

Historically excluded groups in ecology are undervalued and poorly treated

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Hostile workplaces undermine efforts to make the ecological sciences more inclusive and welcoming. Survey responses by members of the Ecological Society of America (ESA) and subscribers to the ECOLOG-L listserv provide a snapshot of a range of workplace experiences in ecology. The bottom line: identity matters. Although the majority of respondents reported positive workplace experiences (for instance, receiving mentorship), historically excluded groups – including scientists of color; women; lesbian, gay, bisexual, queer, pansexual, asexual, and other non-heterosexual (LGBQPA+) individuals; and those who identify as disabled – on average were 1.5 times more likely to encounter negative workplace experiences (for instance, sexual harassment, interpersonal mistreatment, and insulting behaviors) as compared to their counterparts in the historical majority. Moreover, historically excluded groups were more likely to report opting out of professional opportunities, more likely to have considered leaving their institution, and twice as likely to consider a career change. We provide recommendations for professional associations, academic institutions, and other employers of ecologists to address interpersonal mistreatment through culture and policy changes.

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Initiatives to increase diversity in science must move beyond recruitment, to promote behaviors and policies that create and sustain inclusive, equitable, and safe workplaces (NASEM 2018; Miriti 2020). Efforts to improve student and professional recruitment often overlook the quality of the learning or work experience (that is, factors that affect retention) (O'Brien *et al.* 2020). Racism, sexism, harassment, and bullying or intimidation in scientific fields create hostile environments, negatively impacting people's well-being and careers (Sojo *et al.* 2016; Miner *et al.* 2017) and counteracting efforts to recruit, support, and retain a diverse scientific workforce (Berhe *et al.* 2022). Equity and social justice are important goals for the ecological community beyond purely instrumentalist arguments about the benefit of diversity for science (Batavia *et al.* 2020).

Ecologists from historically excluded groups face disproportionate obstacles, including those associated with fieldwork (Morales *et al.* 2020), discriminatory stereotypes and unspoken cultural norms (Bailey *et al.* 2020), and the pervasive nature of gendered and racialized social hierarchies in scientific institutions (O'Brien *et al.* 2020). Like all other scientific disciplines,

ecology is not immune to societal biases. The discipline and origin of many Western academic scientific organizations are rooted in extractivist, colonial, and imperialist enterprises (Wynn-Grant 2019; Trisos *et al.* 2021), leaving legacies in today's institutions. Diversifying STEM (science, technology, engineering, and mathematics) fields should not be thought of as a supply problem to be solved by better recruitment, as it is not lack of interest that prevents certain groups from entering STEM fields (O'Brien *et al.* 2020) but rather that systematic biases reduce retention (Miriti 2020; Tseng *et al.* 2020).

Many ecologists encounter biases and discrimination in their careers – as students, during fieldwork, and as faculty, researchers, and practitioners (Tseng *et al.* 2020; Schusler *et al.* 2021). A quantitative assessment of the frequency and impacts of these experiences can inform initiatives for culture and policy change. We surveyed ecologists' workplace experiences over a 1-year period (experiences that had occurred prior to the start of the COVID-19 global pandemic) and the impact of these experiences on career choices. We provide recommendations for addressing the disproportionate impact of hostile and exclusionary behaviors in ecology.

Methods

We surveyed members of the Ecological Society of America (ESA) and subscribers to the ECOLOG-L listserv via an anonymous survey delivered online via Qualtrics in Fall 2020. The survey reached students and practitioners in ecology, wildlife biology, forestry, fisheries, natural resources, environmental science, and environmental education. Approximately 8000 ESA email addresses received the survey

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invitation, and the ECOLOG-L listserv has approximately 25,000 subscribers, many of whom are ESA members. A total of 584 surveys (~6% response rate with the ESA emails as the base number; 2.3% response rate with ECOLOG-L subscribers as the base number) were started and 384 were fully completed (~4.8% response rate using the ESA emails as the base number). The climate survey, modified from Marin-Spiotta *et al.* (2023), contained questions about workplace (defined as place of employment or learning) experiences over the previous year, including pro-social or supportive experiences, general incivility or interpersonal mistreatment (Cortina *et al.* 2013), negative or discriminatory language (Nelson *et al.* 2017), and sexual harassment using the Sexual Experiences Questionnaire (Fitzgerald *et al.* 1988). Our climate survey included questions about potential outcomes of these experiences as related to professional activities, about familiarity with codes of conduct in the workplace (including field settings), and about experience(s) with reporting discrimination, harassment, and/or intimidating behavior. There were also questions regarding alcohol consumption in professional settings (eg when performing fieldwork, during conferences and meetings). Respondents provided details about their occupation and career stage, as well as demographic information, including gender, age, race and ethnicity, sexual orientation, and disability status (for how information was requested and how terms were defined, as well as the order of questions and tables of anonymized data, see the link provided in the “Data Availability Statement” section toward the end of the main text).

For the different identity categories (gender; race and ethnicity; sexual orientation; and ability status), we compared responses between the historically excluded group and the historical majority group (for example, people of color to white respondents; lesbian, gay, bisexual, queer, pansexual, asexual, and other non-heterosexual [LGBQPA+] individuals to those who did not identify as LGBQPA+; respondents who identified as disabled or with a disability – we deliberately used both people-first and disability-first language to recognize different preferences within the disability activist movement – with those who did not list having a disability). Because individual group numbers were too small for statistical comparisons, we grouped respondents who identified as Black, Latinx, Native American, Indigenous, Pacific Islander, Asian, and/or Middle Eastern into a “people of color” category. We did not compare responses between transgender and cisgender respondents because of very unequal sample sizes and because respondents who indicated they were transgender also identified as LGBQPA+. We recognize that an intersectional analysis would provide valuable insights, yet the small sample sizes precluded this possibility. Unless otherwise stated, to simplify results and create more balanced groupings for statistical analyses, frequency responses were binned. Positive experience data were binned to group respondents who reported that they “never”, “rarely”, or “sometimes” had a certain experience and those who reported that they “frequently” or “always” had the

experience. Negative experience data were binned into two groups: respondents who never had a certain experience and those who had (that is, responses included “once or twice” or “more frequently”). In some cases, several survey questions were combined to create one metric; for example, three questions about insulting remarks were averaged and combined into one metric (see link provided in the “Data Availability Statement” section). We conducted a confirmatory factor analysis for a related study that used the same survey questions and validated these groupings (Marin-Spiotta *et al.* 2023).

R statistical software (v4.0.3) was used for all statistical analyses (R Core Team 2020). Chi-square analysis was used to determine whether there were statistical differences between groups in their response to questions; this was done between groups within a single identity category (eg men versus women). In cases of small sample sizes, Fisher’s exact test was used. Differences were considered statistically significant when $\alpha < 0.05$ (note that the survey design did not permit determination of whether certain experiences caused specific outcomes).

■ Results

Demographics of survey respondents

Of the 384 fully completed surveys, 54% of respondents identified as women, 14% identified as people of color, 14% identified as LGBQPA+, and 8% identified as disabled or having a disability. Of the respondents who identified their career stage, 24% were students, trainees, or postdocs; 35% were in the mid-career stage (under 50 years and not in the previous category); and 42% were in a later career stage (over 50 years) (Figure 1). Age was the best proxy available for distinguishing between mid- and late-career individuals, although we acknowledge its limitations. In terms of workplace type, 70% of respondents were employed at universities and colleges, 16% in government agencies, and the remainder in for-profit and nonprofit organizations and other work situations.

Students/trainees/postdocs were more likely to identify as women (72%, versus 66% for mid-career and 36% for late career), people of color (23%, versus 18% for mid-career and 17% for late career), and LGBQPA+ (28%, versus 20% mid-career and 5% late career). Students/trainees/postdocs and mid-career scientists were equally likely to identify as having one or more disabilities, and were more likely to do so than late-career scientists (10%, versus 6%).

Workplace experiences

Overall, 78% reported positive experiences in the workplace. However, respondents who identified as women (versus men) and/or as LGBQPA+ (versus those who did not) were less likely to experience respectful behavior at work (76% versus 85%, and 66% versus 82%, respectively) (Table 1a). Only one-third of respondents received mentoring regularly, although no differences were found between identity groups (Table 1a).

Supervisors, institutional leadership, peers, and students were equally reported as sources of positive behaviors.

Historically excluded groups were more likely to experience negative workplaces (Figure 2). Approximately one-third of all respondents experienced intimidation or bullying-like behaviors (36%), devaluation of their work (35%), and/or insulting remarks (29%) over the previous year (Table 1b). Respondents who identified as women (42%, versus 24% of men), LGBQPA+ (51%, versus 32% of non-LGBQPA+), and/or with a disability (55%, versus 33% for those without) were more likely to have their work devalued (Table 1b). Those with disabilities (45%) were significantly more likely to experience insulting remarks than people without (26%). Women (12%) were significantly more likely than men (5%) to experience sexual harassment (Table 1b). Other historically excluded groups experienced sexual harassment at twice the levels of majority groups, although these differences were not statistically significant due to small sample sizes. Respondents identified peers and colleagues as responsible for 40% of negative workplace experiences, with supervisors (20%), institutional leadership (20%), and students and trainees (20%) also contributing to hostile climates.

Self-reported outcomes of workplace experiences

When asked about the impacts of workplace experiences on their careers, almost half of the respondents indicated they had considered leaving their institution (46%), with those from historically excluded groups about 1.5 times more likely to have considered leaving than other groups (Table 1c). Similarly, significantly more women (45%) than men (24%), more LGBQPA+ people (60%) than non-LGBQPA+ people (32%), and more people with disabilities (59%) than those without disabilities (33%) have considered a career change (Table 1c).

Ecologists from historically excluded groups reported greater concern for their physical safety (eg more women: 16% versus 8% of men; more LGBQPA+ individuals: 26% versus 12% of non-LGBQPA+; Table 1c). Similarly, significantly more LGBQPA+ people (42%) than non-LGBQPA+ people (25%) and more people with disabilities (47%) than people without disabilities (26%) reported avoiding professional activities (eg classes, conferences, fieldwork; Table 1c).

Reporting hostile workplace behavior

More than three-quarters of the responding ecologists (76%) were aware of how to report discrimination, harassment,

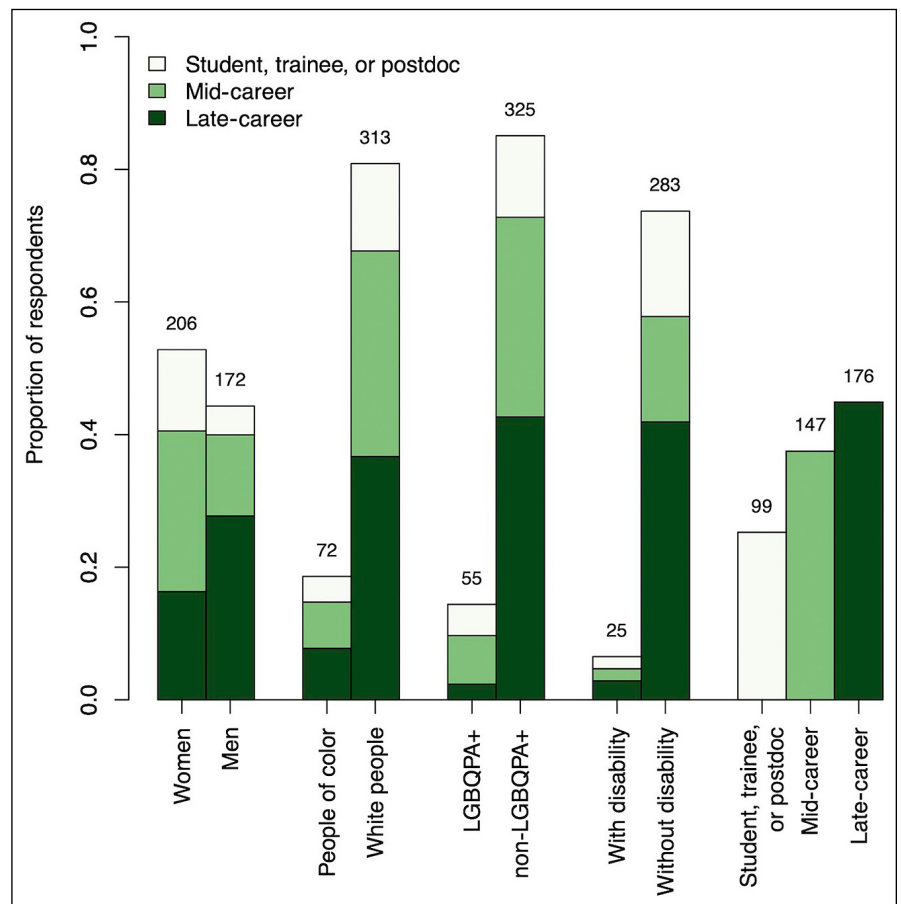


Figure 1. Demographic breakdown of survey respondents, emphasizing differences among students, trainees, or postdocs; mid-career ecologists (under 50 years old); and late-career ecologists (50 years and older). Numbers above bars provide sample sizes.

and intimidating behavior. Those identities with greater historical power were proportionately more aware of the reporting procedures than those historically excluded. For example, white respondents (78%) were more likely than ecologists of color (64%) to know the reporting process, and scientists in the late-career stage (85%) were better informed than both respondents in the mid-career stage (73%) and students/trainees/postdocs (62%). Similar patterns of information inequity were seen between groups regarding how to report discrimination, harassment, or intimidation experienced during fieldwork.

Overall, few ecologists used existing processes to report discrimination, harassment, and/or intimidating behavior, and fewer still were satisfied with the outcomes. Of the 22% who had filed a complaint, only 17% were satisfied with the outcome. Negative behaviors occurring in field settings were reported by 5% of respondents, with 70% of these individuals unsatisfied with the outcome.

Alcohol in the workplace

Overall, 22% of ecologists in our survey expressed some degree of discomfort with the level of alcohol consumption

Table 1. Percentages of respondents reporting positive and negative experiences and different outcomes (*n* = 384 responses)

		Women	Men	POC	White	LGBQPA+	non-LGBQPA+	With disability	Without disability	Overall
(a) % respondents reporting positive experiences “frequently” or “always”	Work mentoring	31.4	37.4	37.0	32.6	36.4	32.9	31.2	33.4	32.9
	Respectful treatment	75.7*	84.7	78.2	78.9	65.5**	82.0	81.2	79.0	78.5
	Psychological safety	55.3***	70.8	50.9	63.8	52.7	64.2	62.5	62.8	62.6
	Inclusive behavior	42.2	40.5	40.7	41.1	40.0	41.4	56.2	39.4	40.2
(b) % respondents reporting negative experiences “once or twice” and more frequently	Devaluing work	42.0***	24.0	41.8	33.5	50.9**	31.6	54.8*	33.2	35.4
	Insulting remarks	31.5	22.4	31.5	27.0	37.0	25.5	45.2*	26.0	28.5
	Sexual harassment	11.7*	4.7	16.4	8.5	16.4	8.05	19.4	8.6	9.8
	Bullying	39.2	30.4	36.4	36.4	45.5	34.2	51.6	34.8	36.4
(c) % respondents reporting negative outcomes as a result of workplace experiences	Considering leaving institution	54.1***	35.8	53.7	45.9	63.6**	43.7	65.6*	44.0	46.2
	Considering career change	44.9***	24.4	38.9	36.0	60.0***	31.7	59.4***	32.7	36.2
	Skipped activity	30.4	22.5	31.5	27.6	41.8*	25.3	46.9*	25.8	27.9
	Concern for safety	16.3*	7.6	20.4	12.5	25.5**	11.5	21.9	12.4	13.2

Notes – asterisks indicate the significance level: **P* < 0.05, ***P* < 0.01, ****P* < 0.001. Comparisons are women versus men; people of color (POC) versus white people; lesbian, gay, bisexual, queer, pansexual, asexual, and other non-heterosexual (LGBQPA+) individuals versus non-LGBQPA+ individuals; and people with a disability versus those without a disability.

in professional settings. Historically excluded groups tended to have a greater level of discomfort, but these differences were not statistically significant. One-third of respondents reported that alcohol was sometimes consumed in the workplace and/or present during fieldwork, and 88% reported that alcohol is consumed at professional meetings.

Discussion

Ecologists from historically excluded groups disproportionately experience more hostility and less positive work environments. Intimidation or bullying-like behaviors, work devaluation, and exposure to disparaging language based on gender, race or ethnicity, age, ability status, and sexual orientation were more frequently reported by scientists of color, women, LGBQPA+ individuals, and those who identify as disabled. These unsupportive and exclusionary experiences were associated with feeling unsafe, avoiding work events, and considerations of leaving current institutions or the discipline altogether. These results align with those of studies from other scientific disciplines showing how those historically excluded from science and who continue to be underrepresented in senior and leadership positions are disproportionately harmed by negative workplace environments (eg NASEM 2018; Tseng *et al.* 2020; Berhe *et al.* 2022). Scientists in disciplines involving fieldwork (such as the geosciences, ecology, and archeology) face similar special difficulties regarding unclear workplace policies, unclear expectations for professional behavior, and unequal and unclear access to resources and opportunities, including transportation, communications, equipment, and field staff (Nelson *et al.* 2017).

Many of these behaviors may be overlooked because they are perceived as not being illegal or not having serious impacts.

Recognized as disguised forms of discrimination, they have harmful consequences on well-being and career satisfaction (Cortina *et al.* 2013; Cabay *et al.* 2018; Gibney 2019). Devaluation of accomplishments, for example, is associated with higher rates of turnover in faculty positions for people of color and women (Settles *et al.* 2022). The harmful effects of these behaviors extend beyond the intended targets and reduce overall workplace morale and satisfaction.

While most ecologists reported receiving support and feeling respected at work, historically excluded groups were both less likely to experience supportive work environments and more likely to experience negative behaviors. Recognition that people experience the same workplace in different ways based on their identity, and that these exclusionary behaviors occur even in generally positive spaces, is critical if institutions are to change culture and climate.

We recognize that the people who responded to this survey may not be representative of the ESA membership, the ECOLOG-L listserv, or the US population. The data for such a comparison are not available. We also recognize that groupings used in this study, such as people of color, LGBQPA+ individuals, and those who identify as disabled, are broad categories used for convenience due to small sample sizes. Such groupings do not consider the large differences in experience within these categories and fail to address issues of intersectionality. Such analyses are critical for gaining a more nuanced understanding of the workplace and will be conducted by our team in a further study that combines data from ecologists with data from geoscientists.

Strategies to advance diversity must address hostile behaviors

Exclusionary behaviors create working and learning environments in the sciences that are counter to values of

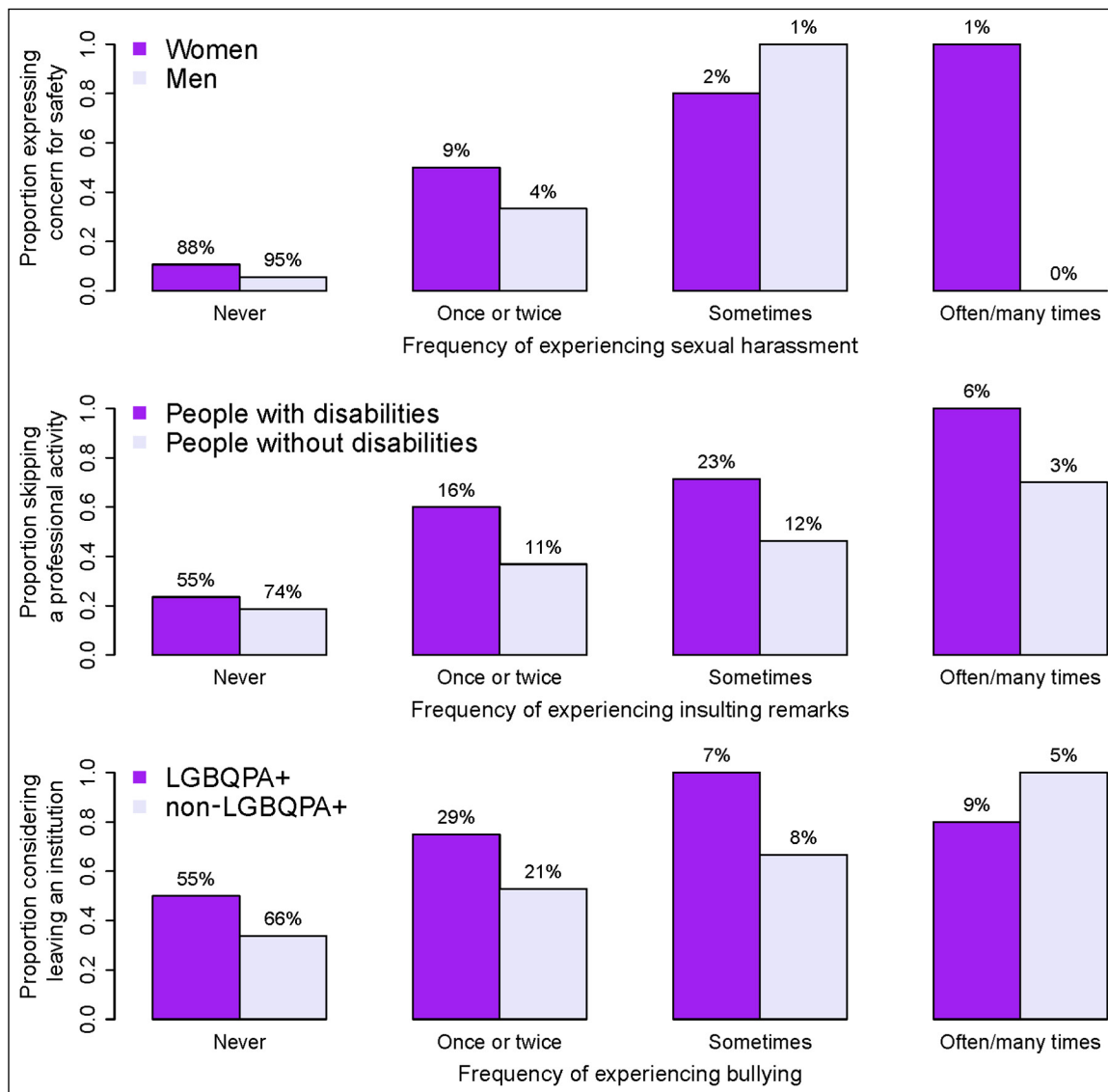


Figure 2. Representative relationships between frequency of negative workplace experiences and proportions of certain outcomes for different groups. (top row) Contrast between women and men regarding how experience of sexual harassment is related to concerns for their physical safety. (middle row) Contrast between people with disabilities and people without disabilities regarding how experiencing insulting remarks is related to skipping professional activities. (bottom row) Contrast between lesbian, gay, bisexual, queer, pansexual, asexual, and other non-heterosexual (LGBQPA+) people and non-LGBQPA+ people regarding how experiencing bullying and intimidating behavior affects people considering leaving their current institution. Above each column is the percent of the sample in that category; for example, 9% of women experienced sexual harassment once or twice in the past 12 months, whereas 4% of men experienced sexual harassment once or twice.

advancing diversity, equity, and inclusion. Below we highlight a few of the actions that individuals, teams, organizational leadership, and funding agencies can take to overcome systemic barriers to the inclusion and advancement of a diverse scientific workforce (eg Cooper *et al.* 2020; Ali *et al.* 2021; Massey *et al.* 2021).

Organizations should invest in practices that promote retention and not just recruitment (Puritty *et al.* 2017; Berhe *et al.* 2022). Ending the tolerance of hostile behaviors requires systems of accountability, including clear communication of values and expectations, and implementation and dissemination of codes of conduct. We found that historically excluded

groups who were more likely to experience negative behaviors were also less aware of reporting mechanisms in their workplace. Information inequities reinforce exclusionary practices and have career consequences, especially in hierarchical organizations such as universities, and in professions, like ecology, with knowledge hierarchies. Failure to communicate policies was a strong predictor of the prevalence of sexual harassment in field research environments (Nelson *et al.* 2017). Reliance on policies and existing legal frameworks alone is insufficient to address workplace culture and climate issues that perpetuate exclusionary behaviors in STEM (eg NASEM 2018). In our survey, of the ecologists who reported incidents to their

institution, only about one in six were satisfied with the outcome. Institutional reluctance to pursue investigations and disciplinary actions along with nondisclosure practices contribute to dissatisfaction and discourage people from filing complaints (Clancy *et al.* 2020). As an alternative, universities should consider a wider variety of mechanisms to address hostile behaviors, including delaying promotions and sabbatical leave, withholding merit raises, and preventing offenders from being able to accept new research students (Clancy *et al.* 2020).

Another mechanism for accountability would be to reclassify harassment, bullying, and discrimination as research misconduct, demanding – at the very least – the same consequences for the mistreatment of others as for data fabrication and plagiarism or mismanagement of funds (Marín-Spiotta 2018; NASEM 2018). Funding agencies implementing sexual harassment policies can expand these to include other discriminatory and hostile behaviors, such as discrimination and bullying, which contribute to career stalling and people's decisions to leave scientific careers. Professional associations can help change discipline expectations and norms, through the adoption and promotion of codes of conduct and the creation of programs to support historically excluded scientists and educators (Marín-Spiotta *et al.* 2020).

Peer accountability can help transform workplace culture and climate, especially when leadership provides models of respectful, inclusive, and supportive behaviors (Schneider *et al.* 2017). All members of the ecological community – but especially those who are not the primary targets of these behaviors – need to recognize the impact of exclusionary behaviors and act to reduce their harm, possibly using skills acquired from bystander intervention training, which teaches people how to intercede to stop inappropriate and potentially harmful interactions (NASEM 2018; Berhe *et al.* 2020; Marín-Spiotta *et al.* 2022). Anti-racism education is another potential tool to identify everyday practices and organizational structures, policies, and processes that sustain exclusion so they can be countered, reversed, and dismantled (Cronin *et al.* 2021).

Transforming workplace culture and climate requires changing customs. One example is alcohol consumption, a frequent feature of professional life, including scientific meetings, networking events, and fieldwork. Social gatherings provide valuable opportunities for career advancement, mentoring, and the exchange of ideas, yet in our study nearly one-quarter (22%) of all respondents expressed some discomfort with the level of alcohol present during these events. Serious consideration must be given to the role of alcohol in professional spaces (Forrester 2021).

■ Conclusions

For ecology and other scientific disciplines to encourage and retain a diverse community of practitioners, we need to recognize the role of exclusionary and harmful behaviors in creating negative work environments. These harmful behaviors, inadequately addressed by current policies, disproportionately impact groups historically excluded from

higher education and from scientific careers. The continued failure to address these behaviors will have long-lasting legacies on equity in our discipline and deny the ecological community the diverse perspectives needed to address complex environmental problems that disproportionately impact underserved and historically marginalized populations.

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■ Data Availability Statement

The survey, including how information was requested, how terms were defined, the order of questions, and how answers were aggregated, along with R code and tables of the anonymized data, are available from the Environmental Data Initiative, at: <https://doi.org/10.6073/pasta/cc877612927ede0304f08fde2f163ff>.

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