Gender relations and inequalities in the Amazon:
The potential of geospatial systems to address gender inequalities

SERVIR AMAZONIA

USAID FROM THE AMERICAN PEOPLE

NASA

Alliance

Bioversity International

CIAT
International Center for Tropical Agriculture
Since 1967 Science to cultivate change

SERVIR-Amazonia is part of **SERVIR Global**, a joint development initiative of the National Aeronautics and Space Administration (**NASA**) and the United States Agency for International Development (**USAID**). Since 2005, SERVIR has worked in partnership with countries to use information provided by Earth-observing satellites and geospatial technologies.

SERVIR-Amazonia, led by the Alliance of Bioversity International and the International Center for Tropical Agriculture (**CIAT**), is a five-year program (2019–2023) that brings together local knowledge and some of the world's best science in geospatial and Earth observation technology. The SERVIR-Amazonia hub works with regional partners to understand needs, and then to translate these needs into the development of tools, products and services that will allow countries of the Amazon basin to improve decision making and to better incorporate the voice of women, indigenous peoples and their communities.

USAID – United States Agency for International Development - is an independent organization of the United States federal government that receives guidance on foreign policy from the Secretary of State. His work supports equitable and long-term economic growth, within the framework of the objectives of the foreign policy of the United States, supporting the areas of:

- Economic growth
- Agricultural trade
- Global health
- Democracy
- Conflict prevention
- Humanitarian assistance

It works in partnership with private voluntary organizations, indigenous organizations, universities, North American companies, international agencies, other governments, and other agencies of the United States government.

The Alliance of Bioversity International and the International Center for Tropical Agriculture (CIAT) delivers research-based solutions that address the global crises of malnutrition, climate change, biodiversity loss, and environmental degradation.

The Alliance focuses on the nexus of agriculture, nutrition and environment. We work with local, national, and multinational partners across Africa, Asia, and Latin America and the Caribbean, and with the public and private sectors and civil society. With novel partnerships, the Alliance generates evidence and mainstreams innovations to transform food systems and landscapes so that they sustain the planet, drive prosperity, and nourish people in a climate crisis.

The Alliance is part of CGIAR, a global research partnership for a food-secure future dedicated to transforming food, land, and water systems in a climate crisis.

www.alliancebioversityciat.org
www.cgiar.org

SERVIR AMAZONIA

USAID FROM THE AMERICAN PEOPLE

NASA

Alliance

Bioversity International

CIAT International Center for Tropical Agriculture Since 1967 Science to cultivate change

Gender relations and inequalities in the Amazon:
The potential of geospatial systems to address gender inequalities

A study by the
SERVIR-Amazonia Program

Jennifer Twyman and Mariola Acosta
Marina Irigoyen (Editor)

Spatial Informatics Group

imaflora

Conservación Amazónica ACCA

eco ciencia

SERVIR Global
SERVIR Amazonia Hub
Alliance of Bioversity International and the International Center for Tropical Agriculture (CIAT)
Americas Hub
Cali, Colombia
Telephone: (+57) 602 4450000
Email: c.gasco@cgiar.org
Website: https://servir.ciat.cgiar.org

Citation
Twyman J; Acosta M. 2022. Gender relations and inequalities in the Amazon: The potential of geospatial systems to address gender inequalities. A study by the SERVIR-Amazonia Program. SERVIR-Amazonia Hub. Cali, Colombia. 78 p.

About the authors

Jennifer Twyman, gender research leader at the Alliance of Bioversity International and CIAT. Jennifer currently works as a social scientist leading research related to gender and social inclusion. She works closely with the impact studies group to monitor and assess the impact of agricultural technologies, practices, programs and policies on gender inequalities.

Mariola Acosta is a gender specialist at the Alliance of Bioversity International and CIAT. Her research interests include the study of social norms and structural barriers to women's empowerment, with a particular focus on intra-household decision-making power and asset ownership in agricultural and livestock systems. She has vast experience in designing and conducting participatory workshops and capacity building on issues related to the nexus of gender, agriculture, food security and climate change. She has worked extensively with national and subnational policy actors in Central America to examine ways to improve the inclusion of gender issues in agriculture and climate change policies in the region. Prior to joining the Alliance of Bioversity International and CIAT, she conducted similar gender research in Uganda and Tanzania under the CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS).

About the editor

Marina Irigoyen, Gender Advisor (Consultant) (CIAT). Marina is a Peruvian sociologist with extensive experience in establishing multi-stakeholder relations and promoting dialogues oriented to sustainable development. With an emphasis on governance- and gender-related issues, she has gained vast experience in national and international team building, capacity development, and monitoring and evaluation.

Disclaimer

This publication was made possible thanks to the generous support of the people of the United States, through the U.S. Agency for International Development (USAID). The contents are the responsibility of SERVIR-Amazonia and do not necessarily reflect the views of USAID or the U.S. Government.

Cover photo: Neil Palmer/CIAT
Design and layout: Lorena García

August 2022

Contents

Figures

Tables

List of abbreviations

Abbreviations / Acronyms	Description
AMWAE	Association of Waorani Women of the Ecuadorian Amazon
APIB	The Articulation of the Indigenous Peoples of Brazil
AIDESEP	Interethnic Association for the Development of the Peruvian Rainforest
CIFOR	Center for International Forestry Research
COIAB	Coordination of the Indigenous Organizations of the Brazilian Amazon
COICA	Coordinator of the Indigenous Organizations of the Amazon Basin
CONFENIAE	Confederation of Indigenous Nationalities of the Ecuadorian Amazon
CORPIAA	Regional Coordinator of the Indigenous Peoples of Atalaya
DHS	Demographic and Health Surveys
GPS	Global Positioning System
IFPRI	International Food Policy Research Institute
MAST	Mobile Application Security Testing
NASA	National Aeronautics and Space Administration
NDC	Nationally Determined Contributions
ONAMIAP	National Organization of Andean and Amazonian Indigenous Women in Peru
UN	United Nations
SEPIA	Permanent Seminar on Agricultural Research
GIS	Geographical Information System
STEM	Science, technology, engineering, and mathematics
STR	Rural Workers' Union
UNEP	United Nations Environment Program
USAID	United States Agency for International Development


© Neil Palmer/CIAT

Executive Summary

In order for geospatial services to reach their full potential to benefit the people and the environment of the Amazon at multiple scales (regional, national, sub-national, community) by supporting communities in monitoring their territories and addressing the various challenges they face (such as deforestation, illegal mining, climate change, and biodiversity loss), it is important to have an inclusive vision that considers both the situation of local women and other actors in the region. These actions can improve local capacity in the use and exploitation of satellite data and geospatial information to facilitate, strengthen, and promote sustainable natural resource management throughout the Amazon.

Examining the gender dynamics in each region and context is important to ensure that development processes and projects using geospatial services are inclusive and successfully reach and benefit women and men from different backgrounds. In particular, it is important to examine gender roles and differences in access to and control of resources, participation in decision-making processes as well as other processes of social exclusion, for example those that may derive from ethnicity, age or class. Thus, one of the main objectives of this report is to synthesize the situation of women in the Amazon and the main challenges they face. A second objective is to generate ideas and recommendations on how geospatial projects and services can address issues of gender inequality and how they can specifically benefit women.

In order to achieve these objectives, the report analyzes information obtained through three main methodologies: i) revision of the scientific and organizational literature; ii) interviews with key informants; iii) survey with different professionals working in organizations affiliated with SERVIR-Amazonia.

The results of the study emphasize that the Amazon is a vast region with diverse populations. Thus, it cannot be assumed that the roles, challenges, and opportunities are the same for all women and men in the Amazon, either across different groups or within the same group. Similarly, the activities and livelihoods of Amazon people are also varied and complex, often presenting many challenges, especially for women from traditional and indigenous communities. Some of these challenges are related to the division of labor and gender roles, geographic isolation, limited access to electricity and internet, machismo, violence, limited access to health services and education, language barriers, loss of traditional knowledge, lack of participation and leadership on the part of women, insufficient representation of women in technical jobs and careers, and lack of land rights.

In general, the literature on gender and geospatial services is scarce and even more limited for the Amazon. Most of the information found, from both the literature and key informant interviews, related to gender within the area of ecosystem service management and far less on the other service areas of SERVIR-Amazonia (i.e. climate and climate change, fire/drought, and water resources). Likewise, the study found no instances of the use of geospatial services to explicitly close gender gaps (or benefit women) in the Amazon, although there are some examples from other regions that could serve as a guide. Moreover, there are not many organizations that have a direct and explicit gender focus in the use of geospatial services. Thus, the report notes that there is a great opportunity for SERVIR-Amazonia to be a leader in providing gender-sensitive geospatial services in the region.

In order to explore ways to improve gender integration, the study presents some suggestions and recommendations for institutions or programs such as SERVIR-Amazonia, that are in charge of providing geospatial information services for use by local organizations and communities. These recommendations include, among others, adopting inclusive communication strategies that use a combination of methods and media; providing services and information in local languages; and promoting the participation of women's organizations and networks in events and in the use of services.

Based on the different phases of the project cycle, the report also provides a series of recommendations for organizations and development projects that will directly use the geospatial services offered by institutions such as SERVIR-Amazonia.

> The report points out that for the design phase, it is important to perform a diagnostic analysis of the context that considers gender and marginalized groups as well as their access to, and control over, natural resources, common problems or challenges they face, and their needs and perceptions.

Such information can help the project leaders understand and be aware of who will participate and who will be excluded, as well as to consider ways in which the project could be more inclusive.

In the project implementation phase, there are also different strategies that can help promote women's participation and benefit them directly. For example, finding times when women can participate; explicitly inviting women (as well as men); having spaces and projects exclusively for women; and facilitating spaces that invite men and women to talk and reflect on gender equality issues.

The monitoring, evaluation and learning phase is also key in terms of being able to reflect in a recurrent manner on how the project is doing in terms of social and gender inclusion in program activities, for example, examining whether women are actively participating and whether implementers are using established gender strategies. Based on this, the program should make adjustments, test other strategies, and/or continue with strategies that work to maximize benefits to women and to close gender gaps.

The report also provides a series of recommendations to better integrate gender and to maximize women's participation and the extent to which they can directly benefit from geospatial services, both from the maps produced and the information that emerges from those maps.

Some of the ideas proposed include having a diverse group of mappers; mapping and providing information on land tenure (including women's land rights); mapping other gender gaps (e.g. income, participation in decision making, participation in organizations and their leadership, access to services and information, representation in technical jobs and careers, etc.); and mapping the locations of services and resources important to women.

Overall, the recommendations and suggestions proposed in this study emphasize three major opportunities through which geospatial service programs can contribute to reducing gender gaps and benefiting women. First, institutions providing geospatial services and interacting with local organizations can provide a number of suggestions on how they can integrate gender considerations into the use and application of their geospatial services. Second, geospatial service providers can design and offer services with an explicit gender focus in the region. For example, by working with women's groups to identify their mapping and information needs and to offer services that are important to women or traditional/indigenous communities.

Finally, geospatial systems also have great potential to highlight and emphasize gender inequalities in different aspects of the rural environment by creating maps to visualize, at different scales, gender differences between men and women in the Amazon. For example, maps could be used to visualize gender gaps in land ownership, education, literacy, technical jobs/careers, and salary levels, among other gender differences that are of interest to stakeholders in the region. Such information could help draw the attention of decision makers to gender inequalities and the challenges faced by women in the region and encourage the design of programs or policies to address such problems.


© Neil Palmer/CIAT

The study was commissioned to two consultants, both specialists in gender, Jennifer Twyman and Mariola Acosta, in late 2020. Months later, Marina Irigoyen, gender advisor to the SERVIR-Amazonia Program, edited the draft manuscript, complementing some of the information and analysis, with a view to releasing its publication.

August 2021.

1. Introduction

In recent years, rural and indigenous communities in the Amazon have faced different challenges such as deforestation, illegal mining, and climate change (Piotrowski, 2019). Geospatial services offer great potential to help these communities monitor their territories and address these challenges. However, these technologies are not always used to their fullest capacity by local communities. Thus, improving local capacity in the use and exploitation of satellite data and geospatial information is essential to facilitate, strengthen and promote sustainable natural resource management throughout the Amazon region.

SERVIR-Amazonia is part of SERVIR Global, a joint development initiative between the National Aeronautics and Space Administration (NASA) and the United States Agency for International Development (USAID). Since 2005, SERVIR has been working in partnership with countries around the world to promote the use of information provided by Earth observation satellites and geospatial technologies.

Led by the Alliance of Bioversity International and the International Center for Tropical Agriculture (CIAT), SERVIR-Amazonia is the latest of five regional centers operated by SERVIR. It is a five-year program (2019–2023) that works with partners to understand the needs of the region better and develop tools, products, and services that enable the countries of the Amazon Basin to improve decision-making and better incorporate the voices of women and indigenous peoples. SERVIR-Amazonia promotes collaboration among governments, universities, non-governmental organizations, community groups, and scientists in the United States. The ultimate goal is to improve local capacity to leverage satellite data and geospatial information to foster sustainable natural resource management throughout the Amazon. The main partners are:

- Spatial Informatics Group - GIS (United States)
- Amazon Conservation - ACCA (Peru)
- Institute of Forestry and Agricultural Management and Certification - IMAFLORA (Brazil)
- EcoCiencia Foundation (Ecuador)

The program is being implemented in Brazil, Peru, Colombia, Ecuador, Suriname, and Guyana.

SERVIR-Amazon works in four areas with the goal of empowering stakeholders in the region to monitor and understand environmental changes in near real time, assess climate hazards, and respond quickly to natural disasters:

- Drought and Fire Hazards
- Water and Water-Related Disasters
- Weather and Climate
- Land Cover, Land-Use Change and Ecosystems

In the pursuit of gender equality, SERVIR Amazonia promotes scientific and technological opportunities for women to actively participate in the design and implementation of demand-driven projects, considering their specific needs and priorities. The program encourages the involvement and capacity building of women leaders and decision makers. In addition to gender considerations, the program involves indigenous peoples' groups to ensure their active representation and participation in the collaborative development process.

To ensure that these development processes and projects are not only inclusive, but also reach and successfully benefit women and men from different backgrounds, it is important to understand and recognize gender roles and differences in access to and control of resources and participation in decision-making processes. In addition, it is important to recognize how gender dynamics vary across different social groups (e.g., by ethnicity, age, class, etc.).

By understanding these social and gender differences, projects can identify the different constraints and opportunities faced by different groups of people to participate in and benefit from their projects. While such information is often known at a local level, it can be difficult for projects working at different scales to

© Gino Germana/PROBOSQUES JICA

adequately integrate and use this information to inform the design and implementation of their interventions. However, such projects have a unique opportunity to influence at multiple scales. They have opportunities to influence implementing organizations and government policies to promote an inclusive approach that increases women's participation and their benefits from these projects, thereby reducing gender inequalities.

In order to achieve this, it is important to synthesize and share what is known about gender dynamics, especially as they relate to women's and men's roles and responsibilities, their access to and control over resources, and their participation in decision-making processes, especially with regard to project impact areas. This information will help identify constraints for participation, as well as opportunities for more inclusive participation and benefit from the project.

2. Objectives of the Study

This study provides an overview of the state of gender relations, specifically the situation of rural women, including indigenous women in the Amazon. In particular, the study documents the main challenges and experiences of women in Brazil, Peru, Colombia, Ecuador, and Guyana in the context of Amazonian ecosystem management and rural development. However, it should be noted that some of these challenges are common to the rest of the rural population in the Amazon, although women may be affected to a greater or lesser extent.

The study also explores the current use of geospatial systems in different organizations working in the Amazon, and the potential of these technologies to improve the situation of women. Finally, based on these challenges and the current use of geospatial technologies, the study offers a series of recommendations to maximize the potential of geospatial technologies to improve the situation of rural and indigenous women in the Amazon.

The results of this study will serve as a basis for the design of SERVIR-Amazonia Program services with a strengthened gender vision, as well as to identify opportunities for women's participation in the Program's activities. Finally, the study will serve as an input for reflection activities carried out by communities of practice on the subject.

Annex I contains the methodological guidelines used to carry out the study.

© Neil Palmer/CIAT

3. Findings of the Study

This section presents the results of the study, organized into two main sections. The first section presents the situation of Amazonian women (including indigenous women) and points out the main challenges they face. The second section addresses gender and geospatial services, including gender barriers in careers and technical jobs; the use of geospatial services by different organizations working in the Amazon; the findings of the literature review for each thematic area of the SERVIR-Amazonia Program; the gender strategies followed in some organizations working in the Amazon; different experiences on the use of geospatial services to close gender gaps; and the perspectives of organizations affiliated with the SERVIR-Amazonia Program on the use of geospatial services for gender equality.

In general, it is important to highlight that the study did not find much literature specific to the situation of women in the Amazon (Schmink and Arteaga Gomez-Garcia, 2015 and SEPIA, 2007), and even less on gender relations and specific issues related to SERVIR-Amazonia and geospatial service areas. Although the literature on the situation of women in the Amazon is scarce, we did find several articles with in-depth analysis of specific communities. Other articles reported findings on gender dynamics and/or the situation of women, even though that was not the main research objective and topic.

3.1. The situation of women in the Amazon and the main challenges they face

This section describes the situation of women in the Amazon. The study identified several challenges faced by women in the Amazon. Some of these challenges are similar to those faced by women in other regions of the world, such as those related to machismo, violence against women, or women's roles as primary caregivers in the home, children, and other family members. Other challenges are more specific to women living in the Amazon, such as geographic isolation, particularly in rural areas. For each of the challenges, we describe the main findings from the interviews and literature review, summarize the key points, and provide a series of recommendations.

3.1.1. Population variability in the Amazon and heterogeneity in the situation of women

As mentioned in one interview, "The Amazon is not homogeneous, it is heterogeneous." This quote from one of the interviews highlights the fact that the Amazon is a vast region with a dispersed and diverse population. Although the Amazon population of around 34 million represents only 11% of the total population of Amazonian countries (UNEP, 2009: 21), there are 420 distinct indigenous groups speaking 86 languages and 650 dialects (UNEP, 2009: 72). Among the inhabitants of the Amazon, Schmink and Arteaga Gomez-Garcia (2015, citing Vadjunec and Schmink, 2012) identify urban inhabitants and a range of rural inhabitants, including indigenous peoples, rubber tappers, neo-native groups, peasants, riparian inhabitants, and agricultural settlers. Moreover, an indigenous territory may host a mix of populations with different cultures and social norms. For example, in their study, Vallejo et al. (2019) explains that due to historical reasons, there are already several residents of different ethnicities in the same territory. In particular, they mention the example of the *Sapara-Achuar, Sapara-Andoa,* and *Sapara-Kichwa* ethnic groups in the *Sapara* territory, as well as the example of the *Kichwa* ethnic group that moved to other regions, interacting with other groups, and through miscegenation creating what the authors call a *"Kichwaizacion"* in the territory. Additionally, there are also cases of internal migration of mestizo or Andean indigenous populations, as is the case in Peru, particularly in regions such as Madre de Dios and Ucayali. These processes contribute to the intensification of miscegenation in the Amazon and can lead to adjustments in gender relations in native communities.

This great variety of cultures that exist in the Amazon was one of the considerations that was also frequently highlighted in the interviews (mentioned in five of the interviews conducted). As such, the situation of women in the Amazon is very varied, depending on the ethnic group and geographic situation, even within each country. For example, in Colombia, one of the interviewees pointed out that within the same country, communities closer to small urban centers in the Amazon have a different way of thinking and acting than more isolated populations. Likewise, indigenous women or men

who have lived in the capital or in large cities for a certain period of time are also more adapted to the existing society in other parts of the country.

Gender and ethnicity identities are impacted and influenced by external factors, such as market access and integration, the formation of new protected areas, extractivist activities (e.g., deforestation processes, road, and agricultural expansion), migration, and settlement policies (Lu et al., 2009; Etchart et al., 2020). For example, Vallejo et al. (2019) explores in detail how extractivist activities and the development projects associated with these activities influence ethnic and gender identities in Ecuador. The authors explain that it was mostly men who were hired to do paid work, and therefore, earned a wage and controlled the income. This process meant a change in their participation and in the time dedicated to other activities such as agriculture, hunting and fishing. On the other hand, women and children from rural and indigenous communities gradually realized that life in the new towns was easier if they accepted and assimilated the mestizo lifestyle, which led to less time spent on the farms, a loss of traditional knowledge (see section 4.1.9), more time dedicated to formal education in schools for children, and more time dedicated to domestic chores in the home for women.

The situation of women varies both between and within population groups. The diversity between groups is clearly evidenced in the study by Lu et al. (2009), which compares the gender equality situation in five indigenous groups in the Amazon. Within these five groups, the Shuar appears to be the most male-dominated group, followed by the *Quichua*, while the *Secoya* and *Cofan* are the most egalitarian. The study reveals that the Shuar women are treated as servants by their husbands, as 'possessions won in war'. Other cultures such as the *Secoya* and *Cofan* are more egalitarian, as well as the *Cashinahua* population who, for example, have the right to divorce. Within the same indigenous group there are also variations. For example, Aikman's (2019) study describes how not all *Harakmbut* women have the same challenges and opportunities in life. Similarly, Hecht (2007) mentions that there was diversity among and within rubber tapping communities. This was due to tappers (and their families) being at different life stages and because of the distribution and accumulation of resources, which in part depends on historical labor relations (slavery, peonage, or paid labor).

KEY POINT:

The Amazon is a vast region with diverse populations. It should not be assumed that the roles, challenges, and opportunities are the same for all women and men in the Amazon, neither across different groups nor within the same group.

RECOMMENDATION:

Conduct diagnostic analyses of context of the beneficiary communities, with an emphasis on gender and the different social groups.

3.1.2. Division of labor by gender, multiple demands over time, and little recognition of the contributions of women

In Amazonian societies, as in almost all societies in the world, there are specific roles that are culturally assigned to women and men. The vast majority of interviewees commented on the importance of understanding these roles and

the division of labor for each society they work with (mentioned in nine interviews). Although as indicated above the division of labor and gender roles vary from community to community, the interviews highlighted that in many of these communities there are strong gender roles, particularly in more traditional Amazonian societies.

The literature associates the division of labor by gender with livelihood strategies and with changes in such strategies (see Hecht, 2007; Schmink and Arteaga Gomez-Garcia, 2015; Perreault, 2005), while other authors associate the division of labor in indigenous communities with their worldviews. For example, different indigenous groups associate natural elements with gender. Thus, the *chacra* is associated with women and the forest with men (Perreault, 2005; Vallejo et al., 2019; Mendoza Hernandez et al., 2017). Therefore, activities carried out in the forest (e.g., hunting) are considered masculine activities and activities near the house and *chacra* are considered feminine (see Lu et al., 2009). On the contrary, the river is feminine but it is also another masculine space that is related to fishing, which is typically perceived as a masculine activity. Other studies talk about the souls of plants and that many plants have female souls, so the farm and agriculture is the domain of women (Caballero-Serrano et al., 2019 citing Karsten, 2000). Similarly, some people and organizations perceive indigenous people, and indigenous women in particular, as conservationists and environmentalists. This is simply due to being indigenous and the perception that indigenous people are closer to the natural environment (see Vallejo et al., 2019 and Seitz Lozada, 2007).

Many articles mention a traditional division of labor according to sex. Women take care of the children and do domestic chores in the house, farm chores, and raise small animals near the house, while men are in charge of fishing, hunting, earning income, and representing the household in the public sphere such as community meetings (Lu et al., 2009; Vallejo et al., 2019; Schmink and Arteaga Gomez-Garcia, 2015; Magalhães et al., 2007; Hecht, 2007; Meola, 2013; Perreault, 2005; Freitas et al., 2020; Fitts et al., 2020; Caballero-Serrano, et al., 2019; Cruz-Garcia et al., 2019).

Traditional gender roles were also identified in the interviews. According to these interviews, in many communities, women have a role taking care of the household, including cleaning, preparing food, caring for children and the elderly. They are also usually in charge of cultivating the family gardens. Men, on the other hand, are more often in charge of market crops and tasks related to fishing, hunting, and monitoring of territories. For example, in Peru, one of the interviewees shared the results of a study where the most fertile lands were destined for monoculture (i.e., market-oriented crops), and were mainly worked and managed by men.

In Guyana and other countries such as Peru, interviewees explained that in general, men are more involved in field surveillance activities due to the perceived nature of these activities. On the one hand, they are considered to be hard because there is a lot of walking, sometimes carrying supplies that can be heavy. On the other hand, they are considered dangerous, because of the risk of encountering people trespassing or carrying out illegal activities, which often leads to confrontations. In many Amazonian societies, men are perceived as stronger and therefore more capable of carrying out these actions than women. In this regard, one of the interviewees emphasized the great potential of geospatial systems to improve women's participation in surveillance and monitoring systems:

"We are not going to deny that carrying out control and surveillance is risky, and there may be confrontations. Confrontations do not mean with weapons necessarily, but if there is a verbal confrontation, it can involve risk. It is not the same for women as for men. [...] However, what technology does at least do, is it allows monitoring far from the area where there may be risk. So, it can help to improve women's participation to a certain extent in this whole exercise of control and surveillance".

Interview 8

Although many studies talk about traditional roles of men and women, others give examples of how the division of labor is not rigid but can change during the life cycle and in response to external conditions. Schmink and Arteaga Gomez-Garcia (2015) explain, for example, how gender roles can be shaped by changes in plot uses (e.g., from deforestation, to annual crops, followed by perennial crops and/or pastures) and by the life cycle of women and their families, influencing the time they have available. Today livelihood strategies are diversified and typically include a mix of subsistence activities, such as agricultural production, extraction of forest products, fishing, hunting, timber harvesting, (see for example Ruiz-Mallen et al., 2017; Etchart et al., 2020, and Fitts et al., 2020), and commercial activities such as commercial agricultural production, making handicrafts, paid jobs, and conditional cash transfers (Hecht, 2007; Perreault, 2005). Within the various livelihood strategies, men and women do different activities and play different roles that are fluid, i.e., change in response to external conditions.

With the integration into markets and livelihood strategies that included paid work and cash crops, the time men and women spent on these activities also increased. The first paid jobs (such as those in the oil industry), from the early decades of the 20th century, were mostly allocated to men, some of whom migrated for these jobs. When men migrated to work in order to feed their families, women stayed in the territory, farming, fishing and hunting, activities that had traditionally been dominated by men. Furthermore, families began to buy products in the market and over time women also began to spend less time on their subsistence activities, as they were no longer as valued or necessary (Vallejo et al., 2019).

With more integration into markets, opportunities for paid work increased and women began to participate as well, thus changing the time spent on subsistence activities. Today many women devote more time to commercial activities than to subsistence activities. For example, Perreault (2005), in her studies in Ecuador, reports that most of the women interviewed dedicated more time to commercial activities than to the *chacra* (a subsistence activity). Mello and Schmink (2017) report that 88% of women in a Rural Women's Microenterprise Network in Brazil worked with forest products to make handicrafts, forest plant medicines, herbal teas, fruits, and jams.

Even in indigenous communities, men and women may devote a substantial proportion of their time to commercial activities. For example, the study by Lu et al. (2009) examines how time is used by men and women from five indigenous groups in Ecuador. They find that men spend between 5% to 25% of their time in commercial production, which is more than women who spend between 4% to 8% of their time in such activities. Men and women spend similar proportions of their time on subsistence activities (between 4% and 13% of their time). The study notes that women still spend more time (between 17% and 25%) on domestic activities (such as cooking, washing, cleaning, preparing, and serving food) than men (about 6%).

In addition, gender roles can also change in response to development projects. For example, Vallejo et al. (2019) describes how gender roles changed in a development project to create the "Millenium Village and School," a project that was associated with an oil company in Ecuador. The project involved the direct incorporation of their communal territory into extractivist and development logics, which meant that women were not allowed to carry out many of their traditional activities (such as smoking meat on campfires, making chicha, cultivating vegetable gardens, or raising small animals) near their homes in the new village, so they began to spend more time cleaning their homes than working on their farms.

Other articles in the scientific literature also make mention of women's invisible roles in activities traditionally defined as masculine. For example, although fishing is traditionally perceived as a male activity, Freitas et al. (2020) and Meola (2013) observed that women also fish, mostly for subsistence, but some also undertake commercial fishing. Furthermore, Freitas et al. (2020) explain how women's participation has increased and started to be valued and paid in most communities with collective fisheries management schemes.

© Neil Palmer/CIAT

While these examples show that women work in what are called or perceived of as masculine tasks, their contributions are often not valued or are undervalued. This can be seen in the differences in pay. Women are often not paid for their contributions and if they are paid, their salaries are lower than those of men. In Ecuador, Lu et al. (2009) stress that opportunities for paid work in the Amazon are limited and most are accessible only to men. In the Brazilian Amazon, Freitas et al. (2020) found that women's contributions to fishing are regarded as informal help, or an extension of their household duties and as such are not paid. Similarly, Schmink and Arteaga Gomez-Garcia (2015) in their review of the gender literature in the Amazon found that both the jobs and most of the benefits in terms of payments in timber management projects go to men, with some women working as cooks.

Other articles, especially Hecht (2007), focus on the labor demands of women and rural residents of the Amazon. Time is a scarce resource and there are multiple demands on time, especially on the time of women who are often responsible for household chores and the care of children, the elderly and the sick, in addition to productive and subsistence activities. Furthermore, commercial extractivist activities such as rubber or Brazil nut *(Bertholettia excelsa)* collection generally depend on family labor. In his study, Hecht (2007) found that agricultural production is dominated by women and children, who contribute 91% of the time and labor to agriculture, and 70% of the total labor to family activities.

An important finding of Hecht's (2007) study is that contrary to the assumptions of many development projects there is no labor surplus, especially for women in rural areas of the Amazon. The study found that, instead of giving up the work of collecting chestnuts that paid little for the time spent, families shifted the obligation from a woman's responsibility to one of the children. Another example from Bolivia, shows that sometimes women cannot even participate in activities typically considered feminine because of the multiple demands on their time. In this example, some women wanted to participate in a community forest management project by providing food to workers, but for many it was difficult, or impossible because of all their other responsibilities (Schmink and Arteaga Gomez-Garcia, 2015). In addition to women not having time to spare, there is the problem that men are often the ones who earn money for their work, while women are tasked with unpaid work that is not valued. For example, in many fish farm projects, which are labor-intensive, women are given the tasks which are not valued, or if they are valued, they are undervalued. Consequently, these unpaid responsibilities force them to leave other domestic, or farm obligations unperformed or incomplete.

Thus, in general, the multiple demands on women's time and the undervaluation of women's time are challenges and barriers that can limit their participation, and sometimes that of men. Changes in factors external to households impact their livelihood strategies and gender roles. Alterations in markets, policies, projects, and other interventions impact gender roles, demands on time, and the value of time for both women and men. Therefore, it is important to take these issues into account in the design and implementation of any intervention.

KEY POINTS:

- The roles and livelihoods of the Amazon's inhabitants are varied and complex.
- There are multiple demands on women's time; time is often a scarce resource.
- Women's roles are often invisible and unpaid.
- Changes in factors external to households, such as market expansion or development project interventions impact livelihood strategies, gender roles, demands on time, and the value of time for both women and men.

RECOMMENDATIONS:

- Understand the various activities and related livelihoods, gender roles and the division of labor according to sex in each population/community where you are going to work.
- Understand the different demands on women's and men's time in the work sites or project intervention zones.
- Consider how project interventions (or how geospatial services) would alter gender roles and living conditions for women and men.
- Ensure that the roles and contributions of both women (and children) and men are recognized, valued, and paid.

3.1.3. Geographic isolation and difficulty of mobility

Other challenges faced by women are geographic isolation and mobility difficulties. These are challenges in general for rural populations in the Amazon, but they have some differentiated impacts and are often more problematic for women. Geographic isolation and mobility difficulties impact participation in projects. In some cases, it is an incentive to carry out collective work by women (Mello and Schmink, 2017), while other times it impedes collective actions due to the distances and times required to travel (Vallejo et al., 2019). Geographic isolation and difficulty of mobility also limits access to social services and the benefits of citizenship rights (Schmink and Arteaga Gomez-Garcia, 2015).

Geographic isolation impacts women more than men because of gender norms and its relationship with hazards, costs, and family obligations (Meola, 2013). Gender norms dictate that women have fam ily obligations to care for children and the elderly, as well as maintain the *chacras*. Therefore, it is difficult for them to travel long distances and be absent from the home for extended periods of time. However, this is easier for men as they do not have the same social pressures in terms of their family obligations (Meola, 2013; Fitts et al., 2020). In addition, traveling with children can be difficult because mothers typically ride with their children on their skirts in the boats, making it difficult (even impossible), or dangerous to navigate with young children (Meola, 2013).

KEY POINT:

Geographic isolation and difficulties of mobility (typically long distances) are challenges for the rural population in the Amazon and can be more problematic for women due to social norms that dictate they should stay close to home and care for children.

RECOMMENDATIONS:

- Consider distances, hazards, and transportation costs - are there strategies to reduce them?
- Consider whether geospatial services could facilitate mobility. For example, if they could facilitate the creation of less dangerous, less costly, or women-oriented means of transportation (e.g., mobile applications such as Uber or Cabify, but with river transportation, including flow information, storm danger, or flood danger for areas with internet service).
- Consider women's family obligations and other gender norms that may limit women to determine who might participate and who might be excluded.
- Decide strategically, the location of meetings and events.
- Establish meeting times and frequency that are favorable to women (and men), considering distances and family obligations.
- Consider services and maps to identify childcare services and transportation that are family/ child friendly, etc.

3.1.4. Limited access to electricity and internet

In general, lack of infrastructure such as roads, electricity, sanitation facilities (e.g., access to drinking water, toilets/ latrines/waste systems), and connectivity to computer and internet services are difficulties for Amazonian populations and have gender-differentiated impacts. Cruz-Garcia et al. (2019) note that communities typically have a lack of or limited access to electricity and basic sanitation facilities. Sanitation facilities could improve health and reduce women's caregiving obligations. Meola (2013) notes that those who live near a reserve in Brazil and who have access to infrastructure have the benefits of access to radio communication, free transportation, frequent news, and interaction with reserve visitors and employees.

The limited internet access that some of the Amazonian communities have was also mentioned as a barrier to the effective use of geospatial services (mentioned in three interviews). Highlighting the importance of good internet access, one interviewee commented:

"One of the great deficiencies in the country is the lack of interconnection capacity. Internet is an example. For an image to really be useful in almost real time for monitoring, it needs to be sent, it needs to be shared. And if there is no internet, there is no way to share it. So, we already have a structural issue".

Interview 8

However, it should be noted that in the interviews these comments were made in a general way, i.e., as something that affects some of the communities in the Amazon, and not specifically as something that affects women more markedly. Nonetheless, when considering

ways in which geospatial services can increase women's participation in monitoring, aspects such as internet connectivity are key. It is therefore important that development projects consider the level of connectivity during project design and budgeting.

On the other hand, the pandemic caused by the new SARS-CoV-2 virus (COVID-19), which has spread globally since the beginning of 2020 and is continuing in 2022, has shown that there are not only limitations of connectivity and internet access, but also a lack of adequate equipment. For example, the phones available are often basic (not smartphones), which would make it difficult to participate in monitoring. One of the interviewees pointed out that there have been cases of women cocoa producers who have basic phones, while their husbands or partners have smartphones. Thus, in the Peruvian Amazon, 90% lack connectivity (EFE, 2021).

KEY POINTS:

- In the Amazon there is little infrastructure, electricity and connectivity that may result in increased inequalities and may limit the effective participation of the most isolated.
- For successful use of internet-dependent geospatial services, such as real-time monitoring, the limitations of electricity access and internet connectivity must be considered and understood. The installation of solar equipment that captures satellite signals could be considered.

RECOMMENDATION:

Assess (map) and be aware of who has access and who does not (to a cell phone/other electronics, to a cell phone signal, to electricity to charge electronic equipment, to internet - data or landline).

3.1.5. Machismo

We found evidence of machismo as a constraint for women, including the perception of women as possessions who must have their husbands' permission to travel and/or to participate in projects; men acting as family representatives in public spaces and the consequent exclusion of women by men and organizations; lack of participation due to childcare obligations imposed by fathers; and domestic violence (the subject of the next section).

Several studies reported that women need permission (or support) from their husbands to participate (Meola, 2013; Cooper and Kainer, 2018; Schmink and Arteaga Gomez-Garcia, 2015). For example, in Brazil, one interviewee commented that in the North Xingu area where they work, they had a group of women who had been interested and participated in forest monitoring data collection workshops. However, leadership conflicts arose, and the men did not allow the woman leader in that region to participate in the workshops. According to this organization, more than 20% of women were not able to participate in these activities due to this type of backward view of their male leaders. However, this dynamic appeared to be less prominent in Southern Xingu, highlighting the great heterogeneity of communities and gender dynamics that exist within a single country.

Meola (2013) also reports that many women in the Amazon area in Brazil are married to men who dominate the home and that both men and women perceive the woman as a man's possession. Similarly, Razuri Montoya (2017) found that in the *Wampi* people in Peru, men ask to possess women during the marriage ceremony, whereby women are perceived as possessions from the beginning. Having children also limits women's participation because of their obligations as primary caregivers, and because of the lack of responsibility on the part of fathers in caring for their children. For mothers it is seen as an obligation but for fathers it is optional (Meola, 2013).

Other evidence and representations of machismo culture in Amazonian communities include the fact that men represent families in public spheres; in some homes the custom is for women to eat sitting on the floor while men use chairs; the exclusion of women in conversations between men; and the exclusion of women as members with voting rights and a say in community associations (Schmink and Arteaga Gomez-Garia, 2015).

KEY POINT:

Machismo is evidenced through various forms and expressions, including viewing women as possessions, gender norms that dictate that women must ask permission from their husbands to participate in activities, the exclusion of women in conversations or meetings, and women's obligations to stay close to home to care for children.

RECOMMENDATION:

Projects should take gender norms into account to understand the constraints for women's participation and look for ways to overcome them. For example, choose meeting times when both women and men can participate; have women technical/extensionists; include men in gender issues; have spaces to discuss and reflect on gender norms (which are often invisible); build gender awareness; and create women-only spaces.

3.1.6. Violence

The Amazon is a territory with multiple forms of violence. Many environmental defenders suffer from aggression, including killings by drug traffickers, loggers, gold miners and other fugitives from the law. For example, in Brazil, nearly 90% of environmental activists killed in 2019 were killed in the Amazon (Global Witness, 2020). Men are also disproportionately more affected by this form of violence. Globally, women make up about 10% of the environmental defenders killed (Global Witness, 2020). Another major scourge for women in the Amazon is gender-based violence, which as mentioned above, is one of the clear representations of machismo in the region.

Two of the interviews explicitly highlighted the gender-based violence suffered by many women in rural and indigenous communities in the Amazon. In Guyana, for example, one interviewee highlighted alcoholism as the main force behind domestic violence, not only in Amazonian indigenous communities but also in other rural communities. According to this interview, in Guyana there is a perception that men are losing the control they used to have over women, and this is what often leads them to use physical violence. This domestic violence affects women's ability to participate in activities and decision-making processes. For example, in Colombia, one of the people interviewed noted:

"There are cultural patterns, there is violence, which also leads to [women] not participating... because that diminishes women's dignity, their self-worth. Many women suffer many things in the territory. I have seen and have intervened in many cases, because I have had to confront the husbands at times".

Interview 10

In relation to domestic violence, this interviewee in Colombia also emphasized that empowered women tend to suffer less violence. An empowered woman is unlikely to be violated. If the woman is well, the children are well, the family is well, the community is well, and there is less violence against women'. Thus, programs aimed at empowering women in different areas (e.g., economic, social) could also indirectly reduce the level of gender-based violence in the communities.

The literature also echoes the serious problems of violence against women. This violence is historical in Amazonian settlements. For example, in rubber tapping areas women were frequently kidnapped and used to force their families to work the *shiringa* (rubber) as well as being used as slaves and forced sex workers (Schmink and Arteaga Gomez-Garcia, 2015). Today domestic and sexual violence is very common and is rarely punished (Schmink and Arteaga Gomez-Garcia, 2015). In some communities, gender-based violence is linked to masculinity and virility (Schmink and Arteaga Gomez-Garcia Arteaga, 2015). Lu et al. (2009) note that women's sexuality and infidelity is perceived as a cause of domestic violence, a social perception that even influences the authorities.

KEY POINT:

Violence against women is quite common in Amazonian communities and can impact women's participation in projects.

RECOMMENDATIONS:

- Consider a strategy that considers violence against women. Even if it is not an issue that the project or activity deals with directly, plan and consider how to react in the event that incidents of violence against one or more women occur or become evident.
- Develop clear and transparent policies indicating that the organization/project will not allow any type of violence against women, including physical, verbal, sexual violence, or human trafficking.
- Map and provide information on prevention and reporting services. Visualize for example where these services are located and how to access them (e.g., police stations, shelters, social care centers, etc.).

3.1.7. Limited access to health services

Access to health services and reproductive health services was also mentioned in the interviews as a fundamental barrier that Amazonian communities face (mentioned in three interviews). According to these interviews, many communities in the Amazon, especially those in more isolated areas, have limited access to medical services. While these communities usually have some access to basic primary care, they do not have good access to hospitals for more serious treatments. For example, one interviewee in Guyana commented on the implications this has for the increasing numbers of cancer cases:

"What we are particularly concerned about, is the increasing incidence of cancers in indigenous communities. It's growing nationally, but it's particularly concerning for indigenous communities because they are further away from cities and have access to lower quality health care to deal with cancers and other serious medical conditions. The ability of these people to be able to access that health care has been reduced".

Interview 7

In Peru, one of the interviewees mentioned the high incidence of respiratory and gastrointestinal diseases, and the effect that the loss of natural spaces has also had on the nutritional quality of Amazonian populations. The loss of access to the forest has caused a drastic decrease in food security and quality in some communities such as products that came from hunting. These communities can now eat more calories from flour, but the quality of the diet is lower due to lower protein intake, for example.

Soil contamination was also mentioned in Peru. One of the interviewees explained that this problem is concentrated in the larger population centers of the Amazonian communities, and the diseases that result from it. Reproductive health was also mentioned as a problem in the Amazon communities. For example, two of the interviewees in Ecuador and Colombia noted that early pregnancy is common among girls in rural communities that are more remote or isolated.

The literature also emphasizes problems in access to health services, and in particular access to reproductive health services (Schmink and Arteaga Gomez-Garcia, 2015). One study mentioned high maternal mortality rates (Cruz-Garcia et al., 2019 cite Celentano and Vedoveto, 2011). In addition, the problem of pregnancies among girls and young women is notable. For example, the article by Meola (2013) discussed cases of women having their first baby at a very young age, some as young as 10 years old, which is considered early pregnancy. There is also the custom in many Amazonian indigenous communities of pairing girls as soon as they have their first menstruation. This not only affects women in their physical and emotional development but also has effects in other areas such as schooling. Monrroy Pardo (2019) discusses pregnancies of young girls and the impact on their lives, such as dropping out of education. The lack of reproductive health and limited access to contraceptives, especially in rural areas, exacerbates this problem.

KEY POINT:

There are problems of access to health services, due to geographic isolation and lack of investment. This lack of access can be more problematic for women in terms of young pregnancies, in terms of their caregiving responsibilities, and in terms of caring for their family's nutrition and well-being.

RECOMMENDATIONS:

- Provide information on where and how to find health, sanitation, nutrition, and even contraceptive services and resources.
- Mapping of socio-demographic information - health conditions, maternal mortality, statistics on diseases caused by lack of sanitation, etc.

3.1.8. Limited access to education and language barriers

Another gender challenge frequently mentioned in the interviews was the limited access to education for many Amazonian communities, especially women, as well as the language barrier (mentioned in 9 interviews).

With regard to education, in Brazil, one of the people interviewed referred to the high dropout rate of indigenous women in the courses offered by her organization, as they often have young children in their care and cannot attend classes for many days because they have to take care of them. In rural areas, it is common for secondary schools to be far from indigenous communities, which means that families often cannot afford the transportation and living expenses involved in sending more than one of the children in the family, usually favoring the male children (interview in Guyana; Perreault, 2005; Schmink and Arteaga Gomez-Garcia, 2015; Meola, 2013). This may help explain the low rates of schooling levels. For example, Fitts et al. (2020) found in their study that 73% of respondents only had primary education or less (45% did not complete primary and 28% completed primary). Aikman (2019) reported that indigenous women have less than half the literacy rate of non-indigenous women (citing Vinding and Kampbel, 2012).

However, it should be noted that the level of access to education is also unequal in the different Amazonian communities, so not all women face this educational barrier. For example, one of the interviewees explained that in Peru (according to her experience), women who are more empowered and have greater leadership are in communities where there is greater access to education and where Spanish is the mother tongue, as this gives them better access to the market, among other things.

Similarly, Schmink and Arteaga Gomez-Garcia (2015) note, that in some cases women and children move to towns to access education while men stay in rural areas.

With reference to access to education and as it relates to language, Aikman (2019) notes the linkage between the educational system and language barriers in his discussion on how teachers in bilingual schools do not necessarily speak the language of the children. Further still, in the literature, Fitts et al. (2020), Schmink and Arteaga Gomez-Garcia (2015), Lu et al. (2009), and Ruiz-Mallen et al. (2017) note that men are more likely to speak Spanish than women.

Similarly, some of the interviewees also highlighted the difficulty of effectively involving women in the programs and activities carried out due to the language barrier. As pointed out by one of the people interviewed in Ecuador:

"There is the problem of language. Often, indigenous women speak their own language, and it is difficult for them to speak Spanish or Portuguese or French. It is a challenge in the Amazon to work with their own languages and especially with women because of their lack of access they have had to education. These women sometimes don't know how to write either".

Interview 2

Finally, referring to the use of geospatial technologies by women in the Amazon, another interviewee stressed the major problem that low education and language barriers pose to these efforts in Brazil:

"Training women in technological tools so that they can produce data is a very big challenge. Because if we talk about indigenous women, some speak Portuguese, others don't, they speak their own language. If we talk about women from traditional communities, they have very little education in writing and reading. This is the sad truth of Brazil, because in the interior of Brazil we have very bad public education".

Interview 4

Thus, language barriers and the lower levels of education for women are aspects that should be taken into consideration in the design and implementation of geospatial programs and services.

KEY POINT:

Education, illiteracy, and the use of the official language present difficulties in many areas of the Amazon, and these difficulties are especially severe for women and indigenous women in particular.

RECOMMENDATIONS:

- Provide services in local languages and have basic and easy-to-use platforms, i.e., that do not require advanced education to understand.
- Have communication strategies that are inclusive and consider different information flows (i.e., leaders and/or the more educated to other community members, children to parents, husbands to wives, etc.).

3.1.9 Loss of traditional knowledge

The loss of traditional knowledge belonging to Amazonian communities, including the loss of indigenous knowledge, was mentioned as a problem that communities face (mentioned in four interviews and also discussed in some articles such as Aikman, 2019 and Seitz Lozada, 2007). They underline the important role of women's knowledge of medicinal plants and their role in passing on traditional knowledge to the next generation (Caballero-Serrano et al., 2019). Although for various reasons (including the low valuation of such knowledge from the mestizo society), traditional knowledge is being lost due to changes in activities, external influences, and because of multiple demands on their time such as school, paid jobs, travel, attending meetings, and going to the market (Seitz Losada, 2007; Aikman, 2019). Interviews highlighted the important role of older generations in the preservation and transmission of traditional and indigenous knowledge. As exemplified by the following quote, the loss of elders in Amazonian communities has been accelerated by the COVID-19 pandemic, with the serious consequences this implies in relation to the conservation of traditional knowledge:

"We have already lost many grandparents in this pandemic. That is very worrying for the Amazon because the death of a grandparent for us means the loss of a whole cultural legacy and knowledge of all kinds, including traditional medicine".

Interview 10

In Guyana, for example, it was also highlighted that younger generations in indigenous and rural communities in the Amazon do not have a good understanding of the value of the land,

or why it is important to do certain activities in relation to the land. Other interviews highlighted that the introduction of new technologies such as smartphones in the communities is also influencing this progressive loss of traditional knowledge. Similarly, and in relation to the previous section, in Ecuador the challenge of continuing to transmit traditional knowledge in the mother tongue for future generations was also underscored. To avoid this loss of traditional knowledge, one of the interviews in Colombia highlighted that, together with deforestation prevention and monitoring activities, cultural conservation work and the maintenance of the oral tradition of their cultures were being carried out as well.

KEY POINT:

There is a loss of traditional knowledge. Although the loss of knowledge is the result of social and economic changes, often the blame and responsibility for such loss is placed on women and the elderly since they are the ones who are most socially recognized as key actors in passing traditional knowledge from generation to generation.

RECOMMENDATIONS:

- Document some of the traditional knowledge and integrate this knowledge into the information collected and used in geospatial services.
- Map where different local languages and dialects are still spoken (combine this information in one layer of the map).
- Design projects that integrate young and old people to exchange experiences and knowledge.
- Recognize and value traditional knowledge (without blaming the loss of such knowledge on any group of people, such as women or the elderly).

3.1.10. Limited participation and leadership

In general, women participate less in community meetings and projects in their communities and are less likely to hold leadership positions. For example, Fitts et al. (2020) reports that in a *shiringa* (rubber) management committee in Peru, there were 31 male members and only 4 female members. They also observed that women participate less in decision making (Fitts et al., 2020 and Freitas et al., 2020). In addition, several articles mention that there are few women leaders in communities and indigenous organizations (Larson et al., 2018; Meola, 2013). There is systemic resistance to women taking leadership positions (Meola, 2013). Schmink and Arteaga Gomez-Garcia (2015) speak of a resistance in the family and because of family obligations that take up women's time. And although there are more and more women participating, they are typically in lesser positions, those related to women and family issues (Schmink and Arteaga Gomez-Garcia, 2015; Vallejo et al., 2019).

Some papers focus on examining why male participation is higher. These articles highlight that typically men have more education, are more likely to speak Spanish, have more time to devote, and there is a perception that they

have more knowledge of technical issues (Fitts et al., 2020; Ruiz-Mallen et al., 2017; Lu et al., 2009). Furthermore, by tradition, they are seen as the representatives of the household (the head of household) and thus, in some organizations they are the ones who are members (Schmink and Arteaga Gomez-Garcia, 2015). Moreover, historically the state and industry have negotiated with men. Some indigenous organizations were formed in response to invasions of their territories by the state and extractivist industries such as oil. Both women and men participated in protests to block extractivist projects in their territories. However, it was the men who took the leadership positions in the organizations, at least in part because historically the state negotiated with them and not with women (Vallejo et al., 2019). In this way, men became "the cultural intermediaries between their communities and mestizo society" (Vallejo et al., 2019). Other research focus on the limitations faced by women in terms of participation (topics already mentioned in the other subsections).

All the interviews conducted also highlighted the lower participation of women in decision-making processes within the Amazonian communities, as well as a lower participation in the activities that the organizations interviewed implement in these territories. Gender roles, which make women mostly subordinate to the domestic sphere, explain to a large extent this lower participation of women. For example, Fitts et al. (2020) highlight that many families have farms far from the community where they spend days at a time and thus cannot attend community meetings. In addition to this, Meola (2013) highlights that even when women are able to attend meetings with children, some do not like to bring them to meetings because they are distracted and thus cannot actively participate (Meola, 2013).

Similarly, one of the interviewees in Ecuador explained, that although her organization seeks to have equal participation of women and men in training activities with indigenous communities in the Amazon, only 30% of those who attend are women. Explaining why this participation is low, she said:

"Often, the projects that we do in the Amazon are long, meaning that women have to leave their home, farm, husband, and grandparents for many days. It is not only the children that the women are in charge of, but the whole family. Very often we run into the difficulty that many of the women do not have a passport in case we want to do regional workshops and mobilize them".

Interview 1

In addition, in another interview Schmink and Arteaga Gomez-Garcia (2015) mention that women are less able than men to obtain citizenship documents (such as passport or necessary forms of identification) and have less recognition of their rights. Therefore, women face barriers to participate in some meetings, especially regional meetings in other countries (although they may be relatively close) and to access social services, which are part of their citizenship rights.

Some of the interviews emphasize that, on occasions, even when women are present in the activities that take place, they tend to sit in the back rows and their participation is minimal. Moreover, some articles mention that women often do not feel comfortable speaking in public or in the presence of men (Schmink and Arteaga Gomez-Garcia, 2015; Freitas et al., 2020; Fitts et al., 2020). Meola (2013) found that women leaders do speak in public, evidencing that lack of confidence and restrictive norms dictating that women should not speak in public can be explained as barriers to women's participation and leadership. Similarly, some of the preliminary interviews mentioned examples of women who gained confidence and skills by participating in different meetings and training sessions. As a result, they became leaders, revealing that these strategies can be a means of integrating more women leaders into geospatial projects and services.

At the community level, gender roles also condition participation in social and economic decision-making. For example, in many communities in Peru, the majority of forest heritage protection and conservation activities are carried out by men, and women have very little representation in the assemblies that manage these issues. According to one interviewee, the few women who are present in these decision-making spaces are there because they have inherited the position from a family member:

"There are very rarely women in the assemblies. For example, in one of the associations, there are only a couple of women and these women are there because they have inherited the position from their father. So, participation is tiny, very small…"

Interview 8

Similarly, Meola (2013) found that some women leaders inherited their position, either through their parents, or as widows after the death of their husband who was a leader. In the latter case, they would have accompanied their husband in his leadership role and gained the knowledge and respect of the people.

However, an increase in women's participation and leadership is increasingly noticeable. For example, some women become exceptional leaders, such as Gloria Ushigua in Ecuador (Vallejo et al., 2019); Marina Silva (Schmink and

Arteaga Gomez-Garcia, 2015), Joênia Wapichana (Congreso), Sonia Guajajara (APIB) and Nara Boné (COIAB) in Brazil; and Ruth Buendía (AIDESEP), Tabea Casique (CORPIAA and COICA) and Ketty Marcelo (ONAMIAP) in Peru, among many others. Also, women's participation in organizations and movements such as the Union of Rural Workers (STR) in Brazil has increased in recent decades from 3% in the 1970s to 33% in 2005 (Schmink and Arteaga Gomez-Garcia, 2015).

Other articles also highlight how women participate. Fitts et al. (2020) observe that women participate in meetings and assemblies, while Larson et al. (2018) find that in some activities women participate more. For example, (Larson et al., 2018) found that women participate more in monitoring compliance of rules and arbitrating in disputes.

Freitas et al. (2020) suggest that women participate in some commercial projects, but their participation is perceived as voluntary. Additionally, Schmink and Arteaga Gomez-Garcia (2015) find that women participate more in projects perceived to be within women's traditional spheres, i.e., those related to food production, medicinal plants, and handicrafts.

Some interviews also highlighted a progressive improvement in the participation of women in Amazonian communities. For example, in Ecuador, it was noted:

"There are now women leaders, especially within the younger population. Even so, there is a lot of cultural baggage that prevents them from carrying out certain productivity activities, or attending certain events, because they have to comply to what their men say".

Interview 1

Two other interviews (in Ecuador and Colombia) also highlighted that when the project is financed by an international donor, a minimum level of women's participation in activities is achieved.

In relation to this progressive improvement in women's participation, another interviewee in Peru pointed out that these changes in dynamics are also due in part to the temporary migration of men:

"In some places what is being observed, is how a generation of women is beginning to occupy positions of responsibility in the community when men leave the community to work. And they start to become communal leaders. It's an interesting process".

Interview 3

Historically, some women started their own organizations to gain some power and a voice, in response to their exclusion from male-dominated organizations. Furthermore, some organizations such as CONFENIAE (Confederation of Indigenous Nationalities of the Ecuadorian Amazon) do not have a gender agenda because gender is seen as a divisive issue, promoted from outside (Schmink and Arteaga Gomez-Garcia, 2015).

However, Schmink and Arteaga Gomez-Garcia (2015) explain that indigenous women fight for women's rights, not to change traditional gender identities, but to rectify their exclusion and lack of rights in new areas of public life. Other indigenous women's organizations, such as the Association of Waorani Women of the Ecuadorian Amazon (AMWAE) established in 2005, were created to give women more visibility, a voice, and power.

Although initially the groups came to give women more visibility and a voice, they eventually began to focus on women-only projects such as handicrafts and nurseries, which help increase women's participation, but at the same time somewhat diminish the power of such organizations (Schmink and Arteaga Gomez-Garia Arteaga, 2015). Thus, the effective inclusion of women is a complicated issue and one that requires in-depth study in each intervention context.

KEY POINT:

In general, the participation and leadership of women is much lower than that of men, although this participation seems to have increased in recent years in certain contexts.

RECOMMENDATIONS:

- To increase women's effective participation, it is important to understand the historical and normative situation that helps explain the challenges women face and thus arrive at ways to overcome those challenges.
- Linking women's organizations, treating their knowledge and contributions with respect, and putting them on an equal footing with other local organizations.
- Reflect on common and/or structural challenges for women, and how to overcome them. For example:
  - Lack of childcare - provide day care service
  - Distance and danger of travel - consider the location of the meeting and/or how to facilitate safe transportation.
  - Multitude of responsibilities and schedules - hold meetings at dates and times when it is easier for women to participate.
  - Education level and language - hold meetings in local language, use tools with few words and more visuals, do activities that do not involve reading and writing.
  - Possessive/lack of understanding by husbands - have spaces with men to reflect on gender issues, have role models of women leaders, have exchanges for men to see, accept and get used to the fact that women can participate and be leaders, talk about new masculinities with men and women.
  - Women are not comfortable speaking in public - have role models of women leaders, exchanges for women to see other women leaders, have women-only spaces.
- Make invitations to events and activities explicit for both men and women. Often membership is by household/family and by default it is the male head of household who participates.

3.1.11. FLack of formalization and land rights

Two of the interviews conducted emphasized that the low proportion of women who own land is a fundamental barrier to accessing information, accessing bank loans, and, making productive decisions in general. For example, it was mentioned that in Ecuador women tend to be very involved in agricultural production, however, there are gender gaps in the marketing of agricultural products.

Although there are some women who do participate actively in marketing (for example, in Peru, the *Shipibo* women are responsible for marketing their handicrafts), women generally face greater obstacles than men in marketing agricultural products. One of these obstacles mentioned was access to credit, as they are generally not the owners of the land, and therefore may have more difficulty accessing formal credit. In Peru, another interviewee also emphasized the invisibility suffered by women who do not have land titles and are not considered heads of household for purposes of, for example, granting them credit, the result of which creates a generalized system that is discriminatory. The interviews also pointed out that in some of the Amazonian countries indigenous communities have more rights over their land tenure (e.g., Guyana), while in other countries these rights are not as strong (e.g., Brazil).

There are many examples of Amazonian women's groups in various countries including Ecuador, Colombia, Peru, and Brazil that are fighting to defend their territories, although they are often threatened and killed. Even given the strong involvement of women in defending their territories, women have little recognition of land rights in communal lands. The *chacra* is the domain, and therefore the property, of women, although their property rights are not formal. Land distribution depends on community norms that typically favor men due to inheritance issues, marriage customs, and bias in favor of men in formalization processes (Caballero-Serrano et al., 2019, Larson et al., 2018). This preference and bias in favor of men impacts women especially when there is separation, divorce, or migration (Deere and Leon, 2001). Moreover, communities often focus so much on defending their communal rights that they do not pay attention to the inequalities and difficulties women face in accessing land. Thus, the community land approach can obscure gender inequalities (Larson et al., 2018; Schmink and Arteaga Gomez-Garcia and Arteaga, 2015). Even more so, few government officials acknowledge the problem and even fewer focus on solving land rights-related problems faced by women (Larson et al., 2018).

KEY POINT:

In the Amazon there is little land formalization, which results in difficulties, especially for women in accessing credit (because they are less likely to have/be named on the land title) and can also result in the loss of a resource (and thus related livelihoods) in the case of household dissolution due to separation, divorce, or death.

RECOMMENDATIONS:

- Support women in land formalization processes.
- Inform public officials of the importance of a gender perspective; to include land rights for women.
- Create maps with information on land tenure and women's rights in the different tenure systems.
- Provide alternatives to access credit that do not depend on a land title.

3.1.12. Other challenges

In addition to these challenges, the interviews and literature review revealed another set of obstacles that women in the Amazon regions face.

Two of the interviews, one in Guyana and one in Ecuador, referred to the fact that in many of these Amazonian communities, especially those close to gold mining areas, many men leave home for long periods of time in search of employment and fortune. This situation means that, during these periods, women are left alone at home and have to maintain the farms and families on their own. They do this with very limited financial resources and suffer a considerable increase in their workload. In these cases, women find it difficult to meet the food security needs of their children and themselves.

With reference to areas where gold mining takes place, which are usually farther away from larger population centers, there is the issue of trafficking of indigenous women. In Guyana, for example, it was explained that some indigenous women in these areas are deceived, offered false formal employment, and that many of them end up engaging in illegal prostitution and are victims of gender-based violence. Another notable case is the trafficking of indigenous, Amazonian, and Andean women in Madre de Dios (Peru) in illegal mining areas. An ongoing study by the SERVIR-Amazonia Program (by August 2021) shows the negative impacts of this activity on women, both because of the health effects of mercury (which is generally found in the populations living in the areas surrounding illegal mining operations) and because of the effects on their lives due to the abuse they suffer.

On the other hand, Schmink and Arteaga Gomez-Garcia (2015) mention that women have less access to training and technical training than men, although in general access to technical assistance is generally limited in the region.

KEY POINT:

There are many challenges facing the populations of the Amazon and in particular indigenous women.

RECOMMENDATIONS:

- Consider the multiple challenges that different individuals/groups of people, including women, may face in participating in, using, or benefiting from services.
- Learn from success stories and be innovative and imaginative in finding solutions to overcome challenges.
- Involve women and diverse groups to get various perspectives and generate a range of ideas.
- Reflect on what works and what doesn't work; adapt as necessary and continue to learn on an ongoing basis.

© Gino Germana/PROBOSQUES JICA

SERVIR AMAZONIA

Service Catalogue

SERVIR uses a service approach to bring diverse technologies. The resulting solutions are tailore "services" because they are more than standalo environmental decision-making.

Land Cover Land Use Change & Ecosystems

Water & Water Related Disasters

Deforestation Monitoring & Reporting
Ecuador

Goal

Provide continuous and rigorous information about the forest and other ecosystems' status and changes.

Co-developers

- Ministerio del Ambiente, Agua y Transición Ecológica de Ecuador (MAATE)
- Spatial Informatics Group (SIG)
- FAO
- Consorcio de Gobiernos Autónomos Provinciales del Ecuador (CONGOPE)

Mon
Guya

Goal

Provid
going
This se
resultin

Mapping of Soil Fertility
Ecuador

Goal

Generate high-resolution digital soil maps to support efforts in maintaining rural soil fertility, increasing productivity, and preventing contamination contributing to reduce soil desertification and degradation in Ecuador.

Co-developers

- Ministerio de Agricultura y Ganadería (MAG)
- Alliance Bioversity International-CIAT

Monitoring of Gold Mining in the Peruvian Amazon
Peru

Goal

Quickly identify possible new illegal mining fronts in priority areas, such as protected area buffer zones, and persistent activity in degraded areas.

Co-developers

- Ministerio del Ambiente (MINAM)
- Programa Nacional de Conservación de Bosques para la Mitigación del Cambio Climático (PNCBMCC)
- Conservación Amazónica (ACCA)
- Spatial Informatics Group (SIG)

Improving Resilience and Reducing Risk of Extreme Hydrological Events
Peru, Colombia, Brazil

Goal

Provide stakeholders in the Amazon Basin region with improved flood forecasting ability, including more accurate information about timing, magnitude and impact, to increase their understanding of risks and support greater resiliency to flood disasters.

Co-developers

- Brigham Young University (NASA/AST J. Nelson)
- Environmental Modeling Laboratory (EMRL)
- Servicio Nacional de Meteorología e Hidrología (SENAMHI)
- Instituto de Hidrología, Meteorología y Estudios Ambientales (IDEAM)
- Centro Nacional de Monitoramento e Alertas de Desastres Naturais (CEMADEN)

Forecasting Seasonal to Sub-Seasonal Fire & Agricultural Risk from Drought
Colombia, Brazil

Goal

Provide information for mitigating the negative impacts of drought and fire on forest and agriculture in the Amazon basin, evaluating drought conditions at temporal and spatial resolution to predict fire vulnerability.

Co-developers

- Goddard Space Flight Center (NASA/AST D. Morton)
- Instituto de Hidrología, Meteorología y Estudios Ambientales (IDEAM)
- Secretaria de Estado de Meio Ambiente (SEMA-Acre)
- Centro Gestor e Operacional do Sistema de Proteção da Amazônia (CENSIPAM)

NASA · USAID FROM THE AMERICAN PEOPLE · Alliance Bioversity CIAT · Spatial Informatics Group · imaflora · ACCA · ecociencia

e stakeholders together to identify local development problems and co-design solutions that use satellite data, Earth science, and geospatial ed, need-based decision-support products (tools, data sets, training resources and capacity building activities). SERVIR calls these solutions one geospatial products and expected to be sustainable and evolve as a long-term service offered by the implementing partners to improve

Weather & Climate

Drought & Fire Risk

Number of Services

itoring and Evaluation of Mangroves
ana

e a platform for automating the analysis of radar and optical imagery back several years and setting a year-2020 baseline for future analysis. rvice makes mangrove-related land-use change transparent and the g analysis publicly available for use by government and civil society.

Co-developers
- National Agricultural Research and Extension Intitute (NAREI)
- University of Guyana (UG)
- Alliance Bioversity International-CIAT
- Spatial Informatics Group (SIG)

Monitoring forest dynamics to enable biodiversity conservation in the Amazon
Brazil

Goal

Assess the impact of private sector engagement on biodiversity conservation in the Amazon by characterizing forest and habitat dynamics.

Co-developers
- Alliance Bioversity International-CIAT / CAL-PSE
- Spatial Informatics Group (SIG)
- Instituto de Manejo e Certificação Florestal e Agrícola (Imaflora)

Guyana 1

Brazil 6

TerraOnTrack - Monitoring Community Lands, Protecting Forests and People
Brazil

Goal

Contribute to community-based initiatives working within the Brazilian Amazon by introducing technological resources that will allow them to quickly identify potential threats to their territories and monitor illegal activities on the ground, which in turn will increase their territorial management capacities and protect forests.

Co-developers
- Instituto de Manejo e Certificação Florestal e Agrícola (Imaflora)
- Spatial Informatics Group (SIG)

Ecosystem Services Modeling in the Amazon's Forest-Agricultural Interface
Brazil and Peru

Goal

Provide accurate maps for stakeholders and decision-makers to understand the policy and economic scenarios that tip agricultural production systems towards deforestation, particularly due to palm oil and cocoa production.

Co-developers
- NASA Jet Propulsion Lab (NASA/AST N. Pinto)
- Alianza Cacao
- Servicio Nacional de Áreas Naturales Protegidas por el Estado (SERNANP)
- EMBRAPA - Unidade Amazônia Oriental (Estado do Pará)
- Centro de Conservación, Investigación y Manejo de Áreas Naturales - Cordillera Azul (CIMA)

Quantifying the Effects of Forest Changes on Provisioning & Regulating Ecosystem Services
Brazil and Peru

Goal

Allow regional and local planners and decision-makers, and citizens of Acre and Ucayali to better understand the tradeoffs between development activities and ecosystem services.

Co-developers
- University of Richmond (NASA/AST S. Spera)
- Spatial Informatics Group (SIG)
- Universidade Federal do Acre (UFAC)
- Secretaria de Estado de Meio Ambiente (SEMA-Acre)
- Comissão Pró-Índio do Acre (CPI-Acre)
- Conservación Amazónica (ACCA)
- Universidad Nacional de Ucayali (UNU)
- Servicio Nacional de Áreas Naturales Protegidas por el Estado (SERNANP)

CONTACT **Brian Zutta**
Science and Data Lead
bzutta@sig-gis.com

#SERVIRamazonia
@SERVIRGlobal
servir.ciat.cgiar.org
servirglobal.net
servir.ciat.cgiar.org/service-catalogue/

3.2. Geospatial Services and Gender

This section begins with a brief description of women's participation in science, technology, engineering, and mathematics (STEM) technical careers, including careers and jobs related to geospatial services or technologies. The section then proceeds to give an overview of how the organizations that were interviewed are currently using geospatial services in their projects. It then describes the gender-specific information found in the literature review for each thematic area of the SERVIR-Amazonia Program, and goes on to briefly examine how these organizations are integrating a gender perspective into environmental management projects in the Amazon. Subsequently, a series of experiences on the use of geospatial services to directly benefit women is given, followed by a perspective of affiliated organizations of the SERVIR-Amazonia Program on the potential use of geospatial services for gender equality.

3.2.1. Gender gaps in careers and technical jobs (STEM)

The participation of women in STEM careers and related jobs was discussed during some of the interviews (mentioned in four interviews). Although the interviews did not provide official representative data or statistics, they appear to reflect that there is a diversity of this participation of women by country. For example, in Guyana and Colombia there appears to be a higher representation of women in STEM careers and related jobs compared to other countries such as Peru.

However, there is also variability within the same country. Thus, in Colombia, one interviewee highlighted that the participation and representation of women in national institutions in the environmental sector is quite strong (although it is not clear whether women also have leadership roles in these institutions), while this representation is lower in the regions, although with an upward trend:

"Those who do remote sensing centrally, in Bogota, are mostly women. Let's say that out of a group of 10 there are only 2 men. [...] At territorial level, most of those who manage the geographic component are men, but women are also filling these positions little by little".

Interview 12

On the other hand, in Colombia it has been found that gender gaps in the research field are a constant, but happily there is an increase in the number of female doctors for the period between 2010 and 2017 (National Information System for Higher Education of the Ministry of Education). Therefore, there is now a consensus about the need to motivate girls and young women, while considering the barriers that exist in accessing scientific careers in society.

Similarly, in Guyana, although relative to other countries, there is a higher participation of women in STEM careers and professions. However, access to this type of education for indigenous communities is lower:

"Very often, if they don't have government support it's especially difficult to access this type of education. That's certainly a barrier for indigenous peoples and indigenous women".

Interview 9

The trend for lower female representation in geospatial technical careers is also noted in the literature. For example, Popp et al. (2019) found

that there are fewer women at higher levels in scientific academic careers and concluded that there is a need for actions to eliminate gender bias in such positions. The results of this study evidence the importance of having role models for women, the importance of creating friendly conditions in families, and of using quotas, even when there is resistance from men.

Similarly, one blog (Moloney, 2020) mentions that there are few women cartographers participating in an open process of mapping urban services (OpenStreetMap), which may reflect the low level of women in STEM careers. It also describes an initiative called Geochicas to increase women's participation by mapping different services that men do not normally consider (such as hospitals, women's clinics, childcare services, public toilets, and domestic violence shelters). Finally, it is important to emphasize, that although there is a clear lack of homogeneous indicators referring to STEM careers in Latin America that allow a comparison by country, gender gaps are generally reported in both participation and salaries in the region (Arredondo Trapero et al., 2019).

In a series of dialogue events organized by SERVIR-Amazonia (between mid-2020 and early 2021) in Peru, Ecuador, Brazil and Colombia, testimonies were collected noting that the number of women participating in GIS activities is decreasing as they specialize in the area, and that there are more women undergraduates than graduates in these areas. One explanation is that women are discouraged, as they do not see other women working in these areas.

Among the recommendations, it was mentioned that giving visibility to women working in geotechnologies would contribute to encourage more young women to continue in the career. Other suggestions include developing affirmative actions in companies, such as recognition and incentives, which would generate more opportunities for young women to enter these areas. On the other hand, it was indicated that it is necessary to bring people from the academic world closer to the communities with different initiatives such as "knowledge weeks".

One of the ways in which professional and technical women seek to integrate and promote their capabilities is through the generation of spaces and networks around gender equality and STEM issues. Thus, networks have been identified such as:

- Women in Nature Network

https://www.womeninnaturenetwork.org/

- Geolatinas

https://geolatinas.weebly.com/

- Women in Earth Engine

https://womensearthalliance.org/blog/

- Laboratory (*Laboratoria*) (Lima)

https://www.laboratoria.la/

- R Ladies - https://rladies.org/
- Women in Conservation Network (Red de Mujeres en Conservación)

https://mujeresenconservacion.home.blog/

- Environmental networks and gender in Latin America and the Caribbean (Redes ambientales y género en América Latina y el Caribe)

https://www.youtube.com/watch?v=CedKeZBJ_Po&feature=youtu.be

- Women in GIS (WiGIS)

https://mundogeo.com/2020/01/08/voce-sabe-o-que-e-o-women-in-gis-conheca-e-participe/

- Colombian Network of Women Scientists

https://www.redcolombianamujerescientificas.org/

WiGIS-BR (Brazil) has a Whatsapp community to promote gender policy integration and research in companies working in georeferencing. Colombian

Network of Women Scientists, which has a Gender, Science and Health group, in which there are researchers from different disciplines with an interest not only in climate change and mining, but also in the generation of alliances to reach the Amazon region.

KEY POINTS:

- Inequalities in technical (STEM) careers and jobs vary by country, area, and organization.
- There are no standard/homogeneous indicators on the number and percentage of women in different STEM careers or gender wage gaps in Latin American countries.
- It is important to include the perspective of women and diverse groups because they can result in new perspectives and ideas.
- Professional and technical women are forming groups that allow them greater self-identification and development of their potential.

RECOMMENDATIONS:

- Map (or use existing maps) women's statistics and gender gaps, e.g., number and percentage of women in STEM careers, types of positions (low/entry, mid, manager, board etc.), and salary gaps.
- If maps/information already exist ask partners to include or report on in projects and services.
- Establish mentoring and tutoring or counseling programs for women interested in using information services, or for women interested in training in geospatial systems and related STEM careers.
- Create family-friendly conditions (childcare, flexible schedules, etc.).
- Use quotas (employees, boards, organizational memberships, etc.)
- Create spaces/events/programs/projects exclusively for women.
- Develop standard/homogeneous indicators on the number and percentage of women in different STEM careers, or gender wage gaps in Latin American countries.

3.2.2. Use of geospatial services

This section presents a descriptive overview of the current use of geospatial services in the organizations interviewed. Subsequently, the study has been complemented by collecting additional information. Even so, given the limited number of interviews and cases detected, these results cannot be extrapolated categorically to the other partners of the SERVIR-Amazonia Program or to other institutions in the region, but they serve to provide an overview of the potential use of these technologies in the different services of the Program.

According to the interviews conducted, the organizations currently using geospatial services do so mostly for services related to ecosystem management. In particular, seven organizations interviewed explicitly reported the use of these technologies for areas related to monitoring deforestation and illegal mining; demarcation of indigenous territories or protected areas; analysis of territorial invasions and conflict resolution; identification of natural resources and identification of sacred natural sites; and analysis of land cover transformation.

Only two organizations reported the use of geospatial systems for drought and fire detection and prevention, one of them uses hot spot monitoring and identification tools. None of the organizations interviewed reported the use of geospatial systems for monitoring and modeling weather and climate predictions, nor for a hydrological disaster service.

There is therefore great potential for SERVIR-Amazonia to use geospatial and satellite systems in these areas that are not currently being used and that can be of great use to communities and organizations in the Amazon, including women's organizations. As one of the interviewees highlighted:

"I think it would be very important to use these geospatial services, because when we go into an extremely dry season, we have a lot of wildfires and they are very destructive. Right now, we've had a prolonged rainy season and some of our communities have been affected by flooding. [...] Definitely knowing the climate system, especially with the weather becoming so unpredictable recently, would be very helpful...in terms of droughts, wildfires and flooding in the rainy season".

Interview 9

In the late 1990s, the Foundation for the Survival of the Cofan People (FSC) supported the implementation of a system of monitoring and park rangers in Cofan territory in Ecuador. The aim of the system was to control and/or prevent activities such as mining, illegal logging, and to prevent settlers illegally occupying their land, among others. With the support of international cooperation, 200 Cofan park rangers, men, and women, were trained and hired. They were trained in GPS and compass navigation, map reading, monitoring, first aid, conflict resolution, and environmental and indigenous legislation, including young people. The dissemination of the activity contributed to expanding forest conservation awareness over indigenous territories although the lack of state funding has limited its expansion to other areas (Mendoza and Carrion, 2016).

Finally, it should be noted that some of the organizations interviewed act as intermediaries (bridge organizations) between national governments and local communities. For example, through the use of geospatial systems they support local and indigenous communities in the Amazon to denounce illegal activities

on their territory and to provide a legal basis in cases where formal lawsuits are filed. These organizations could thus be instrumental in establishing links between SERVIR-Amazonia's services and women's organizations in the territories. This would achieve a more direct impact of these technologies on women's organizations in Amazonian communities.

However, it is important to note that when these bridging organizations interact with local communities, they do so through their leaders or *caciques*, who are usually men. Thus, when communities have specific demands for geospatial information, it runs the risk of only reflecting the needs of part of the population (and local power dynamics), and not necessarily the specific needs of women. Thus, the degree of inclusion of women's needs will depend on the internal decision-making structures of each community and the participation of women in those spaces.

KEY POINTS:

- Many organizations focus on the area of ecosystem services management and few on the other areas (climate change, fire/drought, and water resources); there are opportunities to increase services in these areas.
- When working with communities it is important to consider local dynamics (of power and/or exclusion).
- Further experience needs to be collected and documented.

RECOMMENDATIONS:

- Analyze existing organizations and/or networks in the community - What organizations exist, how do they relate to each other, who is included and excluded, do women participate?
- Include as many organizations as possible.
- Share information and services in an open and transparent manner to avoid exacerbating inequalities, including explicitly to women.

3.2.3. Gender in the different thematic areas of the SERVIR-Amazonia Program

This sub-section presents some of the key gender publications and observations in relation to the different thematic areas of the SERVIR-Amazonia Program. As highlighted above, and as highlighted by other gender researchers working in the Amazon region (Schmink and Arteaga Gomez-Garcia and Arteaga, 2015), this literature is not very extensive. Most of the threats in the Amazon are against ecosystems whose management also encompasses issues such as floods, fires, changes in climate, etc. However, this section is divided into four distinct parts following the thematic areas of the SERVIR-Amazonia Programs, always keeping in mind that these are interrelated. For each thematic area, the most relevant observations and research results are highlighted below:

a. Ecosystem management

In the ecosystem literature, three types of equity are referred to: distributional equity (i.e., of costs, risks, and benefits), procedural equity (i.e., in decision making), and contextual equity (i.e., of access, capabilities and power) (Etchart et al., 2020 citing Corbera, Brown and Adger, 2007; McDermott, Mahanty, and Schreckenberg, 2013; Pascual et al., 2014). Among these, the gender and ecosystem management literature make frequent mention of contextual inequity (in terms of access to and control of natural resources, including forests and lands), and procedural inequity (in terms of decision making), with men comprising more leadership positions in the associations and cooperatives that manage protected areas and reserves (Schmink and Arteaga Gomez-Garcia, 2015).

The following are specific research findings related to biodiversity and ecosystem services management, mangrove management, and mining and forest management, which are some of the topics highlighted in the ecosystem management area of SERVIR-Amazonia's website.

Biodiversity and provision of ecosystem services

In their study, Cruz-Garcia et al. (2019) explore gender differences in the valuation of ecosystem services in an area of the Colombian Amazon. The study indicates that men and women identify and value ecosystem services similarly, but there are some differences in the services valued and their valuation criteria. The resources that are important for both men and women are firewood, construction materials, bush meat, medicinal plants, water, and agricultural land. Women gave more importance to wild fruits (both for food and for cultural reasons – to prepare chicha, for traditional dances and for construction materials), resources for handicrafts, and they generally value ecosystem services for their role in health and well-being (e.g., medicinal plants) more than men. In addition, only women mentioned the criterion of fun and enjoyment (similar to a study in South Africa where women value the criterion of recreation more (Anthony and Bellinger, 2007 cited in Cruz-Garcia et al., 2019).

On the other hand, men focus more on wood and other resources for making tools, as well as coca leaves. With these findings, the study points out that resource scarcity may affect men and women differently. For example, the scarcity of fish and game animals is making men's work more difficult. Based on this, the authors point out the importance of examining in a differentiated manner, which resources are primarily valued by men or women before designing and implementing projects related to ecosystem management. In this sense, depending on which specific resources the project focuses on, it may benefit women or men to a greater or less degree.

Mangrove management: crab fishing

The study by Magalhães et al. (2007) examines the role of women in the crab value chain in the mangroves of northeastern Brazil, in the state of Para. The study points out that the role of women is under-recognized. Women work more frequently in processing and in the market, so their role is typically seen as assistants to their husbands who do the harvesting in the mangroves.

Illegal mining

Aikman's (2019) study is an ethnography of an indigenous woman of the *Harakmbut* ethnic group in the Peruvian Amazon. The ethnography notes that the lives of *Harakmbut* women have been transformed over the past 40 years by practices such as unregulated and illegal gold mining that has led to the loss of their indigenous territory and biodiversity. The article examines how the arrival of outsiders related to illegal

mining has changed their biophysical environment and knowledge. For example, the study refers to the effect of semi-permanent illegal mining camps and settlements, power games and the influence of group leaders and bosses (e.g., mafiosi/criminal gangs) that change the social and power dynamics in the community, and also impact the decrease in fishing and hunting animals.

Community forest management and timber resource management

Men and women use forest resources differently and are also involved in different timber resource management processes. For example, in a study in Amazonian communities in Peru, Larson et al. (2018) note that women and men have different uses of the forest, with women more frequently involved in the extraction of non-timber forest products, while men are more involved in hunting and fishing activities. Similarly, Schmink and Arteaga Gomez-Garcia (2015) note that in a study in Para in Brazil, women listed twice the number of non-timber forest products than men (citing Shanley et al., 2011: 239), while in another study they highlighted that men listed twice the number of timber tree species than women (citing Vazquez, 2013: 16).

Similarly, in their study, Cooper, and Kainer (2018) explore the perspectives of residents of a logging project in a protected area in the Brazilian Amazon. The study found gender differences in reasons for logging support. Men mentioned financial aspects and women mentioned physical assets such as infrastructure, as ways to improve access to health and education services, as well as electricity, that could facilitate the use of household appliances to reduce women's time spent on household chores. The study also found different gender perceptions in the arguments against logging, with men citing more governance issues, while women cited environmental concerns.

These differences in perception and participation are important because forest management projects for timber extraction tend to be led by men, but their management has an impact on non-timber products, which are generally more important and valued by women. Thus, the management of one resource impacts other resources and each resource may be of differential importance to different groups in society. The management of one group impacts other groups that typically do not have a voice in decision making. In fact, in one study they found that women are more critical of logging projects (Schmink and Arteaga Gomez-Garcia, 2015 citing Montysuma and Cruz, 2008). In relation to this, Schmink and Arteaga Gomez-Garcia (2015) describe how forest management for timber extraction focuses almost exclusively on timber harvesting and neglects non-timber forest products (citing De Jong, 2010: 292).

Finally, the study by Larson et al. (2018) also highlights that in certain processes of the development of rules and norms on the use of timber resources, and in some participatory mapping exercises of forest resources, more men are involved. The need to invite more than one member of the household to these processes is noted, because the male head of household tends to attend and participate in these processes alone, and there is a lack of women's perspective in meetings and workshops. Similarly, one study highlighted that timber resource management meetings focus on issues that may be more important to men, such as the development of management documents, issues of encroachment by outsiders, contracts with logging/timber companies, money requirements from companies, rubber projects, and illegal logging (Schmink and Arteaga Gomez-Garcia, 2015 citing Montysuma and Cruz, 2008).

In Peru, the study by ACCA (2021) mentions the concessionaire organization ACOMAT (Association of Timber and Non-Timber Forest Concessionaires of the Manu, Tambopata and Tahuamanu Provinces). It groups male and female concessionaires and develops systematic satellite monitoring work and has been trained by the NGO ACCA (Amazon Conservation). After almost 5 years of working with ACCA and the state, ACOMAT has managed to become an example for other concession holders in the Madre de Dios region for its conservation and monitoring of its concession. The dedication and empowerment of women in ACOMAT has made it a symbol for women in the region. Flor Rumayna, an ecotourism concessionaire in Madre de Dios, has become a point of reference for ACOMAT as a drone operator. She has managed to eliminate all illegal acts of deforestation in her protected forests and reports those who seek to trespass or illegally occupy the area.

b. Drought and wildfire risk

With respect to the thematic area of drought and fire risk, the study by Schmink and Arteaga Gomez-Garcia (2015) mentions the *Proteger* project, which is a fire management project in the Amazon, which managed to increase women's participation by applying a gender approach. The project's gender strategy included issues such as training women extensionists, including topics of interest to women, and considering meeting schedules so that both women and men can attend, among others.

c. Water resources management and hydroclimatic disasters

Regarding the thematic area of water resources management and hydrological disasters, Meola's (2013) study highlights the fact that women do not have the same type of knowledge as men with respect to water resources such as rivers. In this sense, it could be interesting to map waterways with women and men separately to examine the differences in their maps and see which aspects are more relevant to map.

With reference to water resource management, the study by Freitas et al. (2020) in the Brazilian Amazon, indicates that women participate in fishing, albeit in an invisible way. Women fish for their families' subsistence and are also in charge of fish processing, as an extension of their domestic responsibilities. Examining the case of co-management projects for the arapaima species in 54 fishing communities, the study points to the potential of these co-management systems as an innovative source of women's income from fishing and as a way to improve the recognition of women's participation in fishing activities.

Schmink and Arteaga Gomez-Garcia (2015), citing Favila (2006, 25) and Ruffino et al. (2011, 331), mention the *ProVárzea* project as another project that also improved the situation of women in water resource management and hydrological disasters. The project focused on the management of flood-prone areas in the Amazon. This project had a gender focus, collected sex-disaggregated data, trained women, included them in paid activities, and contributed to the increase of women in leadership positions in community associations.

d. Weather and climate thematic area

Finally, no studies were found in the Amazon with a gender perspective regarding the thematic area of weather conditions and climate. The study by Ruiz-Mallen et al. (2017) focuses for example on the capacity of *Tsimane* communities in the Bolivian Amazon to adapt to climate change. However, the study does not do a gender analysis or examine the different adaptive capacity of men and women. Other work on gender and climate change in Latin America emphasizes the importance of understanding gender differences in terms of the division of labor, roles, responsibilities, decision-making, and access to and control of resources (see for example Acosta et al., 2019).

KEY POINT:

Similar to the previous section, we found little information in the literature on gender related to the different thematic service areas. The most represented service is ecosystem services. The existing information focuses on the different needs and perspectives of women and the invisibility, or low valuation of their contributions.

RECOMMENDATIONS:

- Examine and consider how different resources are valued and used by men and women.
- Consider the interconnectedness of resources and how the extraction (management) of one, such as timber trees, impacts others, such as non-timber forest products, and the impacts they have on men and women.
- Make visible, recognize, and value the contributions of women, for example in fishing and crab processing.
- Talk, discuss and obtain input from community organizations and groups (with men and women) about what information and services (about each area) could support them.

3.2.4. The gender approach in organizations working in the Amazon

Examining how the organizations interviewed address the different gender challenges, in general they are making efforts to increase the participation of women in their agricultural development and environmental conservation activities in Amazonian communities. However, the interviews did not identify that these organizations were carrying out projects specifically for women, but rather that some of the projects being carried out were being particularly useful for women.

In Ecuador, one of the interviewees highlighted the pilot experience of "integral farms", which have had good results with local communities, especially with women. These pilot farms use sustainable agricultural methods that seek crop diversification using technical standards to care for the soil, the environment, and to increase the resilience of these farms in general. Similarly, in Brazil, another interviewee highlighted an agroforestry project with cocoa plantations in small forests in the Southern Amazon, where they worked closely with women from a cooperative to think with them about the main challenges and how they could be addressed. According to this interviewee, focusing on working with women or having a gender approach "depends a lot on the individual will of the people on the team, but they are not approached in a structured way".

Similarly, one of the interviewees explained that the Ministry of Agriculture had been strengthening the participation of women and men in events in recent years the differentiated registration, as well as registering who was receiving the incentives distributed by the Ministry (number of women and men beneficiaries). Although this had only been done on a pilot basis in one of the Ministry's investment projects, the interviewee stressed the importance of systematically collecting this gender-disaggregated data in all the Ministry's investment activities.

In the geospatial technologies and monitoring area in Peru, one of the organizations highlighted having conducted a series of workshops on online mapping and data collection with local indigenous organizations, one of which was specifically a women's leadership group. Similarly, in Colombia, one of the interviewees highlighted an education project that used the results of camera traps. Women contributed to compiling and reconstructing the stories associated with the different species that were caught on camera. It should be noted, however, that while these processes can contribute to strengthening the technical capacities of female participants, they were not specifically designed to improve the situation of women in Amazonian communities, including indigenous women.

While the importance of the gender approach and the need to address the specific challenges faced by women in the Amazon was highlighted in all of the interviews conducted, some of the organizations stated that they did not have a formal gender strategy. As one interviewee highlighted:

"To be very clear and very transparent, we don't have a gender strategy yet. There is a greater understanding about what the barriers are for women. But precisely what we don't have is a gender strategy in our projects. We are starting to work this out."

Interview 4

However, some of the interviews did give indications that the development of strategies for the inclusion of women is increasingly a part of the design and implementation of policies, strategies and programs related to agricultural production and environmental conservation.

This is the case in Ecuador, where one of the interviewees pointed out that, as part of the National Agricultural Public Policy, a National Strategy on Rural Women is currently being implemented to generate guidelines for strengthening family farming nationally. Likewise, in Ecuador, gender mainstreaming is being applied in public policies related to the development of Nationally Determined Contributions (NDCs).

In Colombia, one of the organizations also highlighted that the existing gender focus in the National Development Plan provides guidelines that guide and promote work with vulnerable communities and with a gender focus. Similarly, one of the interviewees stressed the fact that efforts are currently underway to strengthen gender mainstreaming in the standards of some conservation certifications globally. In general, this highlights the relevance that gender equality is generating, albeit progressively, in environmental conservation issues.

Likewise, the interviews pointed out that, related to environmental conservation issues, there are also women's networks such as the Network of Women in Conservation of Latin America and the Caribbean, or the Network of Ecuadorian Amazonian Indigenous Women. These networks could be key for the design of geospatial services that are adapted to the needs of women in Amazonian communities, including indigenous women.

KEY POINT:

Many organizations in the Amazon are working on gender, but typically in an informal and/or sporadic way that depends on the willingness of those involved. Formal strategies for more systematic inclusion are lacking (although such strategies are in progress in some organizations/projects).

RECOMMENDATIONS:

- Link women's networks and organizations with the SERVIR-Amazonia Program; encourage their active participation to reinforce the gender approach and ensure that women's needs are considered through the projects/services.
- Continue with the inclusion of several organizations and promote their inclusion of women and a gender approach.
  - Blogging, publishing case studies or success stories.
  - To have spaces to discuss and reflect on gender issues and to talk about lessons learned and generate new ideas.
  - Seek opportunities to complement Amazonian women's projects with geospatial information and services.
- Talk, discuss and obtain input from community organizations and groups (with men and women) about what information and services (about each area) could support them.

3.2.5. Experiences on the use of geospatial services to close gender gaps

The gender approach to geospatial systems is an emerging scientific field and as such there is limited documentation. Although this section examines the potential of geospatial systems to improve the situation of women in agriculture and natural resource management in general, many of these suggestions and experiences can be extrapolated to the Amazon context.

In general, there is a consensus in the literature regarding the potential of using geospatial systems to study and address aspects of gender inequality in rural environments. Satellite imagery can complement traditional surveys by providing more frequent and higher resolution information on women's lives (Furst-Nichols, 2017; SERVIR-Mekong, 2015).

Geographic information systems are systems based on layers of information with different variables such as terrain elevation, land use, population centers and communication routes. One of the great potentials that geospatial technologies offer is the chance to make inequality more visible, or more precisely, their ability to visualize gender differences on maps at different scales. This visualization of inequality could help policy makers and researchers in developing better targeted programs, or policies to improve the situation of rural women.

For this purpose, however, it is essential to have gender-disaggregated data to create information layers with gender variables in the maps. In general, in many countries, there is a lack of gender-disaggregated data, which makes it difficult to have these layers of information nationally and regionally, as pointed out by Meinzen-Dick et al. (2012). They explain that one of the ways to collect the necessary data to make these layers of information would be to include specific gender questions (e.g., in terms of decision-making, land use and ownership, access to credit, and access to information, etc.) in national censuses or representative country surveys. Ideally, these questions are asked at the intra-household level where both partners are interviewed.

Below are a number of examples found in the literature on how geospatial services can be more inclusive. Not all have a direct gender perspective, but they provide insights into the potential to include and/or benefit Amazonian women.

- In 2017, Global Forest Watch launched the Forest Watcher app through which users can access maps and satellite data in real time via GPS and therefore without the need for an internet connection. The app helps view and monitor deforestation and fire alerts, and helps the user navigate through areas of interest. Users can also take photos on the spot and upload them to the app when they have an internet connection (Mendes, 2017). This type of application that can be used without internet connectivity has a great potential utility to involve women who do not normally perform forest monitoring tasks.
- In 2018, using the Global Forest Watch app, and interactive maps from the *Tierras Indígenas* online platform, thirteen indigenous groups from the Gran Chaco region in South America, together with Geographic Information Systems (GIS) experts, came together to determine the extent and legal status of their lands and resources. To do this, participants provided the GIS experts with their land titles, plans of secured lands in the communities, and those lands in the process of being claimed where the claimed ownership data was demarcated. This data was used to create a layer of information on the maps. These participatory activities

and the maps derived from them can help community members to strengthen their land rights and for governments, private companies, and institutions to examine land claims before initiating potential activities in the region (Pedris, 2018). Potentially, these types of activities could visualize inequality in tenure or access to land use by women in Amazon Basin communities and/or could help strengthen women's rights in community systems.

- In a study conducted in Lesotho, Ethiopia, and Ghana, Walker and Vajjhala (2009) explored the use of GIS to study gender assessments in transport. The study combined participatory mapping, demographic, and health surveys (DHS) disaggregated by gender and GIS data from the transport sector. Through these methods the study was able to visualize and assess transportation problems and health barriers for men and women. These data can be used for national priority setting. For example, for the design and development of new investment plans for new roads and clinics, improving access to clinics with new footpaths, or investing in public transport so that women and vulnerable groups can improve access to clinics.
- In Tanzania and Zambia, USAID is making use of the Mobile Application Security Testing (MAST). The mobile application is combined with a geo-data management platform to collect field data, including the names and people who use and occupy the land, in order to document land ownership rights. The use of this application is having benefits in terms of registering and recognizing men's and women's land rights, as well as reducing gender inequality and promoting women's empowerment by obtaining land certificates (USAID, 2019).
- Researchers at the Flowminder Foundation examined nationally representative geo-localized survey data in Nepal with satellite imagery and cell phone data to model and map spatial variations and gender inequalities for literacy, jobs in agriculture, and births in health facilities in the country (Bosco et al., 2019).
- In Nepal, Brown (2003) combined field surveys with geospatial information to examine gender roles, responsibilities, and workloads in a watershed in Nepal. The study found that spatial differences in workloads were related to access to roads. Specifically, women living closer to the road worked on average more than other women. Men living near roads were more involved in tasks that are normally associated with women (e.g., collecting drinking water).

Preliminary interviews also revealed experiences in which geospatial services were being used to directly assist local communities and also women potentially. Among these, it is worth noting:

- ***Mapping cocoa, coffee, and oil palm owners:*** One of the activities highlighted as potentially beneficial to women was the mapping of cocoa, coffee, and palm oil plantations. By studying the proportion of women owners of these crops, and working with local women's organizations, this activity could benefit and target women owners. If, for example, a subset of women producers who own one of these cocoa organizations could be obtained, it would be possible to see what their needs are. In SERVIR-Amazonia, a new experience is the virtual mapping of cocoa plots, in the charge of women, seeking to empower them in terms of geospatial location. The work was done through facilitators during the COVID-19 pandemic.

- ***Land mapping for agricultural insurance programs:*** Another positive experience of the SERVIR program in East and Southern Africa was the use of geospatial technology to assist national agricultural insurance programs. This agricultural insurance program needed to survey farmland on a large scale, to get an idea of who might be included or who might be beneficiaries. Initially, the survey was going to be very expensive, about US$10,000 per district, but using the technology provided by SERVIR, that cost was drastically reduced. Initially, they had been able to insure about 900 farmers, but with this technological support they were able to insure 40,000 farmers. This mapping service to improve access to agricultural insurance could also be potentially beneficial for women with land tenure, who do not have access to maps for their property and farms. Experiences with agricultural insurance are scarce in the Amazon countries, but it could be considered a valid option to explore in the region.
- ***Identification of ephemeral water bodies for pastoralists:*** In West Africa, another of SERVIR's projects sought to provide periodic information to some of the nomadic pastoralist societies of West Africa. In particular, the service provided information on the exact location of ephemeral water bodies to assist them in their nomadic processes in search of pasture and water for livestock. This service was indirectly able to improve the situation of women pastoralists since in many regions of Africa they are usually the ones in charge of watering the animals. By having the ephemeral water bodies located, the women spent less time on these foraging activities. Although the mapping of ephemeral water bodies is not as relevant to the case of the Amazon, the use of these technologies to explore other types of natural resources and land use patterns could be relevant and useful for the region.

On the other hand, the literature also points out the importance of involving women in activities related to geospatial services, as well as in participatory mapping tasks. As McLafferty (2002) states, GIS technologies are not only based on computers or spatial analysis tools, but directly involve the people who create, use, and interact with these technologies, and whose lives are affected by them. In other words, the design, development, and implementation of geospatial technologies do not occur in a vacuum, or are gender-neutral. They are tied to the spaces of everyday life and social relations where they are used and thus often reproduce existing power and gender relations in societies (Leszczynski and Elwood, 2015; Elwood, 2010).

Thus, engaging women in these technologies, as well as orientating these technologies with gender equality-based theories, could help to better understand the potential of these technologies for women in territories (McLafferty, 2002; Leszczynski and Elwood, 2015; Kwan 2002; Bosak and Schroeder, 2005). This process of feeding or informing geographic information systems with theories based on gender equality "begins with the research questions set, the data that are collected, and ends in the graphic representations we produce" (Bosak and Shcroeder, 2005: 236). Similarly, Moloney (2020), quoting UN Women expert Yeliz Osman, points out the need to involve women in order to reflect their interests: *"The (mapping) community is still overwhelmingly male and this means that women's needs, interests and experiences are not reflected in maps. [...] When women make maps, they are more likely to represent women's specific needs and priorities than those of men, which is key to driving changes in local policies, plans and budgets."*

KEY POINT:

There were no examples of geospatial services with an explicit gender focus in the Amazon and relatively few examples from other regions, so there is a great opportunity for SERVIR-Amazonia to be a leader in providing gender-sensitive services in the Amazon.

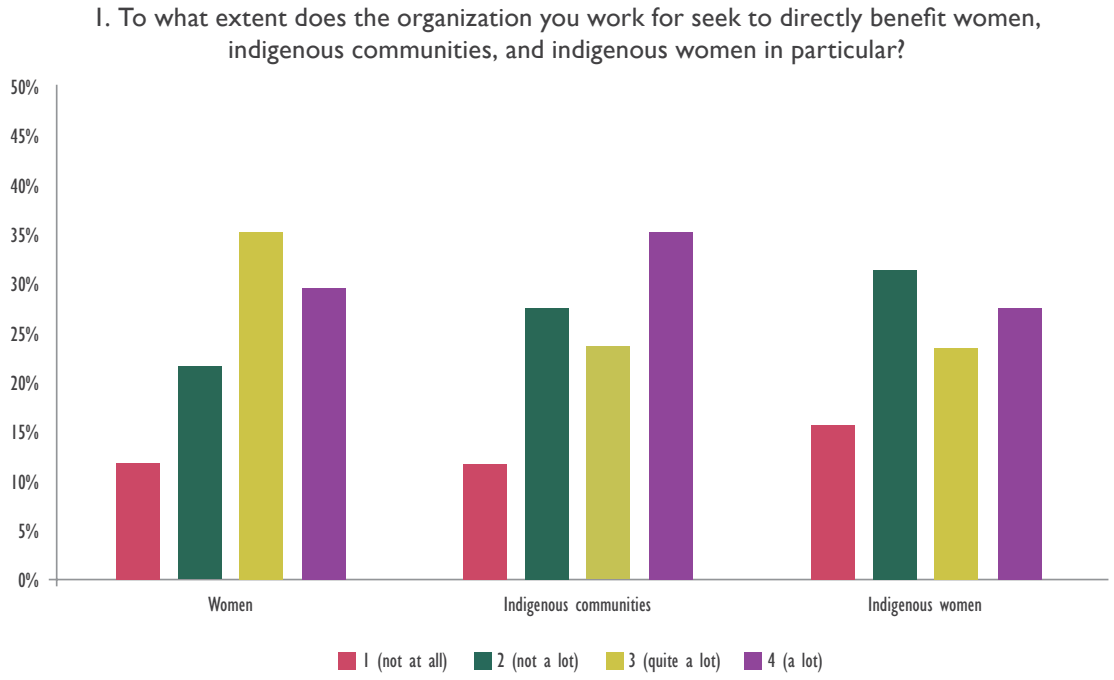
RECOMMENDATIONS:

- It is important to include both women and men as end users of the different services to ensure that their perspectives and needs are being considered.
- Engaging women in geospatial technologies and orienting these technologies with feminist theories can help to better understand their potential for rural women.

3.2.6. Perspective of member organizations of the SERVIR-Amazonia Program on the use of geospatial services for gender equality

This section presents some of the key results obtained in the survey that was distributed to people linked to the SERVIR-Amazonia Program. In general, the survey revealed that the activities of these organizations are perceived to have a direct positive impact (benefits) on women, indigenous communities, and indigenous women (n = 50 responses). In particular, more than half reported that their organizations benefit women, indigenous communities, and indigenous women quite a bit or a lot. Only 12% responded that their organizations have no direct impact or benefits at all for women and indigenous communities, while this percentage was 16% for indigenous women (Figure 1).

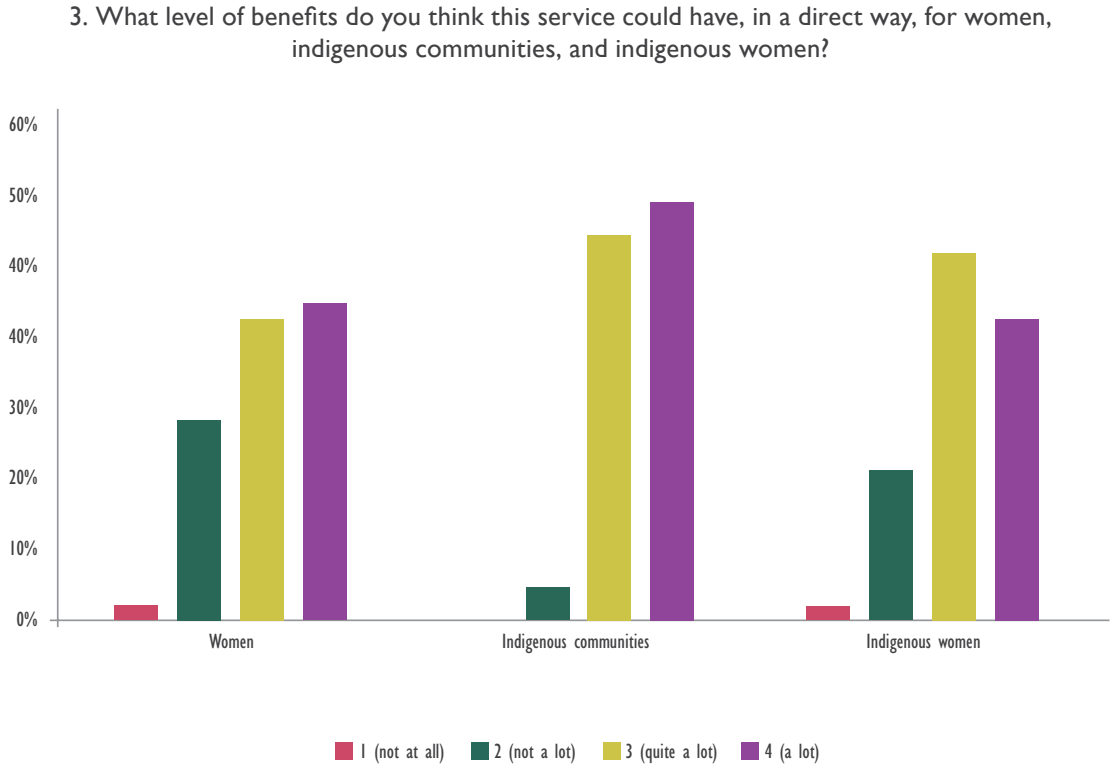
Figure 1. Extent to which respondents perceive that their organizations seek to directly benefit women, communities, and indigenous women.



The survey also explored how the geospatial services of the SERVIR-Amazonia Program are perceived in terms of their impacts on the lives of women, communities, and indigenous women. To do this, we asked each respondent to choose a service and answer different questions about this specific service. Below are the results for the 10 services as a whole (n = 50 responses). It is worth noting that, although all services are represented, most responses were about three services in particular: Deforestation monitoring 22%; ORIGINS 28%; and TerraBio 12%.

Overall, the results show that most respondents believe that the service can have a quite a lot, or very positive impact on women and indigenous communities (74%, 96%, and 80%, respectively). It is interesting to note that the group with the most responses for less impact (i.e., not at all or quite a lot) is for women in general (26%), followed by indigenous women (20%), while for indigenous communities only 4% reported not a lot of impact, and no one reported no impact at all (Figure 2).

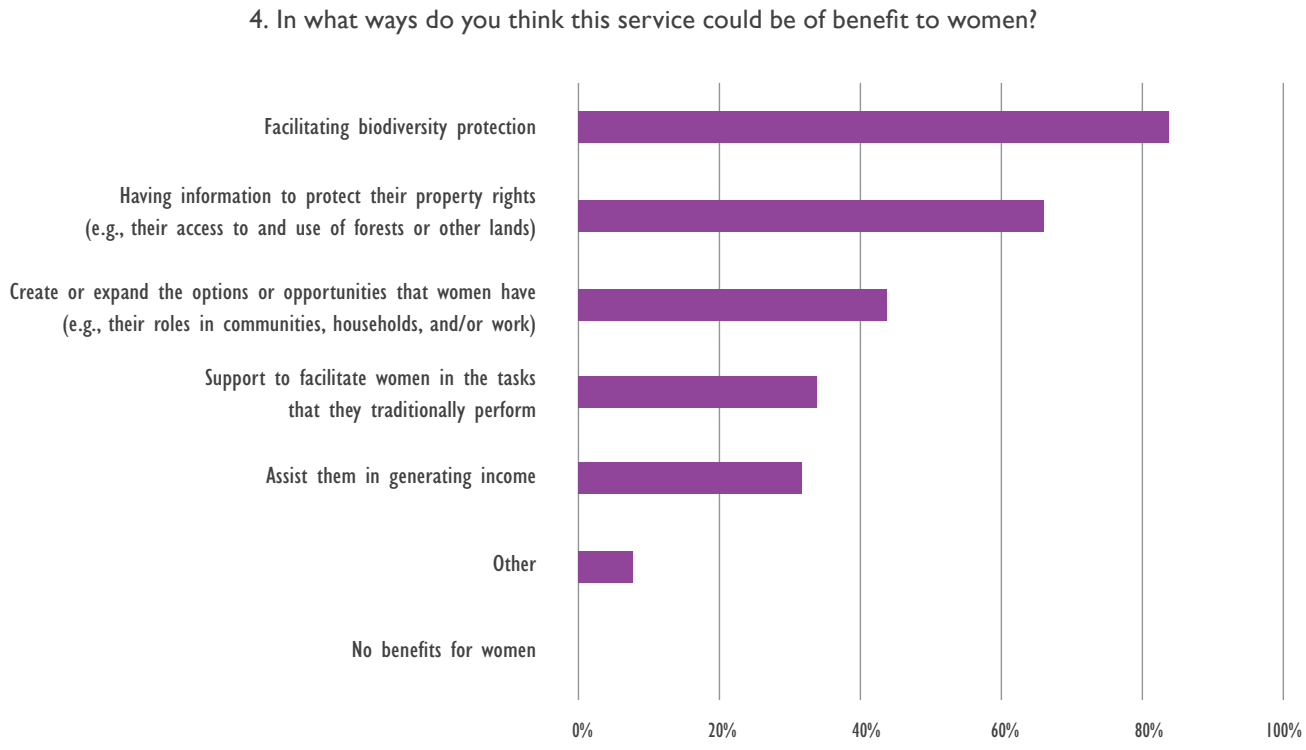
Figure 2. Level of benefits that respondents believe the services (of their choice) could have, directly, for women, indigenous communities, and indigenous women.



In terms of the ways in which the service can have a positive impact for these groups (134 responses from 50 respondents), the most frequently chosen response (84%) was to facilitate biodiversity protection. This highlights the important role that women play in this activity and emphasizes the fact that SERVIR-Amazonia Program services could help them in this regard. The second most frequent response (66%) was related to the potential of these services to help women obtain information to protect their property rights.

Forty-four percent of respondents believed that services can help create or expand the options and opportunities available to women. However, one-third (34%) regarded these services as a way to support women in fulfilling tasks that are traditionally assigned to women, and another 32% believed that services can help women generate income. Finally, 8% responded "other." It is also interesting to note that no one chose that the service "has no benefits for women," which seems to indicate that all respondents believe that the service they chose might have some benefit for women (Figure 3).

Figure 3. How respondents consider that the service (of their choice) could have a benefit for women.



The survey also explored whether there were any particular recommendations that should be considered to ensure that indigenous women in the Amazon can also benefit from the services of the SERVIR-Amazonia Program.

Many of the recommendations received, while still diverse, were grouped into five key topics: 1) Understanding local culture and social/ gender norms; 2) Ensuring women's effective participation; 3) Conducting training sessions; 4) Organizational management training; 5) Involving local indigenous women's organizations. Figure 4 shows a word cloud made with all the recommendations received, in which these five themes predominate, and where it can be seen that "language" is also an important issue.

Figure 4. Cloud generated using the responses to the open-ended question on recommendations to take into account to ensure that indigenous women in the Amazon can benefit from the services of the SERVIR-Amazonia Program. Created with www.nubedepalabras.es

Finally, the most important conditions for indigenous communities to access and use information generated by the SERVIR-Amazonia Program's geospatial services were examined. The results indicate that it is important to have accessible information; using photos or images (reported by 84% of respondents) and also that this information is available in local languages (64%). In addition, one of the most suggested strategies was to transmit the information through community leaders (72%) and radio (54%), and through posters and local newsletters (40%). Twenty percent of respondents answered "other" and included the following additional strategies:

- Improve internet access and carry out an assessment of internet coverage.
- Develop communication strategies that consider the limitations of internet connectivity.
- Train young people who are interested and educated so that the information stays in the communities.
- Select women leaders to deliver information in women's spaces so that they can freely ask questions out loud.
- Community workshops in which everyone can participate.
- Build and create a training center on SERVIR-Amazonia's services for indigenous communities.
- Work with the leaders of these communities since women trust them a lot.
- Connect the university with the indigenous peoples.

The variability of responses received highlights the importance of employing a combination of these strategies to maximize outreach. Taken together, the responses facilitate a better understanding of what communication strategies should be considered to achieve greater reach and impact with indigenous communities.

KEY POINT:

All respondents perceive opportunities to benefit women, communities, and indigenous women through SERVIR-Amazonia's services.

RECOMMENDATIONS:

- Understand the situation of women and gender norms.
- Promote the participation of women.
- Carry out training with women and youth (a training center, technical skills, but also training in organizational management).
- Involve women's organizations (at different scales: local to regional).
- Conduct community workshops (open/inclusive).
- Use a combination of communication strategies, such as transmitting information through leaders, including women leaders, radio, local posters, use photos and images, and ensure that it is available in local languages.
- Carry out an assessment of internet coverage.

© Neil Palmer/CIAT

4. Suggestions and recommendations

Based on the findings of the study, a series of recommendations for working with women in the Amazon and for improving the inclusion and outreach of SERVIR-Amazonia's services are proposed below. Some of these recommendations come from the articles, interviews, and respondents, while others are our own recommendations based on the study's results and the SERVIR-Amazonia Program's services. Some of the recommendations are general, while others are more specific. Therefore, these recommendations should be seen as brainstorming, as entry points for conversations, and for generating more specific ideas. We divide the recommendations into three groups: general recommendations at program level; recommendations for projects and organizations working with communities in the Amazon (focusing on the design, implementation, monitoring, evaluation and learning phases of the project cycle); and ideas for geospatial services for the direct benefit of women.

4.1. General recommendations for institutions or projects providing geospatial services (such as the SERVIR-Amazonia Program)

- Develop, or reinforce, communication strategies that are inclusive, and that consider different information flows from local users (i.e., leaders and/or the most educated to other community members, children to their parents, and husbands to wives, etc.).
- Provide services in local languages and have basic, easy-to-use platforms that do not require advanced education to understand.
- Use a combination of communication strategies, such as transmitting information through leaders (including women leaders); making radio programs or announcements; designing and distributing local posters using photos, videos, and images, and ensuring that these are available in local languages.
- Consider a strategy in terms of violence against women. Even if it is not an issue that the project or activity deals with directly, it is important to plan and consider how if incidents of violence against one or more women occur or come to light. It is important to develop clear and transparent policies that the organization/project will not condone any type of violence against women, including physical, verbal, or sexual violence, or the mistreatment of people (children or women).
- Write and disseminate blogs, video blogs and publish case studies or success stories about Program services that are benefiting women.
- Make videos or video blogs that showcase and represent rural women doing non-traditional jobs to demonstrate to other women that these possibilities exist and thus facilitate changes in the opportunities available and accessible to women.
- Establish mentoring and tutoring or counseling programs for women interested in using information from the services, or for women interested in training in geospatial systems and related STEM careers.

- Include and promote the participation of women's networks and organizations as users and/or affiliates of the SERVIR-Amazonia Program to reinforce the gender approach and to ensure that women's needs are considered through projects and services.
- Consider a training center to build capacity in technical geospatial systems, organizational and gender issues, and social inclusion.
- Provide services and/or support for projects with women's organizations. For example, promote drone projects exclusively with local women's groups, so that they can become familiar with these technologies and can safely monitor their territories.
- Support land formalization processes. Link geospatial services to these processes and work with women's organizations in this area. Additionally, inform officials of the importance of a gender perspective; to include land rights for women.

4.2. Recommendations for organizations working with the SERVIR-Amazonia Program's geospatial services

The SERVIR-Amazonia Program, true to its motto 'Connecting space to village', works closely with national and regional institutions to deliver its services to local communities. These 'intermediary' institutions between the SERVIR-Amazonia Program and local communities are key to ensuring that services are gender-inclusive and really benefit women in local communities directly. Thus, the design and implementation of geospatial services for the direct benefit of women implies that these intermediate institutions have a strengthened gender focus during the different phases of the project cycle. The SERVIR-Amazonia Program could therefore provide a list of suggestions, or gender prerequisites based on the following recommendations for the institutions working directly with them. The following is a list of recommendations for partners for each of the phases of the project cycle: diagnostic analysis and design; implementation; monitoring, evaluation, and learning.

A first phase of a project includes a diagnostic analysis to understand the scope of work, natural resources, issues, and population(s) and their needs, in order to design the project. In this phase it is important to consider issues of gender and marginalized groups. This is in order to understand and be aware of who would participate and who would be excluded, as well as to consider ways in which the project could be more inclusive. In the project implementation phase, there are also different strategies that can help promote the participation of women and other social groups. Lastly, the monitoring, evaluation and learning phase can also be important in terms of being able to reflect and adapt projects. During the evaluation and monitoring processes, it is therefore important to reflect on the social and gender inclusiveness of the Program's activities. For example, to examine whether women are actively participating, or whether implementers are using established gender strategies. Based on this, the Program should make adjustments, try other strategies, and/or continue with the strategies that are working.

In general, and for all phases of the project cycle (particularly in the diagnostic analysis and design phase), it is important to examine and consider how to introduce gender equality issues depending on the partners or communities you are working with and the audience as well. For example, for those people, institutions or communities that may be reticent to discuss the gender perspective (e.g., older generations), it may be important to re-direct the dialogue on how this gender vision will help improve the development of families, communities, and regions in the Amazon.

For each phase of the project cycle, some of the key recommendations arising from this study are set out below (Tables 1–3).

Table 1. Recommendations for the inclusion of gender in the project design phase.

PHASE	RECOMMENDATIONS
DESIGN	• Analyze the situation of women and gender norms in the communities where you intend to work; this should include an analysis of the various livelihood activities and the workload derived from them, and the gender roles and division of labor by sex in each population and community where you work or have projects. • Understand the different demands on women's and men's time at work/project sites. • Do not assume that women's unpaid work is not important, or that they do not have time available. • Consider the dynamics of power and/or local exclusion when working with communities. • Analyze existing organizations and/or social networks in the community - What networks exist, how do they relate to each other, who is included and excluded, do women participate? • Assess and be aware of who in the community has access to a cell phone and who does not, whether the cell phone (Smartphone) allows them to access the internet, other electronic devices, cell phone signal, electricity to charge electronic devices and internet connection (data or fixed line), because successful use of some of the geospatial services depends on having good internet access (e.g., real time monitoring). • Consult the different end users and/or beneficiaries that are organizations, or local or regional groups, including both women and men, as well as people with other gender options, to ensure that their perspectives and needs are considered and what information and/or services might support them. • Examine and consider the way in which different resources are valued and used by men and women. • Consider the multiple challenges (and the historical and regulatory situation that may help explain them), that different individuals or groups of individuals, including women, may face in participating in, using, or benefiting from services and develop strategies to overcome them. • Document some of the traditional knowledge that may be beneficial to obtain a greater impact for services.

Table 2. Recommendations for gender inclusion in the implementation phase of projects.

PHASE	RECOMMENDATIONS
IMPLEMENTATION	• Involve women and women's organizations at different levels, from local to regional. • Include the perspective of women and diverse groups during the implementation of geospatial services as they may result in new perspectives and ideas. • For example, training for women and young people through a training center and training in technical skills and in organizational management. • Conduct community workshops that are inclusive. ◦ Include as many organizations as possible in implementation and consultation processes. ◦ Make invitations to events and activities explicitly for women and men. Often membership is by household or family and by default it is the male head of the household who participates. • To have spaces to discuss and reflect on gender issues and to talk about lessons learned and generate new ideas. • Seek opportunities to complement Amazonian women's projects with geospatial information and services. • Make visible, recognize, and value the contributions of women (both in their activities in value chains and in their contributions to projects). • Share information and services in an open and transparent manner to avoid exacerbating social and gender inequalities. • Establish mentoring and tutoring/counseling programs for women. • Use quotas (employees, boards, members of organizations, etc.) to ensure representation of women, people with other sexual orientations and disadvantaged or excluded social groups. • Establish women-only spaces/events/programs/projects. • Integrate traditional knowledge in the information collected and used in services. • Design projects that integrate youth and older people to exchange experiences and knowledge. • Hire women technicians and extensionists in programs. • Include men in issues and processes of social inclusion and gender equality. Build gender awareness with them. • Reflect on common and/or structural challenges and challenges for women, and how to overcome them. For example: ◦ Lack of childcare - provide childcare services ◦ Distance and danger of travel - consider meeting location and/or how to facilitate safe transportation ◦ Multitude of responsibilities and schedules - hold meetings at dates and times when it is easier for women to participate ◦ Level of education and language - hold meetings in local language, use tools with few words and more visuals, carry out activities that do not involve reading and writing ◦ Possessive/unsympathetic husbands - organize spaces with men to reflect on gender issues, talk about role models of women leaders, have exchanges so that men see, accept, and get used to women being able to participate and be leaders. ◦ Women are not comfortable speaking in public - use role models of women leaders, exchanges for participants (both men and women) to see other women leaders, have women-only spaces.

Table 3. Recommendations for gender inclusion in the monitoring, evaluation and learning phase of projects.

PHASE	RECOMMENDATIONS
MONITORING, EVALUATION, AND LEARNING	• Monitor and examine on an ongoing basis: Who uses the services (and who does not) and how do they use them? • Compare experiences and lessons from different projects and organizations. • Reflect periodically on what gender and social inclusion strategies work and what do not work; adapt as necessary and continue to learn on an ongoing basis. • Consider the ideas generated from the spaces implemented to discuss and reflect on gender issues. • Learn from and document success stories and seek creative solutions that can influence social norms to overcome challenges. • Collect and analyze data that is disaggregated by sex.

4.3. Recommendations and ideas for geospatial services to strengthen the visualization of inequality and address gender inclusion

Geospatial systems have great potential to display, study and address aspects of gender inequality in rural areas by showing gender differences on maps at different scales. Likewise, geospatial services can also help to map and provide information that is particularly relevant to women in communities. Figure 5 shows a number of examples of maps that could help maximize gender inclusion and the extent to which women can benefit from the maps produced, and the information that emerges from them.

Figure 5. Recommendations for possible mapping activities to visualize gender differences and/or to benefit Amazonian women.

Make a diverse group of mappers	• Include women and minorities in the group generating map ideas. • Ensure that maps and services represent the needs and perspectives of a wide range of people.
Maps and/or models of impacts on different resources under different scenarios or management systems	How the extraction (or management) of a resource, such as timber trees, can impact others, such as non-timber forest products. Thus, see the impacts they have on men and women (i.e., availability of resources that each harvests and the impact of their time on harvesting, for example).
Maps that provide information about land tenure	Visualize the rights of women's in diverse land tenure systems.
Seasonal maps for women	Provide seasonal information on weather forecasts, drought risk, and risk of flooding for the zones and plots most used by women.
Climate risk maps for women	Model how crops grown by women will be affected by climate change.
Map the gender gaps (by various scales)	• For example, in terms of income, decision-making, land use and ownership, access to credit, access to information, etc. • Overlay this gender information on the maps regularly produced by SERVIR-Amazonia and examine patterns of inequality.
Map women in STEM careers	• Number and percentages of women by type of career, type of position and salary gaps. • Use maps and information to highlight these gaps so that they can be included, or can inform, projects and services.
Map the locations of important services and resources for women	• For example, health, sanitation, nutrition, and even contraceptives. • Also, socio-demographic information - health conditions, maternal mortality, statistics on diseases caused by lack of sanitation, etc.
Maps of language and dialect usage	• Overlay this information about language patterns. • Develop communication strategies based on these patterns. • Inputs for local language applications/services.
Map information related to violence against women	• Display where prevention and complaints services are located and how to access them (e.g. police stations, shelters, social care centers, etc.). • Statistics on where different types of violence occur.

5. Conclusion


© Neil Palmer/CIAT

The Amazon is a vast region with heterogeneous, dispersed, and isolated populations. This situation makes it difficult to generalize about gender dynamics and/or the situation of women in the region. However, this study finds that, in general, and like other regions of the world, gender norms dictate a gendered division of labor that keeps women close to the home, taking care of the farm and caring for children, the sick, and the elderly. Men, on the other hand, are generally more connected and responsible for activities such as hunting, fishing, income generation, and participation in community meetings, or with outside people and organizations.

It is important for projects to understand local social and gender norms and how these dynamics may impact who participates and who is excluded and why. Similarly, they can identify the challenges that women and others may face in being able to participate in and benefit from projects and activities. By considering these issues, projects and programs can design and implement strategies that help overcome these challenges. They can also increase the likelihood that women will participate in and benefit from project activities and/or services.

This report has identified several challenges faced by rural women in the Amazon. These common challenges were identified through the interviews and the literature review. However, as mentioned above, it is important to recognize that these challenges do not necessarily affect (or affect in the same way), all women in the Amazon. Some of the challenges faced by rural communities in the Amazon (and women in particular), include aspects such as geographic isolation; lack of infrastructure, electricity and internet

connectivity; lack of education, illiteracy and language barriers; loss of traditional knowledge; machismo and gender-based violence; low land formalization, ownership and consequently difficulty in accessing credit; difficulty in accessing health services; low participation and few leadership positions; and low representation in technical (STEM) careers.

In addition, the study raises issues of relevance to the integration of gender in geospatial services and some of the particular challenges that programs and organizations focusing on these issues might encounter, as well as some lessons learned about what has worked in other regions of the world. The study found no examples of gender-sensitive geospatial services in the Amazon and found little information on gender dynamics in relation to the different service areas in the region.

In addition, although respondents to the survey understood that SERVIR-Amazonia's services provide opportunities to benefit women, the organizations affiliated to the Program that were interviewed, generally focus on ecosystem services management issues. Only a few organizations focused on the Program's other areas of interest such as weather forecasting, climate change, droughts and fires, and hydrological disasters. There is therefore a great opportunity for the SERVIR-Amazonia Program to increase services in these areas and become a leader in the provision of geospatial services with a gender focus in the Amazon.

Throughout this report, emphasis has been placed on three major opportunities through which geospatial services programs can contribute to reducing gender gaps and benefiting women.

5.1.1 First, institutions providing geospatial services and interacting with local organizations can provide a set of suggestions (or requirements) on how they can or should integrate gender considerations in a way that is integral to the use and application of their geospatial services.

5.1.2 Second, geospatial service provider institutions can design and offer services with an explicit gender focus in the region. For example, by working with women's groups, identifying their information, and mapping needs, and working with them to offer services that are relevant to women and/or women's/indigenous communities.

5.1.3 Finally, geospatial systems also have great potential to highlight and emphasize gender inequality in different aspects of the rural environment. They can achieve this by visualizing at different scales, gender differences between men and women in rural and indigenous communities in the Amazon. This information could thus help to draw the attention of decision-makers in the region and encourage programs, or policies that are designed to address such gender gaps.

© Ana Acosta, EcoCiencia

6. Annex I. Methodology

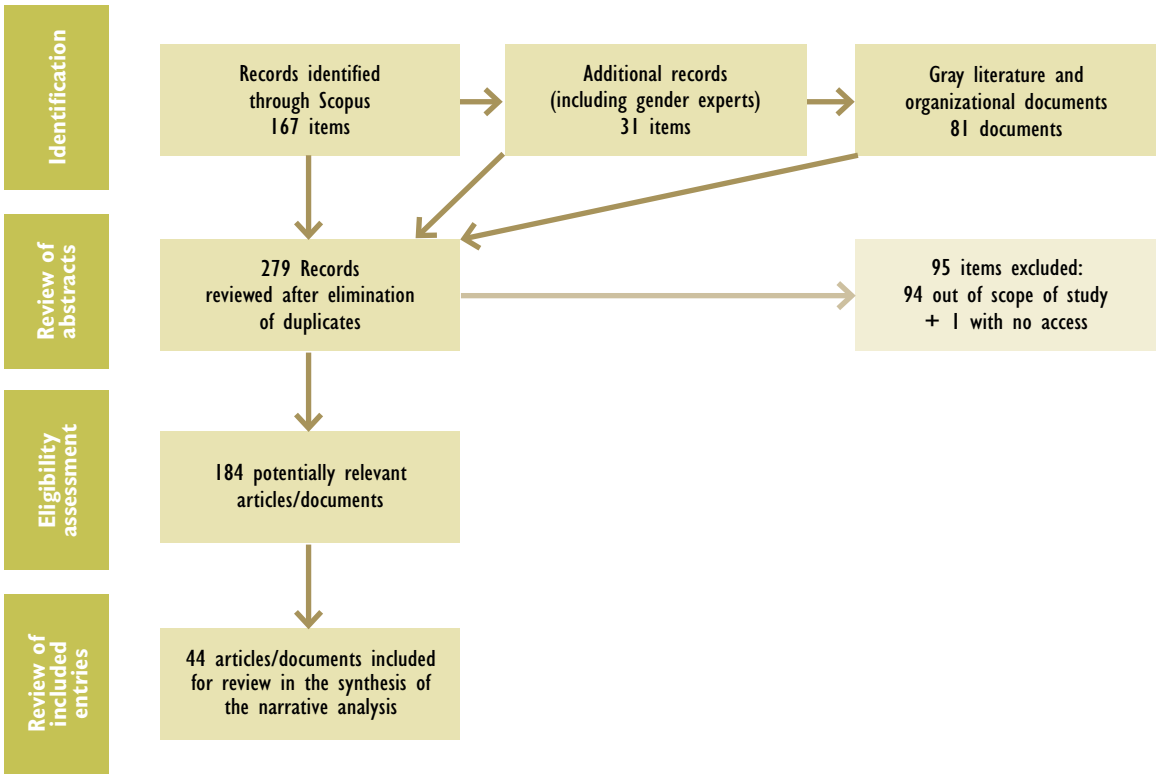
This study is based on the use of three main techniques: i) review of scientific and organizational literature; ii) interviews with key informants; and iii) survey with different professionals working with rural and indigenous communities in the Amazon. Each of these techniques is briefly described below.

6.1. Review of the scientific and organizational literature

The literature review consisted of the one hand of an analysis of the academic literature, which included scientific and grey literature articles, and on the other hand of an analysis of reports from organizations working with rural communities in the Amazon. The search for academic literature for the review was conducted through Scopus, to which key articles were added that were received from different gender experts in the region. The search for documents and reports from organizations working in the Amazon was carried out directly through the websites of organizations related to the SERVIR-Amazonia Program or were received directly by the staff of these organizations. Figure 6 presents an overview of the documents included and the different review phases followed.

The literature review focused on understanding the roles and experiences of rural women in the Amazon, in particular identifying the different challenges they face and their particular needs in terms of natural resource management and rural development (e.g., ecosystem management, drought, fire, water resources, hydro-climatic disasters, weather, and climate). In addition, this review also aimed to examine the form and extent of the use of geospatial technologies for the direct benefit of women, and the potential of these services for rural women in the Amazon. The literature analysis was conducted with the help of the qualitative analysis software Atlas.ti.

Figure 6. Flowchart of the literature and document search for inclusion in the analysis.



6.2. Interviews with key informants

The interviews were conducted in two phases. In the first phase, six experts in Geographic Information Systems and/or Gender close to the SERVIR-Amazonia Program were interviewed. In particular, three conversations were held with Program representatives, two conversations with USAID representatives and one conversation with a NASA representative. These preliminary interviews were aimed at gaining a better understanding of the most important challenges for women in the Amazon and the specific needs of the SERVIR Program in relation to the present study.

In a second phase, 12 interviews were conducted with key informants from Ecuador, Peru, Colombia, Brazil, and Guyana. Participants were selected in an attempt to have representation for the countries where SERVIR-Amazonia operates and representation of the different types of stakeholders (e.g., governmental and non-governmental, indigenous organizations, etc.). These interviews focused on three key areas:

- Document success stories, lessons learned, and any specific insights partners have on increasing women's participation in SERVIR-Amazonia's service areas, and the benefits derived from them.
- Summarize the main challenges facing rural and indigenous women in the Amazon and how partner organizations, or those collaborating with SERVIR-Amazonia integrate gender considerations into their work.
- Identify barriers to and opportunities for women's participation in and benefit from geospatial projects and/or services.

For each of these areas, the analysis of interview data was conducted by identifying recurrent themes, key constructs, and narratives about the situation of rural women in the Amazon. During the analysis, these recurrent themes, key constructs, stories and discourses were assigned codes. These codes were later aggregated into themes through consecutive analyses. These coding and analysis processes were supported by the qualitative data analysis software Atlas.ti.

6.3. Survey

The survey was conducted with the main objective of identifying and generating ideas about ways in which the geospatial services of the SERVIR-Amazonia Program could benefit rural and indigenous women in the Amazon. In addition, the survey sought to collect cases or experiences of organizations in the Amazon that have used geospatial services to help improve the lives of women in the Amazon.

The survey was shared via MailChimp with 1,400 people affiliated with the SERVIR-Amazonia Program, and a total of 50 responses were obtained. The survey was based on the 10 geospatial services currently being implemented or under development in the SERVIR-Amazonia Program. Participants chose one of these services according to their interest, or expertise and were asked about the ways in which the service could benefit Amazonian women.

7. References

Acosta M; Bonilla O; Howland F; Twyman J; Gumucio T; Martínez D; Le Coq JF. 2019. Paso a paso para la inclusión de género en iniciativas de agricultura sostenible adaptada al clima para Guatemala. Programa del CGIAR en Cambio Climático, Agricultura y Seguridad Alimentaria (CCAFS). https://cgspace.cgiar.org/handle/10568/103254

Aikman S. 2019. Indigenous Knowledge, Skills and Action: Indigenous Women's Learning in the Peruvian Amazon. *Studies in the Education of Adults* 51(2):195–212. https://doi.org/10.1080/02660830.2019.1600786

Arredondo Trapero F; Vázquez J; Velázquez L. 2019. STEM y Brecha de Género en Latinoamérica. *Revista de El Colegio de San Luis* 9(18):137. https://doi.org/10.21696/rcsl9182019947

ACCA (Asociación Conservación Amazónica). 2021. Flor rumayna: la piloto de drones que redujo a cero la deforestación en su concesión. https://bit.ly/3EZyomp

Bosak K; Kathleen K. 2005. Using Geographic Information Systems (GIS) for Gender and Development. *Development in Practice* 15(2):231–237.

Bosco C; Watson S; Game A; Brooks C; de Rigo D; Qader S; Greenhalgh J; Nilsen K; Ninneman A; Woord R; Bengtsson L. Towards High-Resolution Sex-Disaggregated Dynamic Mapping. Flowminder Foundation, Stockholm, Sweden. 85 p. https://bit.ly/3kpGYTJ

Brown S. 2003. Spatial Analysis of Socioeconomic Issues: Gender and GIS in Nepal. *Mountain Research and Development* 23(4):338–344. https://doi.org/10.1659/0276-4741(2003)023[0338:SAOSIG]2.0.CO;2

Caballero-Serrano V; McLaren B; Carrasco JC; Alday J; Fiallos L; Amigo J; Onaindia M. 2019. Traditional Ecological Knowledge and Medicinal Plant Diversity in Ecuadorian Amazon Home Gardens. *Global Ecology and Conservation* 17:e00524. https://doi.org/10.1016/j.gecco.2019.e00524

Cooper N; Kainer K. 2018. To Log or Not to Log: Local Perceptions of Timber Management and Its Implications for Well-Being within a Sustainable-Use Protected Area. Ecology and Society 23(2):4. https://doi.org/10.5751/ES-09995-230204

Cruz-Garcia G; Vanegas M; Torres-Vitolas C: Harvey C; Shackleton C; Schreckenberg K; Willcock S; Navarrete-Frías C; Sachet E. 2019. He Says, She Says: Ecosystem Services and Gender among Indigenous Communities in the Colombian Amazon. *Ecosystem Services* 37:100921 https://doi.org/10.1016/j.ecoser.2019.100921

Deere C; León M. 2001. Empowering Women: Land And Property Rights In Latin America. University of Pittsburgh Press, Pittsburgh, PA. https://doi.org/10.2307/j.ctt5hjpf6

EFE. 23 de febrero 2021. América Latina encarna el reto de impulsar la conectividad digital. El Peruano. https://bit.ly/3wJ7QV2

Elwood S. 2010. Geographic Information Science: Emerging Research on the Societal Implications of the Geospatial Web. *Progress in Human Geography* 34(3):349–357. https://doi.org/10.1177/0309132509340711

Etchart N; Freire JL; Holland M; Kelly W. Jones K; Naughton-Treves L. 2020. What Happens When the Money Runs out? Forest Outcomes and Equity Concerns Following Ecuador's Suspension of Conservation Payments. World Development 136:105124. https://doi.org/10.1016/j.worlddev.2020.105124

Fitts L; Cruz-Burga Z; La Torre-Cuadros M. 2020. Wild Rubber Extraction in the Peruvian Amazon: Local Perception and Socioeconomic Indicators as Tools for Decisionmaking. *Ethnobiology and Conservation* 9:1–26. https://doi.org/10.15451/EC2020-06-9.24-1-26

Freitas C; Espírito-Santo H; Campos-Silva J; Peres C; Lopes P. 2020. Resource Co-Management as a Step towards Gender Equity in Fisheries. *Ecological Economics* 176: 106709. https://doi.org/10.1016/j.ecolecon.2020.106709

Furst-Nichols R. 2017. From Texts to Tweets to Satellites: The Power of Big Data to Fill Gender Data Gaps. United Nations Foundation. https://bit.ly/3F2mEQk

Global Witness. 2020. Defending Tomorrow. The Climate Crisis and Threats against Land and Environmental Defenders. https://bit.ly/3TzIgf4

Hecht S. 2007. Factories, Forests, Fields and Family: Gender and Neoliberalism in Extractive Reserves. *Journal of Agrarian Change* 7(3):316–347. https://doi.org/10.1111/j.1471-0366.2007.00148.x

Kwan M. 2002. Feminist Visualization: Re-Envisioning GIS as a Method in Feminist Geographic Research. *Annals of the Association of American Geographers* 92(4):645–661.

Larson A; Monterroso I; Canturias P. 2018. Gender and Formalization of Native Communities in the Peruvian Amazon. InfoBrief NO. 238. Center for International Forestry Research (CIFOR). https://doi.org/10.17528/cifor/007108

Leszczynski A; Elwood S. 2015. Feminist Geographies of New Spatial Media. *The Canadian Geographer* 59(1):12–28. https://doi.org/10.1111/cag.12093

Lu F; Brandie F; Bilsborrow R. 2009. Gendered Time Allocation of Indigenous Peoples in the Ecuadorian Amazon. *Ethnology* 48(3):239–268.

Magalhães A; da Costa R; da Silva R; Carneiro L. 2007. The Role of Women in the Mangrove Crab (Ucides Cordatus, Ocypodidae) Production Process in North Brazil (Amazon Region, Pará). *Ecological Economics* 61(2–3):559–565. https://doi.org/10.1016/j.ecolecon.2006.05.013

McLafferty S. 2002. Mapping Women's Worlds: Knowledge, Power and the Bounds of GIS. *Gender, Place & Culture* 9(3):263–269. https://doi.org/10.1080/0966369022000003879

Meinzen-Dick R; van Koppen B; Behrman J; Karelina Z; Akamandisa V; Hope L; Wielgosz B. 2012. Putting Gender on the Map. Discussion Paper 01153. IFPRI, Washington, D.C.

Mello D; Schmink M. 2017. Amazon Entrepreneurs: Women's Economic Empowerment and the Potential for More Sustainable Land Use Practices. Women's Studies International Forum 65:28–36. https://doi.org/10.1016/j.wsif.2016.11.008

Mendes K. 2017. Mobile App Uses Real-Time Satellite Data to Strengthen Forest and Land Rights. Reuters. https://reut.rs/2YzxEoI

Mendoza R; Carrión ME. 2016. Hacia una gestión moderna del territorio cofán. En: Robles-Pillco J. ICAA, Consorcio Paisajes Indígenas en la Amazonía de Ecuador. The Nature Conservancy, Quito. https://bit.ly/3BUVtVC

Mendoza Hernández D; Rodriguez O; Mendoza C; Mendoza E; Gómez A; Kutdo L; Ortiz J; Crisóstomo J. 2017. Moniya Ringo. Mujer de Abundancia y Reproducción: Estudio de caso de la chagra de la Gente de Centro, Resguardo Indígena de Monochoa. Instituto Amazónico de Investigaciones Científicas (SINCHI), Bogotá, Colombia. 190 p.

Meola C. 2013. Navigating Gender Structure: Women's Leadership in a Brazilian Participatory Conservation Project. *Forests, Trees and Livelihoods* 22(2):106–123. https://doi.org/10.1080/14728028.2013.798947

Moloney A. 2020. Visible Women: Female Mappers Bridge the Data Gap in Urban Design. UP42. https://bit.ly/3cAGTvO

Monrroy Pardo N. 2019. Cuando me empieza a decir mamá: el abandono escolar en la experiencia de jóvenes madres que han tenido un embarazo en la adolescencia, distrito de Belén - Iquitos. Tesis de pregrado, Pontificia Universidad Católica del Perú. 134 p. https://bit.ly/3pWN6VV

Pedris L. 2018. Tech and Collaboration Are Putting Indigenous Land Rights on the Map. Mongabay Environmental News. https://bit.ly/3bToE0K

Perreault T. 2005. Why Chacras (Swidden Gardens) Persist: Agrobiodiversity, Food Security, and Cultural Identity in the Ecuadorian Amazon. *Human Organization* 64(4):327–339. https://doi.org/10.17730/humo.64.4.e6tymmka388rmybt

Piotrowski M. 2019. Nearing the tipping point: Drivers of Deforestation in the Amazon Region. Inter-American Dialogue. Washington, D.C. 28 p.

Popp A; Lutz S; Khatami S; van Emmerik T; Knoben W. 2019. A Global Survey on the Perceptions and Impacts of Gender Inequality in the Earth and Space Sciences. *Earth and Space Science* 6(8):1460–1468. https://doi.org/10.1029/2019EA000706

Rázuri Montoya D. 2017. En busca del entendimiento: una primera aproximación al matrimonio y al parentesco wampis contemporáneos desde el punto de vista masculino en una comunidad nativa del Alto Río Santiago (Amazonía peruana). Trabajo de grado, Pontificia Universidad Católica del Perú. https://bit.ly/31GkTcZ

Ruiz-Mallén I; Fernández-Llamazares A; Reyes-García V. 2017. Unravelling Local Adaptive Capacity to Climate Change in the Bolivian Amazon. *Climatic Change* 140(2):227–242.

Schmink M; Arteaga Gómez-García. 2015. Under the Canopy: Gender and Forests in Amazonia. Center for International Forestry Research (CIFOR), Bogor, Indonesia. 45 p. https://doi.org/10.17528/cifor/005505

Seitz Lozada G. 2007. Ruptura generacional en las comunidades nativas awajun Shushug, Nayumpim y Wawas durante las últimas tres décadas. En, Género y gestión de recursos naturales. Resúmenes de investigaciones, experiencias y lecciones aprendidas, 125–150. Lima, Perú: SEPIA.

SEPIA (Seminario Permanente de Investigación Agraria). 2007. Género y gestión de recursos naturales: Resúmenes de investigaciones, experiencias y lecciones aprendidas. Lima, Perú: SEPIA. 152 p. bit.ly/3gddQg2

SERVIR-Mekong. 2015. Gender and GIS: Guidance Notes. Asian Disaster Preparedness Center, Bangkok, Thailand.

UNEP (United Nations Environment Programme). 2009. Geo Amazonia: Environment Outlook in Amazonia. Panama City, Panama; Brasília, DF, Brazil; United Nations Environment Programme, Regional Office for Latin America and Caribbean (UNEP); Amazon Cooperation Treaty Organization (ACTO). Available at bit.ly/3ue6b9r

USAID (Agencia de Estados Unidos para el Desarrollo Internacional). 2019. USAID's MAST Mobile Tech Programs Promote Women's Empowerment in Tanzania and Zambia. LandLinks. Available at https://bit.ly/3F7gezv

Vallejo I; Cielo C; García F. 2019. Ethnicity, Gender, and Oil: Comparative Dynamics in the Ecuadorian Amazon. Latin American Perspectives 46(2):182–198. https://doi.org/10.1177/0094582X18820296

Walker W; Vajjhala S. 2009. Gender and GIS: Mapping the Links between Spatial Exclusion, Transport Access, and the Millennium Development Goals in Lesotho, Ethiopia, and Ghana. Discussion Paper 09–27. Resources for the Future, Washington, D.C. https://bit.ly/3RqSHzq


© Conservación Amazónica, ACCA


SERVIR AMAZONIA


USAID
FROM THE AMERICAN PEOPLE


NASA


Alliance
Bioversity International
CIAT
International Center for Tropical Agriculture
Since 1967 Science to cultivate change


Spatial Informatics Group


imaflora


CONSERVACIÓN AMAZÓNICA
ACCA


eco
ciencia