Moving forward on a slippery floor: Extra challenges faced by women ecologists related to fieldwork, traveling and the working environment

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ABSTRACT. Female ecologists are limited by obstacles that include the disproportionate burden of domestic and caregiving tasks, as well as harassment and discrimination. These factors contribute to their underrepresentation in prominent academic positions and lower visibility in publications. Through a survey of 665 Argentine ecologists, we explored two hypotheses: 1. caregiving responsibilities limit women's ability to travel, and 2. women experience harassment more frequently than men. The results showed that women with caregiving responsibilities travel less for fieldwork and scientific meetings. Eighty percent of women avoid traveling alone to the field, compared to 66% of male respondents. In addition to logistical limitations, increased workloads, and wildlife-related safety issues mentioned by both genders, women reported concerns related to their personal integrity and vulnerability. Women report experiencing more instances of harassment than their male colleagues. We conclude that gender inequities and vulnerability to safety issues differentially affect the careers of female researchers. Institutional policies are proposed to address these inequalities, including grants for caregiving assistance and measures against harassment, emphasizing the need to create a more just and equitable work environment that fosters emancipatory leadership to promote the professional advancement of women in science.

[Keywords: gender, caregiving tasks, unpaid work, inequity, harassment, violence, ecology, science, CONICET, Argentina]

RESUMEN. Avanzar sobre suelo resbaladizo: desafíos que enfrentan las ecólogas, relacionados con el trabajo de campo, viajes y el entorno de trabajo. Las ecólogas se ven limitadas por obstáculos que incluyen la carga desproporcionada de trabajo doméstico y cuidado, así como el acoso y la discriminación. Estos factores contribuyen a su subrepresentación en posiciones académicas destacadas y a una menor visibilidad en publicaciones. A través de una encuesta realizada a 665 ecólogos argentinos, exploramos dos hipótesis: 1. la carga de trabajo de cuidado limita la capacidad de las mujeres para viajar y 2. Las mujeres sufren acoso más frecuentemente que los varones. Los resultados mostraron que las mujeres con responsabilidades de cuidado viajan menos al campo y a reuniones científicas. Un 80% de las mujeres evita viajar sola al campo, en comparación con el 66% de los varones encuestados. Además de las limitaciones del tipo logísticas, de recarga de trabajo y problemas de seguridad relacionada a fauna silvestre mencionados por ambos géneros, las mujeres reportaron problemas relacionados a su integridad personal y vulnerabilidad. Las mujeres reportan sufrir más situaciones de acoso que sus colegas varones. Concluimos que las inequidades de género y la vulnerabilidad a situaciones de inseguridad afectan diferencialmente la carrera de las investigadoras. Se proponen políticas institucionales para abordar estas desigualdades, incluyendo subvenciones para asistencia en el cuidado y medidas contra el acoso, destacando la necesidad de crear un entorno laboral más justo y equitativo que fomente formas emancipadoras de liderazgo para fomentar el avance profesional de las mujeres en la ciencia.

INTRODUCTION

Women in scientific careers often face drawbacks in their progression compared to their male colleagues. Female scientists encounter more obstacles for doing fieldwork in remote places (Wesely and Gaarder, 2004), working in the office (Wilkins et al., 2023), and traveling, which likely contribute to the underrepresentation of female researchers in protagonist authorships, higher academic ranks, and decision-making positions, as well as their overrepresentation in less favorable authorship positions, lower citation rates of their papers and there being fewer female recipients of scholarships and awards (Huang et al. 2020; A. James et al. 2019; Maas et al. 2021; Zandonà 2022), among others. All of this has been conditioned by power asymmetries, inequities, and even risks for marginalized and oppressed groups (e.g. women, the LGBTQ+ community, people of color, Indigenous people, and people with disabilities) (Demery and Pipkin 2021). This could manifest in uncomfortable and unsafe positions arising from prejudice or discrimination (Demery and Pipkin 2021), harassment, and assault situations (Clancy et al. 2014). Day-to-day micro-chauvinistic behaviors in our workplaces, even if

seemingly minute, may have strong negative effects on women in the long run. In comparison with male colleagues, women in the workplace are more often assigned tasks related to laboratory housekeeping (Miller and Roksa 2020), or administrative and other support roles (R. James et al. 2023),which takes time away from core scientific activities, such as staying up to date with literature, publishing, and writing proposals. It also detracts from decision-making tasks that are crucial for progress in a researcher's career. These and other gender inequities remain pervasive, and either in the short or long term, they can impact mental health, productivity, and professional development of scientists, but also threaten their physical health and safety, and even their lives (Demery and Pipkin 2021).

Academic activities occur in a hierarchic environment with an inherent power imbalance among its members, namely, between undergraduate students and professors, and between graduate students and their advisers. Grades, letters of recommendation, mentoring, networking, and funding, are just a few examples in which undergraduate and graduate students often depend on their professors and advisers (Karami et al. 2020). Unbalanced interactions are particularly noticeable when the hierarchical role is taken by a man (Harding 1993; Karami et al. 2020). Harassment, particularly sexual harassment, suffered by graduate students, has been reported to not only negatively affect their graduate life experience but also their career trajectory, to the point of potentially quitting professional engagement (Wilkins et al. 2023).

One of the most ubiquitous activities for career advancement in most scientific fields is traveling, whether to field sites, scientific meetings, courses or workshops, and short-term stays at other institutions. Traveling facilitates data collection, performing experiments, obtaining analytical skills, and building collaborative networks to improve one's research. In particular, gender inequities often limit women's ability to travel, one major barrier being the greater burden of unpaid domestic work, including caregiving, compared to male colleagues (Lomáscolo et al. 2024).

Another significant obstacle for traveling is safety concerns, which differentially affect women's mobility. Doing research in ecology, and other disciplines that require doing fieldwork, is particularly challenging in this respect because it may involve going to remote sites. Women often express fear of going to lonely places, which may restrict the choice of potential field sites. Just as much in urban or rural sites, women express fear of being exposed to violent situations, such as harassment (Condon et al. 2007; Wesely and Gaarder 2004). For this study, we were particularly concerned with how women feel about traveling alone to remote sites to do fieldwork. It is interesting to note that sexual harassment in fieldwork situations not only comes from locals and therefore should not be only attributed to cultural differences (Clancy et al. 2014). In fact, most reported perpetrators are senior scientists within the same research team (Clancy et al. 2014). This suggests that harassment is not limited to field-related situations: women also suffer violent situations in their everyday work environment (Fitzgerald and Cortina 2017; R. James et al. 2023; Karami et al. 2020).

To explore some of the potential mechanisms behind women's difficulties in their scientific careers, specifically in ecology, we surveyed Argentinian men and women ecologists to test two non-mutually exclusive hypotheses: (H1) that women's ability to embark on academic traveling is limited by a higher burden of caregiving work, and (H2) that women suffer harassment more frequently than their male colleagues in work-related situations and that women advised by male researchers will particularly suffer these situations. Under H1, we predict that, compared to their male colleagues, women with caregiving responsibilities will 1. spend fewer days in the field, and 2. will travel fewer days to scientific meetings away from their hometown. Under H2, we predict that, in comparison with their male colleagues, women will: 1. report suffering more harassment situations in their workplace, especially if their adviser is a man; 2. associate going alone to the field with the risk of suffering violent situations, and, therefore, 3. travel less to the field alone. These hypotheses allowed us to identify inequities based on gender and caregiving responsibilities. We make suggestions for improving the work conditions of female researchers based on institutional policies.

MATERIALS AND METHODS

We composed an online survey with 60 questions (Appendix 2) distributed amongst Argentinean ecologists between November 2019 and June 2020. Participation in the survey was voluntary and anonymous, and respondents were aware of the use of the data for research purposes, as this was specified in the text preceding the survey (Appendix 2). All methods followed the relevant guidelines and regulations of our Institution, and approved by the Committee of Ethics in Research of the National University of Tucuman and CONICET (CEI, UNT-CONICET). We obtained 665 responses (Appendix 3), of which we selected 437 that were from Argentinean ecologists from CONICET in order to work with a homogenous sample. This represented approximately 39% of the total population of Argentinian ecologists (Lomáscolo et al. 2024). Among the participants, 282 were women (65%), 152 were men (35%), and 3 respondents (< 1%) identified themselves as "Other gender". Therefore, given the low numerical representativeness of this last category, we restricted statistical analyses and conclusions to women and men. In some cases, our sample size was smaller than 437 because cases were included according to relevance to the question being asked (for example, not all respondents do fieldwork). Responses recorded information related to the gender of respondents and their advisers, level of caregiving responsibilities, number of days traveling to the field or to scientific meetings, and general harassment situations suffered by the respondents (Appendix 2 and 3).

To investigate inequities based on gender and caregiving responsibilities, represented by the time dedicated to doing fieldwork and attending scientific meetings (H1), we performed two separate analyses. First, we compared the number of days spent in the field and at scientific meetings between men and women using a Wilcoxon rank sum test, as the data were not normally distributed (Shapiro-Wilk test, $p < 0.05$). Next, we analyzed the impact of caregiving responsibilities on fieldwork and scientific meeting attendance using a Generalized Linear Model (GLM). Researchers were divided into two caregiving categories: those without caregiving duties (who reported no caregiving responsibilities or less than 50%) and those with caregiving duties (who reported taking care of 50% or more of caregiving responsibilities). Gender was included as a covariate to test for interaction effects between caregiving and gender. All statistical analyses were performed using R version 4.3.0 (R Core Team 2023).

To address whether women feel more vulnerable than men to experience violence, or perceive greater unsafety during field trips (H2), we compared the responses of men and women to the question of whether respondents go to the field alone. Originally there were five possible responses that we summarized in two categories to simplify analysis and ensure that there were enough responses in the categories analyzed: 'Yes' (including the original options "Commonly", "Almost always", and "Always"), and 'No' (including "Never" and "Exceptionally"). We performed a Pearson's Chi-squared test to compare the frequency of men and women who reported traveling alone. We applied a Yates' correction to avoid overestimating statistical significance, which is plausible to occur with small sample sizes (Yates 1934). We also explored the reasons behind not traveling alone in order to understand better the differential perception of unsafety between men and women; for that, we used word cloud analysis of long answers where respondents could expand on why they go or do not go alone to the field. Word cloud analysis involves a visual representation of the frequency of words in a text of interest, as a graph where the size of each word is proportional to the number of times that it appears in a given text relative to other words. This analysis has been increasingly used to explore data and ideas (Atenstaedt 2012; Chuliver Pereyra et al. 2021; Karami et al. 2019). We compared word clouds between responses given by female and male fellows/researchers using the Iramuteq software (Justo 2014). Lastly, to quantify the difference in the frequency with which female and male researchers report suffering harassment situations, we used a Chi-squared test. Here, we also performed a word cloud analysis using Iramuteq to compare responses about harassment between female and male fellows/researchers.

RESULTS

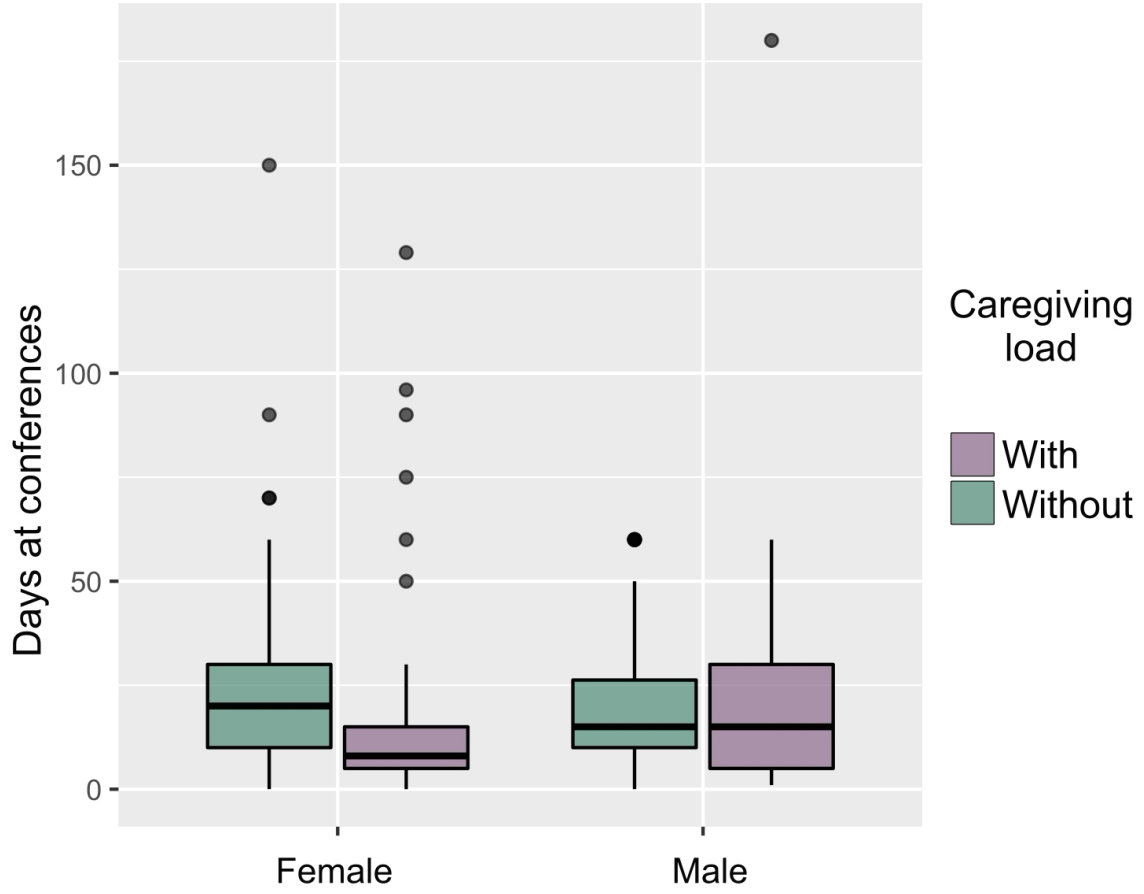
Regarding inequities based on gender and caregiving responsibilities and evidenced in the time dedicated to do fieldwork and attend scientific meetings (H1), we found that the difference in mean duration of field trips in terms of days was not significant between genders, with women spending a mean of 24.5 days (SD = 21.5) in the field, and men a mean of 27.1 days (SD = 24.7) (W = 17314, p = 0.37). Researchers with greater caregiving responsibilities, regardless of gender, traveled fewer days to the field (mean = 22.4 days, SD = 22) than researchers without caregiving responsibilities (mean = 28 days, SD = 23.1) (W = 23510, p = 0.001).

Caregiving responsibilities significantly affected the number of days that researchers travel to scientific meetings too. The interaction between gender and caregiving (Gender * Caregiving; Table 1) is also significant, indicating that the impact of caregiving responsibilities varies by gender. However, gender alone does not have a statistically significant effect on the number of travel days. The mean number of days traveling to meetings for women was 18.4 (SD= 20) and for men 20.4 (SD=20.1). Researchers with caregiving duties travel on average 15.8 days (SD = 18.7) while those without such responsibilities report traveling 22 days (SD = 21). Moreover, our results revealed that women with caregiving responsibilities undertook the least amount of travel (Fig. 1).

Table 1. Results for the Generalized Linear Model testing the number of days that researchers travel to scientific meetings based on responses to an online survey among ecologists from Argentina.

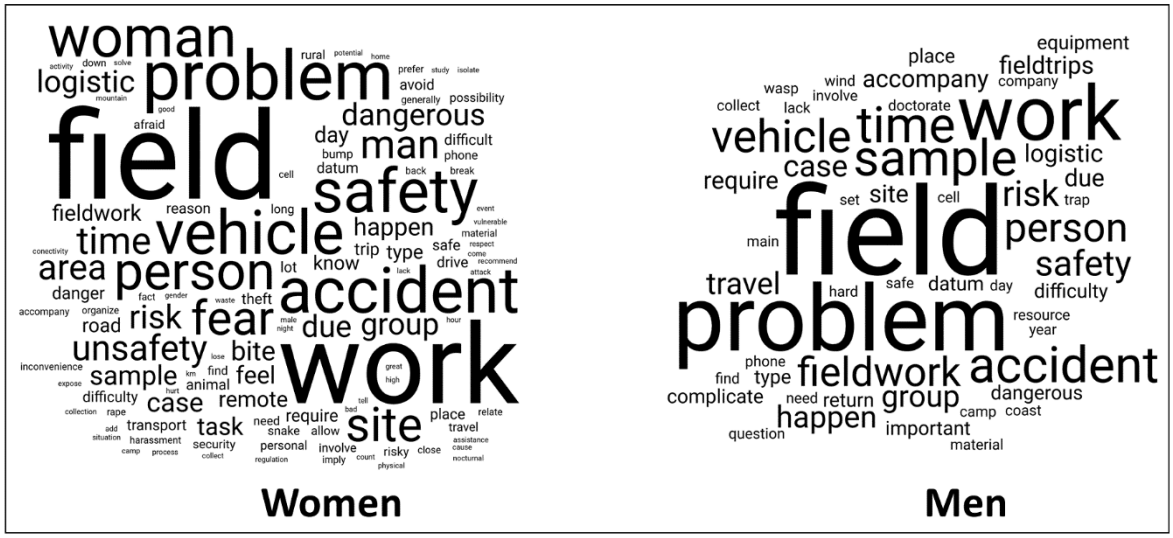
Table 1				
Variable	Estimate	Standard Error	z	p
glm(n days off ~ Gender + Caregiving + Gender*Caregiving)				
(Intercept)	18.521	1.230	15.063	< 2e-16 ***
Gender	1.929	2.090	923	0.356726
Caregiving	-6.707	1.739	-3.857	0.000134 ***
Gender * Caregiving	7.151	2.956	2.419	0.016015 *

Figure 1. Number of days that researchers from Argentina travel to scientific meetings. The comparison is between male and female researchers with (purple) and without (green) caregiving responsibilities.



Our results also showed that among women researchers, 80% (n = 206) indicated that they do not travel on their own to field sites, while 66% of male researchers (n = 94) said they avoid traveling on their own. These outcomes reveal noteworthy differences between genders (W = 9.7643, p = 0.002), indicating that women exhibit a greater propensity to refrain from independent travel. When we evaluated the reasons for not going to the field alone, and whether there differed between female and male ecologists (H2), cloud analysis showed that female and male fellows/researchers used different words (Fig. 2). Although male and female respondents frequently pointed to accidents and danger in general, in particular, female responses had a higher frequency of words related to personal safety and vulnerability, with words such as fear appearing with high frequency. The words rape, vulnerable, theft, hurt, and even death appeared in female responses and not in male responses (Fig. 2). Male responses, according to the frequency of words used, seemed to be more often related to general logistic problems having to do with accidents, workload, and car-related issues (Fig. 2).

Figure 2. Word clouds from extended responses to a survey question of whether researchers go to the field on their own, and why. This is a comparison between responses from female and male ecologists from Argentina.

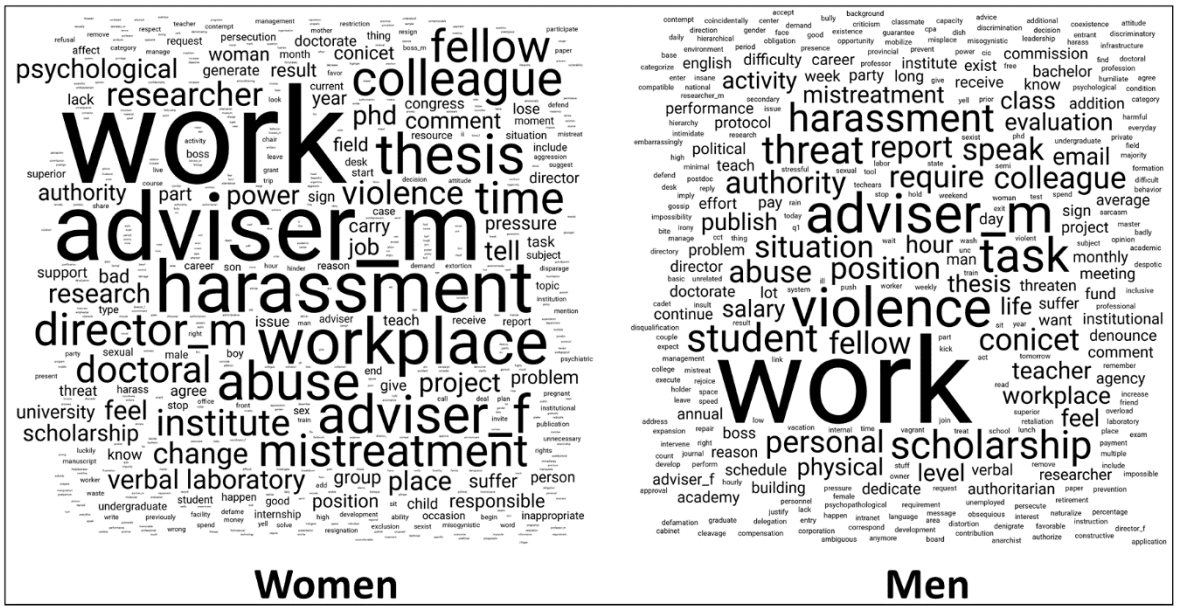


Finally, our results indicate that female ecologists reported more harassment situations in their workplace than male ecologists in general, that women reported almost an equal frequency of harassment regardless of adviser gender, and that men with female advisers reported more harassment than those with male advisers. Moreover, the greatest difference in reported harassment was between female and male ecologists with male advisers (Chi-squared = 10.306, df = 3, p = 0.016) (Fig. 3).

Figure 3. Percentage of responses from researchers that reported suffering (purple) or not suffering (green) harassment situations in their workplace. On the left are responses from female ecologists and on the right from male ecologists. For each gender of respondents, we compare those with female and male advisers.

Word cloud analysis of harassment issues, showed that male adviser (adviser_m) was a frequent term used by both female and male respondents (Note: the survey and answers were written in Spanish, and therefore noun gender is explicit) (Fig. 4). In the case of female respondents, other frequent words were: abuse, mistreatment, and violence (which describe types of harassment situations) as well as colleague, female advisor (adviser_f), and male institutional authorities (director_m). Male respondents also frequently mentioned violence, abuse, and threats as harassment situations (Fig. 4).

Figure 4. Word clouds from extended responses to a survey question of whether researchers suffered harassment situations in their workplace. This is a comparison between responses from female and male ecologists from Argentina.



DISCUSSION

Limitations to travel away from home may be an important obstacle for academic development, as traveling is a significant part of a successful academic career. Field trips are essential in ecological research, as they are vital for acquiring data. Moreover, previous studies show that researchers with greater fieldwork experience tend to have a higher publication rate and better access to funding (Clancy et al. 2014). Traveling to scientific meetings or short-term stays at other institutions also represent networking opportunities, learning about related research, mastering new techniques, and sharing our findings with colleagues to spark interest in our work.

Our study shows that ecologists with caregiving responsibilities report traveling less than those without such duties, regardless of gender. However, previous research (Lomáscolo et al. 2024) indicates that gender does make a difference in the amount of caregiving duties a person takes charge of: women ecologists carry the heaviest load of unpaid caregiving work. Therefore, women will be more affected than their male colleagues as to their possibilities of traveling and, therefore, of advancement in their scientific careers. Earlier studies have found that female researchers with children face greater difficulties in fieldwork, as they report more often than their male colleagues that they hire someone to care for their children at home or bring them to the field (McGuire et al. 2012). As a result, that study reports that female tropical biologists are less likely to maintain an active tropical field research program compared to men (McGuire et al. 2012). This is particularly unsettling when considering what was mentioned above, that fieldwork is associated with higher publication rates and funding opportunities.

Due to a perceived vulnerability predominant among women when they go to the field, female ecologists are under higher pressure than male ecologists to find colleagues or students to accompany them, hire field assistants, or accommodate their travel dates to fit other people's schedules. In fact, other studies showed that women were more likely than their male colleagues to bring a field assistant with them (McGuire et al. 2012). This may represent incurring in greater expenses and coordination with other people, increasing women's financial and mental load. Unfair as it is, the extra burden of finding extra people and the need for extra resources to do so, is a relatively minor consequence compared to the broader impacts of harassment, whether in the field or in the office. Women perceived greater risk when traveling alone to remote field sites than men did. Although both female and male ecologists perceived fieldwork in remote sites as challenging, citing logistic difficulties such as car breakdowns, accidents, encounters with dangerous wildlife, or handling extenuating tasks alone, women additionally reported fear of encountering strangers, harassment, rape, and even murder. In other words, while men mostly have to worry about logistic problems and issues having to do with the higher efficiency of working in groups, women fear for their integrity and for their life. Although the safety of field sites is often beyond the control of scientific institutions, public policies could facilitate safer traveling conditions for female field ecologists by providing extra resources, such as funding to hire field assistants.

We identify certain limitations to our work, and here we suggest further issues to take into account in future studies. We did not investigate specifically sexual harassment, a specific type of harassment, but we think it is worth discussing it in the academic context, given that the academic workplace has the second highest rate of reported sexual harassment, only after the military environment (Johnson et al. 2018). As reviewed by Gutek and Koss (1993), the impacts of sexual harassment, in particular, include dissatisfaction with the job itself, difficulties in developing positive interactions with colleagues, decreased commitment to the institution, loss of motivation, and ultimately reduced work performance. The same review showed studies reporting mental and physical health consequences. In conclusion, because harassment, specifically sexual harassment, may push the victim to quit a job and interrupt their career, it may be one possible mechanism behind the well-reported phenomenon of the "leaky pipeline" in academia (Huang et al. 2020; Wolfinger et al. 2009). As we found in this study, although harassment is reported by both male and female ecologists, it was more often reported by women, adding up to the reported obstacles suffered by the women ecologists who took part in this study. It would be important to investigate further into this pattern, and identify specifically sexual harassment issues suffered by women in science, also including all people that identify as female. We can only speculate as to why we find this, because our study was not designed to study specifically the gendered power relation between advisees and their advisors. Female advisers seem to be just as hard on women advisees than male advisers, and even harder on male advisees. Women academics have been reported before to marginalize or subordinate colleagues, as a case of "pulling the ladder up behind them"(Skelton 2005). This has been interpreted as cases of women that do not challenge pre-existing masculinized practices, common in academia, either because they are unable to do it, or because they decide not to do it because it is somehow useful to them (Skelton 2005, Rogers 2017, Domínguez et al. 2021). In any case, a correct interpretation of this behavior would entail a detailed understanding of the environment in which women developed. The strategies that serve each person will depend on their personal and academic history, as well as on the specific academic surroundings they are in. What we do point our finger to is changing the patriarchal customs in the scientific environment, that may lead some people to believe that, in order to prosper as a scientist oppression and violence are necessary. This diminishes the opportunities of certain scientists, be it due to their gender, their skin color, and/or their social class, among other things.

Meritocracy is presented as the governing principle and the basis for advancement in an academic career. Defined as a system in which individuals' merits and abilities are the sole ground on which their position in academic institutions is established, it does not seem to hold in our study system. For meritocracy to be real, all "contenders" in the "competition" (in this case., advancement in

a scientific career) should part from the same point and have the same opportunities during "the contest". Yet, when measuring the merits of women ecologists, evaluation procedures often overlook the extra hurdles that they face in comparison with male colleagues, reportedly caregiving duties, extra difficulties when going to the field, and a perceived threatening work environment, as shown in our study. Hence, progression in the scientific career, at least for Argentinian ecologists, cannot be considered meritocratic until all scientists are on a leveled ground with equal opportunities, regardless of their gender. To achieve so, we need institutional policies that contribute to leveling the ground for women ecologists. First, we propose special grants to hire assistance in caregiving and during fieldwork. Second, tighter control of potential harassment in our institutions is indispensable, as are procedures to facilitate reporting of harassment situations and not re-victimize those who decide to denounce the perpetrator. Until we achieve this, women scientists will continue to walk on a slippery floor, having to make extra effort to arrive at the same point as their male colleagues. This has been termed overcompensation (Fontanarrosa et al. 2024; Lomáscolo et al. 2024), which means that women need to outperform their male colleagues to be perceived and evaluated as equals, which in turn requires extra effort and a challenge to sustain throughout their careers. This may well be contributing to inequalities in science and one of the mechanisms behind the leaky pipeline phenomenon (Fontanarrosa et al. 2024).

Working under safer and more just conditions, in the field or in the office, we urgently need public policies aimed at helping caregivers, protecting those that feel vulnerable while doing their job, and leveling the ground for those whose personal characteristics or history intersect to make it more difficult for them to thrive. Care-less-ness in the working environment (sensu Rogers 2017) just reproduce oppressive behaviors between colleagues (Ramirez-Castaneda et al. 2022; Rogers 2017). We will continue to work towards achieving just working environments, that nurture more emancipatory forms of leadership (Spirito et al. 2022).

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