9 Seeing the World Through Maps: An Inclusive and Youth-Oriented Approach

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Abstract

Through YouthMappers, young women students are able to design and participate in activities that collect, create, and disseminate spatial data and information to prepare spatial databases and maps for visualization, analysis, planning, and decision-making in their local communities. Because the field of geography is dominated by men, the contributions, needs, and priorities of women are frequently overshadowed and ignored. We cannot imagine a society labeled as fully mapped if it does not represent all its members. Through its innovation programming, YouthMappers aims to engage future generations of women mappers to reduce inequalities (SDG 10) and support gender equality (SDG 5).

Keywords

Gender · Equality · Women · Nepal · Everywhere She Maps

1 Maps and Their Makers Often Exclude Women's Perspectives

> Oftentimes the world of women cartographers seems to be hidden, much like the so-called dark side of the moon.

Will C. van Den Hoonaard wrote this in his book, *Map Worlds: A History of Women in Cartography* (published by Wilfrid Laurier University Press), which was shared by Cathy Newman on her blog post for National Geographic, "Mapping Out the Hidden World of Women Cartographers." Many women have contributed significantly to the fields of mapmaking, GIS, surveying, geospatial technology, and more, but oftentimes those who write history and control resources fail to mention their names. The contributions and names of some

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women geographers may be lost entirely and their work made invisible by institutional and individual gatekeepers of geographic knowledge. Vincent Varney featured three often forgotten women geographers on his blog in a post titled "3 Women Mapmakers Who Changed the Way We View the World," including Marie Tharp, Kira B. Shingareva, and Florence Kelley. Marie Tharp was an oceanographic cartographer who created the first scientific map of the ocean floor. Florence Kelley was a social and political reformer who created a map of Chicago showing demographic information that helped improve the lives of residents living in poverty. Kira Shingareva was the first cartographer to map the dark side of the moon. They revolutionized the cartographic field and helped us change our perspective of how we conceive the world. But sadly, very few of us discuss their names when we talk about innovative and leading cartographers.

> Maps are representations of the world. Whoever is making the map is showing what they are perceiving that reality to be, they are privileging and prioritizing elements and attributes. Having a more diverse range of mappers means we actually have richer information on those maps – not just for the women to use, but for everyone.

Maps have always been symbols and instruments of power that strive to represent the reality of our world, a sentiment captured in the quote above from YouthMappers co-founder and director, Dr. Patricia Solís. Clearly, it requires great effort from engineers, cartographers, and volunteers to design maps that we use in our day-to-day life, from finding the best route during the busiest time of the day to having a parcel delivered to our footsteps. Humans have made maps from the earliest periods of our existence, but what is needed now is a much stronger focus on inclusivity. Inclusiveness in maps ranges from involving people of different races to people of different genders to people of different economic standards to people of different age groups. A global map should represent everyone, regardless of their origin, color, race, gender, ability, or ethnicity.

Maps are essential to many sectors and should contain more diverse data. For this to happen, increasing diversity among mappers is vital. Gender inclusion in maps seeks to contribute to the global community by collecting and creating critical data to amplify evidence-based interventions that can be sustainable, impactful, and scalable (Moloney 2020).

Because the field of geography is still dominated by men, the contributions, needs, and priorities of women are frequently overshadowed and ignored. This problem is visible in both the OpenStreetMap (OSM) database and the network of communities built around OSM. OSM contributors aren't asked about their gender when they create their account and establish their username, so it is impossible to know exactly how many women or nonbinary people add data to the platform. However, based on the results of a 2021 survey hosted by the OpenStreetMap Foundation, it is safe to estimate no more than approximately 8% of OSM contributors fall in these categories. Some experts estimate that as few as 2–5% of contributors are women or nonbinary. In this era of an increased focus on inclusivity, women are still significantly underrepresented in the geospatial industry. By comparison, YouthMappers engage a much higher rate of female and nonbinary mappers: Some chapters are 100% women, and overall among the nearly 300 chapters in 60+ countries, estimates of female participation fall in the range of 35–45%. While there are many other steps to take to ensure full participation and inclusivity, YouthMappers has shown through its design and programming that it could be a mechanism to potentially reduce inequalities for mapping, OSM, the fields related to geography, and technology in general. But what is even more important are the potential outcomes that inclusive spatial data created by an inclusive community could generate.

2 Missing Data → Missing Representation → Missing Societal Development

Accurate and complete data is critical to the success of development initiatives and to all of the SDGs. Data users range from simple route navigators to policymakers and planners. But what if the data we rely upon miss critical information? Even riskier, what if we are unaware of the impact of missing data? Sadly, this is often the case of our present world.

In 2019, Melinda and Bill Gates (2019) included the following thoughts in their annual blog post:

> Data helps us create goals and measure progress. It enables advocacy and accountability. That's why the missing data about women and girls' lives is so harmful. It gets in the way of helping them make their lives better. The data we do have – data that policymakers depend on – is bad. You might even call it sexist.

We cannot imagine a society labeled as fully mapped if it does not represent all its members. The work needed to collect and analyze data can seem tedious. But what's not tedious is using this data to empower millions of women and girls. When women map, they are more likely than men to represent women's specific needs and priorities, which is key to driving changes in local policies, plans, and budgets.

Geographic attributes, details, and services that are important to one group of people might be overlooked by other OSM contributors, which ultimately results in a biased map. Data cannot be decoupled from the biases of those who create, collect, and analyze them. Services such as bus parks, childcare, women's health clinics, safe routes at night, washrooms, police stations, streetlights, and organizations that specifically help women may be overlooked by men mappers and absent from OSM due to the lesser number of women mappers involved.

Aishworya Shrestha, a research assistant at Kathmandu Living Labs, a leading civic-tech organization in Nepal, told us the following:

> Since data drives most of our world today, algorithmic bias plays a huge role in what is perceived as "real" and to what extent it is real. These are not gender specific problems, these are societal problems. It's not the battle of the sexes, it's a struggle between all of us and the power system. We need more inclusive data for the world to be more inclusive. Here, merely being NON-SEXIST is not enough, we need to be ANTI- SEXIST.

The unsafe streets of the cities and towns can be mapped using, in part, OSM data, which not only helps secure the well-being of individuals using the maps but can also provide important insight to planners and policymakers who seek to address security problems. Details shown by more gender-equal maps can help planners and policymakers identify the changes to improve public spaces, services, and facilities in order to make the community a better place for everyone.

3 Bridging the Gender Gap Through Everywhere She Maps

In 2020 YouthMappers launched the Everywhere She Maps program with the aim of increasing women's participation in the network and strengthening the inclusiveness of the geospatial community to ensure women's perspectives are represented in apps, websites, and mapping platforms. Through Everywhere She Maps, the next generation of women mappers will build their technical capacity, enhance their professional and networking skills, and contribute to mapping projects focused on adding data relevant to women's needs, with the effect of improving security, saving lives, spurring innovation, and increasing prosperity. The figure below illustrates the four interconnected core activities of Everywhere She Maps (Fig. 9.1):

3.1 Professional Development and Internship Matching

Women and nonbinary individuals who pursue careers in geography, data science, technology, and other STEM (science, technology, engineering, and mathematics (STEM) fields often face challenges due to their gender. Just a few of the many barriers to women's full participation in these fields are:

- False stereotypes about women's ability to perform and their men counterparts in STEM courses and careers.
- A lack of women in leadership roles in university geography departments and the geospatial industry, for example, only 22% of GIS executives globally are women (*GIS Lounge*).
- Paternalistic perceptions among some employers that women should not be allowed to con-

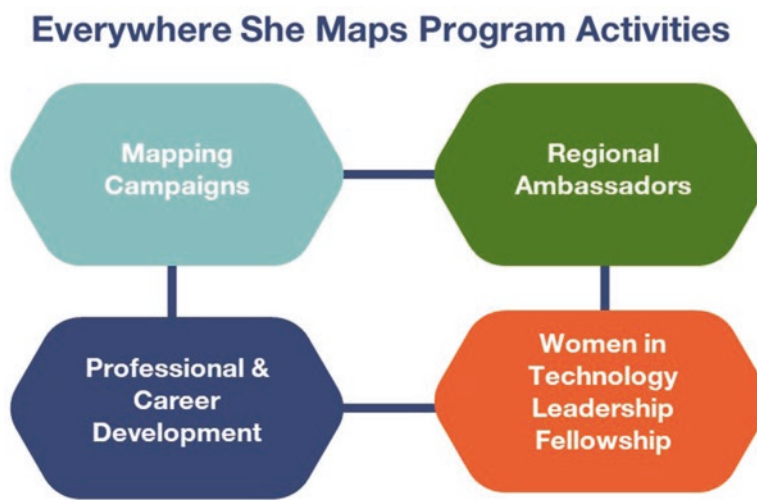

Fig. 9.1 Four interconnected core activities of Everywhere She Maps appear in the framework designed for the project

duct geographic fieldwork for the women's own safety.

- Impostor syndrome, which is especially common among women, who are more likely to doubt their own abilities and skills when they work in fields dominated by men.
- Unequal distribution of domestic and care labor between women and men: Globally, women spend about 4.2 h daily on domestic and care work, while men spend about 1.7 h. As a result, women have less time to participate in extracurricular activities – such as attending an OpenStreetMap training after class – while they are university students and to engage in networking, volunteering, and other critical career-building activities once they graduate.

To help women and nonbinary YouthMappers students overcome these barriers, we have developed an Internship Match program and series of online professional development sessions. Through the Internship Match program, Everywhere She Maps pairs qualified YouthMappers participants who identify as women or nonbinary gender with internship opportunities from YouthMappers' partners that will allow them to develop professionally and strengthen their geospatial and technology skills as they help their host organization achieve its goals.

3.2 Mapping Campaigns for Gender Equality

Everywhere She Maps is also leading mapping and geospatial data activities that invest in women and girls' security, livelihoods, prosperity, and participation in innovation and the digital economy.

One of our current mapping campaigns includes mapping rural locations in Sierra Leone, Nigeria, and Niger to increase remote communities' access to adequate electricity. Power distribution networks in these countries are scarcely mapped, especially in rural locations. Mapping buildings helps us know where residents who use electricity live, and mapping roads provides a strong inference for where power lines are likely to be. This data will be used for electrification planning by the Ministry of Energy, national utilities, and other energy sector stakeholders in the target countries. Women and girls will especially benefit from access to modern and affordable energy in remote communities.

3.3 Women in Technology Leadership Fellowship

YouthMappers' Leadership Fellowship program brings together YouthMappers student leaders, partners, and staff from around the world for two

weeks for an intensive, in-person, leadership development training. Everywhere She Maps will adapt this model to design and implement a Leadership Fellowship for Women in Technology (WiT).

The Fellowship workshops will cover topics such as challenges faced by women geospatial professionals and WiT as they prepare to enter and develop professionally as members of fields that have historically been and currently are male dominated, the principles of intersectional feminism and the unique challenges faced by women of color and women from the Global South, and the opportunities available to participants as they define and work to achieve their professional and personal goals.

Everywhere She Maps will also assist Women in Technology Leadership Fellows in receiving placement for external internships, fellowships, and employment and empower them to lead efforts to increase the number of OSM edits made by women and nonbinary YouthMappers chapter members.

3.4 Regional Ambassadors

Everywhere She Maps engages eight regional ambassadors from Asia, Africa, and Latin America who conduct outreach, host trainings, and provide mentorship to YouthMappers chapters in their region of focus, with the goal of increasing women's participation in the chapters and in OSM editing activities. These ambassadors are highly accomplished and respected members of the YouthMappers network and serve as inspiring role models for other YouthMappers students who are women or nonbinary (Fig. 9.2).

Airin Akter serves as an Everywhere She Maps regional ambassador in Bangladesh. She is a well-recognized leader in YouthMappers and OpenStreetMap and serves as a senior research associate for Capacity-Building Service Group in Bangladesh. Below, she shares her experience as part of Everywhere She Maps (Fig. 9.3):

Fig. 9.2 Team members take a drone selfie

Fig. 9.3 Everywhere She Maps Regional Ambassador participating in a training in women empowerment

Being a small-town girl, I have always dreamt to be a changemaker. After getting admitted to the University of Dhaka, Bangladesh, I started participating in different projects, unaware that women were considered less productive in various sectors of job and education. In the course of exposing myself to available opportunities, I initiated the mapping in OpenStreetMap. In 2016, we started YouthMappers chapters at the university. Afterward, I began to organize activities like mapathons with some of my fellows. It was the first time I experienced sexism when many of the male students started humiliating me, 'Oh!! That girl!! What would she do? This program seems like a disaster to them!' Rather, I took those comments as the fuel to expand more, to prove of being capable.

During my Master's, I took the course 'Gender Development and Environment' in which I got to know more about gender equality, and it attracted me a lot. At that time, YouthMappers published their Research Fellowship Program, where I applied under the supervision of one of my professors. She instructed me rigorously, and I happened to get selected as one of the YouthMappers Research fellows where my study was about Gender Equality and Awareness of Climate Change. And then comes the Everywhere She Maps Project. I am overwhelmed to get selected as one of the regional ambassadors under this project. I have learned many things about Gender Equality and Equity. What allures me is "Engaging Men in Women's Empowerment" which is a new thing to me. When I completed the training, I was fascinated by thinking about the dimension of the idea. If you want to empower women, you need to engage men in this campaign as women and men are essential parts of society.

4 Breaking Stereotypes: Mapping Modi Gaupalika

Shraddha, co-author of this chapter, first learned about OpenStreetMap (OSM) during Open Data Day 2016. Open Data Day is an annual celebration of open data with events around the world. Since then, she, along with her friends Kshitiz, Sovas, Susmina, and Sandhay frequently heard about the applicability of OSM in post-disaster response activities and humanitarian activities. However, they hadn't had the opportunity to use it themselves, until one of the group members came up with the idea to start a project called

"*Mapping Modi Gaupalika*." Here, Shraddha tells the story of the project from her perspective.

The main objective of this project was to collect, create, and disseminate spatial data and information to prepare spatial databases and maps for visualization, analysis, planning, and decision-making in Modi Rural Municipality. We officially started "*Mapping Modi Gaupalika*" at the end of September 2018, and we collaborated with the municipal bodies of Modi for the smooth execution of the project.

Kshitiz was the leader of the project and a resident of the municipality. At the end of September, we received a call from Kshitiz that we were ready to begin with a field survey as the first step of the project. We were informed that it would take us approximately a month to collect the data and were supposed to travel the whole municipality on foot. "*How are we going to be treated?*", "*Are the routes even safe to travel?*", and "*What if we don't get proper food and a warm place to sleep?*" were just a few of the questions that lingered for days. With all the doubts and confusion, we asked our parents for permission. Surely, being overprotective Nepali parents, they were skeptical about our travels. They were concerned about our safety; however, we were able to convince them. Being female, our greatest fear was menstruation and its rituals that have been followed in Nepal for ages. Generally, people are strict when women menstruate. We must follow an arbitrary set of values that restricts our activities from the kitchen to the temples. So, we had a constant mental fear of how people would perceive the issues if it happened to us during our time in the field.

The next big question was about security. We had to travel through the forest, the paddy fields, dusty motor roads, and foot trails that were not traveled often. But the reality turned out to be so different from our fears. We had a wonderful time traveling through the villages (Figs. 9.4 and 9.5).

We collected information regarding institutions, health facilities, religious places, community centers, governmental offices, roads, foot trails, tourist attractions, agricultural farms, and more using a GPS survey. We used self-developed mobile applications for the survey. After completion of the field survey, we uploaded the data to OpenStreetMap. Then the data was preprocessed, checked for redundancies, filtered, formatted, and finally validated. The next step of the project was to prepare different kinds of thematic maps for which we used Quantum GIS (QGIS). Our final output contained various types of maps visualizing the following types of data: administrative boundaries of each of the eight

Fig. 9.4 We jump for joy when data collection is complete

Fig. 9.5 The team enjoys the scenic view from Poonhill after completing data collection

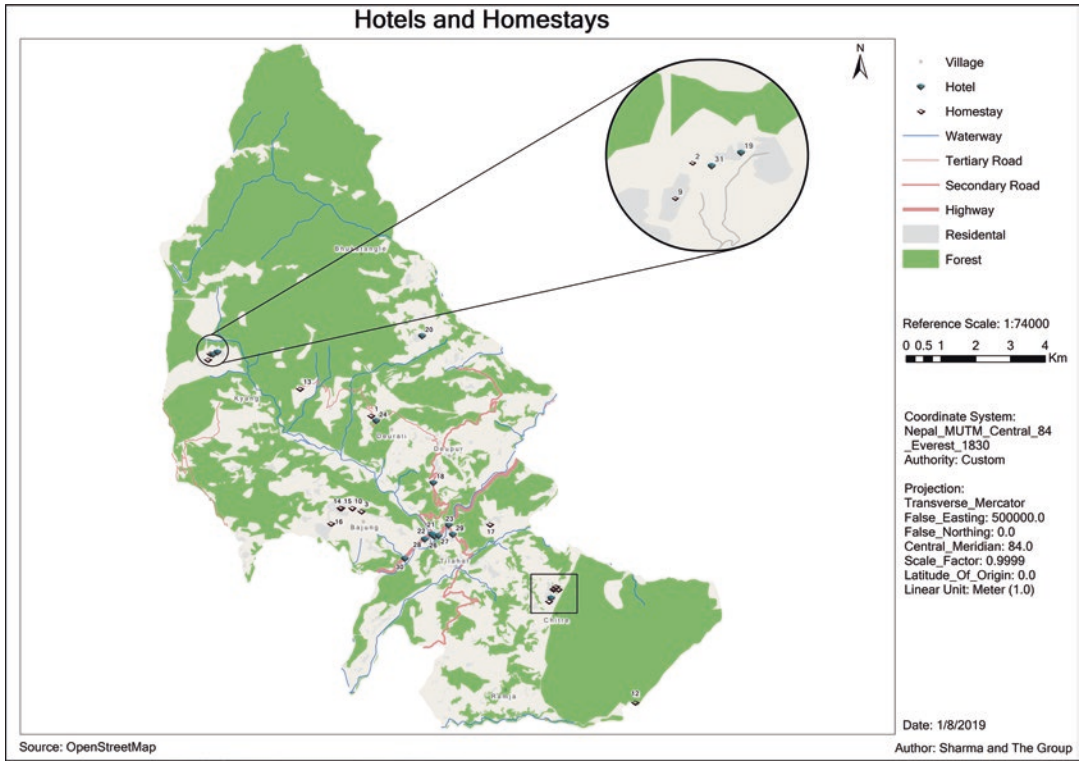

Fig. 9.6 Maps visualize hotels and homestays of the rural municipality and provide a transparent, open source of information for the whole community

Fig. 9.7 The municipality uses the resulting maps for the construction and maintenance of drivable roads

wards and demographics by ward, including population, population density, number of households, and literacy rate (Fig. 9.6).

4.1 Impact on the Community

The end products of the project formed the basis for spatial decision-making for various stakeholders across the wards. All the data was uploaded to OpenStreetMap and could be updated easily. The municipality used the resulting maps for the construction and maintenance of drivable roads. It also became easy for them to monitor the quality of education and the quality of services provided by various organizations and institutions. Data was also now available to help to promote tourism. We uploaded the contact information of homestays and the hotels, which helped tourists contact them more efficiently. The locals also used the maps to find an alternative route during landslide incidents. Because these maps existed in an open spatial platform rather than relying on the tabular information in the municipality profile documents, there was accountability and transparency to the users and community (Figs. 9.7 and 9.8).

5 Achievements

Being female and growing up in a patriarchal society, we had heard a lot about how we were not suitable for fieldwork in our profession. Regardless of our capacity, we were frequently demotivated by these harmful stereotypes. Our safety and our strength were so-called barriers to our succeeding in our profession of choice. We took the courage to break the stereotype and went to the field. Walking through the rough terrain and dense forests and interacting with the people made us realize how wrong we were to doubt our strengths. We realized that regardless of gender, race, origin, and ethnicity, all human beings are equally capable. Not only did we change our own perceptions of ourselves – we were also able to change the perceptions of our parents and other people around us.

One of our proudest moments was inspiring the local girls to engage in professions like ours, which required frequent field visits. They were curious about our work and asked if they could pursue careers like ours. We could see ourselves in their positions, as we too had similar doubts before we set on this journey. We encouraged them to pursue their dreams and tackle the chal-

Fig. 9.8 Locals also use the maps to find alternative routes as options during landslide incidents

lenges that hinder women's involvement in field and technology-based careers.

6 Women in the Spotlight: Hearing from the Ones Leading the Chapters

Shraddha interviewed several women leaders of the Geomatics Engineering Students' Association of Nepal (GESAN) YouthMappers chapter about their experiences and perspectives on inclusivity and mapping. Their stories illustrate the powerful impact that YouthMappers' participation and leadership can have on a student's life and are reminders of the importance of ensuring women and nonbinary people have equitable access to the YouthMappers network. Sandhya Dhakal, vice president (3rd Executive Committee), shared the following:

I served as the vice-president of Geomatics Engineering Students' Association of Nepal, an inaugural chapter of YouthMappers for a year. The tenureship was full of passion, motivation which helped me enhance my communication and presentation skills as well as build up my confidence. We, the GESAN family conducted various programmes like mapathon, ArcGIS Training, Open Data Day Celebration, OSM training etc., where the whole team united wholeheartedly for better results. I participated in the programme 'Empowering Women in Geospatial Information Technology' organized by the International Centre for Integrated Mountain Development (ICIMOD) as a GESAN representative. There, I learned various programming and spatial analysis skills which I shared enthusiastically with my juniors through the chapter. In addition, we also published the yearly magazine 'Geoworld-II' overcoming numerous obstacles. As beginners, we lacked behind in many aspects such as proper strategies and abundant links. But the unity, dedication and zeal of the team finally led to the successful publication of the magazine which refined us in interpersonal, mana-

gerial, and professional capabilities. The chapter helped enhance the geospatial knowledge in Geomatics Engineering students, provided a platform for exposure of different issues as well as bonded all students as a single family.
Being a vice-president, I learned to conquer my insecurities and thrive in difficulties. It left me with a remark that the bond among the diverse people is what really matters in the prosperity of an organization.

Saugat Nepal, secretary (6th Executive Committee), told us:

I am currently working as a secretary for our YouthMappers Chapter, Geomatics Engineering Students' Association. Initially, I had very little experience about leadership and conducting a program. In November of 2020, I got to be a part of the 5 days Innovation Bootcamp program held at our campus. After the participation, I was very much inspired and wanted to implement the learnings. GESAN was the perfect opportunity for me to execute those. There were some slight reservations about if I was fit for the role, but my passion and hunger to serve for the chapter were the positive assets by my side.
After becoming the secretary of GESAN, our team has worked collaboratively and has organized various programs from which we have got positive responses. The responses really motivated us and pushed us harder to thrive for higher pinnacles. At the end of our every program, we used to take feedback as well as suggestions from participants which helped us to improve the program strategy as well as to fix our next move. We had to face a pandemic during our tenure: lockdown all over the world. Despite the challenge to be physically present, we were all motivated to follow in the footsteps of our previous committees and thus conducted programs like OSM training, Web Mapping, Drone data processing and many more virtually. We faced some issues in our very first virtual program, but those were the learning outcomes for us to improve as a committee. We had organised almost 10 programs during lockdown collaborating with many organisations like Kathmandu Living Lab (KLL), IT Maps, Naxa, and Geo 3D Modelling. Continuing the trend of our organisation, we also published the fourth volume of our annual GeoSpatial Magazine, "GeoWorld" which contains articles related to the Geomatics Field, interviews of the reputed personalities related to our field as well as suggestions from alumni.
While being a secretary, I got the opportunity to learn, teach, implement as well as sharpen my leadership skills. I also learned about time management, communication, and public speaking skills. But most importantly, the opportunity has taught me not to lose hope, stay motivated in the lowest situations and see my mistakes as the opportunities to improve.

7 Engaging Future Generations of Women Mappers

OpenStreetMap provides a platform for everyone to contribute to the global map, where their contributions are visible and saved. YouthMappers provides a global stage to amplify our voice of what we have been doing as students. Our YouthMappers chapter, Geomatics Engineering Students' Association of Nepal (GESAN), has made every possible effort to engage women and girls at different levels.

One of our highly successful programs is Map Literacy, an annual program organized by our female members who are motivated to educate high school students, especially girls, about the basics of map science and the use of OpenStreetMap. Women chapter members lead planning, coordination, and implementation of the program. After the program, young girls are very much motivated to see these women as role models leading a technical campaign and are aspired to expand their ambitions and reach for higher summits. The program provides an opportunity for YouthMappers students to share their knowledge with future generations, who will benefit from map literacy whether they pursue formal careers in geography or not.

Maps are integral to development and the face of a society. The data within should be something that every individual can rely upon, and it is possible to achieve this with youth leading the way and including underrepresented groups in the process. The inclusion of female leaders helps to increase the participation of females in YouthMappers, and such inclusion can help themselves and other

females get more comfortable in the spotlight. The involvement of female mappers in field surveys helps break the stereotype toward female participation in fieldwork. Hence, organizations seeking better results and high-quality data should ensure the inclusion of women and youth on their teams.

Likewise, the achievement of true advances to any and all of the SDGs requires this level of attention – to gender-sensitive data about gender-relevant topics and an inclusive set of data creators – which at the same time will advance SDG 5, gender equality within and across nations, to the benefit of everyone, SDG 10 generally reducing inequalities in our societies and our world.

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