommendations identified by participants, by research objective

Research objective	Key takeaways
Experiences with NSF funding and resources	<p>NSF-funded fellowships and scholarships open doors to the field for historically underrepresented students and scholars. At least five interviewees were the same interviewees who later received NSF grants as PI</p> <p>Networking and engagement opportunities, including mentorship, conferences, and NSF-supported programming, were reported among interviewees as an effective way to promote awareness of NSF hazard and disaster research infrastructure, resources, and support</p>
Barriers to accessing NSF funding and resources	<p>Structural barriers hinder access to and awareness of NSF hazard and disaster research infrastructure, resources, and support. These barriers include a lack of representation on funding review committees, real and perceived capacity constraints of HBCUs and MSIs, lack of mentorship, difficulty understanding the NSF grant process and guidelines, issues receiving assistance or more context from NSF program officers, and a lack of representation (e.g., in terms of race, social science disciplines, gender) in the disaster and hazard space. Other factors mentioned included lack of mentorship, difficulty understanding the grant process, language barriers impacting those whose first language is not English, and complex, hard-to-understand language used in grant solicitations and guidelines</p> <p>Competing demands placed on marginalized scholars limit their capacity to apply for and successfully obtain NSF support. Intersectional identities of many marginalized scholars that compound should be considered when developing responsive solutions</p>
Opportunities for diversifying the use of and improving access to NSF funding and resources	<p>Acknowledgment of structural and institutional barriers is a first step in developing targeted solutions to increase access and awareness</p> <p>Incorporation of underrepresented groups in disaster scholarship can facilitate access to the field among marginalized scholars, including through targeted funding and engagement opportunities, inclusive and equity-forward outreach across all existent opportunities, recruitment and support of diverse grant review panels, and mentorship and supportive networks</p> <p>Increased outreach to marginalized scholars about NSF resources and services is necessary to enhance awareness of and engagement with NSF hazard and disaster research infrastructure, resources, and support in places (e.g., at HBCUs and MSIs) and spaces (e.g., conferences) frequented by marginalized scholars</p>

summer program seemed like something that rich white kids could do [and] that it was not accessible to me. It was only because it had a pretty generous stipend with it that I was able to take a leave of absence from my job and afford to even participate in that. And had it not been for [my advisor] being a part of the disaster research and environmental justice research space, I would have never even been exposed to the field. And I think also, even if I had been exposed to this area of research if I hadn't

been plugged into some of those elite institutions like the Disaster Research Center, I still may not have had the same access to the field.”

Networking and engagement opportunities Networking and engagement were described as an avenue for researchers to gain awareness of NSF-funded and supported resources and opportunities. For instance, many participants emphasized that they were often unaware of opportunities unless their mentors brought them along into a space with other disaster scholars or made events open to them. Participants also highlighted the impact of attending conferences and other networking opportunities, which helped propel their scholarship further while introducing them to the ‘heavy hitters’ in the field. Some other NSF-related opportunities and resources highlighted by the participants included the Minority Scholars from Underrepresented Groups in Engineering and the Social Sciences (SURGE) program, the Enabling Program, and the NSF INCLUDES initiative. Others have been a part of various NSF-funded interdisciplinary research teams and projects. Participant 11 emphasized the importance of NSF programs specifically designed to include marginalized scholars intentionally:

“[One project] was a pilot program where we mentored graduate students, Ph.D., and masters and Ph.D. students in the areas of hazards and disaster research. And actually not only enlisted them with professional development in terms of the hazard and disaster community but also exposed them to boots on the ground reconnaissance opportunities as part of our work.”

Participant 7 reflected on their early career experience, noting the challenges faced by those affiliated with institutions without existing NSF disaster or hazard-related resources and the importance of supportive mentoring:

“Even on my path to disaster research... there are just certain things that didn’t make it onto my radar because I was not affiliated with one of the centers at that time, so NSF opportunities, learning how to apply for grants, learning about the various resources that were out there, even though there were fewer at that time, I just wasn’t getting exposed to information about it. And I think that that’s a big barrier. I also think that it can be intimidating. Unless you’re looking for this stuff and view yourself as part of this community already, I think it could be intimidating to try to access some of these resources.”

6.2 Barriers to accessing NSF funding and resources

Participant-reported barriers to accessing NSF and NHERI networks centered around two themes: (1) Structural barriers, and (2) Competing priorities.

Structural barriers Most participants reported having a positive experience engaging with the NSF and NHERI. However, participant 10, in particular, highlighted the gatekeeping culture that is often underscored within the field and in accessing NSF RAPID facility funding overall. They stated that the grant process is like a “boys club,” which “tends to be institutions that historically have received this type of funding.” Because these institutions are frequently awarded and the impact that financial freedom and flexibility have on “the ability of science to really facilitate change,” this participant explicitly asserted that “science is compromised because of how the funds are distributed.” Participants described limited diversity, both in terms of lived experience and demographics, as well as discipline, of senior researchers and those that serve in gatekeeping roles (e.g., on grant review

committees) as perpetuating these challenges. Participant 1 expounded on the challenges of recruiting diverse reviewers who might not have the resources or institutional support to participate in review processes:

“Part of the issue is the review process, too, which is problematic. And I know it’s always okay; you need to get more diversity in reviewers, and that’s easy to say. But again, who is supported to do that? So, most folks aren’t going to be able to participate in the review process. You have to find ways to be able to support people to do that. And I don’t believe that creates bias in any sense. That’s just if you want to take an equity approach to it. So it’s a very, very narrow field of who can actually participate in the review process. And we’ve seen, I mean, quite frankly, it’s most often-- I mean, just from comments you can kind of read between the lines that we all know, right, that it’s mostly white males, physical scientists.”

Furthermore, interviewees called attention to the financial and institutional strains for social scientists and scholars in Minority Serving Institutions (MSIs), smaller colleges, or institutions that do not have a disaster or environmental program. Participants reported that historical barriers faced by individuals at MSIs, such as restricted access to quality and well-resourced educational spaces, classism, racism, and sexism, introduce difficulties for marginalized scholars when competing with their counterparts who can avoid such hindrances. Other factors mentioned included language barriers impacting non-English speakers, lack of mentorship, difficulty understanding the NSF grant process and guidelines, issues receiving assistance or more context from NSF program officers, and a lack of representation (e.g., in terms of race, social science disciplines, gender) in the disaster and hazard space. Race and gender, which are directly impacted by implicit and explicit systemic biases, gatekeeping tactics, and discriminatory stereotypes, likewise were reported to determine individuals’ awareness of and access to NSF resources and support (e.g., technical grant writing assistance). Participants reported how this lack of access precludes individuals from developing a shared sense of identity within the disaster field and limits opportunities for collaboration with individuals who rarely face such roadblocks. As participants emphasized, these barriers result in many underrepresented researchers and practitioners shying away from the grant application process or finding funding sources that seem more nuanced in their selection process. As such, participants suggested that organizations must recognize and address structural barriers by providing technical assistance with proposal writing and development, assistance with submission inquiries, and support with post-award activities.

Competing demands While interviewees called for NSF to consider other compounding factors that impact marginalized scholars, they also recognized that competing institutional demands placed on marginalized scholars limit their capacity to apply for and be successful at obtaining NSF support. Often, these participants are among the few in their institutions conducting research for, with, or on behalf of disproportionately impacted communities. This dynamic, compounded with limited financial and institutional capacities and other responsibilities that pull at the scholars’ bandwidth, results in researchers being overworked and underresourced. This includes having limited resources to construct a grant proposal and manage grants or insufficient funds to adequately pay and support community members, students, and faculty members. Participant 5 emphasized this sentiment of fatigue, saying,

“I know people at th[ose] kind of dominating institutions get overwhelmed, but I feel like, especially earlier career faculty, the amount that’s put on them is so immense.

And so it might not be necessarily a lack of interest or lack of thinking, "Man, I would love to do this," they just simply might not have that bandwidth. And so I think it's also beyond just them. But looking kind of what administratively or organizationally is put on them, and [they are] asked to wear so many hats and play so many roles that it's just like even if this furthers the work they're doing, and this is what they want to engage in, I could just be like, "I just can't."

In addition, participants emphasized the need to consider marginalized scholars' individual and intersectional experiences in unpacking barriers faced and developing responsive solutions. Participant 8 shared:

"A lot of minority scholars are first-generation scholars, but you also have to distinguish because there's minority scholars that come from very privileged backgrounds. It's not just race. It's race, class, and gender. But, yeah. The fact that in a disaster, these scholars are not detached or removed from their contexts; they're also dealing with a lot of things. And if you're a first-generation scholar, you have a family, and there can be all kinds of things going on. So the funding can be there, but if you are not aware and empowered that this is something that you can access in the middle of a disaster, you are just engaged in other ways in the response."

6.3 Opportunities for diversifying the use of and improving access to NSF funding and Resources

Participants provided various recommendations for diversifying the disaster and hazard research field. Three main considerations include: (1) Acknowledging structural and institutional barriers that produce and reproduce inequality; (2) Incorporation of underrepresented groups in disaster scholarship; and (3) Increased publicity of NSF resources and services.

Acknowledgment of structural and institutional barriers Exposure to the opportunities, resources, and benefits of engaging with NSF and its constituent programs would increase participation among historically marginalized groups. Scholars acknowledged that identifying and recognizing how structural and institutional barriers may prohibit particular populations from engaging with the NSF and the disaster and hazards research field would help determine how to address the gaps. However, as participant 13 highlighted, "*In addition to just understanding some of the structural barriers that these institutions and researchers at these institutions may face, there's first and foremost a need for an acknowledgment.*" Acknowledging the structural and institutional barriers that continue to reproduce challenges for historically marginalized scholars is a necessary first step toward identifying gaps in existing practices and barriers to navigating NSF resources. To broaden and diversify participation (both at the NSF/funding agency level and within the hazards and disasters community more broadly), there needs to be direct recognition of how racist practices, whether intentional or not, have resulted in inequity and stymied progress in the field. Participant 3 stated that institutions need to move beyond "bringing someone to the table" and instead focus on the impacts of power dynamics "because, as minorities, we get to sit at the table, but we don't have power [at] that table. And the relations that take place in that table are just sometimes totally unacceptable." They expanded, sharing that "You are not seeing your colleague as equally competent as you. You're trying to treat your colleague as an informant, as a participant, as a research assistant; I'm thinking specifically about

reconnaissance teams that came [to location] and that I was pretty much an event planner.” Participant 9 echoed this sentiment stating,

“I think that’s usually the big challenge, especially where a field that is not necessarily known for its diversity or sometimes even [its] ethical behavior, right? It’s just kind of like the elephant in the room. But as society changes, as our fields do actually change, we cannot just simply invite somebody to dinner, have them sit at the table, and then don’t give them anything to eat or engage them in conversation. And I think that’s a challenge, and that’s the next big step out here if we really want to produce a big change.”

Meaningful inclusion of diverse perspectives not only encourages the development and sustainability of innovative solutions and approaches for equitable participation in the field of hazards and disaster research but may bring necessary and new perspectives in identifying barriers to the field. Understanding these structural barriers would foster a more inclusive academic community by creating spaces for productive and intentional collaboration, mentorship, and support networks to empower underrepresented scholars.

Incorporation of underrepresented groups in disaster scholarship As Participant 5 stated, and as other interviewees frequently emphasized, “*When you look at the research that [is] done on underrepresented people, the underrepresented people are almost an afterthought in the research.*” Participant 7 spoke about how structural limitations and lack of exposure to resources shift how underrepresented scholars can interact with the disaster and hazards field, stating that “*as minorities, we don’t tend to have a broad access to many fields. We are exposed to certain professions or certain opportunities based on what has always been available to our community.*” While targeted funding and engagement opportunities (e.g., training specific to marginalized scholars) are necessary, some interviewees mentioned the need for inclusive and equity-forward outreach and engagement strategies across all current and future funding opportunities. Such engagement opportunities should be rooted in inclusion and equity and not serve as meeting explicit or implicit diversity criteria. To further address this lack of exposure and lack of research conducted by these scholars, many participants likewise highlighted “*leveling the playing the field*” by reconsidering membership on grant committees to include BIPOC scholars, those attending state colleges and universities, MSIs, and social scientists. Such review processes should examine and reflect on methods towards incorporating scholars from “*disadvantaged background[s] who are more likely to connect with those who are also disadvantaged.*” Participants highlighted the importance of mentoring and supportive networks in creating spaces where underrepresented scholars can thrive in the hazards and disaster research field. For instance, one organization frequently referenced was the Bill Anderson Fund. This organization’s actions create opportunities for NSF-defined Black and Brown underrepresented minority scholars to foster a shared sense of identity, build social capital within the field, and receive direct mentorship that is otherwise absent at their home institutions.

Increase outreach to marginalized scholars about NSF resources and services Beyond acknowledging the systemic barriers and intentional and equitable inclusion of historically underrepresented students and scholars in the hazards and disaster research field, most participants also noted the need to increase accessibility and awareness of NSF resources and services. Each participant asserted that intentionally publicizing the benefits of these resources and making them accessible to underrepresented researchers would increase the number of diverse users and also advance disaster and hazard science significantly since they are asking questions that are ripe for investigation in the field. Through these actions and continuous promotion of these resources in universities and conferences that

underrepresented scholars often frequent, there would likely be an increase in the interaction with NSF-related resources, opportunities, and services. These actions include inviting students and early career professionals to various NSF-supported workshops or sessions to learn about the resources and services available, offering mentorship to students from underrepresented spaces, and promoting funding opportunities and projects. Participants recommended culturally sensitive and intentional tactics when inviting underrepresented scholars into a space. Beyond a “*checked box*,” participants suggested intentional and direct follow-ups with historically underrepresented scholars, continuously exposing the availability of the resources and providing easily digestible context on how to obtain or interact with such services. The compounded intersectional identities of marginalized scholars should be considered when developing such responsive solutions. When constructing and extending access to research projects that highlight and are looking to engage underrepresented scholars, participants cautioned that institutions and mentors alike check their biases and continuously consider creating a collaborative learning space rather than an extractive process that can result in damage to marginalized scholars and community members.

7 Discussion

Leveraging the lived experience and expertise of scholars who are leaders in promoting equitable opportunities for diverse scholars to succeed and contribute in the disaster and hazard research space, this study identifies challenges and opportunities for marginalized scholars to actively participate in NSF funding and NSF-supported resources. The themes derived from their shared perspectives challenge the field of hazards and disaster research by (1) illuminating the types of challenges faced by underrepresented students and scholars in becoming aware of and actively participating within the disaster and hazard research field; (2) examining how underrepresented scholars have navigated and interacted with the disaster and hazard research field to overcome these challenges; (3) conceptualizing ways forward for the equitable development and integration of marginalized scholars in disaster scholarship. Our findings underscore the importance of autonomy over research, thought leadership, and equal partnership, emphasizing the strength of community building and the power of incorporating voices frequently excluded within this research community. As Collins (2019) asserts, this acknowledgment and analysis would provide breadth and an opportunity to move beyond conceptualizing intersectionality as just a notion and more as an avenue for praxis (Moradi and Grzanka, 2017).

Our findings echo prior research that has determined how intersecting factors like race, gender, and sexuality all contribute to an individual’s journey in navigating nationally funded resources and institutions (ibid). The intersectional dynamics of discrimination are tied to structural and institutional processes, conditions, limitations, and factors that have systematically prevented particular groups from engaging fully in the disaster and hazard fields. While past research has called for those who have consistently occupied positions of power to consider the impact it has on those who have historically marginalized identities (Thorne et al. 2021), our findings show that marginalized scholars in the disaster and hazard research field continuously experience being “*tacked on*” as meeting an explicit or implicit diversity criteria instead of a genuine effort towards intentional and equitable inclusion. In instances where marginalized or underrepresented scholars are included for their expertise or experience, it is often in a supportive role and rarely as contributing and

equal thought leaders. This lack of reciprocity, leadership, autonomy, and respect are issues that continue to perpetuate and directly impact if and how marginalized scholars are willing to engage in research that comes off as disingenuous or extractive. Indeed, prior research has shown how harmful and unintentional tactics to diversify spaces can often lead to the tokenization or mistreatment of underrepresented groups (Gareau 2003; Fredericks 2011). This tokenization can directly impact how and to what extent underrepresented scholars participate in spaces where they are often one of the few from their identity groups. Incorporating and intellectually validating underrepresented scholars with the intent of research convergence and not for personal gain is recommended to combat the feeling of tokenism, being over-committed, and feeling under-supported in the hazard and disaster research field.

Real and perceived administrative, personnel, and financial capacity constraints of institutions where marginalized scholars frequently work, including smaller institutions such as MSIs and HBCUs, were reported to create a perpetual cycle in which researchers from these institutions are inhibited from substantively contributing to and engaging with the field. These limited capacities preclude applications for grants, as no grant submitted means no grant awarded; they cannot use grant funds to, then, build research capacity. When grants are submitted, the quality of work of affiliated investigators may be questioned or compared to studies produced at Research 1 institutions and predominately white institutions. Referencing the grant space or any disaster and hazard-related space as a "boys' club" highlights the intersecting power dynamics and microaggressions of gender, language, and patriarchy used to exclude groups or gatekeep specific opportunities and limit access to resources. Targeted, non-competitive federal investments in MSIs can help to quell this cycle of exclusion. In addressing the restricted administrative capacity that MSIs and other disproportionately under-resourced institutions face, participants suggested providing technical assistance with proposal requirements and development, submission inquiries, and post-award activities. Grant panels should be diversified to include MSI representatives to mitigate biases, and panelists from such institutions should be provided financial and administrative support to participate, given the limited institutional capacity to provide space for these scholars to volunteer.

Fostering long-term bonds with and among marginalized scholars can inform and advance disaster research by producing a more collaborative and holistic approach to research (Kyne and Aldrich 2020). Intentionally nurturing these connections increases their support system, as highlighted in the bonding and bridging aspects of social capital theory. In particular, mentorship and financial and social support were reported to provide space for students and early career scholars to explore their research interests, learn from others, and assist in career development (Acosta et al., 2016). When reflecting on their career trajectory, participants continuously credited their personal mentoring and networking opportunities, which broadened their perspectives and ability to access the necessary resources and services. It was through a reciprocal and supportive mentor–mentee relationship, an example of the linking component of social capital, that the participants gained access to the opportunities available to scholars who have the social and financial means to engage. Further, mentoring networks were reported as opportunities to enhance access to such supports, particularly for scholars without robust hazard and disaster research programs at their home institutions. The Bill Anderson Fund, an organization dedicated to expanding the reach and presence of historically underrepresented Ph.D. students and professionals within the disaster and hazard field (The Bill Anderson Fund, n.d.), was highlighted as an exemplar of such a supportive network. Created in honor of William (Bill) Averette Anderson, a pioneer in diversifying the disaster and hazards field within NSF, this

organization creates workshops and programs specifically designated to train, support, or create opportunities for these underrepresented scholars entering the field. Such workshops and programs focus on topics like preparation help for comprehensive exams and dissertation defenses, assistance with developing grant and dissertation proposals, guidance and writing help with publishing academic literature, and career or salary negotiations. Additionally, this organization works to connect underrepresented students with “heavy hitters” in the field to broaden their perspective and gain insight and mentorship, increase their visibility in the field, and partake in research and co-production activities.

Finally, participants also called for more transparency regarding the resources available and opportunities to implement their respective research methodologies or techniques, which are often overlooked. Increasing exposure to NSF-funded hazard and disaster research infrastructure, resources, and support was a common sentiment among the interviewees. By orienting this study around and viewing findings through the lenses of social capital theory and intersectionality, our findings demonstrate how participants’ intersectional identities are directly connected to their ability to develop and draw upon bonding, bridging, and linking relationships to position themselves as active and equitable participants within the hazards and disaster research field. Studies have highlighted how those with marginalized identities form connections with like individuals or communities to build up their network in the face of barriers, as seen with the emphasis on doing direct outreach in spaces where historically marginalized groups exist (e.g., presenting or holding tables at conferences and directly offering training programs to minority-serving institutions and groups) (Foertsch 2019a, b; Gall et al. 2020; Gallegos et al. 2023). Participants in the current study acknowledged that a significant barrier underrepresented scholars face is that they are unaware of funding opportunities and mechanisms that other, more resourced, or privileged scholars and institutions access. Participants recommended that NSF-funded infrastructure like the NHERI RAPID Facility have a presence at conferences through invited, open Tribal convenings or offer workshops or webinars at MSIs or state-funded schools to increase the visibility of the NHERI network.

Such engagement methods, as participants highlighted, are crucial to ensure that (1) outreach and relationship-building are intentional and rooted in equity, (2) access for historically underserved individuals to engage in resources necessary for research and DRR practices is improved and sustained, and (3) relational factors like autonomy, trust, and reciprocity are recognized, emphasized, and maintained. These points are crucial given the intersections of discrimination and the cascading impacts of these attributes on the rate of progress in diversifying and forwarding the disaster and hazards field.

8 Limitations

Our study is limited by its small sample size and lack of generalizability outside the hazard and disaster research field. Our study purposively sampled researchers with expertise or lived experience related to diversifying the disaster and hazards research field. Given the small number of individuals who meet this criterion, our sample was inherently limited by a small sampling frame. However, this criterion allowed participants to contribute nuanced insights, and the targeted sampling criteria allowed for early meta-theme saturation. Other early career professionals, such as post doctoral studies, should be considered for future research, especially as they are learning to navigate hazards and disaster research resources independently. Personnel from offices of sponsored research

within MSIs, HBCUs, and state institutions, as well as climate and disaster scholars employed by organizations other than academic institutions, could also be engaged through future research to gain more insights into the issues impacting historically underrepresented scholars and researchers. Indeed, as the field of hazards and disaster field expands, disaster scholarship is valued outside of the academy, as evidenced by scholars working in private and public organizations and may face distinct barriers than those situated inside the academy. Further, this cross-sectional study was conducted at a single point in time. Given the ongoing focus on equity, diversity, and inclusion, new programs and opportunities are being created daily. Longitudinal research should explore the impact of these programs on scholars and scholarship within the field.

9 Conclusion

As disasters increase in frequency and magnitude, with disproportionate impacts on BIPOC and marginalized communities, it is essential that scholars with similar lived experiences and concordant racial, ethnic, and socio-economic identities are engaged in hazard and disaster scholarship. Through semi-structured key informant interviews with scholars who are leaders in promoting equitable opportunities for diverse scholars to succeed and contribute in the hazard and disaster research space, this study revealed considerations and recommendations for promoting and enacting equitable options and opportunities for marginalized scholars to actively and equitably participate in the field, thus advancing disaster scholarship. Participants reported the influence of NSF-funded fellowships, scholarships, networking, and engagement opportunities on entry to the hazard and disaster research field and awareness of and access to NSF-supported hazard and disaster research infrastructure. Nevertheless, myriad structural barriers, both that directly impact marginalized scholars and others that limit the capacity of institutions where such scholars frequently work, alongside competing demands placed on marginalized scholars, strain ongoing and meaningful engagement and integration in the field. Participants called for an initial acknowledgment of such barriers as a first step in identifying culturally appropriate and proactive solutions. Intentional, non-tokenistic strategies for funding marginalized scholars and promoting their access and attendance at trainings and other activities must be coupled with targeted outreach and engagement strategies that meet such scholars in familiar places (e.g., home universities) and spaces (e.g., conferences they regularly attend). Recognition of systemic barriers, coupled with action-oriented approaches toward inclusion, can broaden the participation of marginalized scholars in the field.

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Declarations

Conflict of interest The authors declare that they have no conflict of interest.

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Authors and Affiliations

Cassandra Jean¹  · **Jamie Vickery**² · **Joseph Wartman**² · **Jeffrey Berman**² · **Nicole Errett**^{1,2}

✉ Cassandra Jean
cjean@uw.edu

Jamie Vickery
vickeryj@uw.edu

Joseph Wartman
wartman@uw.edu

Jeffrey Berman
jwberman@uw.edu

Nicole Errett
nerrett@uw.edu

¹ Department of Environmental and Occupational Health Sciences, University of Washington, Seattle, WA, USA

² Natural Hazard and Disaster Reconnaissance Facility, University of Washington, Seattle, WA, USA