frontiers | Frontiers in Soil Science

TYPE Original Research
PUBLISHED 21 July 2023
DOI 10.3389/fsoil.2023.1194828

OPEN ACCESS

EDITED BY
Sabine Grunwald,
University of Florida, United States

REVIEWED BY
Cristina Angueira,
Independent Researcher, Santiago del Estero, Argentina
Saif Ullah,
University of Agriculture, Faisalabad, Pakistan

*CORRESPONDENCE
Blanca Prado
bprado.pueis@cic.unam.mx

RECEIVED 26 April 2023
ACCEPTED 15 June 2023
PUBLISHED 21 July 2023

CITATION
Hernández J, Rodríguez-Bustos L, Barreras A, Caballero L, Lara I, Guevara M, Lopera A, Vázquez-Lule A, Torres-Gómez M and Prado B (2023) Women representation in soil science: gender indicators in the University Program of Interdisciplinary Soil Studies. *Front. Soil Sci.* 3:1194828. doi: 10.3389/fsoil.2023.1194828

Women representation in soil science: gender indicators in the University Program of Interdisciplinary Soil Studies

Jhoana Hernández[1], Laura Rodríguez-Bustos[2], Aylin Barreras[1,3], Lizeth Caballero[4], Ilce Lara[2], Mario Guevara[2,5], Ana Lopera[2,6], Alma Vázquez-Lule[7], Mariano Torres-Gómez[2,5] and Blanca Prado[2,6]*

[1]Unidad Multidisciplinaria de Docencia e Investigación, Facultad de Ciencias, Universidad Nacional Autónoma de México, Ciudad de México, Mexico, [2]Programa Universitario de Estudios Interdisciplinarios del Suelo, Universidad Nacional Autónoma de México, Ciudad de México, Mexico, [3]Forest and Rangeland Stewardship, Colorado State University, Fort Collins, CO, United States, [4]Escuela Nacional de Ciencias de la Tierra, Universidad Nacional Autónoma de México, Ciudad de México, Mexico, [5]Centro de Geociencias, Universidad Nacional Autónoma de México, Ciudad de México, Mexico, [6]Instituto de Geología, Universidad Nacional Autónoma de México, Ciudad de México, Mexico, [7]Climate Change, Energy and Low Carbon Development, Center for International Forestry Research (CIFOR), Bogor, Indonesia

Introduction: In the world, 33% of soils are degraded, and 2.9 million people are affected by land degradation, with problems associated with food security, conflicts over natural resources, and migration with different impacts on men or women. To support sustainable soil management, it is necessary to include women's contributions to soil Sciences; their achievements and academic performance still need to be represented. Women in Science represent 30% worldwide. In Mexico, only 24% of top academic positions are women. For commitment to soil Sciences for Sustainable Development Goals (SDGs), UNAM created the University Program for Interdisciplinary Soil Studies (PUEIS).

Methods: This research evaluates women's representation through gender indicators in the PUEIS and SNI datasets and discusses their implications for the gender gap in the soil Science community from Mexico. The data was collected with an online semi-structured survey and the gender indicators selected were related to participation, gender gap, sexism, equal opportunities, exclusion, and academic performance.

Results: The results show that in the PUEIS, 54% of members identify themselves as women and 46% as men. The gender gap shows equality in the total number of members. However, low-rank jobs, such as lecturers and lab technicians are women dominated, and the top-ranked positions as a full professor, associate professor, and research scientist are equal. One result to consider for the PUEIS members is that the younger generation, as is the older generation, is dominated by men. This could indicate a setback in intermediate generations' progress toward achieving gender equality. In the case of SNI members, there is a gender gap problem; of members with a Ph.D. degree, only 38% are women, and the

elite group of scientists with a Ph.D. at the top position is represented only by 24% of females.

Discussion: This work constitutes the first gender exercise for analyzing women's participation in the soil Sciences in Mexico. From our perspective, it is not about competition in scientific careers between women and men; however, it is essential to recognize that gender inequalities are related to income, professional development, and science funding inequalities, and these disparities impact women more than men.

KEYWORDS

gender gap, gender equity, women in science, STEM, Mexico

1 Introduction

Soil is a non-renewable resource that hosts 25% of the planet's biodiversity and provides the natural contributions that all humans need for their well-being (1). In the world, 33% of soils are degraded, and 2.9 million people are affected by land degradation, with problems associated with food security, conflicts over natural resources, and migration, each with different impacts on men or women (2). To promote the adoption of a gender-responsive approach and support sustainable soil management is necessary to include women's contributions to soil Sciences (3, 4). Still, their achievements and academic performance are underrepresented (5). For example, the International Union of soil Science (IUSS) has 95 years of existence, and in 2019 Laura Bertha Reyes Sánchez became the first female president in their history (5), and 2022 women from IUSS executive jobs were only 20-37%. The *Sociedad Mexicana de la Ciencia del Suelo* (SMCS) (Mexican soil Science Society) has 83 active members, and women represent only 15% (6). These circumstances promote a male-dominant role model, limiting the inclusion of women's knowledge, experience, and background to solve problems related to sustainable soil management. As of today, the SMCS has never had a female leader.

Women in Science represent 30% worldwide, and the regional proportion varies from 25% in Asia and the Pacific to 46% in Latin America (7). Even though each region and discipline have specific statistics, women still need to be represented in high-ranked academic positions (8). In STEM fields (Science, Technology, Engineering, and Mathematics), including the ones with a high presence of women (e.g., Biology), commonly occurs a phenomenon known as the "*scissors effect*" is described as the decrease of women's presence when increasing academic position and leadership (9, 10). Access to education helped to reduce this bias; however, global indices show that women are more likely to leave academia after their Ph.D. (11). The reasons are associated with several barriers, such as economic limitations due to higher household care, maternity, or lower research funding (12, 13).

In Mexico, the Ministry of Science, called Consejo Nacional de Ciencia y Tecnología (CONACyT), created the Sistema Nacional de Investigadores (National System of Scientists) known as SNI, which is an evaluation for researchers based on scientific productivity through peer-review manuscripts, teaching, and science dissemination (14). The SNI ranked scientists, depending on their academic performance and time laboring, in early career professionals, Level 1, Level 2, Level 3, and Emeritus (15). Women represent 45% of early career professionals, 37% in Level I, 33% in Level II, and 24% in the highest ranks (Level 3 and Emeritus) (16). Each level has a monthly incentive from 698.92 to 1639.39 US dollars. This data demonstrates a *scissors effect* on Mexican women scientists' academic ranking reflected in economic income, promotions, and research opportunities. The National Autonomous University of Mexico (UNAM) is the largest public institution for graduate studies and hosts the oldest scientific community in the country (17, 18). For 2021, the academic labor from UNAM represented 14.47% of SNI members, with 1794 Associate Professors, Full professors, Associated research scientists, and 1384 Lab technicians. Total academic positions are 45% for women and 55% for men. UNAM announced their compromise for working to increase women's representation in leading groups between 2019-2021, duplicating the number of women leading Research Centers, increasing from 6 to 12. However, advances for the gender gap are scarce because the proportion of women increases for Associated research scientists, but the best-ranked positions remain lower (19).

In 2021 the UNAM, in commitment to soil Sciences for Sustainable Development Goals (SDGs), created the *Programa Universitario de Estudios Interdisciplinarios del Suelo* (PUEIS) (University Program for Interdisciplinary Soil Studies). PUEIS's objective is to study, preserve, and promote the sustainable management of soils, to maintain its essential functions for life on the planet, biodiversity, and productivity for people's well-being (20). We consider PUEIS and UNAM a perfect model to investigate the gender gap in soil Science because they can reflect what happens nationally. This research aims to evaluate women's representation through gender indicators in the PUEIS dataset and discuss their implications for the gender gap in the soil Science community from Mexico. The objective was to evaluate the women's representation in the soil Science community from PUEIS and visualize the inequalities between men's and women's academic rankings. We

recognize that there is not a single solution to the gender gap. Still, this investigation will set a baseline for demographic patterns of Mexican women's participation in soil Science, expose inclusion needs, and discuss the findings in a broader context, such as the Latin American region.

2 Materials and methods

2.1 Survey data and data collection

One of the central tasks for PUEIS was to create a database with information related to soil scientists, laboratory technicians, teachers, research scientists, and others dedicated to studying soil Science. Although the data we present here includes several disciplines, we highlight that all survey participants in the database identify themselves as soil researchers, the main reason why they are registered in PUEIS.

Thus, our results describe a diverse soil-related scientific community. The sparsity of consistent regional, national and global gender datasets in the soil science profession represents a research opportunity to investigate the intersection of 'gender and soil science' in the future.

To achieve a high number of participants, an online semi-structured survey (Appendix 1) was designed to collect information about two themes, personal information related to age and sex identification; and their academic role in the university (workplace), rank position within the university classification, SNI level, research interest, lectures, and lab head in the case of Professors with experimental laboratories. We recognize that other genders and identities are a part of the UNAM community. However, for this investigation, we refer to women as people that identify themselves in the survey as women and men as people that identify themselves as men.

The survey record was open for the UNAM community during the campaign *SUMATE al PUEIS* (Join to PUEIS) developed from July to December 2022. Final information was concentrated in a database for future analyses available upon request.

2.2 Gender indicators

The gender indicators used in this investigation are part of the "Indicators system for gender equality in scholar centers" methodology by Buquet et al. (21), developed to identify inequalities, known the information related to equity, gender relationships, weight gender information for equity, and test changes in relations between men and women. Gender indicators (GI) selected and described below were used to evaluate the database and compare the PUEIS, UNAM, and SNI statistics.

2.2.1 Participation in the total academic population

This primary indicator expresses the percentage of women and men above the academic population. Percentages show the women and men distribution as an expression of job opportunities; this distribution is the basis for comparing gender gap participation in the academic ranking (21). The indicator is expressed as

$$Percentageofwomen = (\frac{W}{P})*100 \quad (1)$$

Where W is the total number of women, and P is the total number of participants. The indicator was calculated for SNI members at the national level and PUEIS members in UNAM.

2.2.2 Gender gap

This indicator quantifies the difference between women's and men's participation (22). The indicator is expressed as

$$GenderGap = \%\ women - \%\ men \quad (2)$$

Where %women are the women's percentage respect to the total population, and % men are the percentage of men respect to the total population. A positive gender value indicates a clear difference for women, and gender equality is closer when approaching zero (22). The indicator was calculated for SNI members at the national level and PUEIS members in UNAM.

2.2.3 The contribution to Sexism Index

Expresses the degree to which an institution contributes to reproducing sexism within the institution (21). The indicator is expressed as

$$CSI = \frac{(Pm - Pw)_e}{(Pm - Pw)_{ies}} \quad (3)$$

Where P_m is the participation of men, P*w* is the participation of women, *e* refers to an entity of the institution, in this case, the PUEIS, and *ies* to the institution as a whole, in this case, UNAM. When CSI is equal to 1, it refers to a non-sexist institution.

2.2.4 Indicator of equal opportunities

This indicates equal access to academic jobs and represents the relationship between low-ranking and high-ranked ones. This indicator is expected to have similar results between women (RW) and men (RM). We estimated it for PUEIS members and the PUEIS members in the SNI to compare them with SNI members at the national scale. The indicator is expressed as

$$RW = \frac{Wx}{Wy} and RM = \frac{Mx}{My} \quad (4)$$

Where *RW* is the relation between low-ranking and high-ranking jobs from women (W) and men (M), *x* is the lower-ranked job, and *y* is the highest-ranked one.

2.2.5 Indicator of exclusion

This indicator reflects the possible inequality between educational levels (21), in this investigation is the academic rank of PUEIS participants. It measures the differences in participation between women and men per academic ranking. It is expected that percentages be the same. The indicator is expressed as

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$$Percentageofwomen = (\frac{Wf}{Pf}) * 100 and Percentageofmen$$

$$= (\frac{Mf}{Pf}) * 100 \quad (5)$$

Where W_f is the number of women at each academic rank f; M_f is the number of men in each level of teaching practice f; P is the total staff at each academic ranking f.

2.2.6 Indicator of exclusion per academic fields

Measures the distribution of men and women by academic fields. An unequal result expresses a sexual division of knowledge. For this investigation, the academic filed classification is the one from UNAM, with fields I for Mathematics Physics and Earth Sciences, fields II for Biology and Chemistry Sciences, III for Medicine and Health Sciences, IV for Behavioral Sciences and Education, V for Humanities and Social Sciences, VII for Agriculture, Farming, Forestry, and Ecosystem Sciences, VII. For Engineering and Technological Development, and IX for Interdisciplinary. The indicator is expressed as

$$Percentageofwomen = (\frac{Wc}{Pc}) * 100 and Percentageofmen$$

$$= (\frac{Wc}{Pc}) * 100 \quad (6)$$

Where W is the number of women in each area of knowledge c; M is the number of men in each area of knowledge c; P is the total number of personnel in each area of knowledge c. The indicator was calculated for SNI members at the national level and PUEIS members in UNAM.

2.2.7 Academic performance

It shows the proportion of women and men in top positions (21). In this investigation, the indicator was calculated by gender belonging to the PUEIS at different SNI and national levels. The indicator is expressed as

$$\frac{W_{SNIn}}{P_{SNIn}} * 100 and \frac{M_{SNIn}}{P_{SNIn}} * 100 \quad (7)$$

Where W_{SNIn} is the number of women in some SNI level (sni_n) M_{SNIn} is the number of men with some SNI level, P_{SNIn} is the number of women and men with SNI. It is expected that the proportions are equal.

3 Results

We found that of 213 academic members of the PUEIS, 54% identify themselves as women and 46% as men. The transgenerational gender representation shows that PUEIS members are between 26 and >65. In the 26-33 years rank, 35% are women, and 65% are men. In the 34-41 age ranking, 55% are women, and 45% are men. In the 42-49 rank, 64% are women, and 36% are men. In the 50-57 ranks, 62% are women, and 38% are men. In the 58-65 years ranking, 43% are women, and 57% are men. The last rank was >65 years, where 44% are women and 56% are men (Figure 1A).

Participation of the academic population by academic rank shows that full professors, associated professors, and research scientists represent 37% of PUEIS members, where 51% are women and 49% are men. The 42% of members leading working groups were women, and 13% were the heads of laboratories. Lab technicians represent 13.3%, where 64% are women, and 36% are men. Lecturers represent 46.6% of total members in the PUEIS, of which 52% are women, and 48% are men. The remaining 3.1% of PUEIS members are executives and retired (Figure 1B).

Data distribution by academic field shows that 27% of PUEIS members are from Biology-Chemistry, where 54% are women and 46% are men. 24% are from Mathematics Physics- and Earth Sciences, where 60% are women and 40% are men14% of PUEIS members are from Social Sciences and Humanities, 53% are women, and 47% are men. 9.8% are from the Agricultural Sciences, 52% are women, and 48% are men. Multidisciplinary fields are represented in 21% of PUEIS members, 54% are women, and 46% are men. STEM is represented by 4% of PUEIS members, where 22% are women and 73% are men (Figure 1C).

The total gender gap (GG) for SNI members was -20% by academic field; -49% in Mathematics- Physics and Earth Sciences,

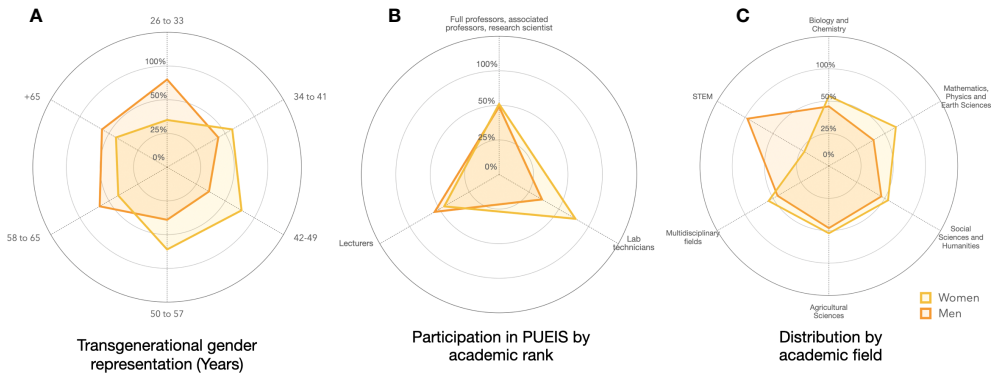

FIGURE 1
Distribution of PUEIS members by age **(A)**, academic rank **(B)**, and academic field **(C)**. Women's representations is highlighted in yellow and men's representation by orange.

-14% in Biology-Chemistry, in Humanities and Social Sciences -15%, and for STEM -54%. For PUEIS members, the total GG was 8%; 18%in Physics-Mathematics and Earth Sciences, zero in Agricultural Sciences, 10% in Humanities and Social Sciences, 15% in Biology and Chemistry, and –67% in STEM (Figure 2).

The indicator for equal opportunities (IEO) results for SNI members at the national level was 1.70 for women and 0.70 for men. For PUEIS members participating in the SNI, the IEO was 2.17 for women and 1.25 for men (Figure 3).

The indicator for exclusion (IEO) in SNI members shows differences depending on the field of science; in the mathematics-Physics- and Earth Sciences for women was 26% and 74% for men; in Biology-Chemistry for women was43% and 57% for men; for Humanities and Social sciences for women was 45% and 55% for men, in Agricultural Sciences for women was 37% and 63% for men; for STEM was 40% are women, and 60% for men (Figure 4).

In the case of PUEIS members, the IEO by academic field shows a distribution of 41% for women and 59% for men in the mathematics-Physics and Earth Sciences, 43% for women and 57% for men in Biology-Chemistry, 56% for women and 44% for men in Humanities and Social Sciences, 57% for women and 43% for men in Agricultural Sciences, and 50% men and women respectively for STEM (Figure 5).

The contribution to the sexism indicator (CSI) result was -0.82 for PUEIS members. In the case of PUEIS, members participating in the SNI was -1.19 (Figure 6A). The academic performance (AP) indicator for PUEIS members in the SNI results is 53% for women and 46% for men (Figure 6B).

4 Discussion

4.1 The importance of visualizing disparities for women in science

In Mexico, as in Latin America, the historical, sociological, and anthropological studies about women, their lives, interests, and activities have not been considered a priority (23). This work constitutes the first gender exercise for analyzing women's participation in the soil sciences in Mexico. Our starting hypothesis assumed a favorable gender gap for men, as Dawson et al. (24) point out for Latin America. The results show a negative gender gap scenario in PUEIS and SNI members, especially in STEM. This key finding sets a baseline for women's participation in soil Sciences in Mexico for bringing elements to reduce the existing gender gap in the community. Among the factors that can explain gender parity is the growing presence of women soil students at UNAM, the creation of women's inclusion initiatives in Science, and the access of researchers with a gender perspective to higher positions (25). One result to consider is the PUEIS members distribution which indicates that the younger generation is dominated by men, as is the older generation. This could indicate a setback in intermediate generations' progress toward achieving gender equality. One strategy to avoid this problem could include institutionalizing a gender perspective concept as a reference for its integral incorporation in all university areas (7). At the institutional level, UNAM has developed initiatives to reach an accessible and equitable environment (19), with programs such as the University Program for Gender Studies (PUEG, in Spanish "Programa Universitario de Estudios de Género "). This program aims to promote gender equality and equity in the academic-administrative structures at UNAM (26). In addition, as a social initiative, women teachers and scientists from UNAM created the "Group for Women and Science at UNAM" in 2007, which seeks to promote the participation and development of women scientists through the formulation of policies with a gender perspective that could strengthen and empower the scientific community in the country (27).

At the family level, systemic and cultural issues are the main challenges; some strategies may depend on each woman's context. However, institutions and society must work together to reduce the inequality in household chores and housecare activities (e.g., maternity). Women do more than three-quarters of unpaid care work globally, making up two-thirds of the workforce doing paid

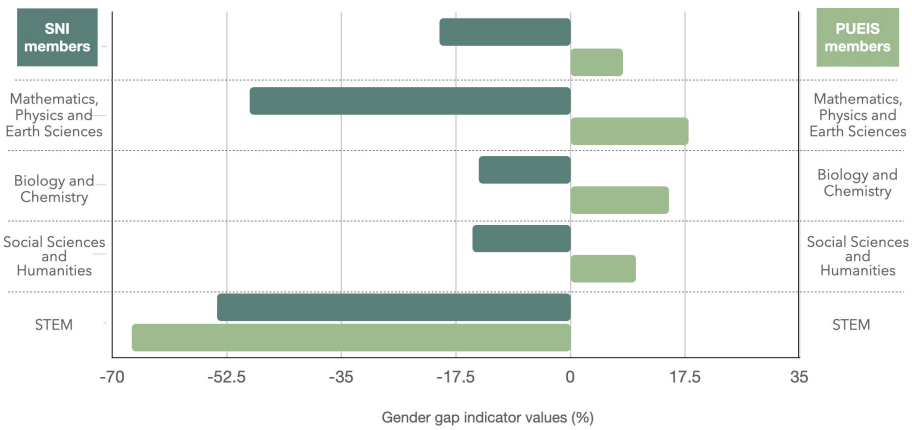

FIGURE 2
The gender gap indicator for SNI members and members of the PUEIS participating in SNI. The gender gap indicator is shown by the academic field. Light green bars represent the index for PUEIS members, and green bars represent the index for SNI members.

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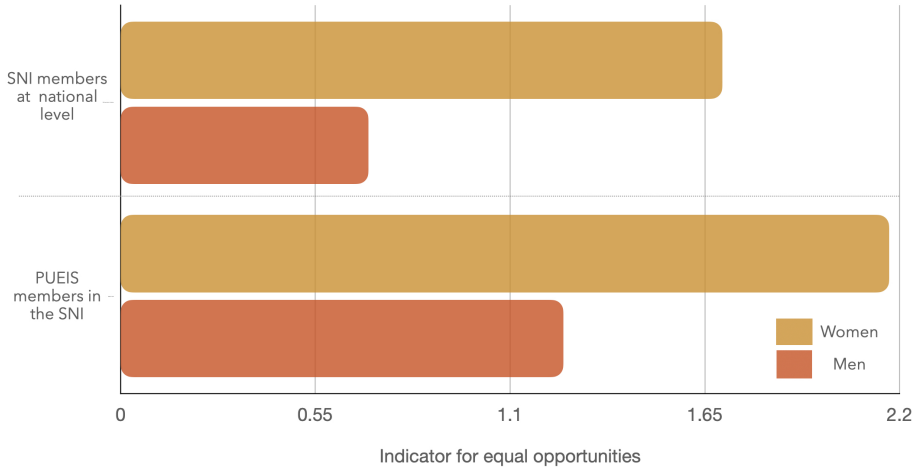

FIGURE 3
The indicator for equal opportunities for SNI members at the national level and members of the PUEIS participating in SNI. Women's representation is highlighted in yellow and men's representation by orange.

care work. An estimated 42% of women cannot continue paid employment because they become responsible for care work, compared to just 6% of men. One solution is for governments to give care work the same importance as other jobs to build an equitable economy that works for everyone (28). In the case of motherhood, it is a transformative process in the trajectories of salaried women because it generates trade-offs about their professional development and personal and family decisions (29). This condition in part could be mediated by the socio-economic level of the mothers and other particularities (30); however, employers are responsible for generating policies for retention, paid leave, and time flexibility for women and men with motherhood/parenthood activities. In addition, governmental actions and policies should be in place to regulate and monitor those employers' actions. his information is taking place at different scales across institutions and governments. However, the scientific community in Mexico needs to propel the implementation of these actions and their long-term sustainability.

The interest in analyzing women's gradual incorporation and participation in Science and technology is recent. According to López-Villegas (23), the inclusion of women in Science in Mexico started in the late 1970s; before this, women's traditional activities were related to reproduction, caring, educating children, and managing the family economy. Then, women started participating in agricultural work and the service sector. In 2021, public information related to Mexican women in Science showed that the gender gap is an ongoing problem; from 34,162 members of the SNI with a Ph.D. degree, only 38% are women (16). In the PUEIS

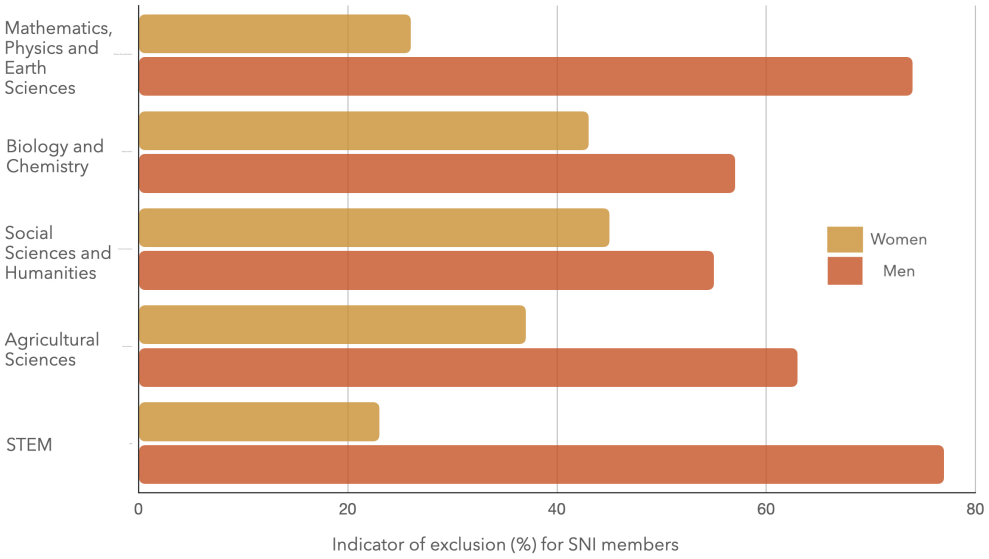

FIGURE 4
Percentage indicator of exclusion for SNI members by academic field. Women's representation is highlighted in yellow and men's representation by orange.

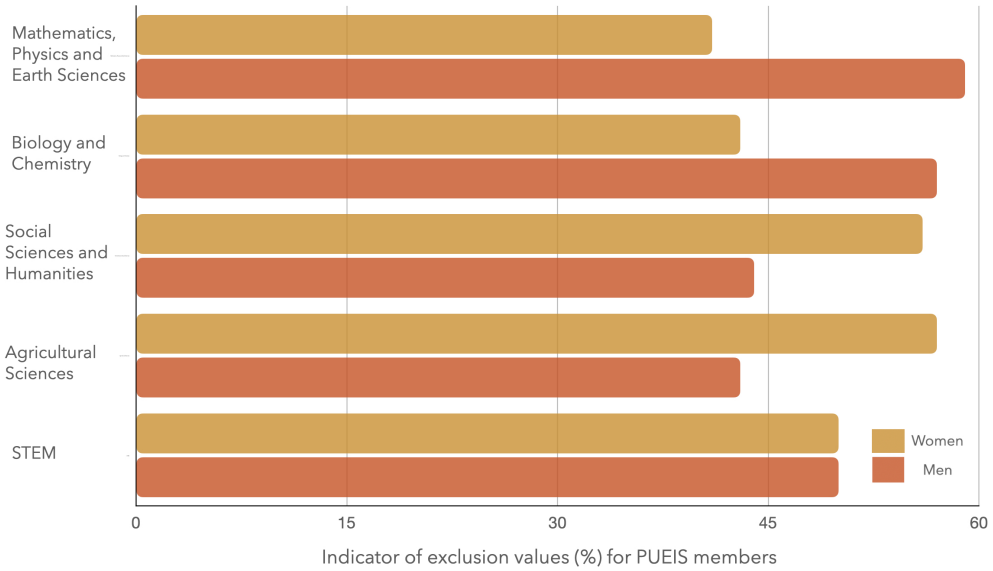

FIGURE 5
Percentage indicator of exclusion for PUEIS members by academic field. Women's representation is highlighted in yellow and men's representation by orange.

the gender gap shows equality in the total members. However, job rankings show that women dominate low-rank jobs, such as lecturers and lab technicians, and the top-ranked positions as a full professor, associate professor, and research scientist are equal. This suggests a *scissors effect* in the soil Science community because more women work with soil, and not all reach the highest academic positions. In the case of SNI members, there is a gender gap problem; the elite group of scientists with a Ph.D. at the top position is represented only by 24% of females (16). In this case, the *scissors effect* is confirmed because all researchers have a Ph.D. degree, but only men have access to the top positions within the institution. From our perspective, it is not about competition in scientific careers between women and men; however, it is essential to recognize that gender inequalities are related to income, professional development, and science funding inequalities, and these disparities impact women more than men.

This manuscript also contributes to the current lack of information and data about women in Science, which limits the ability to recognize the gender gap problem and generate better strategies to eliminate it at the institutional level. There is a growing

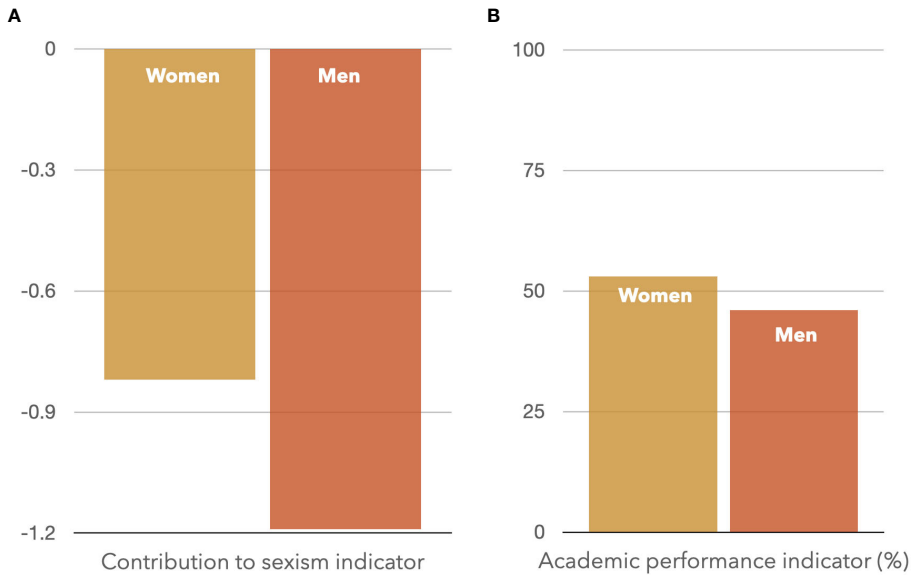

FIGURE 6
The contribution to sexism indicator **(A)** and the academic performance indicator **(B)** for women and men participating in the PUEIS and in the SNI. by academic field. Women's representation is highlighted in yellow and men's representation by orange.

demand for worldwide data and statistics on women in Science at the national level, and their use in policymaking still needs to be improved. The national statistics for Mexico show that between 30-55% of all scientists are women (7); the data from SNI confirm that 38% of scientists with a Ph.D. degree are women (16), which is 6% less than the calculation for the Latin America region, where Mexico is in the bottom three of countries for women in Science. Gender equality is an institutional commitment to Sustainable Development from governments and universities (31), and we encourage this investigation to be worthwhile for institutional authorities and other minorities in Science to start carrying out in-depth investigations to generate information and visualize the tradeoffs of women in Science related to gender, minorities, and discrimination.

4.2 Breaking the stereotypes

Soil Science is a multidisciplinary field. In the PUEIS, we observed that all fields of knowledge participate in studying soil. This scenario is an opportunity to generate an inclusive job environment. Vargas-Solar (32) argues about the importance of organizations with gender equality because, besides the economic welfare, a workgroup with women representation is a diverse workspace with scientific, technological, and solutions better designed, more creative, and effective in performing and sharing knowledge.

To understand Why women's participation in STEM careers remains low? It is a worldwide challenge. The misconception about a scientist is commonly a man doing laboratory testing. This stereotype is close to reality, considering that of 896 Nobel prizes awarded throughout its history, only 5% have been for women. Women's representation in science is essential for future generations. The exclusion indicator results for PUEIS members' order by field of science are consistent with data on the reality of women scientists worldwide. Alonzo-Gonzalez (33) proposes that STEM vocations begin at an early age, particularly in women's early to late teen years, with interest in these areas declining as one advances to higher educational levels, so initiatives should be aimed at promoting programs that foster vocations in STEM for girls and young people. An information gap regarding girls and adolescents in STEM still needs to be resolved. Recognizing it before women reach higher academic levels and limiting their approach to STEM careers is necessary.

In soil Sciences, the main problems limiting equity and representation are a lower percentage of women working as soil scientists, fewer chances to serve on committees, tensions with work-life balance, poor funding, lower pay, and lack of career progression and networking opportunities (24, 34). In the PUEIS, women working as soil scientists are equal to men. Still, the results suggest that career progression is limited because there are more women in low-rank jobs than in the top ones. Dawson et al. (24) found that 20% of national soil Science societies that belong to the International Union of Soil Science have less than 30% women memberships. This explains an underrepresentation of women in soil Science. This is a problem of representation because girls feel they need to be identified with a job in research and STEM careers. Socially imposed traditions and stereotypes limit girls from studying what they want (35). OECD (36) points out a need for more confidence among women about their performance in mathematics and science, which generates little predisposition when choosing a university degree in STEM areas. Added to this, there is the underrepresentation of women in secondary education courses related to STEM fields and the need for more female university role models and mentors. The studies that explain the participation of women scientists represent countries of the Global North, and there needs to be more information available about it in countries of the Global South (37). In Latin America, the low representation of women in scientific and technological areas does not allow reference models to be produced for their incursion into these areas (35). Therefore, equity in developing STEM skills must consider girls' empowerment before choosing a university career. We recognize that breaking the stereotypes for women in STEM and soil Science is a long-term plan. Castro-Merrifield (38) explains that to eliminate them, two aspects must be considered: the pedagogical and cultural levels. The pedagogical level implies that adult society educates children around cultural gender stereotypes related to the domains of men in Science. The cultural one involves dissolving stereotypes to make them seem arbitrary.

4.3 What can PUEIS do to bridge the gender gap in soil Science?

The government of Mexico recognizes that to achieve the 17 Sustainable Development Goals (SDG) of the 2030 Agenda established by the UN, it is necessary to close the gender gap for women in Science (33). Faced with this need, the PUEIS is conceived under the institutional development scheme for sustainability at UNAM. Therefore, their work includes generating viable proposals to reduce the gender gap in soil Science at UNAM and Mexico. Facing this need, we propose for women and minorities,

- Monitor the current statistics in the PUEIS database to preserve equal participation of minorities in soil Science.
- Promote collaborative work in working groups that, in addition to being multi, inter, and transdisciplinary, also seek gender, age, and equity for all PUEIS-related participants.
- To improve the representation of women in Science, we can prioritize the role of women speakers during public events, especially for women in soil Science involved in STEM careers. As well as paid recognition and care commodities (i.e., free childcare) for their participation.
- Generate the information, knowledge, and appropriate policies to recognize the difficulties women in soil Science go through between family life and work and the obstacles to their professional development.
- Create safe spaces for women in the workplace and platforms to attend to concerns as soon as possible that these are spoken or requested. Scientific women's issues should be

listened to and attended to by responsible authorities (i.e., academic institutions, scientific committees, and local and federal governments) as soon as possible.

- Demand other sectors of the scientific community to educate themselves on gender diversity, equity, and social justice. It is usually assumed that education on these topics is the responsibility of the minority groups when indeed is a social and moral responsibility.
- Share funding opportunities and leadership in research projects to increase the amount of funding and investment for women.
- Foster and care collaboration networks among all PUEIS members, so women can join new collaboration networks and find safe spaces and potential mentors.
- Increase outreach activities and facilitate role models for young scientific generations. These proposals can be achieved internally in the program. Still, the results must be scaled-up at the institutional level with the University board through work, collaboration, technical reports, and outreach and policy actions. We did not exclude the need for more information on women and minorities in science and encourage a sustained dialogue about these concerns The information necessary to make decisions does not exist, and the work of scientists must focus on being more inclusive and empathetic to establish the foundations of gender equality.

5 Conclusions

This work allowed us to quantify and show, for the first time in Mexico, gender distribution among the soil scientist community in UNAM, and contribute to analysis with gender perspective for SNI members at the national level. The results show a negative gender gap scenario in PUEIS and SNI members, especially in STEM. The data distribution by field of knowledge let us visualize that women's participation has increased in Biology and Chemistry, Agricultural, and Humanities sciences. However, men's participation still dominates STEM careers within PUEIS and SNI members (GG, SCI, IEO). In the PUEIS, women working as soil scientists are equal to men. Still, the results suggest that career progression is limited because there are more women in low-rank jobs than in the top ones. This key finding sets a baseline for women's participation in soil Sciences in Mexico for bringing elements to reduce the existing gender gap in the community, and generate an inclusive job environment.

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

Ethical review and approval was not required for the study on human participants in accordance with the local legislation and institutional requirements. Written informed consent from the participants was not required to participate in this study in accordance with the national legislation and the institutional requirements.

Author contributions

BP and MG contributed to the conception and design of the study. JH, AB, LR-B, IL, and AL organized the database. JH, AB, LR-B, and LC performed the statistical analysis. JH, LR-B, MG, and BP wrote the first draft of the manuscript. AV-L wrote sections of the manuscript. All authors contributed to the article and approved the submitted version.

Funding

MG was supported by grant UNESCO-IGCP-IUGS, 2022 (no. 765), and by grant UNAM-PAPIIT (#IA204522).

Acknowledgments

The authors thank all PUEIS members for their registration. Sandra Carpinteyro-Urban for sharing their ideas about the conceptualization of the manuscript. MG was supported by grant UNESCO-IGCP-IUGS, 2022 (no. 765), and by grant UNAM-PAPIIT (#IA204522).

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

Supplementary material

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fsoil.2023.1194828/full#supplementary-material

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