An intersectional analysis of women's experiences in forest carbon monitoring in Peru, Cameroon and Nepal

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HIGHLIGHTS

- Bias and differences in experiences can occur based on one or more intersectional identities (e.g., age, gender or the place an individual is from or associated with) and can vary depending on unique combinations of identities.
- Bias and differences in experiences can occur if an additional identity characteristic (e.g., weakness) is socially constructed and assigned to an individual.
- Of the intersectional identity and structural factors identified in this study, seven out of 14 emerged in all three countries, while the other half were only reported in one or two countries. Of these, three were personal identities (age, caretaker and (dis)ability), one was a constructed factor (lack of physical strength compared to men), and three were structural factors (education, geography and marital status).
- Intersectional identities or structural factors found across more than one country were often talked about differently between each country and even within the same country. For example, women in all three countries reported challenges based on assumptions that women are weaker than men in a fieldwork setting, but described different ways that this discrimination was displayed, ranging from receiving special care to being told they did not belong in the field.
- Although including local and Indigenous people in forest carbon monitoring was reported as valuable for better results, few examples were reported of this happening in practice.

SUMMARY

Gender equity has progressed unequally within science, technology, engineering and mathematics (STEM) fields, with geosciences and specifically the Earth Observation (EO) field remaining largely unbalanced. Limited work has centred women's experiences in forest carbon monitoring (FCM), a field that combines EO and *in situ* data collection. Fewer studies have focused on perceptions of women from Latin America, Africa and Asia. This study examines participants in SilvaCarbon, an interagency technical cooperation program of the U.S. Government to build FCM capacity in tropical countries, where fewer women have historically participated as participants or training leaders. To better understand barriers that women face in FCM, we analyse personal narratives shared by women in Peru, Cameroon and Nepal. The framework of intersectionality facilitates exploration of intersectional identities in concert with gender that affect women in three distinct country contexts. Findings indicate that individuals' opportunities in FCM are affected by multiple combined identities and circumstances at the personal and structural levels, and through socially constructed, attributed, and perceived identities.

Keywords: intersectionality, gender, forest carbon monitoring, international, Earth Observation

Analyse intersectionnelle des expériences des femmes dans la gestion du carbone forestier au Pérou, au Cameroun et au Népal

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L'égalité entre les sexes a progressé dans les domaines de la science, de la technologie, de l'ingénierie et des mathématiques (STEM); les géosciences et spécifiquement le domaine de l'Observation de la terre (EO) demeurant largement déséquilibrés. Un travail limité s'est penché

sur les expériences des femmes dans la gestion du carbone forestier (FCM), un champ qui combine l'EO et un recueil de données sur site. Les perceptions des femmes d'Amérique Latine, d'Afrique et d'Asie ont été l'objet de moins d'étude. Cette étude examine les participants de SilvaCarbon, un programme de coopération technique interagences du gouvernement des Etats-Unis, visant à construire la capacité de FCM dans les pays tropicaux, où les femmes ont historiquement moins participé comme membres, et comme directeurs de formation. Pour mieux comprendre les obstacles auxquels les femmes doivent faire face dans le domaine du FCM, nous analysons des histoires personnelles partagées par des femmes du Pérou, du Cameroun et du Népal. Le cadre d'intersectionnalité facilite l'exploration des identités intersectionnelles, ainsi que genrées, affectant les femmes dans trois contextes nationaux distincts. Les résultats indiquent que les opportunités des individus dans le FCM sont affectées par des circonstances et des identités combinées multiples, aux niveaux personnel et structurel, ainsi qu'à l'aide d'identités perçues, attribuées et construites socialement.

Un análisis interseccional de las experiencias de las mujeres en el monitoreo del carbono forestal en Perú, Camerún y Nepal

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La equidad de género ha progresado de forma desigual en los campos de la ciencia, la tecnología, la ingeniería y las matemáticas (STEM, por sus siglas en inglés), y las geociencias, en concreto el campo de la observación de la Tierra (EO, por sus siglas en inglés), siguen estando muy desequilibradas en cuanto a equidad de género. Se han realizado pocos estudios centrados en las experiencias de las mujeres en el monitoreo del carbono forestal (MCF), un campo que combina la EO y la recopilación de datos *in situ*. Muy pocos estudios se han preocupado de las percepciones de las mujeres de América Latina, África y Asia. Este estudio examina a los participantes en SilvaCarbon, un programa interinstitucional de cooperación técnica del Gobierno de los EE.UU. para desarrollar la capacidad de MCF en países tropicales, donde históricamente han participado menos mujeres en actividades de formación, ya sea como participantes o como líderes. Para comprender mejor las barreras a las que se enfrentan las mujeres en el MCF, se analizaron los relatos personales de mujeres de Perú, Camerún y Nepal. El marco de la interseccionalidad facilita la exploración de las identidades interseccionales en función del género que afectan a las mujeres en los contextos de tres países distintos. Los resultados indican que las oportunidades de las personas en el MCF se ven afectadas por múltiples identidades y circunstancias combinadas a nivel personal y estructural, y a través de identidades construidas, atribuidas y percibidas por la sociedad.

INTRODUCTION

The importance of diversity in science, technology, engineering and mathematics (STEM) and natural resource management has been documented globally. Minorities in science contribute diverse perspectives and solutions (Hofstra *et al.* 2020), and gender-diverse research and development teams create inter-team dynamics linked to radical innovation (Díaz-García *et al.* 2013). However, the novel contributions of women and non-white scientists in the United States (U.S.) are less readily adopted than those of white men, who have traditionally formed the scientific majority (Hofstra *et al.* 2020). In natural resource management groups in Latin America, Africa and Asia, positive outcomes of women's involvement have been observed. Mixed gender groups and women-only groups had higher solidarity, and members of women-only groups collaborated more frequently both formally and informally and managed conflict more effectively. Finally, women-only groups scored highest for ability to "sustain collective action," a critical component to making lasting changes in natural resource management (Westermann *et al.* 2005).

Western and U.S.-centric studies on inclusivity in STEM have contributed to our knowledge of women's experiences in higher education (Crandall *et al.* 2020, De Welde and Laursen 2011 and Ong *et al.* 2018), hiring biases and stereotypes (Hill *et al.* 2010, Popp *et al.* 2019 and Reuben *et al.* 2014) and whether previously identified gender challenges are still relevant (Ceci and Williams 2011). However, calls have been made to expand the study of women in conservation leadership across cultural contexts (Jones and Solomon 2019). While some international work exploring women's experiences and representation in STEM has been done (Avolio *et al.* 2020, Ramirez and Kwak 2015 and Stoet and Geary 2018), these do not focus on understanding specifics within countries. The perspectives and experiences of women in Latin American, African and Asian countries have been less often centred in these discussions (see Fru *et al.* 2021 for an example of a paper about bias experienced by African women). As a result, data are limited on whether women's experiences in STEM fields are comparable across cultural and geographic contexts, and specifically, whether intersectional factors beyond gender are similarly salient across different geographic and cultural contexts.

Gender as a social construct affects daily life but is just one component of a person's identity. The term "social construct" is used in this paper to point to the combination of assumptions and stereotypes that help inform individuals' perceptions of one another. When identities such as gender are discussed in this paper, it does not mean biological sex, but how individuals' identities are perceived and at times assumed and constructed by the perceptions of others. This paper focuses on how this affects women's participation in forest carbon monitoring (FCM). Many factors shape the opportunities and outcomes experienced by individuals across the globe. These affect one another in such a way that the

sum of a person's identities is not the full picture; rather, the interplay between these identities is more complex (Hankivsky 2014). In the environmental context, and more narrowly in that of natural resource management and forest conservation, gender has been identified as a key factor for inquiry (Agarwal 2009, Elias *et al.* 2017 and Meinzen-Dick *et al.* 2014), although the depth to which this is currently being done may be limited (Asher and Varley 2018). Scholars point to various inequities between women and men in participation and decision-making around programs designed to help conserve natural resources, such as work done concerning gender and the implementation of Reducing Emissions from Deforestation and forest Degradation + (REDD+) programs (Bradley *et al.* 2013, Khadka *et al.* 2014 and Samndong and Kjosavik 2017), gender and other forest-related conservation (Evans *et al.* 2017, Nhem and Lee 2019), and gendered factors in other conservation areas including fishing (Resurreccion 2006) and sustainable agriculture (Akter *et al.* 2017). FCM, a relatively new and male-dominated field that emerged in support of climate change mitigation through carbon sequestration and storage, is largely unexplored in the literature. It combines elements of forestry, ground truthing, geographic information system (GIS), remote sensing, data modelling, analysis, and in some cases social surveys. To account for the complexity surrounding gender and other identity facets, there is a need to apply an intersectional approach to their study in the natural resource management and climate change contexts (Colfer *et al.* 2018 and Djoudi *et al.* 2016). To consider how personal identities and structural factors interact to both create and limit opportunity, this paper uses a theoretical framework rooted in intersectionality.

The intersectionality literature is not conclusive about one single definition of the term (Nash 2008); however, there are common threads in most works on intersectionality. Crenshaw (1989: 140) wrote in one of the foundational works on intersectionality that "Because the intersectional experience is greater than the sum of racism and sexism, any analysis that does not take intersectionality into account cannot sufficiently address the particular manner in which Black women are subordinated." A more recent text also explains that "inequities are never the result of single, distinct factors. Rather, they are the outcome of intersections of different social locations, power relations and experiences" (Hankivsky 2014: 2). Intersectionality was applied in the current study as a way to understand women's diverse experiences in their FCM work in different countries. Three main components of intersectionality were selected for application in this paper: social constructionism, a non-additive approach and relationality.

Intersectionality necessitates adoption of a social constructionist understanding of social phenomena (Windsong 2018). Taking the example of gender, social constructionism rejects the idea that gender is innate, static, based on a set of physical traits, or simply a role played by each individual (West and Zimmerman 1987). Instead, social constructionism posits that gender is a "project of social doings," (West and Zimmerman 1987: 129) and "is a powerful ideological device, which produces, reproduces, and legitimates the choices [that individuals have]" (West and Zimmerman 1987: 147). Important to studies across different countries, intersectionality theory "recognizes that not all social identities are prominent in all contexts" (Windsong 2018: 137). Additionally, different structural factors, such as the education system or social hierarchies, may be more or less prominent in different country contexts. This leaves flexibility to understand the narratives of individuals in each country, who have their own unique set of experiences that have shaped their perspectives, without imposing upon them a standardized meaning of identities such as gender or class.

A second key component of intersectionality is its movement away from an additive approach (Bowleg 2008, Rouhani 2014 and Windsong 2018). Categories are not dichotomous (e.g., one can only be privileged or oppressed but not both simultaneously), nor ranked as more or less influential (e.g., one's race being more important than one's gender in understanding the types of discrimination they may face) (Collins 1993). While analysing one part of a person's identity at a time reduces complexity, this obscures the realities that are produced when those identities are taken together. The additive approach assumes that a given identity generally associated with marginalization adds the same amount of oppression to the lives of all people holding that identity (Bowleg 2008), when often it is the interactions between those identities that cause privilege or oppression.

The third key component of intersectionality is a focus on relationality (Hunting 2014 and Windsong 2018). Relationality recognizes that often identities are defined by contrasting them with each other (Windsong 2018). Recognizing multiple identities' relation to each other allows inquiry into why one is taken as the standard or held up as superior. This also allows for discovery of similarities across groups and the establishment of categories that are not static and analyses that are not final, leaving room for continued discussion and interpretation through additional lenses (Glenn 2002 cited in Windsong 2018). Two other aspects of relationality are the historical and social contexts that accompany the subject of analysis and the ability of the researcher to put themselves in context, acknowledging their power and privilege in relation to their study participants and subject matter (Hunting 2014).

We explore the following questions to demonstrate intersectional identities and structural factors in action in FCM work as these factors are perceived by participants both in their own lives and in their countries more broadly:

- What intersectional identity and structural factors were salient to FCM participants in Peru, Cameroon and Nepal?
- Which intersectional identity and structural factors were transcendent across country contexts, and which were country-specific?
- What are examples of intersectional factors that participants reported regarding personal identity, structural factors, and constructed factors across multiple levels?
- How do these intersectional identities shape the experiences of women in FCM work across three unique country contexts?

We asked participants about their identities and corresponding experiences. This study contributes to the literature

by offering a comparison of participants' responses across three distinct country contexts in Latin America, Africa and Asia and providing illustrative examples of how these identities affect women's work in FCM, a field that combines various disciplines within STEM (e.g., Earth Observation (EO), natural resource management, social sciences).

METHODS

Sampling and interview topics

This study centred the experiences of women in the traditionally male-dominated field of FCM. We over-sampled women to better understand their lived experiences but included a smaller number of men's perspectives as they play an important role in this field. Across the three countries, 42 women and 12 men participated.

Semi-structured interviews were conducted individually with each participant for a larger program evaluation focused on women's involvement in capacity building programs. Semi-structured interviewing facilitated the exploration of topics containing multitudes of subcategories. A general topic was introduced, and participants spoke freely about what came to mind. Researchers then probed these unique answers for further details. This technique can be illustrative of commonalities between interviewees and can provide in-depth case studies to demonstrate these themes. The flexibility of the semi-structured interview enhanced communication between the participants and researchers, who each brought different knowledge to the conversations. It allowed for clarification from both parties, ensuring that deep, accurate understanding of perspectives and experiences were understood by the researcher and therefore informed the results (Rubin and Rubin 2012). One semi-structured interview guide was created and pre-tested with 12 subject matter experts in FCM, resulting in slight modifications for tailored versions for each country. The focus of those interviews were gendered experiences in FCM. Due to the difficulty of finding women for these interviews in some countries, men were asked to compare and contrast their experiences with those of women colleagues. Additionally, participants were asked to identify identity and structural factors that may influence engagement in FCM work beyond gender.

Protocols

Potential participants were contacted via email based on either their prior participation in SilvaCarbon (https://www.silvacarbon.org/) programs or by network sampling in participants' professional networks. SilvaCarbon is an interagency technical cooperation program of the U.S. Government that builds countries' capacity for measuring, monitoring, and reporting on carbon in forests and other lands (SilvaCarbon 2022). The initial email provided background information about the study and a form with participant rights and protections in English as well as Spanish, French or Nepali, as appropriate per country. Participants were also informed of the availability of an interpreter and invited to select a one-hour time convenient for them. Interviews were completed in a virtual format suitable to each participant through an online platform.

At the beginning of each interview, a verbal consent form was read to the participants and permission to record the interview was obtained. All participants consented to the recording. Interviews proceeded according to a combination of the semi-structured interview guide, related topics introduced by participants, and periodic follow-up questions. All interview recordings were transcribed verbatim by a social research-focused transcription company.

Precautions were taken to increase comfort and avoid unnecessary burden. Participation was voluntary and made as convenient as possible, network sampling was used to avoid contacting uninterested people, and the interview process ended after saturation of information was complete. To increase comfort for most participants, all interviewers and interpreters were women.

Data collected for this paper were part of a one-time conversation on multiple topics. Repeated conversations or one more focused conversation could allow participants to get more comfortable thinking about and delving into the topic. Due to the small sample size of this qualitative study, the fact that an identity or structural factor did not appear in an interview set for a country does not mean it is not a factor in this context. Finally, online methods such as video call interviews will not reach people without internet who may have different experiences.

Data analysis

An interviewing team of three researchers met weekly to discuss completed interviews and emerging themes. Coding of interview data was an iterative process completed by one researcher, with coding checks performed by a second researcher on randomly selected transcripts for additional codes and clarifications to existing ones.

Country data were coded independently. At the beginning of analyzing data from each country, the lead and check coders independently coded the same two interviews to create the base codebook for each country. A combination of deductive and inductive coding was used. A base set of codes created from the semi-structured interview guide was applied across all three countries. Interview data were coded inductively for themes that arose within each country.

Interviews ranged from 19 to 90 minutes, averaging 54 minutes. Twenty-nine of 54 interviews were completed with the help of interpreters, and some quotes were edited for readability. Participants indicated to the researchers what language they preferred to communicate in for each interview (Table 1). Although these steps presented opportunities for exact participant phrasing and subsequent meaning to be lost, in order to ensure that meaning was preserved, draft results were shared with all participants. Few edits to the quotes were received from participants, indicating that meaning was adequately captured and preserved through the interpretation, transcription and editing processes.

TABLE 1 *Participation, interview language, data collection period, and participant career length for Peru, Cameroon, and Nepal*

	Peru	Cameroon	Nepal
Number of Participants	21	19	14
Interview Language	Spanish (14), English (7)	French (13), English (6)	Nepali (2), English (12)
Data Collection Period	Nov 2021-Jan 2022	Jan-April 2022	April-May 2022
Career length	Range of career stages (Avg ~10 years)	Mainly early career (Avg ~5 years)	Mainly mid-career (Avg ~15 years)

*Averages calculated from those who gave career length (Peru N=21, Cameroon N=17, Nepal N=11)

RESULTS

Salient intersectional identity factors and their distribution across countries

Intersectional factors coded from participant interviews are split into three categories: those that were; 1) observed across all three countries (Tables 2 and 3), 2) observed in two countries (Table 4), and 3) observed in one country (Table 5). Within these four tables, identities and factors in the left column are further distinguished into three categories. These are; 1) personal identity factors applicable at the individual level (e.g., age), 2) structural factors that influence lived experience but are not necessarily an intrinsic personal trait (e.g., geography) and 3) attributes socially constructed and applied to participants but not necessarily claimed by them (e.g., assumptions about physical strength). Even when the same overarching factor was identified across all three countries, participants often reported different challenges or enablers related to that factor. Tables 2, 3, 4 and 5 illustrate the complexity of each identity or factor by showing examples of how each was talked about across country contexts. It should be noted that the factors listed in the following tables are not applicable only to women; however, these examples were given by women or about women, indicating that they were applicable to at least one woman's experience.

The following four sections use examples of intersectional identities and factors, including physical factors, geographic factors, and Indigeneity. These were described by participants and reported in the tables above. Socially constructed identities and assumptions made by individuals in work and school settings about women in FCM are also included. Bias based on assumptions of homogeneity across all people with these intersectional identities resulted in enhanced or hindered opportunities to engage in FCM. Examples are given at the personal identity level, the structural level, and points at which identities are socially constructed and applied to women. Distinction is drawn between identities that are carried by everyone, such as their age and where they live, and identities that are not held by everyone, such as Indigeneity. The fourth section of results illustrates real-world intersectional identities and considerations from participant interviews.

Personal identity: Physical factors

Age

Age was associated with stereotypes, expectations and traditional life decisions across the three countries.

Young women from Peru working in various countries in Central America faced difficulties being listened to or respected. This was magnified in fieldwork environments, where challenges existed even when young women held leadership roles.

> *". . .you would really feel the pressure, the pressure of being a woman and young. The toughest part was doing field work because you're out in the field and you're coordinating them. . . and not everyone is very accepting of that situation." Peru participant*

Although age and status can be correlated, one participant's experience illustrates that increased age may not stop preconceived assumptions that women are not as good to work with as men.

> *". . .some students that arrive to my team. . . I feel that they don't want to work with me because I am a woman, but at the end, they admire me for my work. . . . They change the first idea that 'I don't want to work with a woman because they are very complicated and difficult.'" Peru participant*

Age was also discussed in the context of fieldwork usually being done by people under 40 in Peru (Table 2) and age limits associated with hiring for government positions in Nepal.

A participant from Nepal saw an advantage to bringing women of different ages together to solve complex problems. The participant spoke positively about how women made different contributions based on their life experiences (Table 2).

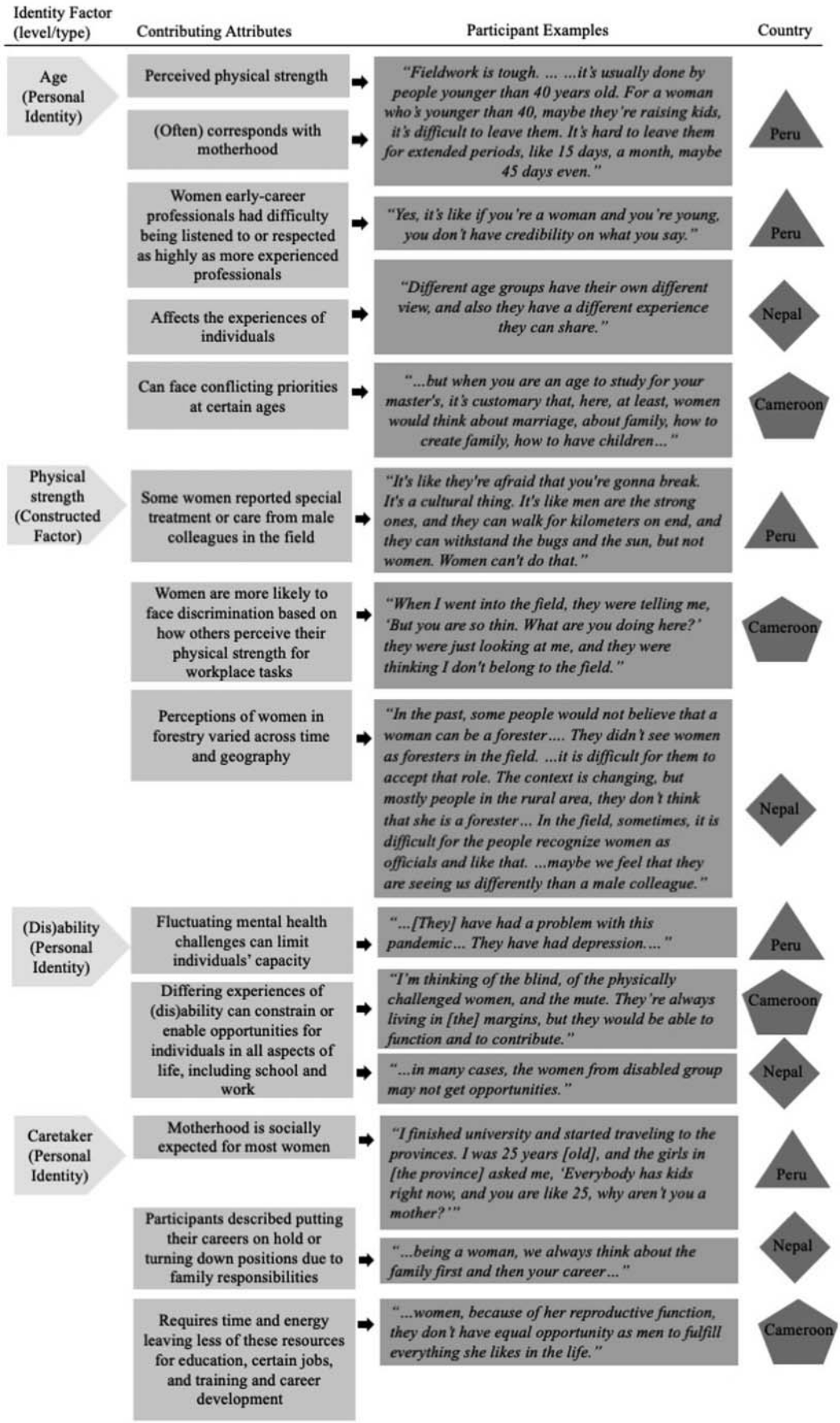
Age, intersecting with other factors, can matter for women considering their paths into science. A participant from Cameroon identified age, in combination with social norms, as a potentially limiting factor in obtaining a master's degree to work in forest conservation (Table 2).

Physical strength

An assumed lack of physical strength, particularly in relation to fieldwork, was reported by women across all three countries (Table 2). Women argued that physical strength would not matter in a wild animal attack, nor did it really matter as much as grit and determination in fieldwork.

> *"In fieldwork, people prefer to work with men because it's so difficult. You need to be strong, et cetera, but in my experience, this difference is not important because in*

TABLE 2 *Intersectional factors and identities identified across all three countries with examples of nuance within each category (personal identities and constructed factors: individual traits)*



hard conditions, you need determination. You need perseverance. You need to love your job. If you have determination and perseverance, and you love your job, it's still easy to work in difficult conditions. It's not only for men or for women. It's about your personal skills." Peru participant

". . .it's not only the senior male staff. . . .even in the lower male positions because all the generations, even my colleagues, they are the same age. . . They say that, 'women are vulnerable.' Everyone is vulnerable if you go in front of a tiger, if you encounter a rhino. That's same with male and female." Nepal participant

Structural Factor: Geography

Geography, meaning the place an individual is from or associated with, can facilitate or inhibit opportunities, as well as imbue individuals with perceived qualities.

Foreigner status conferred favourable perceptions of intelligence and leadership in Peru, and different levels of foreignness were reported as status-enhancing. Participant perceptions indicated that professionals in the capital were more highly regarded than those in the rural regions, while those who had studied abroad or were from another country had an even greater likelihood of starting out in a position of leadership (Table 4).

". . .there's this predisposition that the best professionals are the ones in the capital or coming in from abroad. . ." Peru participant

". . .he had this belief that people that studied abroad were more intelligent or more credible." Peru participant

In Peru, participants often reported the importance of geographic location for differences in accessibility of training. Participants reported that professionals living in the capital, Lima, had more access to training opportunities. However, a participant who lived and worked in a rural region of Peru also considered their geographic location to be an advantage for attending training. Because fewer professionals lived in the rural regions, they were more often selected to attend training to fulfil quotas for each region. Geography was also reported in Cameroon as a limiting factor in attending school and training, and for jobs available to individuals. In Nepal, participants reported that communities farther away from district forest offices are less able to access this resource (Table 3).

Another participant in Peru claimed enhanced physical abilities for those from geographies at high elevations.

"I am from Cusco, and Cusco is high elevation, 3 400 meters. . . . The people from here, it is easy to go to the jungle or to the mountains." Peru participant

Personal identity unique to some individuals: Indigeneity

In contrast to age and geography, Indigeneity is an identity factor not experienced by all individuals.

Languages and accents

One participant from Peru was concerned that one of their students, although good at their work, would struggle to find a job because they spoke Quechua, an Indigenous language, but were not as fluent in Spanish or English (Table 4).

Similarly, a participant in Nepal recounted the different languages they had to learn for use in their household, community, and country more broadly (not mentioned in the quote, this participant was also able to communicate effectively in English over email).

". . .in my household, we would speak in our own ethnic language, which is Tamang, but outside of the household in the community, we had to speak Maithili, which was the dominant language in the area that I was living in. I was raised in Tarai, and even learning the official Nepali was not easy for us because we would either speak in Tamang or Maithili, so I had to learn Nepali also by heart. . . . My struggle was with language." Nepal participant

In addition to the barriers imposed by language, discrimination based on an individual's accent was reported by participants in both Peru and Nepal (Table 4).

Education

In general, to work in FCM, at least a university degree is required. However, participants reported different barriers to accessing the education system in their countries.

". . .it's very challenging to make the government workforce inclusive because people are already left behind during their education. The ethnic groups, local people, and very economically poor people, they cannot go to school. They cannot go to universities. They cannot get a forestry education." Nepal participant

Indigenous participants in Nepal highlighted challenges they had observed and experienced, including the barriers faced even by more privileged Indigenous communities and conflicts within their families about whether or not they should study.

"Even for the so-called high-class communities, . . .studying in this field is very limited. . ." Nepal participant

"I'm from Tarai, and we used to live in a joint family. My ethnic group in Nepal is Tamang. Because of that, normally, when you say ethnic groups in Nepal, like mine, people think that we are comparatively more liberal than other societies. However, we were not living in the hills, we were living in Tarai, and Tarai is a closed society, so that affected how we were raised. . . My grandfather and

TABLE 3 *Intersectional factors and identities identified across all three countries with examples of nuance within each category (structural factors: opportunities)*

Identity Factor (level/type)	Contributing Attributes	Participant Examples	Country
Geography (Structural Factor)	Intra-country cultural differences, including differences in views between urban and rural areas	*"...all the different states are much more conservative than in the capital so the gender topic is a barrier for women to hold certain positions, and they will have a very high migration of people, professionals that move to the capital."*	Peru
	Educational opportunities differ between rural and urban areas, and access can be mediated by gender	*"Yes, because in the [regional] University, we have only three careers, and then you have to go to another province to study, but... people don't let a daughter go. They prefer to let a son go... The daughter has to study in the same place that the parents lives, so they have few options."*	Peru
	Where someone lives impacts their ability to attend trainings	*"If you want to organize training, when training is really far from a local community, it's difficult and challenging for a woman to attend the training in the rural area because they have to take care of children."*	Cameroon
	Restricting access to forest officers and associated knowledge and resources	*"...usually the district forest officers are at district headquarters. It is far away from the village. ... You have to walk on foot. It may take up to one day to visit the forest officers, from their home to the office."*	Nepal
Education (Structural Factor)	It may be difficult to get the education needed for work in FCM within countries	*"I think that there are very few specialists in Peru because there are no opportunities to develop these skills. ...I think it has to do with the way they teach it in school. Students are afraid of it. They don't want to get into remote sensing."*	Peru
	Participants listed barriers for women to achieve the education needed for FCM such as financial constraints and parents' education and values	*"These private universities are expensive and... from generation to generation, the family will invest more money and send their boys... They will not invest so much money into the education of the women."*	Cameroon
	Access to education can be restricted by gender and the associated responsibilities	*"...in my childhood, I got many opportunities because I'm a son. Maybe my sister was not getting the opportunity because she's a daughter, and she has other responsibilities, and so she cannot focus on studying. I did not have those responsibilities that she was carrying, and so I got a little bit more opportunity, or I got more time to study."*	Nepal
Marital status (Structural Factor)	Ability to pursue desired field when jobs are scarce	*"Right now, I'm single. I don't have kids. I can afford to risk it. I can afford to go four or six months without a job or being unemployed until I get a remote sensing offer. But a person that has responsibilities needs that job security."*	Peru
	Marriage and starting a family is a widely followed tradition. Within this, there is variation on how this affects women's work in FCM	*"...there are some societal norms that pull back women. Like, at certain age, you need to get married and then get divided from that career to that marriage, and so then we have a lot of traditions to follow."*	Nepal
	Expectations about availability to work differed for married and unmarried women	*"It'll be defined more by your marital status. ...maybe you have to stay many hours after at the office, usually for married women the boss will let you go one or two hours before the others.... If you are single, you stay many hours over."*	Cameroon

*FCM = forest carbon monitoring

my grandmother, they did not want the daughters to study, and we had very strict environment at home. I had to struggle when I had to study class one, then again when I reached class three, then again when I reached class five. There was always this push between my mother and my grandparents about whether I should be studying or not, but my mother, who had come from the hills, she took a stand, and she said, 'No, my daughter is going to study,' and that's how I could continue my studies." Nepal participant

Intelligence questioned

An example of an identity leading to a socially constructed and attributed additional identity was that in Nepal, Indigeneity was correlated with perceived less intelligence.

"*I faced this during my childhood in school. Being Indigenous, I'll always be a joke, joke in my class that your caste, your community is dumb." Nepal participant*

Indigenous knowledge

Although different terms were used, the importance of including Indigenous and local communities in FCM and conservation work more broadly was discussed in all three countries. In Nepal, participants mostly talked about the importance of including Indigenous people, while in Cameroon the term 'local people' was used more often. In Peru, participants talked about both Indigenous and 'local' populations which were distinguished from each other. Participants expected that knowledge of the landscape would greatly enhance current FCM efforts. Participants from Nepal hoped that inclusion of Indigenous and local communities would produce positive outcomes for these communities as well.

"...the potential that we have with the locals is very strong... We only need more training because local knowledge is very strong... To talk to people in the field will only enrich those studies..." Peru participant

Participant examples of multiple combined identities

While intersectional identities where various factors interacted with gender were discussed above, some participants elaborated on the complexity of experiences when multiple identities are taken together. The quotes below combine structural (historical social systems, place-based vulnerability, urban versus rural geographies) and personal (gender, Indigeneity, marital status, age, caretaker role) factors and identities. In Nepal, participants indicated that both Dalit communities (so called lower caste) and Indigenous groups are historically discriminated groups.

"We have a history of oppressive caste system in Nepal. Some castes we consider privileged... ...women from privileged caste and in urban areas tend to have less vulnerability than a woman who is Indigenous, who is away from urban areas. They face triple discrimination because they belong to unprivileged caste, are marginalized due to nature as well because they mostly live nearby forests or nearby the sources of natural resource management. Also, they are the most vulnerable to climate change and natural disasters." Nepal participant

"...inside the cities you will find women who want to study. ...as women age, there is a time that they want to start a family. They will get pregnant. They will have to stop their studies and start again. There is that in the path of the women." Cameroon participant

DISCUSSION

Distribution of salient intersectional identities and factors across countries

Seven of the 14 intersectional identities and factors beyond gender identified by participants were discussed in all three countries. These included three personal identities (age, caretaker and (dis)ability), one constructed factor (lack of physical strength compared with men), and three structural factors (education, geography and marital status). Three identities were reported across two countries (language/accents, 'otherness' identity and religion, all characterized as personal identities). Four were uniquely discussed in one country. These were profession-based identity (personal identity), leader (constructed factor), and personal connections and household wealth (structural factors). This distribution suggests more similarity in salient intersectional identities and factors than differences despite cultural and historical differences among countries. Importantly, commonality of over-arching themes was observed across countries, but the ways these themes were discussed and the individual experiences with them were unique both across countries and at times within countries. This points to the value in taking a non-additive intersectional approach when considering these factors, as even two people sharing an identity will likely not experience it in quite the same ways given their other, unique identities that interact with the shared identity.

Half of the identities were categorized as personal identities, five were structural factors, and two were constructed. The way that participants identified these aligns with previous literature, which also tends to categorize intersectional factors as micro-level or personal identity and macro-level or structural. Less intersectionality literature identifies the third category of socially constructed identities, although literature about stereotypes identifies some of these and their detrimental effects for women in hiring (Hill *et al.* 2010 chapter 3, Moss-Racusin *et al.* 2012 and Reuben *et al.* 2014). However, participant experiences in this study highlight the outcomes of socially constructed and attributed identities. In some cases, fictional personal identities were constructed (e.g., weakness or delicateness) based on real personal attributes (e.g., gender and age). This created additional challenges for women's opportunities in fieldwork.

TABLE 4 *Intersectional factors and identities identified in two countries with examples of nuance within each category (personal identities: community and ethnic group)*

Identity Factor (level/type)	Contributing Attributes	Participant Examples	Country
"Otherness" (Personal Identity)	International status (or lack thereof) can affect perceptions of an individual	*"It's in our subconscious. When a foreigner comes to work in Peru, automatically, it's like they're smarter, they're going to earn more money, they will not start at the bottom, they're going to get director's positions right away."*	Peru
	Different ethnic minorities may have different privileges and disadvantages	*"There are ethnic minorities… they used to say lower caste women. …there is caste system in Nepal, and there is discrimination among castes, and so for low caste women, there is also another group."*	Nepal
	Participants emphasized connection with land as a key aspect of Indigeneity in Nepal	*"Indigenous peoples have their own identity. They have their own customary practices, but these aren't understood by other communities."*	Nepal
Language/ accent (Personal Identity)	Language can be a barrier if one does not speak the language used in education and work environments, but speaking multiple languages can also bolster one's resume	*"…they're a very good worker, but they won't get a very good job because they cannot speak very well in any language, in Spanish or English. …their mother language is Quechua…"*	Peru
	Individuals can experience discrimination based on their accent	*"The issues are accents… I can't speak Nepali properly."*	Nepal
Religion (Personal Identity)	Religious practices and beliefs can grant power to some groups over others and influence social interactions	*"Yes, of course, they are sometimes kind of hesitant, because of their cultural perspective. For example, with women from Islam religion, they have concern not to see the face of men, so when they talk, they are not seen."*	Nepal
	Religious practices and customs can influence education opportunities	*"It's quite balanced. …where I'm teaching, it's at almost the northern part—the most north part of Cameroon. Over there, the population is Muslim, and it's already very difficult for women to have education in there, and so it's an incredible thing for me to realize so many women were able to be at the university and be able to follow these classes because it's quite a difficult subject too."*	Cameroon

Previous intersectionality-framed work in natural resource management and STEM inclusion has identified diverse intersectional factors and identities. These include structural factors ranging from access to resources and differential vulnerabilities to gender roles, livelihoods and migration patterns (Colfer *et al.* 2018 and Djoudi *et al.* 2016). Previously identified personal identity factors include race, ethnicity, caste, place of origin, gender, sexual orientation, (dis)ability, age, education, religion, occupation, political party, ownership of land, and social and economic capital (Colfer *et al.* 2018, De Vita *et al.* 2016 and Djoudi *et al.* 2016). Many of these factors were reported by participants in the present study. Participants also identified less common factors in the intersectionality literature such as profession-based identities and socially constructed identities (e.g., weak or delicate).

Effects of the three identified categories: Personal identity, socially constructed, and structural intersectionality factors

Participant experiences demonstrated how intersectional identities and structural factors can help and hinder engagement in FCM.

Age

Age is a fluid personal identity possessed by everyone and was discussed as an advantage and a disadvantage. Some participants valued a group with diverse ages and backgrounds for problem solving. Increased innovation has been linked to diversity in the ages of team members (Mothe and Nguyen-Thi 2021), as well as diversity in higher education and ethnicity

(Mohammadi *et al.* 2017). Others reported difficulty in fieldwork when they were seen as either too young to lead or too old to be physically capable. Notably, age was reported by participants as a barrier only for women, providing an example of two intersectional identities, age and gender, creating more barriers taken together than they would separately. Women leaders and managers in the United States and Europe have reported challenges with age, including hiring and promotion discrimination, more harassment experienced by younger women, and all women being seen as the wrong age, no matter what the task (Jones and Solomon 2019, Jyrkinen and McKie 2012). Additionally, age did not seem to mediate the challenges women faced throughout their careers in striving to be both liked and assertive at work (Jones and Solomon 2019).

In Nepal, participants indicated there are policies that limit the age of applicants for government positions, but the details of those policies seemed unclear to some of them. These policies may be particularly detrimental to women, who are more likely than men to take time out of their careers to focus on the care of children and elderly family members – meaning that when they apply for jobs they might be considered 'too old.' Participants indicated that newer policies exist to increase the age limit for women, but age may still be a limiting factor in their opportunities.

Perceived physical capacity

Capacity to endure difficult and dangerous terrain cannot be known just by observing an individual's physical appearance. However, managers, leaders and co-workers sometimes constructed identities of weakness or delicateness and applied these to women scientists. These constructed identities created an additional barrier for women to do fieldwork across Peru, Cameroon and Nepal. This finding speaks to a wider discussion about women's experiences in, or exclusion from, fieldwork. Traditional notions of masculinity, including the necessity for exceptional speed and strength in fieldwork, create bias against women. However, these qualities are not paramount to success in most fieldwork settings and simply contribute social barriers to those who do not fit this socially constructed ideal of a field scientist (Bracken and Mawdsley 2004). Additionally, assumptions about physical strength were made based on factors beyond gender, such as age and where an individual came from, further complicating who was assigned an identity of weakness and to what extent. For example, a thirty-year-old woman from a high elevation region may benefit from a combination of identities including age and geography (physical capacity from living at a higher elevation) that mediate the perceived weakness ascribed to her due to her gender.

Geography

Affiliation with the capital or a foreign place was reported as a status-enhancing identity by participants in Peru. As written in Babb (2022), elevation is a measure of social status in Peru, where Lima at sea level has the highest prestige, and there is a stigma toward people from the mountain provinces. Our results are consistent with those of Babb (2022) that this social imbalance is particularly salient in the context of high rates of migration from the provinces toward the capital city. However, a reported benefit of living at higher elevations was the perception of better stamina to do fieldwork both in the mountains and at low elevations.

Beyond the consideration of where a person is from within Peru, participants also reported the effect of social prestige gained from having lived or studied in another country, with individuals who had this experience being more likely to be offered better job positions. Studies in other countries have also found that experience abroad influences outcomes in obtaining work; however, the value drawn from experience abroad varies depending on the country of origin, country in which one studies, and the prestige of the university (Lulle and Buzinska 2017 and Jiang and Kim 2019). This is consistent with our finding that the same experience can attribute different amounts of cultural capital depending on the individual's nationality and other identities. To highlight this point, a study in the United States context found no difference in career outcomes from studying domestically or abroad (Schmidt and Pardo 2017). However, in the context of Peru, participants perceived that foreign professionals in particular, but also those with international experience, rise to leadership positions more quickly than Peruvians with no international experience.

In Peru, the ability to attend training sessions was less influenced by the rural/urban divide than might be expected because of the quotas for people from each of the provinces to participate. However, participants across the three countries reported difficulties for those in rural areas to access forestry training, education, jobs, resources and social networks.

Participants across all three countries experienced discrimination based on the languages they spoke or didn't speak, as well as their accents, in education and professional settings. Accents may trigger bias based on the assumptions made about an individual's accent and other identities they may hold. An intersectional lens encourages consideration of how a person's accent or repertoire of languages are perceived in the context of their other observable and socially constructed or assumed identities. Accents may signal nationality and class (Opara *et al.* 2020) as well as trigger discrimination when the accent does not match the dominant one (Nelson *et al.* 2016). Further, women with foreign accents face greater discrimination than men (Nelson *et al.* 2016).

Indigeneity, local people, and collaboration incorporating different knowledges

Participant examples consistently demonstrated the importance of not assuming homogeneity of any social group. Participants in this study and previous literature indicate that among Indigenous peoples in Nepal, variation exists in social status, privilege and access to resources (Khadka *et al.* 2014). Although policies existed in some countries around the rights of Indigenous peoples, participants reported that this has not

produced desired results from the perspective of Indigenous groups. Work remains to be done to bridge the gap between Indigenous groups and policy and decision-making processes. Indigenous women's ethnobotanical knowledge in particular has been undervalued in the past and can contribute positively to conservation efforts (Howard 2003).

Nepal's unique context of community forestry demonstrates some of the challenges in integrating local knowledge with Western science. In cases where the scale of local knowledge and Western scientific knowledge are different, political decisions assign privilege to one type of knowledge (Ahlborg and Nightingale 2012). When Western knowledge is privileged, individuals with the ability to access it (generally literate, high-caste men who do not tend to frequently work in the forest) wield the power associated with understanding this perceived higher-valued knowledge, placing those with more local knowledge in less powerful and valued positions (Ahlborg and Nightingale 2012). In the present study, participants in Nepal reported that government forest offices can be a day's walk from villages. This distance creates both physical and conceptual separation between the government's and communities' knowledge systems.

Participants in all three countries reported value in increasing the inclusion of local and Indigenous people in forest carbon monitoring work, often citing how local and Indigenous knowledge and scientific methods could complement each other to produce fuller understanding and more accurate results, in agreement with Kankeu *et al.* (2020). Increased collaboration across different knowledge systems creates potential for a larger and more accurate base of scientific information to inform policy. Despite recognition of potential benefits, participants in this study gave few examples of this collaboration happening in practice. In Southeast Cameroon, Kankeu *et al.*'s (2020) study showed that local people had experience using tools such as compasses and GPS, and their guidance both saved researchers time and improved accuracy and detail in observations. One challenge noted were errors in filling out forms, which the authors attributed to lower educational levels among local people (Kankeu *et al.* 2020).

The participation of Indigenous and local women is another key topic in the literature (Bradley *et al.* 2013, Evans *et al.* 2017, Howard 2003 and Khadka *et al.* 2014). It can be beneficial for outside entities to be sensitive to current conceptualizations of gender within communities. One project to promote Indigenous women's involvement in community forestry decisions in Nicaragua reported tension between preserving cultures and introducing foreign concepts about gendered participation (Evans *et al.* 2020). The results of the current study indicate the importance of understanding unique social and historical contexts of communities. Participants described some communities where women currently or historically held leadership roles. This context can help guide how issues of gender equity are approached. In communities where women historically held leadership roles, this may mean a return to traditional practices instead of the integration of a Western conceptualization of gender equity.

Balancing family and career

Participants in this study considered multiple factors simultaneously such as age, starting a family and geography. They reported that access to education for women is unequal due to structural factors such as whether women live in rural or urban areas, their family's wealth, and the societal norms and expectations within their communities. Similarly, factors of marriage and motherhood may be prioritized differently across geographic regions, affecting the timing and length of their education and later their participation in field activities.

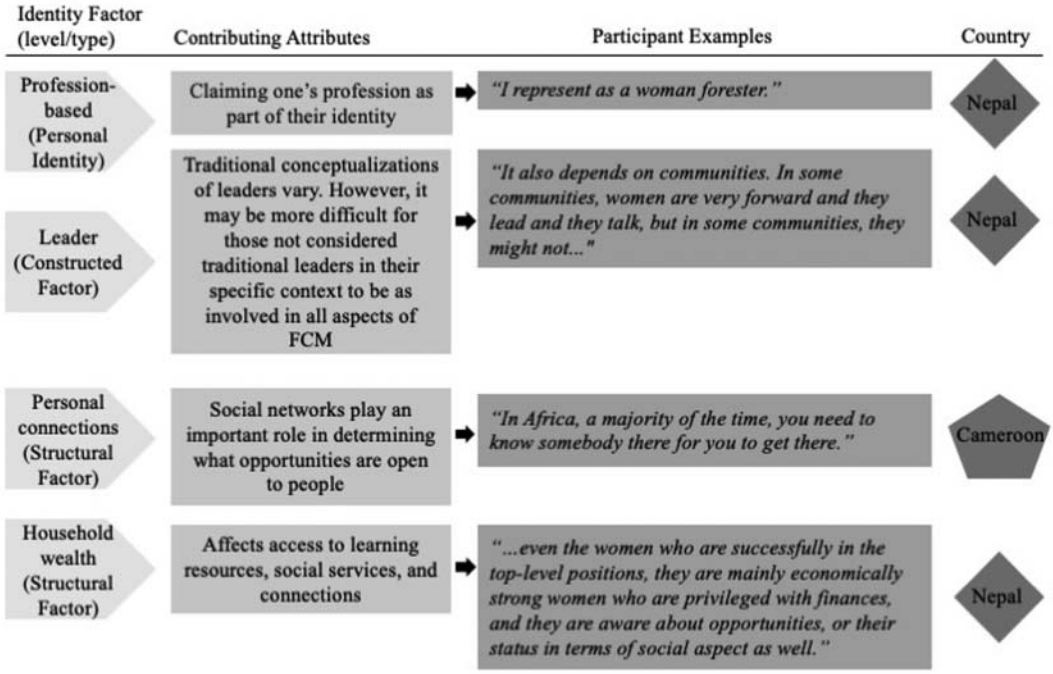
Participants in our study reported that women often have additional responsibilities at home compared to men. A study of Peru, Mexico and Ecuador identified that women perform fewer hours of paid work compared to men, but they perform more hours of unpaid work, childcare, other care and total work (Campaña *et al.* 2017). The present study indicates that while some women did have less time to devote to their professional careers, supervisors' assumptions that all women have limited time to devote to their careers may hurt women's professional opportunities, whether or not the assumption is correct in the individual case. For example, supervisors at times remove women from projects or assign women fewer responsibilities than men who perform at the same level, putting women at a disadvantage for promotion. Demanding work hours, greater contributions to family and household care, prioritization of partner's careers and stigma around parental leave are contributing factors in underrepresentation of women in STEM (Beddoes and Pawley 2013). In the United States context, a panel survey found that 43% of women and 23% of men left fulltime work in STEM fields 4–7 years after having or adopting a child (Cech and Blair-Loy 2019), which mirrors our participants' experiences of additional challenges in maintaining their careers in FCM after having children.

The complexity of identities

Some identities blur the line between social factors and personal identities. Participants described stereotypes about women that are socially constructed and attributed to a woman's personal identity. In other words, social actors constructed or accepted stereotypes around women's identities. They also construed generalized and socially constructed identities onto women in FCM, which were often not true of all women. Thus, women in FCM may face discrimination based on identities that are not their own but are placed onto them by society. Examples included perceptions that women are not strong enough to perform fieldwork, or that women are not naturally capable of using technology. Participants explained that in some cases, hearing these stereotypes numerous times can make women accept them as a real part of their identities, too.

However, identities consisting of what are traditionally considered challenges are sometimes enablers. One Indigenous woman forester explained how her identity enhanced her ability to communicate with local women. Additionally, her visibility in that role made her a role model for other women in the community, as well as a representation of an Indigenous woman forester in the professional sphere (Table 5).

TABLE 5 *Intersectional factors and identities identified in one country with examples of nuance within each category (personal identities, constructed and structural factors: social standing in community)*



*FCM = forest carbon monitoring

CONCLUSION

Half of the intersectional identities and factors identified by participants transcended all three countries, despite differences in cultural context. However, different facets of the same factor were often discussed in each country, and in some cases, the same factor was talked about differently by individuals within the same country. Other identities and factors emerged uniquely in one or two countries. Often, these identities and factors conferred positive, negative, or some of both types of effects on individuals who held or were perceived to hold them. Bias occurred when one or more intersectional identities (e.g., age, gender) was used to draw a conclusion about an individual, or if an additional identity characteristic (e.g., weakness) was socially constructed and assigned to an individual.

Gender is but one intersectional factor that influences the opportunities and experiences of individuals. In general, women are less likely to be involved in FCM than men in SilvaCarbon partner countries in the Latin America, Africa and Asia regions. This is an area that can be improved from an equity standpoint as well as a practical standpoint, i.e., increasing diversity of thought and life experiences of people working on scientific challenges leads to more creative solutions (Apesteguía *et al.* 2011, Díaz-García *et al.* 2013 and Hofstra *et al.* 2020).

A better understanding of the intersectional factors that help or hinder women's participation in FCM, a field that applies STEM topics to climate change mitigation efforts across forested countries, can help inform programs to increase the quantity and quality of women's participation. Participants suggested a range of actions to address the challenges they experienced. Similar to the different levels at which challenges were reported, solutions provided by participants ranged in scale from micro (individual) to meso (workplace) to macro (national or international). For example, solutions suggested included supporting working mothers by providing childcare and flexibility in work scheduling to accommodate non-work responsibilities, zero-tolerance harassment and discrimination policies in workplaces, and national and international networking groups for women in forestry. Another example highlights the importance of mentorship and representation for women in FCM as socially constructed stereotypes, which are either false or poor indicators of professional success, can be internalized and create self-doubt.

Participants' experiences demonstrate that gender is only one factor influencing opportunities and experiences for individuals working to begin and maintain a career in FCM. An intersectional lens brings into focus the resources and social circumstances needed to participate in FCM and helps identify how access to these is facilitated and impeded. Personal identities, structural factors, and socially constructed identities all work in conjunction to simultaneously limit and enhance each individual's avenues into and through this field. Pervasive negative stereotypes can be internalized and create self-doubt, adding an additional challenge particularly for early-career FCM professionals in underrepresented groups. Based on these findings, gender equity initiatives may benefit from; 1) considering women as a heterogenous group, with each individual bringing their own unique mix of personal identities and circumstances, 2) learning about the social and historical context of communities to better understand the

history of women's roles in leadership to inform discussions around gender equity, and 3) remaining aware of personal biases and differing conceptualizations of gender equity so as not to impose external values on local communities. Intersectionality studies in general may benefit from expanding from personal identities and social factors to including a third category of socially constructed identities or stereotypes. This third category allows for the consideration of identities that individuals may not claim for themselves, but are still part of how they are perceived and so influence their opportunities and experiences.

Interviews with each participant provided rich detail from the perspectives of these FCM professionals, who shared insights into the areas that were important to their lived experience. Participants reported a range of experiences, not all of which were discussed in this paper. For example, some comments about danger in fieldwork and harassment in the workplace were not included in this paper to protect study participants' privacy. In general, these comments were about risks for women to be harassed or assaulted during field work, particularly by men also involved in the work. Continued inquiry with expanded research methods will complement the strengths and weaknesses of qualitative methods used here. This exploratory study used semi-structured interviews, providing deeper insight into fewer individuals' experiences. This method provided specific examples and a better understanding of the patterns of perceptions and experiences of participants in three unique contexts about gender and other factors that contribute to barriers or supports for engaging in FCM work.

ACKNOWLEDGEMENTS

This study would not have been possible without the assistance of many individuals and the participation of interviewees, who were also invited to review the results and analysis and provided feedback and clarifications. We gratefully acknowledge the helpful inputs from the editor and reviewers. Many thanks to many other reviewers and contributors at Global Forest Observation Initiative, SERVIR, SilvaCarbon, U.S. Agency for International Development, U.S. Forest Service, and U.S. Geological survey for their support, and to Anna Levine for assistance with data collection. Any use of trade, firm, or product names is for descriptive purposes only and does not imply endorsement by the U.S. Government.

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