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Reevaluating Diversity and the History of Women in Soil Science: A Necessary Step for a Real Change

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Over the last decades, diversity in science has focused on the inclusion of individuals from formerly under-represented backgrounds. While this is important, it can result in reducing the topic to a game of numbers and quotas, but individuals are not numbers. Science today must include all that a human can be, and this means both to include the under-represented and the represented. As a group endeavor, science can only be as good and innovative as the sum of its individuals' brilliance, because of this, science needs to ensure it has the largest pool of individuals to choose from. In the same sense, now more than ever, soil science faces problems that come from complex causes and require interdisciplinary equally complex solutions, meaning that it requires minds with different perspectives, different skills, and different life histories. Minds that contribute diverse knowledge and visions to the soil's preservation so that it maintains its properties and ecosystem benefits over time: minds capable of making soil's sustainable use. While only two aspects of diversity (the recognition of Women and Traditional Knowledge in soil science) were analyzed in this document, is an attempt of broadening the understand of diversity and their fundamental importance to achieve soil sustainability and contribute to reach the UN sustainable development goals (SDGs) as has been widely documented in FAO (2010), mentioned in Reyes-Sánchez (2018) and discussed in Dawson et al. (Eur J Soil Sci, 2021, 72, 1929–1939).

Keywords: gender, equity, soil science, women in science, diversity and inclusion

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INTRODUCTION

Over the last century and a half, the western world has tied the word diversity to three iconic movements that helped recognize women's rights, civil rights, and LGBTQ + rights (Library of Congress, 2022a; Library of Congress, 2022b). These fights are so inspiring and important for each generation, that it is only normal that our attention made intense focus on each of these specific areas of diversity. Nevertheless, in doing such an intense focus, we might have excluded from our perspective the main and broad meaning that the word diversity has.

Narrowing the meaning of diversity and inclusion has brought intense polarization around this topic. In some instances, it could seem that talking about diversity means removing quality as the main criterion for moving upwards in any discipline, or that we are suddenly trying to exclude certain population groups as punishment for the past. However, no scientific discipline has ever benefitted from narrow views, and soil science is not the exception.

Diversity, Going Back to the Basis

The first references in the English language for the word "diverse" come from the 14th century as a loan from Latin meaning "turned in different directions, situated apart, differing" (Merriam-Webster, 2021). If we start anew from this point, diverse and diversity seem a lot less radical and polarizing because they simply mean different and variety.

It is not possible to have variety when one has a single object or subject, this helps us understand that plurality is the basis for diversity, an individual cannot be diverse, but groups of individuals can possess diversity (Gibbs, 2014). For purpose of this article, our group could be the international community of Soil Scientists.

Over the last decades, diversity in science has focused on the inclusion of individuals from formerly under-represented backgrounds. While that is not unimportant, bringing diversity to Soil Science means including individuals with different skills, different political views, coming from different backgrounds, from all genders, or that identify with different sexualities and might be gender non-conforming, that belong to different races, and that have disabilities, among other identifying features and factors. When we read this list, it is easy to feel overwhelmed at the size of the task; however, this feeling can dissipate if we go back to the basics once again. We are simply asking to allow inclusion of all scientists based on their professional qualifications, and to not make any exclusions based on the above-mentioned or similar identifying features and factors.

Making science is the process of understanding and solving complex problems. In soil science, problems such as salinization, degradation, acidification, and nutrient imbalance, are all complex problems and in need of interdisciplinary and urgent solutions that likely cannot be found by an isolated single individual in a single moment in time. Instead, the process of solving complex problems requires the effort of a group of individuals, or multiple groups of individuals, over time. This is where diversity becomes essential because the ability to see complex problems from different perspectives cannot be achieved if all the individuals in a group share the same perspective.

Quality in science is closely linked to the quality and brilliance of the scientists as individuals; including all that a human can be, means that our pool to search for brilliance grows, that the quality of the training that our soil scientists get will increase, and that soil science will increase the impact it has to apply necessary changes in the real world out of the laboratory and classroom.

SCIENCE AND SCIENTISTS: A REVIEW OF TIME AND GENDER

It is hard to understand why diversity and inclusion are necessary for science if we continue to believe that science started only a couple of centuries ago from a male-centered scientific community. Hence, we propose a quick exercise in reviewing science from its inception and scientists from its most basic gender composition.

Science and Soil Science as Human Endeavors

When we talk about Science, the common image of a person in a laboratory wearing laboratory coat and laboratory goggles may come to mind; after all most of us grew during the last decades of the 20th century and have indeed developed scientific careers inside a laboratory. However, a quick review of literature on the History of Science can easily show that scientific practice can be formally traced back at least to Ancient Egypt and Mesopotamia starting from the fifth century B.C. (Lindberg, 2007).

In the same sense, if we think of the origin of soil science, the name Vasily Vasilyevich Dokuchaev likely comes to mind. However, if once again, we think about the history of science, we can understand that it is impossible to pinpoint the start of our discipline a mere century and a half ago.

As soil scientists, we recognize that soil is a vital resource for life on Earth and as such, it is only natural that its study has been common to all human societies for thousands of years, even before the advent of writing systems. What this means, is not that we should reduce the merits of great soil scientists such as Dokuchaev, on the contrary, it means that we should also recognize the merits of great human thinkers that paved the way for our discipline.

Today we know that approximately 9,000 years ago our ancestors in Mexico domesticated maize from a plant named *teocintle* (Beadle, 1980; Matsuoka et al., 2002), which could only have been achieved through observation and experimentation, two main pillars of the scientific method involving substantial knowledge and technique not only about the domestication of plants but also about soil and water management for the development of agriculture.

This is a clear example of how, as with any other area of science, the real point to start tracing history is with indigenous people. Indigenous people have traditionally occupied territories in all regions of the world, except for Antarctica; today they compose 5% of the world population accounting for approximately 400–500 million people (UNESCO, 2022a). Indigenous people are responsible for the conservation of 21% of the world's soil resources (ICCA Consortium, 2021), which are key to soil science and many other areas of science; in contrast, even in advanced countries, indigenous people barely represent 2% of the composition of studies in STEM. Another important aspect that we need to recognize is the role of indigenous knowledge and indigenous decision-making systems as an important national resource that has been ignored, neglected, and sometimes maligned (Warren, 1989). In this sense it is key that the soil science community make clear efforts to include indigenous communities in its ranks, and to recognize the role of indigenous traditional knowledge in their research and conservation practices.

Half of the World, Half of Soil Science

In the same way that during centuries formal science did not provide proper credit to traditional knowledge and indigenous communities, during many centuries formal scientific institutions

precluded women from entering their ranks. The 2019 Revision of World Population Prospects report (United Nations, 2019) shows that 50.4% of the human population is male, while 49.6% is female. Data of this type naturally does not reflect variation per country or life expectancy but does show a very evident truth. Women and men are each, on average, half of the human population. Today, women constitute half of the agricultural workforce around the world (World Bank, 2017), and any efforts to overcome the complex problems that endanger the soil resource need to include women in its study, solution design, and application. However, when we closely observe the international community of Soil Scientists as our closely selected group of study, we can immediately notice that it does not reflect the above-mentioned balances on gender. In reviewing the participation of soil science societies around the world, one can find that women constitute only 32% of their members (Dawson et al., 2021). Taking the United States as a sample, women constitute 50.52% of the country, they hold half of the degrees in soil science, yet they only hold 24% of the academic faculties' positions in that same area (Vindušková et al., 2021). When go through a similar exercise in reviewing inclusion statistics for to race and origin we can find that in the United States 88% of doctoral degrees in Soil Science correspond to people of white race, 9% to Hispanics, 3% to black people, and an appalling 0.1% for native Americans (Carter et al., 2020) and (National Science Foundation and National Center for Science and Engineering Statistics, 2019). If we review the percentages that each of these populations actually represent in the US, we will find that white population is 61%, Hispanic is 18%, and black population is more than 12% (United States Census Bureau, 2021). It is evident that soil science's rates of diversity and inclusion are far from being a fair reflection of society. In the US, Soil Science doctoral degrees show less variety of different races than Agronomy, Geology, and Ecology, and all these areas show much less diversity than STEM in general (Carter et al., 2020).

WOMEN IN SOIL SCIENCE: THE PIONEERS IN THE XIX CENTURY

If we acknowledge that, despite political views and temporary trends, science is above all a human endeavor, we must then also acknowledge that no science can exclude any half of the population from its history. While very little can be found in the history of Soil Science to recognize the lives and labor of women that have contributed to this science the authors of this article want to identify the modern pioneers.

Mary Emilie Holmes

She earned a Master of Arts degree in 1882 and was the first woman to earn a doctorate in Earth Science from the University of Michigan, and in a US University in 1888. She became the first woman fellow elected to the Geological Society of America in 1889. She was an advocate for the importance of teaching geology early in children's education. University of Michigan website (2015), Schwarzer and Crawford (1977).

Florence Bascom

Florence Bascom was born in 1862 in Massachusetts, US. She earned two bachelor's degrees: a Bachelor of Arts in 1882, a Bachelor's in science in 1884, and by 1887 she earned her Master's degree in Geology, all at the University of Wisconsin. She became the second woman to earn a PhD. in Geology in the US and the first woman to earn a doctorate in the Johns Hopkins University. She also was the first woman to teach at Bryn Mawr College in 1895. University of Wisconsin-Madison website (2012), Schneiderman (1997).

During her studies at Johns Hopkins University, she was forced to take classes behind a screen so she would not distract her male classmates (Ignostofsky, 2016). As a teacher and researcher at Bryn Mawr College, she founded the geology program training many other female geologists and working intensely in geomorphology. Florence Bascom became an expert in crystallography, mineralogy, and petrography, and her studies and results in these fields of knowledge were essential to understanding the evolutionary mineralogical composition of rocks, which is fundamental for the study of soils. She was editor of the American Geologist, a member of the National Academy of Sciences, the National Research Council, and the Geophysical Union. In 1937, 8 out of 11 of the women who were part of the Geological Society of the United States were graduates of the Geology course that Florence Bascom taught.

A Woman in the Founding of the International Society of Soil Science

According to Van Baren et al., in 1924 "the Fourth International Conference on Pedology lasted from 12 to 19 May 1924 (**Table 1**) and was held under the patronage of the King of Italy and the auspices of the International Institute of Agriculture. The number of adherents to the conference was 463, representing 39 countries." As expected, and can be seen in **Figure 1**, at that time there were very few women who participated in scientific meetings.

During this Fourth International Conference on Pedology, six commissions were established: I. Soil physics; II. Soil chemistry; III. Soil biology; IV. Nomenclature and classification of soils; V. Soil cartography; and VI. Plant physiology in relation to pedology. These commissions formed the structure of the International Society of Soil Science (ISSS), which was founded during the morning session on the last day of the Fourth International Conference on Pedology, 19 May 1924 (**Table 1**).

Dr. Hermann Stremme and his wife Emma Marie Antoine Täuber, who was the first woman to graduate as Ph.D. in the subject of geology in Germany, were some of the attendees to the Fourth International Conference on Pedology in May 1924; this makes Emma Marie Antoine Täuber one of the few women who probably were present at the formation of the International Society of Soil Science (ISSS).

Emma Marie Antoine Täuber (Antonie Stremme-Täuber)

Emma Marie Antoine Täuber is the only woman whose presence and identity in the foundation of the International Society for Soil

TABLE 1 | Meetings preceding the formation of the International Society of Soil Science (ISSS) in 1924. Data was obtained from Van Baren et al. (2000).

Year	Meeting	Location	Number of participants	Important outcome
1909	First International Conference of Agrogeology	Budapest	86	Regularly organize agrogeological conferences
1910	Second International Conference of Agrogeology	Stockholm	170	Formation of three Commissions
1922	Third International Conference of Pedology	Prague	50	Formation of five Commissions
1924	Fourth International Conference of Pedology	Rome	463	Formation of the ISSS

Sciences we can assume given her usual presence at the Conferences of Pedology in Europe (Stremme-Täuber, 1957).

Emma Marie Antonie Täuber was born in Berlin on 31 January 1882, and died 4 August 1961. She studied Geosciences at the Berlin University from 1909 to 1912 and finished her studies in 1913 with a Ph.D. as the first woman in geology.

Her teachers were the geologist Wilhelm Branca (1844–1928) with Hermann Stremme (1879–1962) as private lecturer, the geographer Albrecht Penck (1858–1945), the mineralogist Theodor Liebisch (1852–1922), the petrograph Otto Erdmanns-Dörffer (1876–1955) the philosopher Benno Erdmann (1851–1921) and the theologian Georg Lasson (1962–1932) together with their assistants: She graduated as Dr. phil. at the end of 1912 as the first woman in the subject geology with the dissertation: Location and relations of some Tertiary volcanic areas of Central Europe to contemporaneous seas or large lakes. The subject of the thesis was based on the observation of others that during eruptions of some active volcanoes the release of water vapor had been observed and therefore an influence of sea or lake water was assumed (Täuber, 1913). Their studies could not confirm this. The work was recognized by the Faculty of Philosophy as the best dissertation of its year.

1912 followed the marriage with her teacher Hermann Stremme and worked in the following years as a scientific assistant in the institute of mineralogy, and geology of the Technical University of Gdansk. She also taught lectures of her husband while he worked as a military geologist in Romania and the Vosges. After the war, she worked cartographically for the Geographic Institute of the University of Berlin at the Institute for Soil Mapping of the German Administration for Agriculture and Forestry.

WOMEN IN SOIL SCIENCE IN THE US

According to Levin (2005), the women's work from 1895 to 1965 was limited to the administrative work of cartographic editing and drafting. In his work Levin (2005) refers that Janette Steuart was the first woman hired in 1895 to work for the Soils Division which was part of the Weather Bureau within the USDA; along with Sorena Haygood, Janette maintained laboratory and field records until her retirement in 1920. He also points out that in 1901, Julia R. Pearce became the first woman to graduate with a degree in agriculture from the University of California at Berkeley (UCB) and the first woman hired to work in soil survey; but unfortunately, she never had the opportunity to join in field trips, due to which she only did cabinetwork. Levin also indicates in his work that until 1950, women were not authorized to join in field trip studies of soils because that activity was reserved for men; hence women were only allowed to work in soil science editing, writing erosion history, and doing laboratory work Ibid.

Through his work, Levin (2005) documents that Ester Perry was the first woman to earn a Ph.D. in Soil Science from Berkeley in 1946 and became the first doctorate in soil science in the United States. She directed the USDA Soil Laboratory at UC-Berkeley until 1965. However, she never was acknowledged in the USDA records as an official soil survey collaborator. In 1951 Mary C. Baltz from Cornell University was the first woman hired to work in the field for the Soil Conservation Service (SCS).

GENDER EQUITY IN SOIL SCIENCE TODAY: AN INTERNATIONAL LOOK FROM THE IUSS SOCIETIES AND FAO

The UNESCO worldwide report in 2021 (UNESCO, 2021b) indicates that while a growing number of women are enrolling in university, only 30% of the world's researchers are women because many of them opt out not participate a research career due to the obstacles that women face in scientific fields. In the same vein, while women earn almost half of advanced soil science degrees awarded in the US, they only make up about a quarter of its soil science workforce (Vaughan et al., 2019). All the recent studies indicate that even though more women earn their doctorate in soil science, the number of women scientists in academic and research institutions, and actively participating in scientific Soil Science Societies, has strongly decreased, widening the gender gap in this area of science (Dawson, et al., 2021; Maas et al., 2021; Velander et al., 2021).

The bibliometric study of 5,483,841 research papers and review articles with 27,329,915 authorships carried out by Lavivière et al. (2013), indicates that even when the gap is different for different fields of knowledge, on average, men publish more articles than women. This trend increased during the COVID-19 pandemic because while the number of scientific publications increased during this period, the number of women publishing decreased because the lockdown increased the work of women at home, limiting their professional and scientific work by limiting the time they could dedicate to it (UNESCO, 2020a; Viglione, 2020; UNESCO, 2021c; Velander, et al., 2021).

According to de Vries (2020) and Vaughan et al. (2019), the fewer opportunities to be invited as main speakers, to be part of Committees, the difficulties they face in receiving funding for their research, the differences in salary and professional

advancement opportunities they face concerning those of their male colleagues, and the difficulty in managing professional life in a balanced way concerning personal life, are only some of the most important reasons for the gender inequity that prevails in soil science, and also for the low percentages of women who work as soil scientists. To this we must add the obstacles that women in the scientific fields face because men in the scientific fields do commonly not establish respectful and egalitarian work relationships with them partly due to "unconscious bias." However, while "unconscious bias" is indeed important, it should never be used to avoid accountability for discriminatory behavior from individual scientists, nor to exempt the scientific community and the scientific institutions from their responsibility to address it through initiatives such as providing mandatory training about it, establishing firm guidelines to avoid it, and providing easy and non-retaliatory pathways to report cases of discriminatory behavior.

Indeed, there is no doubt that Soil science is a male-dominated field in most countries worldwide. In a recent study, Dawson et al. (2021) reported that from the data obtained from 44 national societies belonging to the IUSS in 2020: 37 out of the 44 societies had more male members than females, only 32% of the soil science society members were women, only one society had 69% female membership, and only 20% of the national soil science societies belonging to the International Union of Soil Sciences had a female president. Vaughan et al. (2019) report little progress in the US.

In 2012, within the Food and Agriculture Organization of the United Nations (FAO), a new context was set to address the "urgent need to raise awareness of the importance of soils and specially to protect and use them in a sustainable manner" (FAO, 2012), and the Global Soil Partnership was launched in Rome where soil scientists from around the world were invited to form the Intergovernmental Technical Panel on Soils (ITPS). The Global Soil Partnership (GSP) is coordinated by a General Secretariat working in collaboration with an Intergovernmental Technical Panel on Soils (ITPS). The ITPS is a working group composed of 27 top soil experts representing all the regions of the world (https://www.fao.org/global-soil-partnership/intergovernmental-technical-panel-soils/es/); 18 of their current members are men and 9 are women, then, although the ITPS is currently chaired by a woman, only 33% of the ITPS are women in 2021.

In 2019, the International Union of Soil Sciences, 96 years after its foundation, elected and for the first time has a woman as its president for the period 2019–2024 IUSS Alert (2018). The Latin-American Soil Science Society (SLCS), and the East and Southeast Asia Federation of Soil Science Societies (ESAFS) are two of the largest Regional Organizations of Soil Sciences Societies belonging to the IUSS and both have currently a woman as president. 30% of the Soil Science Societies that make up the SLCS have a woman as president (https://www.slcs.org.mx/index.php/miembros), and 22.8% of the Soil Science Societies belonging to the IUSS have currently a woman as president Dawson et al. (2021) and SLCS website.[1] Although these data represent a small advance on women's recognition as soil scientists and their capacity to perform successfully in the highest leadership positions in our professional societies and world organizations, they also show that gender equality in soil science is far from being achieved.

While in 2020 the ASA, CSSA, and SSSA Women in science Committee organized a workshop to help women in soil sciences develop skills to effectively deal with conflict, using emotional intelligence on important workplace issues, such as harassment, micro/macro aggressions, and bullying SSSA (2020). However, although this could surely help women face gender problems, this is not the solution because as long as men are not educated in a culture of equality, expressions of harassment, micro/macro aggression, and bullying will not disappear. The real change we need and must seek is not women resist or confront the gender gaps but that gender issues do not exist. Achieving this implies understanding that inclusion begins early when ideas are structured, and the identities of men and women are defined through an education that encourages and socially practices diversity, equity and equality. An education based on the full understanding that "equality does not mean that women and men will become the same but that women's and men's rights, responsibilities and opportunities will not depend on whether they are born male or female." UN Women (2021).

That is why today, worldwide, both organizations such as the UN and UNESCO as well as the NGOs and networks of women scientists warn about existing inequalities and the damage that these inequities mean for everyone in economic, scientific, social, and human terms. Organizations such as Earth Science Women's Network,[2] Frantecologist,[3] 500 womenscientists,[4] and UNESCO not only seek to recover the historical memory of the contributions made by women throughout the history of humanity but build future history from the registration and dissemination of scientific activities and achievements of women as means of struggle and empowerment.

As part of its efforts to collaborate with sister organizations in closing the gender gap and fighting for inclusion, in 2021, the IUSS signed a Memorandum of Understanding (MOU) with the Standing Committee for Gender Equality in Science of the International Scientific Council (ISC) International Union of Soil Sciences. Although this is not a simple task, the IUSS, needs to continue working hard to advance on this issue, and to demonstrate its commitment to promote, encourage and strengthen daily behaviors towards the construction of a culture of conscious recognition of our human equality. We need to do it because history shows us that seeking confrontation or social punishment to advance, is not the path, and on the contrary, for humanity, the pathway is the construction of a culture of equity, inclusion, diversity, and equality, so working on to achieve it is essential to close all the gaps.

[1]https://www.slcs.org.mx/index.php/miembros.

[2]Earth Science Women's Network https://eswnonline.org/resource/newsletter-ofthe-association-of-women-soil-scientists/.

[3]Frantecologist https://franciskadevries.wordpress.com/women-in-soil-science/.

[4]500 womenscientists https://500womenscientists.org/.

FIGURE 1 | Group photo from people attending the Fourth International Conference of Pedology, during the Formation of the ISSS in Rome, May 1924. © IUSS Historical Gallery: https://www.iuss.org/about-the-iuss/iuss-history/.

OUR TURN FOR DIVERSITY AND INCLUSION

Despite the undeniable progress made over time, gender inequalities are still present in the world in general and in scientific life in particular. According to UNESCO data (2020b), less than 30% of the world's researchers in the areas of engineering and mathematics are women, but they also receive lower salaries for their research.

For UNESCO (2021a), "women and men must enjoy equal opportunities, choices, capabilities, power and knowledge as equal citizens," however, the differences of gender, race, ethnic group, religion, political inclination, skin color, etc., are at the center of all non-inclusion within academia and science.

The current practices of non-inclusion are an inherent factor in gender inequality. Oral, written, and body language determine the social attitudes and behaviors that make up a culture, which can be inclusive or exclusive of gender, and which can explicitly or tacitly conform to gender prejudices and stereotypes thus limiting a sector of society from certain areas. From this derives the importance of promoting language that is non-discriminatory of gender, race, ethnic group, religion, political inclination, or skin color. That is why, all kinds of discriminatory languages between scientists and members of our scientific societies are not admissible in any case, and the reason because these practices must be rejected by all since no divisive practices are admissible, well they are the pathways that encourage the use and reinforcement all kind of discriminatory behaviors.

Soil science communities need to fight for changing the present situation because ensuring an inclusive and equitable quality education promoting lifelong learning opportunities for all is the point of link and interrelation between all the SDGs to achieve soil sustainability (Reyes-Sánchez, 2018). For that reason, within the scientific societies of soil science, we need to promote an education paradigm that recognizes the soil is not only a natural resource but also a social, economic, cultural, political, and patrimonial good *Ibid*.

The soil as a resource allows humans to live on it, and through our work it enables us to obtain food, water, and legitimate sustenance, which is essential to overcome poverty, to construct an identity and a culture, and to achieve economic independence. Gender-based discrimination in land ownership has historically been a crucial factor in determining the distribution of power and resources between men and women, and is a key obstacle to equity and equality; it is not possible to achieve equal economic independence without equal access to land ownership and land care (Reyes-Sánchez, 2018). Fighting for legitimate land

ownership for all genders is a key element in achieving equality, in the construction of a just society, and in ending all forms of gender-based discrimination.

As mentioned before, UN (2020) data indicates that women and girls constitute half of the world's population and consequently half of all human capacities, which means that the participation of that half of humanity is essential for the enrichment of scientific, economic, and social activity for the achievement of the SDGs. It also means that failing to include half of the human population puts the sustainability of the soil and its biodiversity at risk, affecting food security, agricultural production as a fundamental economic engine, and the real possibility of mitigating climate change.

Similarly, UNESCO (2022b) celebrating the International Day of Women in Multilateralism on 25 January 2022, stated that "all forms of discrimination based on gender are violations of human rights, as well as a significant barrier to the achievement of the 2030 Agenda for Sustainable Development, and its 17 Sustainable Development Goals." That is why it is of the utmost importance to work in the continuous and conscious effort to include women and girls in all areas of human life.

Now is the time to act as scientists to review the current patterns of diversity and inclusion of our scientific community to apply the scientific method to the analysis of our behaviors. It is time to act and apply the scientific method, not only to observe, record, and analyze both the historical events and movements and the proposed hypotheses as possible solutions to the continuous and unjust absence of inclusion. We need to challenge those hypotheses to make it go through the falsifiability principle (Popper, 1959), like an indispensable step to advance toward building new progression hypotheses that allow us to move towards diversity and inclusion as the basis of equity.

We should now be at the point in time in which we should test the results of our actions. Soil Science should be able to pass the test to show what was learned and what actions were taken based on that diversity and inclusion are valued by its scientific community because it is only logical to infer that being composed of scientists, the community acts and decides based on knowledge and analysis.

However, from the statistics shown in this article, it is evident that the soil science community has not made enough efforts towards diversity; for gender, race, and origin, soil science has lower percentages of diversity than those of STEM in general, and much lower percentages of diversity than what the real population composition is in any country.

The important part about having clarity is to understand the message that our scientific community is expressing, in this case about diversity and inclusion, and to decide how to act to advance on diversity, equity, and inclusion.

CONCLUSION

A single article can only allow these authors to begin outlining where diversity and inclusion efforts should start. As shown, while women constitute more than half of the world's population, they are a much smaller portion of the scientific community and despite making important contributions to science throughout history, they also have consistently been unrecognized and underrepresented at all levels. This same pattern can be traced through the history of the Indigenous Communities, who constitute 5% of the population (UNESCO, 2022a) and who preserve 21% of Soil that we all need to survive (ICCA Consortium, 2021) and who are paid back with 15% (UNESCO, 2022a) of the world's poverty and whose presence in science is almost non-existing.

Gender equity data for soil science is extremely limited worldwide, and there are few scientific studies published on gender and indigenous communities within soil science. Shortage of specific information on gender equity in soil science indicates by itself both the lack of existing interest of soil scientists in this topic and that the gender gap is not recognized as a significant issue within the national societies of soil science. This equally is a reverse way of showing that the gender gap in soil science is real and that we need to work on it.

Closing the current gaps in diversity, equity, and inclusion that exist today in soil science are pending and essential tasks to be carried out urgently by our scientific community because to face the current environmental challenges, we require all the brains and hands working together -and not just half of them-, to achieve the sustainability of the soil resource as the essential element for life on Earth. Soil Science Societies will develop, implement, and monitor the adoption of a policy of equity, equality, inclusion, respect, and diversity for each other to close all the gaps.

We need to take down gender stereotypes that link science to masculinity, or that exclude racial backgrounds or similar identifying features and factors, we need to clearly show the new generations that there are great examples of researchers, engineers, technicians, and soil scientists from all genders and backgrounds.

AUTHOR CONTRIBUTIONS

LBR-S and AI contribute with the conceptualization, data curation, formal analysis, investigation, project administration, resources, software, validation, writing-original draft, writing-review and editing.

CONFLICT OF INTEREST

AI is employed by John Wiley & Sons, Inc.

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

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