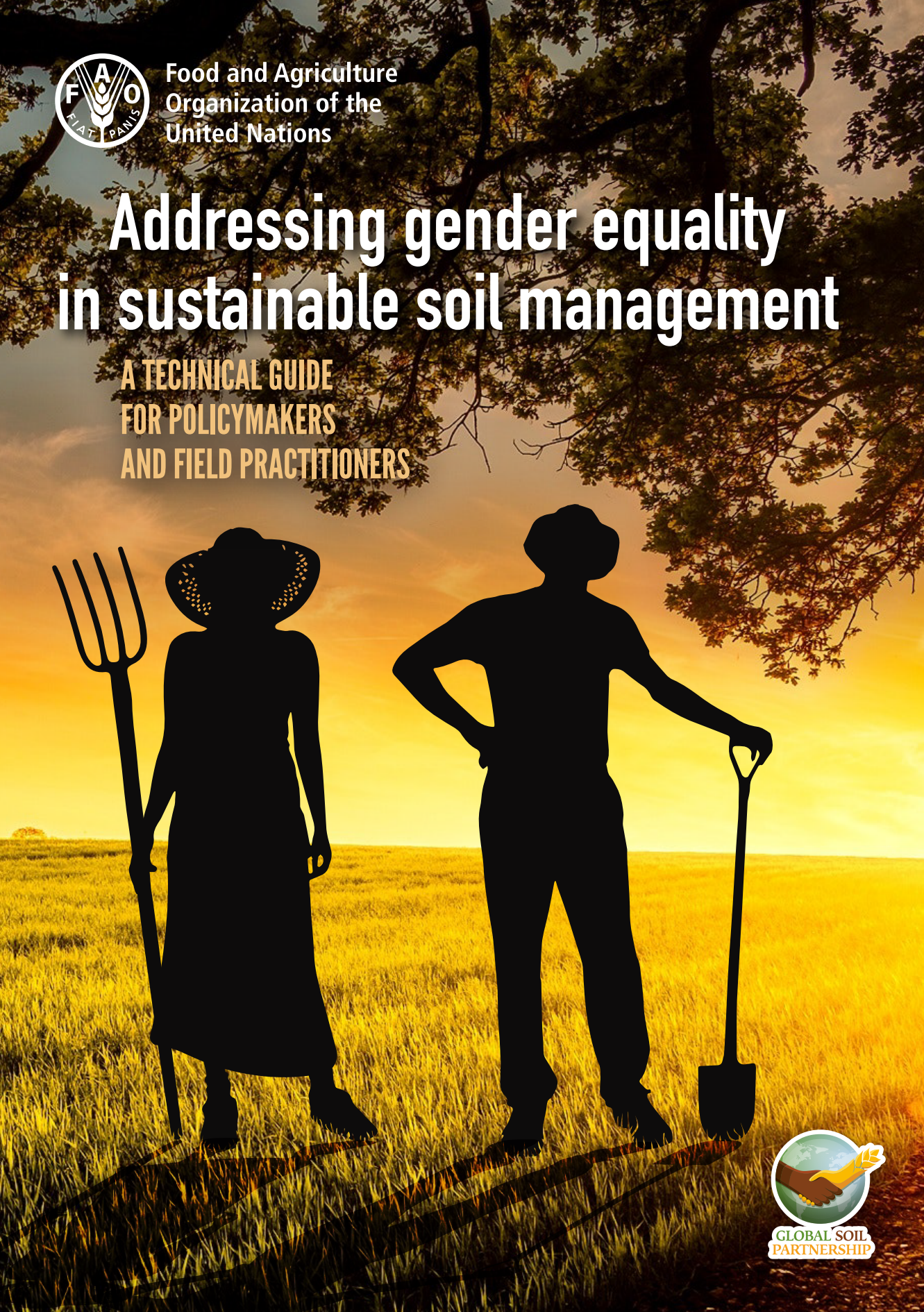
Food and Agriculture
Organization of the
United Nations
Addressing gender equality
in sustainable soil management
A TECHNICAL GUIDE
FOR POLICYMAKERS
AND FIELD PRACTITIONERS
GLOBAL SOIL
PARTNERSHIP

Addressing gender equality in sustainable soil management

A TECHNICAL GUIDE FOR POLICYMAKERS AND FIELD PRACTITIONERS

Food and Agriculture Organization of the United Nations
Rome, 2023

Required citation:
FAO. 2023. *Addressing gender equality in sustainable soil management. A technical guide for policymakers and field practitioners*. Rome. https://doi.org/10.4060/cc5289en

ISBN 978-92-5-137806-9

Cover photo: Pixabay

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Foreword

The world is currently dealing with a variety of challenges including conflicts, health crises, and rising food and fertilizer prices. This situation is further exacerbated by the effects of climate change and the depletion of natural resources. All these drivers are challenging the ability to build resilient and sustainable agrifood systems.

It is widely acknowledged that food security and nutrition, and the livelihoods, health and well-being of rural people, depend primarily on their access to natural and productive resources and available services. Likewise, it is recognized that healthy soils are vital for food production and the provision of essential ecosystem services, as established in the Revised World Soil Charter.

However, soil degradation continues to increase around the world, limiting the access to fertile and productive soils for rural people and often exacerbating gender inequalities and food insecurity, which affect particularly women, youth and the most vulnerable and poor populations.

Women face more barriers than men to access land, healthy soils, credit, technologies, inputs and extension services, which reduce their ability to invest in soil health and productivity. In addition, rigid and harmful socio- cultural norms often perpetuate gender stereotypes reducing women's participation in decision-making and planning processes, further reinforcing gender inequalities. Gender-transformative approaches are required to remove structural barriers to gender equality and support a more equitable distribution of resources and allocation of roles and responsibilities between men and women, with more equal power dynamics. These approaches are also important to overcome the multiple and intersecting forms of discrimination that women are facing and to support sustainable soil management.

To address these important issues, FAO has developed the technical guide "**Addressing gender equality in sustainable soil management**", which provides valuable insights on the intersection that exists between gender and sustainable soil management, building on the Voluntary Guidelines for Sustainable Soil Management. The technical guide was jointly developed by the Land and Water Division and the Inclusive Rural Transformation and Gender Equality Division, building on our extensive experience related to natural resources management, ecosystem services and gender equality, and will contribute to the implementation of the FAO's Policy on Gender Equality (2020-2030).

This guide is to provide practical guidance to policymakers, field practitioners and researchers for addressing these challenges, by offering a range of innovative approaches, strategies, case studies and tools for supporting gender-responsive sustainable soil management. It also provides guidance on how to increase women's participation in decision-making processes related to sustainable soil management, and facilitate their access to education, training, credit and other resources to strengthen their capacity and enable them to equally participate in sustainable soil management.

We hope this guide provides valuable resource to support the adoption of sustainable soil management practices that contribute to the achievement of gender equality and women's empowerment, and ultimately the Sustainable Development Goals of the 2030 Agenda. All stakeholders are expected to work together for ensuring that women's voices and perspectives are heard and incorporated into all aspects of sustainable soil management. Only in this way, it is possible to achieve a more sustainable and equitable future for all, and attain food security and nutrition for all men and women, boys and girls.

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Acknowledgements

This technical guide was developed by Ilaria Sisto and Maurizio Furst from the Inclusive Rural Transformation and Gender Equality Division (ESP) together with Vera Boerger and Carolina Olivera Sanchez from the Land and Water Division (NSL) of the Food and Agriculture Organization of the United Nations (FAO), based on FAO's experience related to the achievement of gender equality and sustainable soil management. Significant insights were also received during the online discussion, *Mainstreaming gender for sustainable soil management,* held during the FAO Global Forum on Food Security and Nutrition (FSN Forum) from 23 September to 25 October 2019. The authors would like to thank the experts who participated in the consultation from 28 countries for sharing information on their organization's initiatives, providing their interesting insights and suggesting actions to be taken for moving ahead with the subject.

The authors are grateful for the valuable feedback provided by the technical reviewers of the document, namely: Ronald Vargas, Natalia Rodriguez Eugenio, Isabelle Verbeke, Inkar Kadyrzhanova, Molefi Mpheshea, Francisco Carranza, Omnia Rizk, Marta Speciale and Alisha Kersbergen. The idea for developing this technical guide came from Eduardo Mansur, Director of the Office of Climate Change, Biodiversity and Environment.

Appreciation is also extended to Sylvie Baumgartel and Andy Murray for editing and to Matteo Sala for the layout of the publication.

Abbreviations and acronyms

CSA	climate-smart agriculture
ES	ecosystem service
FAO	Food and Agriculture Organization of the United Nations
FFS	farmer field school
GAP	Gender Action Plan
GHG	greenhouse gas
GLRD	Gender and Land Rights Database
ITPS	Intergovernmental Technical Panel on Soils
LDN	land degradation neutrality
NAPs	national adaptation plans
NDCs	nationally-determined contributions
SDG	Sustainable Development Goal
SEAGA	socioeconomic and gender analysis
SCBD	Secretariat of the Convention on Biological Diversity
SSM	sustainable soil management
UNCBD	United Nations Convention on Biological Diversity
UNCCD	United Nations Convention to Combat Desertification
UNFCCC	United Nations Framework Convention on Climate Change
VGGT	Voluntary Guidelines for the Responsible Governance of Tenure of Land, Fisheries and Forestry in the Context of Food Security
VGSSM	Voluntary Guidelines for Sustainable Soil Management

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1 | Introduction

Food and nutrition security, livelihoods, health and the well-being of rural people mainly depend on their access to natural and productive resources, available services and local institutions. Pressing global challenges and natural disasters – including land and soil degradation, water scarcity, climate change, post-COVID-19 impacts, conflicts, pollution and poverty – often exacerbate gender inequalities and poverty, particularly affecting women, youth and the most socially and economically vulnerable people.

Thus, it is crucial to acknowledge that women and men are affected in different ways by the degradation of natural resources and biodiversity (Daley and Mi-young Park, 2011; SCBD, 2019). Specifically, women and men are impacted in different ways by the degradation of soils. Degraded and low resilient soils occur mostly in poor rural areas and affect agricultural productivity, climate change mitigation, as well as the provision of a range of ecosystem services. Although many sustainable soil management (SSM) practices are known to prevent or reverse degradation, there are a large number of social, cultural, institutional and economic barriers that impede their widespread adoption. There is an urgent need to move more rapidly to restore and maintain soil productivity and ecosystem functions, as well as to leverage soil health management for advancing gender equality (Zhang *et al.*, 2019).

In order to address the specific requirements and priorities of women and men to achieve food and nutrition security, there is a need for the building of resilient and sustainable livelihoods and agrifood systems. This implies analysing and addressing the specific roles, needs and opportunities of women and men to access productive soils, as well as land, water, agricultural inputs, technologies, extension and financial services, and local institutions. Women's lack of secure access to or ownership of land often relegates them to marginal, poor quality and more remote lands, where the maintenance of healthy soils and the provisioning of ecosystem services are particularly challenging. Despite the essential contribution of rural women to agricultural production, gender norms often relegate them to lower-paying or unpaid jobs, as well as time-consuming tasks that are perceived as an extension of their household duties. Moreover, all too often, women's contribution to agriculture and food security is not adequately recognized by official statistics and policymakers. This results in the limited participation of women in agricultural planning and decision-making, which leads to poor analysis of employment data, among other problems. Limited attention is also paid to the important role and high potential of young people to be agents of change.

To overcome this situation, many more efforts and commitments are required to include women and girls among key stakeholders in the design and implementation of gender-responsive projects, programmes, policies and strategies, in order to ensure their equal engagement in and benefit from any intervention aimed at SSM, making sure to "leave no one behind".

It is also important to understand the difference that exists between land and soil, recognizing the relevance of soil for people's lives, and also to consider how soils vary across the landscape and contribute to the world's economy – from agriculture, forestry,

gardening, town and country planning – and through ecology and conservation (Lal *et al.*, 2021). In addition, it is important to visualize the link between SSM and soil health (see Box 1).

Box 1 | Definitions of land, soil health, soil and sustainable soil management

Land is defined as "the terrestrial bio-productive system that comprises soil, vegetation, other biota, and the ecological and hydrological processes that operate within the system" (FAO, 1976).

The Intergovernmental Technical Panel on Soils (ITPS) has defined a **healthy soil** as "the ability to sustain productivity, diversity and environmental services of terrestrial ecosystems" (FAO and ITPS, 2020). According to the Revised World Soil Charter (FAO, 2015a), healthy soils are a basic prerequisite for meeting varied needs for food, biomass (energy), fibre, fodder, and other products, and for ensuring the provision of essential ecosystem services in all regions of the world.

Sustainable soil management (SSM) is defined according to Principle 3 in the revised World Soil Charter as follows:

Soil management is sustainable if the supporting, provisioning, regulating, and cultural services provided by soil are maintained or enhanced without significantly impairing either the soil functions that enable those services or biodiversity. The balance between the supporting and provisioning services for plant production and the regulating services the soil provides for water quality and availability and for atmospheric greenhouse gas composition is a particular concern (FAO, 2015a).

The Voluntary Guidelines for Sustainable Soil Management (VGSSM) elaborate the types of ecosystem services and the soil functions referred to in the definition above as:

- Supporting services include primary production, nutrient cycling and soil formation;
- Provisioning services comprise the supply of food, fibre, fuel, timber and water; raw earth material; surface stability; habitat and genetic resources;
- Regulating services imply the regulation of aspects such as water supply and quality, carbon sequestration, climate regulation, control of floods and erosion; and
- Cultural services denote the aesthetic and cultural benefits derived from soil use (FAO, 2017, p. 3).

Sources:
FAO. 1976. A framework for land evaluation. Soils Bulletin 32. Rome. www.fao.org/3/x5310e/x5310e00.htm
FAO. 2015a. Revised World Soil Charter. Rome. https://www.fao.org/3/I4965E/i4965e.pdf
FAO. 2017. Voluntary Guidelines for Sustainable Soil Management.
Rome. www.fao.org/3/bl813e/bl813e.pdf
FAO & ITPS. 2020. Towards a definition of soil health. ITPS Soil Letters #1.
Rome. https://www.fao.org/3/cb1110en/cb1110en.pdf

Healthy soils, as a consequence of sustainable soil management, contribute to the achievement of several Sustainable Development Goals (SDGs) including: SDG 1: No Poverty, SDG 2: Zero Hunger, SDG 3: Good Health and Well-being, SDG 5: Gender Equality, SDG 6: Clean Water and Sanitation, SDG 13: Climate Action, SDG 14: Life below Water and SDG 15: Life on Land (FAO *et al.,* 2020). In this context, it is essential that policies and programmes supporting sustainable production and food security recognize the importance of sustainable soil management and address discriminatory gender norms and conditions that perpetuate gender inequalities and marginalize women and girls. This requires designing sustainable and labour-saving interventions that identify and address gender inequalities around soil management, in order to improve crop productivity and increase the income of rural people, with positive impacts on food and nutrition security for women and their households, and to reduce women's work burdens.

Other relevant aspects to consider are the complex interactions that exist between gender equality and soil management issues, and the importance of designing and implementing inclusive and gender-responsive interventions, which address the specific needs and priorities of women and men from different socioeconomic groups, especially among the most marginalized and vulnerable people.

To address this need, the Food and Agriculture Organization of the United Nations (FAO) responded by developing the technical guide *Addressing gender equality in sustainable soil management: A technical guide for policymakers and field practitioners*, which complements the existing Voluntary Guidelines for Sustainable Soil Management (VGSSM) (FAO, 2017). The aim of the guide is to support the adoption of an inclusive and gender-responsive approach to achieve gender equality in the sustainable management of soils. In preparation for this guide, the online discussion on *Mainstreaming gender for sustainable soil management* was held during FAO's Global Forum on Food Security and Nutrition (FSN Forum) from 23 September to 25 October 2019, which provided important inputs and shared some lessons learned.

1.2 | Goal and target audience of the guide

This technical guide for addressing gender equality in SSM is designed to provide an easily accessible and understandable reference on how to apply the VGSSM for building healthy soils, while ensuring gender equality and women's empowerment in all aspects of SSM. It is intended for use by a wide audience, including policymakers, public institutions and development partners, as well as by rural communities, farmers' organizations, women and youth groups, and agricultural advisory services involved in the design, implementation, monitoring and evaluation of soil management policies and programmes.

The guide may also be useful for other relevant stakeholders, including academia and research organizations, intergovernmental organizations and non-governmental organizations, civil society and the private sector, who can play an important role in supporting, strengthening and documenting efforts made to achieve gender equality and women's empowerment in SSM.

The structure of the guide consists of four sections:

- guiding framework to achieve gender equality in sustainable soil management;
- how to consider gender issues in sustainable soil management;
- tools for conducting gender analysis and gender-responsive and transformative approaches for sustainable soil management; and
- suggested actions to integrate gender equality in sustainable soil management.

1.3 | Use of the guide

If the users of the guide are already familiar with the relevance of gender issues in sustainable soil management, they might want to go directly to Section 3, which provides practical tools for conducting a gender analysis and for adopting gender-transformative approaches (Chapter 3). Section 4 presents examples of possible actions that could be taken for better addressing gender equality issues in sustainable soil management.

Field practitioners might want to quickly consult the checklists presented in Section 3 to conduct a gender analysis for assessing gender roles and addressing the specific needs of women and men related to SSM in any given context. Some of the proposed questions can also be added and adapted to other ongoing gender analyses, such as when conducting a land or a value chain assessment, considering soil-related issues, or exploring how any initiative can contribute towards SSM.

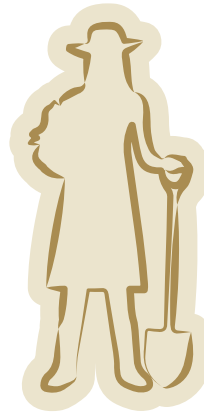
2 | Guiding framework to achieve gender equality in sustainable soil management

Sustainable soil management and gender equality are at the core of different interconnecting institutional mechanisms that are supported by global commitments and partnerships, with the ultimate goal of achieving the SDGs and leaving no one behind.

2.2 | Sustainable soil management, gender equality and the Food and Agriculture Organization of the United Nations

The conservation and responsible management of soils is central to FAO's mandate to help countries eliminate rural poverty, hunger, food insecurity and malnutrition for a growing population, as well as to help them to adapt to and mitigate climate change. As part of the efforts taken to recognize the essential contributions of soils to ecosystem services, including food production, FAO has supported the establishment of the International Initiative for the Conservation and Sustainable Use of Soil Biodiversity in 2002, the Global Soil Partnership (GSP)[1] in 2012, the establishment of World Soil Day in 2014, the organization of the International Year of Soils in 2015, the adoption of the revised World Soil Charter (FAO, 2015a), the development of the Voluntary Guidelines for sustainable soil management (VGSSM) (FAO, 2017), and the international Code of Conduct for the sustainable use and management of fertilizers (FAO, 2019c).

The VGSSM provide guidance to all stakeholders on proven and science-based principles to support SSM, by addressing various technical issues, describing the major soil threats and challenges, and identifying potential solutions. However, in order to provide inclusive and equitable opportunities for sustainable soil management, and to give equal opportunities of access for women and men to natural and productive resources, information, technologies and innovative practices, it is crucial to address the gender dimensions. Box 2 describes some of the main definitions related to gender equality and women's empowerment.



[1] The Global Soil Partnership (GSP) was established as a mechanism to develop a strong interactive partnership and enhanced collaboration and synergy of efforts between all stakeholders. From land users to policymakers, one of the key objectives of the GSP is to improve the governance and to promote sustainable management of soils.

Box 2 | Gender-related definitions

Gender refers to socially constructed attributes and opportunities associated with being female and male. It has to do with how society defines masculinity and femininity in terms of what is the appropriate behaviour for women and men.

Gender equality means ensuring that women and men fully enjoy their rights and have the same opportunities and entitlements in civil and political life, by addressing their specific needs and priorities, and by providing them with the same engagement, treatment and benefits. This implies that they can equally be engaged in decision-making, having access and control over productive resources, services, and technologies, and opportunities for decent employment and livelihood systems.

Women's empowerment is the process of supporting the economic advancement and enhancement of power and agency (the ability to act on one's will) to expand women's ability to control their lives. It implies empowering and enabling women and men to participate more effectively in agriculture, which also translates into improved well-being for children, thereby building human capital for future generations.

The FAO Policy on Gender Equality (2020–2030) (FAO, 2020) aims to achieve equality between women and men in sustainable agriculture and rural development, for the elimination of hunger and poverty. It includes the four gender equality objectives as described in Figure 1.

Figure 1 | The four objectives of the FAO Policy on Gender Equality

Source: FAO. 2020. FAO Policy on Gender Equality 2020–2030. Rome. www.fao.org/3/cb1583en/cb1583en.pdf

The second gender equality objective of the policy (as shown in Figure 1) is to ensure that women and men have equal rights, access to and control over natural and productive resources, and that they equally contribute to, and benefit from, sustainable agriculture and rural development. This objective comprises important gender aspects related to sustainable soil management in terms of equal rights and entitlements to resources, such as productive inputs for soil management and access to land and equal opportunities to control, purchase, own and use resources, and to access advisory and financial services tailored to the different needs and priorities of women and men. The policy calls for ensuring that women not only have the capacity to access resources, but also have the right to decide over their use and management. It implies challenging and addressing existing inequalities and discriminatory social norms that often limit women's effective and sustainable management and preservation of soils. When rural women are empowered, they are also more efficient in building the resilience of rural livelihoods and agrifood systems, in the face of the increasingly adverse effects of climate change and environmental degradation, which often exacerbate the gender gap in agriculture.

The work of FAO in achieving gender-equitable land tenure – which has strong impacts on soil management – is supported by the Gender and Land Rights Database (GLRD) (FAO, 2022a). This work highlights the major political, legal and cultural factors that influence and hinder the realization of women's land rights. Gender equality is fully mainstreamed and constitutes one of the ten principles of implementation in the Voluntary Guidelines for the Responsible Governance of Tenure of Land, Fisheries and Forestry in the Context of Food Security (VGGT) (FAO, 2022b). By amending discriminatory inheritance and property laws, the VGGT makes specific provisions to improve gender equality in both formal and customary systems, by recognizing women´s land rights, and also by encouraging governments and other relevant decision-makers to play a proactive role in achieving gender equality and women's empowerment. The Practical Guide for Improving Gender Equality in Territorial Issues (IGETI) (FAO, 2018), described in more detail in Section 3.2, supports the adoption of a convergent and people-centred gender approach, based on dialogue and negotiations, in order to reach a shared vision between women and men for a given territory or landscape.

2.3 | International commitments to mainstream gender equality in sustainable soil management

Gender equality and SSM and the approaches that support them are closely intertwined concepts in rural and agriculture development. Gender is a fundamental dimension of any soil practice or technology, as women and men have different needs and priorities in managing their soils, and inclusive SSM can be beneficial for reducing the gender gap in agriculture and for improving food security and nutrition.

While gender equality is considered a priority in the 2030 Agenda for Sustainable Development, both as a stand-alone goal (Goal 5) and as a cross-cutting theme, the SDGs do not refer directly to soil conservation (Lal *et al.*, 2021). However, there is a strong connection between soil management, food security, biodiversity, resilience and the related gender and social aspects. The increasing pressure on natural resources by a growing population has led to the deterioration of the relationships between rural people and soils. This has resulted in the unsustainable management of agricultural soils, leading to environmental degradation and major consequences for agricultural households and communities in rural areas, with different impacts on women and men.

Sustainable soil management strongly contributes to collective efforts towards climate change adaptation and mitigation, combating land degradation, and supporting biodiversity conservation. Therefore, it has specific relevance to the United Nations Framework Convention on Climate Change (UNFCCC), the United Nations Convention to Combat Desertification (UNCCD), and the United Nations Convention on Biological Diversity (UNCBD).

Furthermore, SSM and conservation of biodiversity and ecosystem services are pivotal for the commitments made under the UN Decade on Ecosystem Restoration (2021–2030), which constitutes an international call for the protection and revival of ecosystems all

around the world, for the benefit of people and nature. It aims at halting the degradation of ecosystems and restoring them to achieve the global goals.

Accompanied by a landmark decision on *Gender equality and women's empowerment for the enhanced and effective implementation of the Convention*, the UNCCD Gender Action Plan (GAP) mandates for mainstreaming gender issues in advancing country efforts to achieve the systematic integration of gender considerations into effective land degradation neutrality policies and actions, where soils and land management are their critical components (UNCDD, 2018). The Paris Agreement (UNFCCC, 2016), adopted in 2015 at the Conference of the Parties of the UN Framework Convention on Climate Change, also highlights women's crucial contribution to combat climate change. Given the crucial role of soils in climate change mitigation and adaptation – through carbon sequestration facilitated by SSM – it is imperative for countries to address the specific challenges that women are facing to access productive resources and assets. These include the inputs and skills that are necessary for achieving sustainable soil management. The Secretariat of the Convention on Biological Diversity (SCBD) has also recently developed a post-2020 gender plan of action to support the gender-responsive implementation of the post-2020 global biodiversity framework (SCBD, 2019).

3 | How to consider gender issues in sustainable soil management

To achieve gender equality while improving soil health, it is important to analyse the strong linkages that exist between sustainable soil use, management and conservation on the one hand, and gender equality on the other. These links are related to economic, social, cultural, educational and political issues. However, the strength and features of these relationships differ across contexts (FAO 2019a; Zhang *et al.*, 2019). Their impacts on gender roles, behaviours and the access to assets and rural services – such as agricultural advisory services and training – are also dynamic in nature, often demonstrating a self-enforcing or feedback loop relationship (Zhang *et al.*, 2019).

3.2 | A framework on gender-responsive opportunities for achieving sustainable soil management

The International Food Policy Research Institute (IFPRI) has developed a comprehensive conceptual framework to analyse the gender aspects in soil health improvement which helps identifying gender-based constraints, unintended consequences and opportunities in adopting SSM technologies and practices (Zhang *et al.*, 2019), according to the local sociocultural context (as challenges might change substantially from one region or country to the other). Figure 2 shows the different gendered dimensions of SSM from the broader enabling environment to the household and individual levels. It also shows how gender-based constraints affect – at different levels – the opportunities for women and men when adopting SSM practices and benefitting from the related ecosystem services.

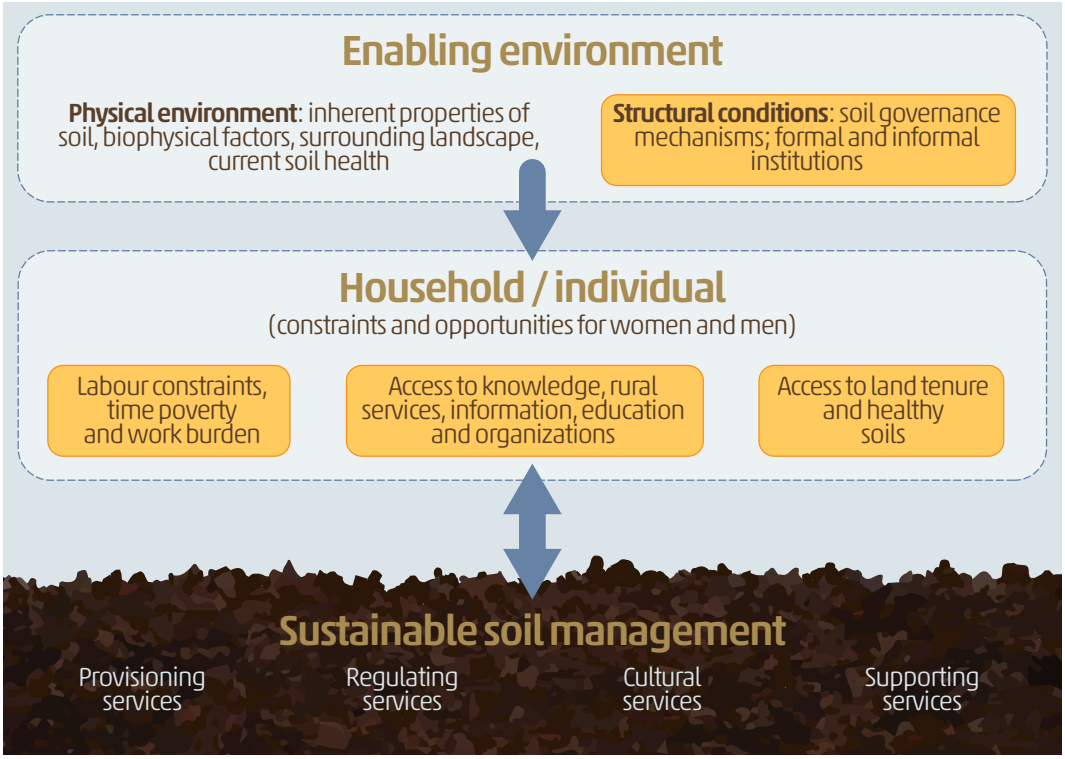


Figure 2 | The gendered dimensions of sustainable soil management

The yellow boxes indicate the underlying gender dimensions affecting adoption and benefits from SSM related ecosystem services (ES)

Sources: Adapted from **Zhang, W., Walker, D., Hernandez, C.C., Elias, M., Meinzen-Dick, R. & Nkonya, E.** 2019. Gendered opportunities for improving soil health: A conceptual framework to help set the research agenda. IFPRI Discussion Paper 1822. Washington, DC., International Food Policy Research Institute (IFPRI). https://doi.org/10.2499/p15738coll2.133203 and **FAO**. 2016a. Developing gender-sensitive value chains – A guiding framework. Rome. www.fao.org/3/i6462e/i6462e.pdf

On a larger scale, the **enabling environment** is defined by the physical environment and structural conditions that determine the opportunities for women and men to manage soil in a sustainable way. The **physical environment** includes the inherent properties of the soil and the surrounding landscape and biophysical factors, which are important conditions underlying the extent to which soil health responds to management choices. The **structural conditions** are macro-level conditions – including the specific legal and sociocultural context – as well as land governance mechanisms which influence farmers' access to and ownership of natural resources (FAO, 2013). These conditions are in addition to the soil governance mechanisms that affect farmers' use, management and control of soils. They include formal institutions, laws and policies, formal credit facilities and extension systems, information institutions, and the gender norms that shape what is considered as appropriate behaviour for women and men in a given society. For example, the structural conditions defining a gender difference in soil management consider the access to healthy soils, which will determine different decision-making mechanisms about soil management practices, such as the specific agricultural investments needed by women and men (FAO, 2022b).

The **individual factors** include highly context-specific capitals and assets, knowledge, perceptions, preferences and behaviours regarding soil management and technology adoption. Recent studies have identified relevant underlying gender differences,

opportunity costs and trade-offs associated with soil management can also differ between women and men (Zhang *et al.*, 2019). These factors will determine different gender-related reactions, based on similar conditions and information. For example, in the analysis of management practices, it was seen that men are often more concerned with the risk of losing money (due to production costs or their concern regarding the loss of harvest), while women are more interested in the environment and the implications of land and soil degradation, as they depend more on natural resources for their livelihoods and food security.

At **the household level**, the framework recognizes that the household is not always the appropriate unit of analysis for soil health management, as women and men have their own individual preferences and constraints regarding the adoption of technologies on the plots they manage, and make decisions over production, time use, control over income and other dimensions. However, gender roles and responsibilities are assigned within the household and determine how and to what extent household members are involved in productive activities and management practices, defining who controls available resources and benefits, and who participates in planning and decision-making. At this level, it is important to be aware of different gender-related decision-making mechanisms existing under similar conditions and with access to the same information. Moreover, these differences are associated with the cultural characteristics of the population. For example, in Europe, although women's participation is lower, there is a greater interest of women in soil health in the long term, while in other places such as Nigeria or North Africa, women's involvement is more related to household livelihoods (FAO, 2019a). For example, when looking at the fertilizer plans, it was observed that women were often more interested in the relationship that exists between soil and human health (healthy food), while men were more concerned with the relationship between soil and produced output (yield).

The underlying causes of **gender-based constraints** often lie at the individual and household levels, since they are fundamental to determine the different access of women and men to productive resources[2] and their decision-making power. At the same time, the establishment of an enabling environment towards gender equality and sustainable soil management greatly influences the participation of both women and men in resource management decisions, often creating or reinforcing gender-based constraints and discrimination (FAO, 2016a).

Moreover, it is important to recognize the different access to and the resulting benefits from soil **ecosystem services** (ES) for women and men. Therefore, their individual perception and knowledge of soil ecosystem services may also differ, with significant implications on their SSM choices and strategies (Yang *et al.*, 2018). Gender-based constraints are described as a cause or a consequence of SSM and soil ecosystem services provided, such as food production (provisioning ES) or carbon sequestration (regulating ES). These issues will be analysed more in detail in Section 2.2.

[2] It is essential to identify the different rights of people within the household beyond "ownership" or "control" of assets in order to understand the intrahousehold dynamics with respect to an asset: **Use rights** refer to the right to use resources, including to physically operate a technology. **Management rights** refer to the right to make decisions on what investments to make in the land or how, when, and where to apply the technology. **Fructus rights** refer to the right to control outputs and profits generated by the use of the resources. **Alienation rights** refer to the right to sell, lease, or give away the resources (Zhang *et al.*, 2019).

3.3 | Gender roles and gender-based constraints in sustainable soil management

While gender-based constraints that limit the adoption of SSM practices differ across locations, some common issues hindering their uptake can be identified (Box 3). The three gender constraints affecting SSM that are considered of high relevance are:

1. labour constraints, time poverty and work burden affecting mostly women and girls;
2. women's and men's differing access to knowledge, financial and rural advisory services, information, education, local institutions and networks; and
3. women's and men's different access to production assets such as healthy soils or agricultural inputs.

Regarding the second and third constraints, men very often have greater access to services and assets than women.

Box 3 | Gender roles and gender-based constraints

Gender roles include:

the productive roles that generate an income: women engage in paid work and income-generating activities, but gender disparities often persist in terms of wage differentials, contractual modalities and informal work;

the reproductive roles related to social reproduction, such as growing and preparing food for family consumption and caring for children;

the community managing roles that include unpaid and voluntary activities, mainly carried out by women, to complement their reproductive role for the benefit of the community, such as fetching water for the school; and

the community or political roles related to decision-making processes, such as membership in assemblies and councils.

Women are traditionally involved in reproductive, productive and community managing roles, while men's roles are categorized mainly as either productive, community, or political. Women's multiple and competing roles lead to their time poverty, which can imply asset and income poverty. The unequal value placed on the roles of women compared with men is often related to their inferior status in the household and the community and the persistent gender discrimination they experience.

Gender-based constraints include restrictions on women's or men's access to resources or opportunities, based on gender roles or responsibilities. They encompass both the measurable inequalities that are revealed by sex-disaggregated data collection and gender analysis, as well as the factors that contribute to a specific condition of gender inequality. Gender-based constraints can limit women's and men's participation in social life, access to resources, time use, mobility, legal rights, or exercise of power (USAID, 2009).

Source: USAID (United States Agency for International Development). 2009. Promoting Gender Equitable Opportunities in Agricultural Value Chains. Washington, DC. https://pdf.usaid.gov/pdf_docs/pnaeb644.pdf

3.3.1 | Labour constraints, time poverty and work burden

Rural women typically experience time poverty because their daily activities are time- and labour-intensive. In general, these activities include agricultural production but also care work to maintain the household. Work to maintain the household includes caring for young, elderly or sick household members, cooking, cleaning, collecting firewood and water, and preparing food. Moreover, discriminatory social norms traditionally imply that the access to new technologies is often limited only to men, leaving women with restricted use of labour-saving and climate-smart agriculture technologies and practices. In general, men have easier access to draught animal power and mechanization for ploughing and the clearing of land, while women's work tends to be more manual, tedious and labour-intensive. In many countries, women are traditionally responsible for home gardens, whereas men take care of cash and food crops produced on larger plots and fields. As a result, rural women spend more time working than men to produce less. This has broad implications for their family and the productive work, as it affects the choices women can make, including decisions related to SSM (FAO, 2015b; Zhang *et al.*, 2019).

Work constraints have implications for women's adoption of innovative soil management practices, such as integrated pest management (IPM), biological nitrogen fixation technologies, and conservation (minimum tillage) practices (Zhang *et al.*, 2019). Labour shortages are also reflected in the inability to make full use of conservation farming techniques on women-managed farms, especially in the short term. Djurfeldt (2018) identifies the shortage of labour as the distinguishing feature of farms managed by women in a study carried out in Malawi, where women heads of households attributed the loss of male labour to a gradual decrease of soil fertility over time.

When labour-intensive soil management approaches are adopted in household production systems, they may also increase women's work burden – exacerbating inequalities – if the gender dimensions are not adequately considered and addressed. Giller *et al.* (2009) show that conservation agriculture interventions in sub-Saharan Africa aimed at reducing the use of herbicides often increase women's work burden disproportionally, as they are responsible for the labour-intensive task of weeding. Women may also fail to benefit from conservation agriculture that targets labour practices that are traditionally considered men's activities (such as weeding with oxen), as this complicates their implementation in women's fields (Zhang *et al.*, 2019).

Moreover, many common issues are embedded in the structural conditions such as women's restricted access to productive resources, education, paid jobs, advisory and financial services, as well as the lack of targeted and gender-responsive policies and legal frameworks at the national level (FAO, 2019a). Worldwide, the gender-related patterns linked to labour (human capital, including time use) and land tenure (natural capital) play a central role in shaping soil management practices (Zhang *et al.*, 2019).

3.3.2. | Gender-differentiated access to knowledge, rural services, information, education and organizations

The access to information and education – acquired through formal public channels and informal networks – also tends to be gender-differentiated. Women and girl farmers generally have lower levels of formal education, which affects their knowledge and adoption of technologies and innovative practices, especially if they require technical or higher knowledge. In many cases, sociocultural barriers, such as the perceived inappropriateness of women participating in planning and decision-making or interacting with male extension officers, as well as time poverty, represent major constraints preventing them from acquiring information through training and demonstration sessions. Moreover, women are often excluded from formal and informal institutions that disseminate land and soil management and conservation practices and innovative technologies.

Fewer opportunities exist for women's engagement and leadership roles in local groups and producers' organizations, limiting their ability to use existing platforms and avenues for consultation and information-sharing with other stakeholders, including extension agents and researchers (Ragasa, 2012). Bernier *et al.* (2015) performed a study in Kenya and found that women were less likely to be aware of many climate-smart agricultural practices, which are often designed to improve soil health and build resilience to climate change and consequent natural disasters.

The links between gender constraints and technology adoption have been studied extensively. It has been well documented that women in different low- and middle-income countries are generally less endowed with income and other forms of capital, and have limited access to training and formal education, technical information, financial, advisory, and other services compared to men (FAO, 2015b). This situation affects the successful adoption of SSM practices. In fact, women's limited access to soil knowledge and decision-making increases the probability that soil management decisions will be based mostly on production and performance criteria, rather than on long-term sustainability. A consequence of this is that women's specific needs and priorities will not be adequately considered.

3.3.3. | Different access to and tenure of land

Secure access to and control over land plays an important role in determining soil management decisions. Traditionally, rural women have limited land rights and insecure land tenure, as they often do not own or have continued secured access to the land where they grow their crops. They also manage smaller-sized and lower quality land plots, with restricted access to and use of land and other natural resources. This is due to inadequate legal frameworks and harmful sociocultural norms that perpetuate inequalities (FAO, 2019a). Besides being relegated to smaller parcels of land and poorer soils, women's reduced access to resources and services limits their ability to invest in soil improvement, which could lead to more degraded women-owned soils than those of men (World Bank, FAO and IFAD, 2009). Social norms that influence land inheritance patterns and limit women's access to the most fertile lands – as well as existing labour constraints – also

influence the quality of women's lands compared to men's (FAO 2011). This is all to the disadvantage of women and girls.

Research shows that when smallholder farmers have secure land rights, they are more likely to preserve the soil, plant trees and protect forests. Gender-biased laws and social practices often limit women's ability to invest in conservation and climate-smart strategies, enjoy equal benefits from soil health initiatives, and participate in decision-making regarding the use of the land upon which they rely for their livelihoods. A gender review of agricultural innovation in Africa (Doss, 2002) concluded that women's insecure access to land often resulted in their lack of incentives to adopt SSM measures on their plots because of the potential risk of losing their access to land, and consequently not being able to benefit from their investments in the long term.

Without secure land rights, women are often left without resources and incentives to improve the productivity of their lands in the face of changing climate conditions. This is particularly true for collective or communal customary tenure, where internal land management dynamics are mostly governed by men, meaning that women do not have the option of owning land as an alternative and have to settle for whichever lands are assigned to them. Weak legal, familial and social protection – in addition to limited support mechanisms to secure women's land and forest rights – increase the likelihood of resorting to practices that degrade the soil (Zhang *et al.*, 2019). In some countries, even when legal mechanisms exist, families might not support women to access their own inheritance, which puts a high social pressure on them to renounce of their rights. Additionally, where existing rural financial institutions use land as collateral, secure land tenure can facilitate the access to credit for investment, and thereby investments in soil management. For example, Kazianga and Masters (2002) and Etongo *et al.* (2018) report that land rights are a key determinant of farmers' soil conservation practices in Burkina Faso.

Together with land tenure, another important asset for SSM is water provision. The access to water and related services is usually limited for women, who are less likely to have access to irrigation or may receive land that is often farther away from water resources than that of men. This implies that women and girls have to travel long distances to collect water or could have few opportunities to make investments in irrigation infrastructure, thus limiting their agricultural productivity. This situation is increasingly common in many areas due to climate change and soil degradation. Moreover, women often have limited access to water user associations (WUAs), which implies that they have fewer opportunities than men to participate in decision-making regarding the provision of water services (World Bank, FAO and IFAD, 2015).

3.4 | The gendered dimensions of soil ecosystem services (SES)

Sustainable soil management ensures the delivery of provisioning, regulating, supporting and cultural ecosystem services provided by soils (FAO, 2015a). The different types of ecosystem services and the soil functions referred to in the SSM definition (FAO *et al.*, 2020) can be described as follows:

- **provisioning services**, including the supply of food, primary production (fibres, medicine, fuel and wood or timber), nutrient and water cycling, raw earth material, and water quality control;
- **regulating services**, including climate regulation, control of floods and erosion, and biodiversity regulation, among others;
- **supporting services**, including carbon sequestration, soil formation and habitat and genetic resources; and
- **cultural services**, including tourism, recreation and the aesthetic and cultural benefits derived from soil.

The analysis described in Table 1 will focus mainly on provisioning, regulating and supporting soil ecosystem services, as it is important to assess the gender dimensions to see how women and men benefit from them, and what their engagement in providing these services is.

In a systematic review of the links between gender issues and ecosystem services, Yang *et al.* (2018) assessed the specific knowledge and interests of women and men in different ecosystem services. The information in Table 1 is based on their proposed research methodology.

Table 1 | Provisioning soil ecosystem services

Relevance for SSM	One of the most appreciated soil functions is to support the growth of agricultural and horticultural crops. Healthy soils are crucial for ensuring the continued growth of vegetation, and for providing food, feed, fibres, fuel, water and medicinal products. Fertile soils[a] provide macronutrients and micronutrients that support plant growth and biomass production. Furthermore, healthy soils play a key role in the supply of clean water by capturing and storing water for plant growth. Optimum growth of most plants occurs when roots have access to nutrients, oxygen and water in the soil.
Food security, nutrition and human health	
Relevance for SSM	Healthy soils are critical to produce enough food for meeting the energy and nutritional requirements of the global human population (SDG 2: Zero Hunger), while protecting the environment and soil quality.

Note:
a | Soil fertility refers to the ability of a soil to support and sustain plant growth by making nutrients and water available for plant uptake (FAO, 2019c).

Gender dimensions

Gender-based food provisioning ecosystem services can differ to a great extent according to the type of production: men are usually more involved in commercial production, while women are more concerned with providing food for their household consumption needs. In general, local agroecological knowledge (human capital) differs between women and men due to differences in socially ascribed roles in production (FAO, 2006). For example, Elias (2016) demonstrates that women and men are responsible for growing different crops, farming in different zones, completing different phases of the cultivation cycle, or performing the same tasks using different tools. This implies that in some places and depending on the crop, men may contribute to land preparation and pest management, while women are responsible for sowing, weeding and threshing, and other activities are jointly performed by women and men (Doss 2002; Orr *et al.*, 2016). The knowledge, perceptions and preferences they acquire – including with respect to SSM techniques – will thus differ between women and men (Elias 2016; Yang *et al.*, 2018).

Women also play an active role in relation to medicinal products and biodiversity use and conservation, especially from forest or mangrove ecosystems. They usually have a stronger knowledge of medicinal plant species and their uses, particularly for species associated with childbirth and childhood ailments (Yang *et al.*, 2018).

For example, in Burkina Faso, and throughout the western Sahel, rural women carefully collect fruits, leaves and roots of native plants for use in their families' diets, supplementing the agricultural grains that provide only one part of the nutritional spectrum and may fail in any given year, depending on climatic variability. More than 800 species of edible wild plants have been catalogued across the Sahel and women are traditionally the custodians of their management and sustainability (FAO, 2006).

Raw materials (wood, fibres and biofuels)

Relevance for SSM

Production of raw materials from biomass (wood, fibres and biofuels) is the second major provisioning service of soil, after food production. Fibres from cotton, rattan, hemp or cane are used for producing textiles and ropes, while forests provide raw materials for cooking, heating and building.

Wood and agricultural crops, including oilseeds, moringa, palm oil and sugarcane, are increasingly used to produce biofuel in green energy initiatives aiming at climate mitigation (supporting SDG 13: Climate Action). It is expected that these initiatives will be used even more in the future to avoid and reduce greenhouse gas (GHG) emissions and to achieve carbon neutral energy, with strong effects on land use and soil management (FAO, 2020).

Gender dimensions

The main gender aspects for raw material production depend on the level of technology available to women and men in the value chains. In general, fuel production requires high technological conditions for product transformation, which makes the entire value chain very selective, providing limited opportunities for small-scale farmers and women in particular. In contrast, wood and fibre production can be an important opportunity for small-scale women and men as they can be valued both at small and large scales. They can also be combined with different types of products, which make these value chains more flexible with the possibility of an added value, such as handicrafts.

For example, the +Algodón Cooperation initiative in Latin America and the Caribbean has carried out a study showing that women are mostly in charge of weeding and post harvesting activities, while men are responsible for soil preparation and fertilization for cotton production. Furthermore, organic cotton production can contribute to improved soil management, as it does not apply agrochemicals and at the same time generates higher income linked to the women´s role in the manufacturing of a highly appreciated handmade raw material (FAO and ABC, 2017, 2018).

According to Yang *et al.*, (2018), men are more engaged in commercial biomass production for biofuel supply at large scale, while women have a more in-depth knowledge about domestic fuel supply. The adoption of different sources of fuels can impact the gendered trade-offs but has no influence on SSM practices (Yang *et al.*, 2018). In the specific context of community-based forestry, healthy soils – which support water quality and biodiversity conservation – are considered an important factor contributing to successful forestry management (FAO, 2016d).

Water quality and availability

The fraction of rainfall that infiltrates into the soil and remains in the soil pores available to plants, is called green water. It represents an average of 25 percent of the total volume of topsoil, which is essential for agriculture and food security (Ringersma, Batjes and Dent, 2003). The soil ecosystem service of providing clean water depends on the physical, biological and chemical conditions of the soil to filter water, and its capacity to adsorb organic and chemical substances that can affect water quality. Soil organic matter contributes to a good soil structure and porosity. A compacted soil has limited porosity to store water and therefore a reduced resilience to both drought and flash floods.

Relevance for SSM

Water quality and availability play an essential role in agriculture and food security and are crucial for numerous SDGs, from SDG 2: Zero Hunger, and SDG 3: Good Health and Well-being to SDG 6: Clean Water and Sanitation, and SDG 14: Life below Water, (FAO, 2020).

Inappropriate and excessive mechanization and unsustainable livestock management lead to soil organic carbon loss, soil compaction and pollution and consequently to a decrease of green water. Sustainable soil management prevents compaction and the conservation of soil organic matter.

A greater access to water for domestic use and agriculture production will be crucial for increasing women's productivity, both for their home gardens for home consumption and for their income-generating activities. In turn, increased access to water improves both the household diet and income, and will also facilitate women's involvement in local governance structures that shape local communities.

Land and water governance, including land tenure insecurity, may be the single largest underlying cause of women's limited access to water and related services. Research shows that in some regions, women's land plots are often of smaller size than those owned by men, or women may be given lands that are often farther away from water resources, especially in the case of inheritance, and therefore less likely be able to access irrigation (FAO, 2011; SOFA Team and Doss, 2011). This implies that women and girls have to travel long distances to collect water or have limited opportunities to make investments in irrigation infrastructure. Insecure land tenure discourages farmers from making investments that improve water access, thus limiting their agricultural productivity (FAO, 2016b).

Gender dimensions

Another relevant aspect to consider is the fact that women often do not have the same access to WUAs and informal irrigation management groups that decide on who gets the water, how much and at what time (FAO, 2016b). This means that women and girls might get water at times that are not suitable for them to be outside and irrigating. This can be for reasons such as heavy work burdens, or if they receive water late at night, which poses serious risks due to social stigmas, and increases their exposure to gender-based violence.

Home gardens are typically women's domain in developing countries, but their productivity is often constrained by water scarcity, which is becoming increasingly common in many countries, due to climate change and resource depletion. By reducing the risk of crop failure caused by the diminished soil moisture and the lack of reserved water, the adoption of SSM – together with water harvesting and irrigation systems – can increase the value of produce typically controlled by women. This can encourage greater investment in water harvesting, through small garden ponds and roof water harvesting in tanks for food production in home gardens. Multi-purpose water reservoirs for adapted irrigation systems and household water consumption can also reduce the time that women and girls spend collecting water for household consumption and home gardens, and result in increased time and energy available for education and productive work (World Bank, FAO and IFAD, 2015).

Supporting and regulating soil ecosystem services	
Relevance for SSM	Supporting services support other ecosystem services, while regulating services are the benefits obtained from the regulation of ecosystem processes. For example, soils play a crucial role in climate change regulations when managed in a sustainable way. Soils are important for climate change mitigation and adaptation, by storing carbon and decreasing GHG emissions to the atmosphere. Moreover, for climate adaptation, functional soils play a key role in habitat conservation for thousands of invertebrates and other soil organisms. Functional soils are also important for regulation and for resilience-building to floods and drought, due to their capacity for storing water in the soil pores. Soils filter water and trap pollutants, preventing them from leaching into the groundwater.
Gender dimensions	In this context, it is crucial to ensure that both women and men farmers have equal access to information and technical support that will allow them to adopt SSM, so they can equally benefit from these ecosystem services. Most studies reviewed by Yang *et al.* (2018) suggest that women with stronger knowledge accorded more importance to supporting and regulating soil ecosystem services.
Climate change regulation and carbon capture	
Relevance for SSM	Soils contribute to GHG emissions (which implies emission of carbon dioxide, methane and nitrous oxide), but they also offer regulating services for climate change mitigation, by sequestrating carbon and contributing to SDG 13: Climate Action). As part of the natural functions and ecosystem services provided by soils, healthy soils have the potential to store more carbon than the atmosphere and vegetation combined, with carbon also having the advantage of remaining sequestered in the soil for thousands of years (FAO, 2019b). However, the world's cultivated soils have lost an important part of their original carbon stock by it being released into the atmosphere as CO2, mainly due to changes in land use and the adoption of unsustainable management practices that result in increased land degradation and the amplified impacts of climate change. Soil organic carbon (SOC) can be potentially valued in the carbon market (recarbonization of soils) and for enhancing soil health and the provision of ecosystem services. The regulatory role of SOC can sustain the relevant SSM approaches and practices such as climate-smart agriculture, conservation agriculture and other practices including crop rotation, green cover, and erosion control.

Yang *et al.* (2018) showed that in general, men have more knowledge of and give more importance to ecosystem services related to climate regulation. Climate change has different impacts on women and men, who develop their own coping strategies to adapt to extreme climatic conditions. One of the most important effects of environmental stress in farming systems is related to the increased workloads for women and the decrease in assets available for poor households (Nelson and Huyer, 2016; Yang *et al.*, 2018). Sex-disaggregated data on climate-smart agriculture (CSA), collected in countries as diverse as Kenya, Senegal, Uganda and Bangladesh show that both women and men are indeed taking up new agricultural practices that are likely to enhance their resilience to the effects of climate change. These practices can result in additional changes such as modifications in the planting date, or introduction of different crop varieties (World Bank, FAO and IFAD, 2015). Nevertheless, in some cases, women have less access to climate information, such as weather forecasts through SMS or radio, in comparison to men. In contrast, when women have the same access to information on weather and production processes such as crop sequencing for soil water management, they are often just as likely as men – if not even more likely – to adopt SSM practices. For example, in Kenya, the most rapid adoption of drought-resistant crops was among women who were heads of the households, as they could have access to climate information and extension services (Nelson and Huyer, 2016).

Nature-based solutions like agroecology and CSA have shown to be practices suitable and beneficial for women in terms of long-term impacts. These solutions can contribute to building climate resilience by improving soil structure, fertility and moisture retention, by lessening the effects of droughts, and by reducing irrigation requirements (FAO and WHO, 2013; World Bank, FAO and IFAD, 2015). However, the effect of those practices on women's labour needs must be further assessed, as it can be beneficial or add to their work burden depending on the local context.

Gender dimensions

The Economic Inclusion Programme for Families and Rural Communities (ACCESSOS) funded by IFAD in Bolivia (Plurinational State of), applied the gender-responsive Climate Vulnerability and Capacity Analysis framework (CARE International, 2019) to identify practices and technologies adapted to women's specific priorities. The programme aims at recovering the indigenous environmental knowledge – especially women's knowledge – so that it can be blended with modern techniques and technologies to ensure a more effective and equitable response to climate change. Based on the local knowledge of the community, a list of potential adaptation practices adopted by women and men was identified, such as the restoration and adaptive management of soil and vegetative cover (IFAD, 2014).

With respect to organic fertilizers (manure, compost, mulching and household refuse), poor farmers have insufficient livestock units to produce an adequate supply of manure, and existing labour constraints limit their application. These limitations are particularly severe for women and girl farmers and women-headed households, who have fewer livestock units and the smallest amount of available labour. These constraints in natural, physical and financial capital result in an inability to replenish soil fertility amid a loss of nitrogen due to erosion, intensive harvesting and leaching of crop nutrients (Zhang *et al.*, 2019). However, manure application is considered a woman's job in some parts of the world. For example, several studies in Africa showed that in fulfilling their gender-ascribed roles and responsibilities, women have shaped the soil landscape. In Liberia and Sierra Leone, women's cultural practices and preferences regarding the use of organic matter as fertilizer have resulted in carbon-rich fields, while in Ethiopia, increased organic fertilizer use was observed in households with more women (Frausin *et al.*, 2014; Zhang *et al.*, 2019). Additionally, due to their role in food preparation and processing, women may have greater access to crop residues and to household food waste residues. Stall-fed livestock may give women greater access to manure at the homestead.

However, the production of organic fertilizers can lead to some backlashes: on one hand it is a labour-intensive activity that can add to the heavy workloads of women and inhibit their ability to adopt other soil conservation and soil fertility improvement practices. On the other hand, the use of household residues or manure to fertilize soil limits their use as fuel or for feeding domestic animals, which are activities for which women are more responsible (Zhang *et al.*, 2019).

Habitat conservation and biodiversity regulation	
Relevance for SSM	Soils host more than one-quarter of global biodiversity, with up to 90 percent of living organisms spending part of their lifecycle in soils. The huge variety of organisms living in soils mediate many important natural processes that support soil and wider ecosystem functioning related to SDG 15: Life on Land. Specifically, soil biodiversity is critical to food and fibre production. It is also an important regulator of other vital soil services, including nutrient cycling, moderation of GHG emissions, and water purification. The interactions of soil organisms affect the overall structure of the soil food web directly and indirectly through competitive, facilitative, mutualistic, pathogenic or predatory relations. These interactions are self-reinforcing and self-regulating processes that lead to biological disease control or biocontrol. These processes often occur below ground within plant roots, at the rhizosphere or more generally within bulk soil. The interactions that lead to biodiversity regulation correspond to the reinforcement of stable populations within the soil system, including pest control (FAO, 2020).
Gender dimensions	Women and men play different but equally important roles in farming activities as decision-makers in agrobiodiversity management. All decisions affect the total amount of genetic diversity that is conserved and used (FAO, 2006). Many farmers, especially those in environments where high-yield crops and livestock varieties do not prosper, rely on a wide range of agrobiodiversity, including non-harvested species that support production (soil microorganisms, predators and pollinators). This helps them maintain their livelihoods in the face of pathogenic infestation of crops, uncertain rainfall and fluctuations in the price of cash crops, sociopolitical disruption, and the unpredictable availability of agrochemicals. Crops that grow in poorly fertile or eroded soils, and livestock that feed on degraded vegetation, are often used by women and girls to support household nutritional strategies (FAO, 2006).
Flood and erosion prevention	
Relevance for SSM	The ability of soils to store and release water is a widely acknowledged regulating ecosystem service related to SDG 6: Clean Water and Sanitation) and SDG 15: Life on Land. In view of the current dramatic climatic changes, it is crucial to enhance water storage to build resilience to weather extremes. Regulation of water flow is threatened by compaction of agricultural soil, which can be caused by mechanization and loss of soil carbon due to unsustainable agricultural practices. (FAO, 2020). When grasslands are converted into cropland, or peatlands are drained for agricultural purposes, loss of soil structure can be observed due to mechanical disturbances and increased soil organic matter degradation. Soil stability is strongly dependent on soil texture, with finer-textured soils, clays and loams leading to the highest stability, and an increase in soil organic matter content preservation. Building a healthy and stable soil structure in croplands contributes to SDG 12: Responsible Consumption and Production), SDG 13: Climate Action and SDG 15: Life on Land (FAO, 2020).
Gender dimensions	In the Pacific, women's groups and women-led NGOs are implementing projects and organizing training on SSM and practices to reduce soil erosion. These initiatives are leading to transformational changes in soil management – in particular by targeting soil erosion and improved soil health – in the Marshall Islands, Micronesia (Federated States of) and Palau. For example, in Micronesia (Federated States of), women's associations have adopted portable and normal dry litter piggeries, which are also used to produce local compost from pig waste. This practice reduces the threat animal waste poses to water resources while enhancing soil health (FAO, 2019a).

4 | Tools for conducting gender analysis and gender-responsive and transformative approaches for sustainable soil management

4.1 | Gender analysis: a tool to identify and address gender-related specific needs and constraints in the context of SSM

The previous section presented the main gender inequalities and constraints hindering SSM adoption. However, as SSM is highly context-specific, it is essential to conduct a gender analysis (see Box 4) to assess the specific gender roles and the different needs of women and men related to SSM in a given geographical, socioeconomic and productive context. Different types of gender analysis are available, including a context analysis, a stakeholders' analysis, a livelihood analysis, and a needs assessment.

Some of the questions included in the various checklists can also be added and adapted to other ongoing gender analyses, such as when conducting a land or a value chain assessment, to consider soil-related issues and explore how each initiative can contribute towards SSM.

Box 4 | What is a gender analysis?

Gender analysis is the study of the different roles of women and men in order to understand:

- What do they do?
- What resources do they have?
- What are their needs and priorities?
- What are the power relations (who decides on what)?

It provides the basis to address gender inequalities in policies, programmes and projects, and can be conducted at multiple levels (household, community and national), across different life stages, considering the various roles of women and men.

4.1.1 | Gender-sensitive context analysis for soil management

This type of gender analysis assesses a number of socioeconomic patterns that influence the coping strategies of women and men and their opportunities for sustainable development and resilience building. These socioeconomic patterns can either support or constrain the adoption of SSM practices and technologies.

Possible environmental and socioeconomic patterns that can affect women and men in different ways include (among many others): land and water scarcity, land degradation,

extreme climate events such as floods and droughts, rising temperatures, changes in precipitation patterns, soil erosion, loss of soil organic carbon, soil salinization and contamination, deforestation, conflicts over natural resources, growing population, migration, gender and social inequalities, feminization of agriculture, job opportunities, available advisory and finance services, markets and farmers' organizations.

A list of possible questions to be asked for conducting this type of gender analysis is provided in Box 5, to be further developed and adapted to the specific context and type of SSM initiative.

Box 5 | Checklist for a gender-sensitive context analysis for sustainable soil management

- Do women and men have equal land ownership?
- Do women and men have the same access to fertile, resilient and healthy soils?
- Do women and men report changes or impacts in the local context related to soil degradation? What are their specific perceptions regarding what is getting better or worse in terms of soil health?
- Do women and men have the same access to good quality irrigation (with moisture monitoring, low salinity and toxicity)?
- What policies and institutional support mechanisms exist to facilitate the adoption of SSM practices, while considering the gender dimensions? What are the main constraints for implementing them?
- How are women and men affected and benefitting from financial incentives oriented to soil health protection?
- Who (women, men or both) benefits from SSM practices and technologies that sustainably increase productivity and address environmental degradation and climate change?
- What are the existing knowledge and skills of women and men related to SSM practices and technologies? What are the specific training needs of women and men?
- What are the existing assets of women and men related to SSM practices and technologies? What are the specific assets and needs of women and men?

4.1.2 | Gender-sensitive stakeholder analysis for SSM

This type of gender analysis (Box 6) helps to identify the women and men stakeholders and relevant institutions and groups to be involved in the SSM-related interventions. It aims to establish how a specific problem related to soil health and management affects different stakeholders, and their views on what will contribute to solving their concerns related to the soil conditions. This analysis is also useful for determining the specific priorities of different stakeholders and for deciding how to best address their interests and needs. These include how to overcome the constraints on their participation or access to expected benefits, and to find out how stakeholders of different genders are likely to affect or be affected, to make appropriate decisions on how to best involve each one of them.

Box 6 | Checklist for a gender-sensitive stakeholder analysis for sustainable soil management

- What are the most important environmental, economic, institutional and social partners in the specific context that influence SSM and soil degradation?
- Who are the stakeholders or institutions to be involved in the planning and decision-making process regarding SSM practices and techniques?
- What do women and men from different socioeconomic groups have at stake?
- What are the stakeholders' priorities? Are there gender-linked differences among various stakeholder groups?
- Who are the main stakeholders representing the interests of women and youth involved in SSM?
- What are the perceptions of women and men in terms of their engagement in the SSM intervention?
- How can we better engage women and youth and their organizations in SSM, including demonstration and training sessions?

To conduct a gender-sensitive stakeholder analysis, it is important to let both women and men express their views and concerns, and to consider other intersectional issues such as age, class, caste, ethnicity, religion, education and information levels, disability and socioeconomic status to avoid treating "women" and "men" as homogeneous categories. It is also important that stakeholders representing marginalized groups and those who lack power and capacities have their voices heard in planning and decision-making. This implies planning targeted actions to reach specific stakeholders to hear their views, including Indigenous Peoples and refugees – particularly the poor, most vulnerable, marginalized and at high-risk farmers – who might not be easily targeted during the analysis, due to pre-existing social norms, power differences or due to living in remote areas.

Women and girls are often not adequately represented and have fewer opportunities than men to participate in decision-making within households and communities, or to equally benefit from planned interventions (such as training and demonstration sessions). For example, even though women's groups and female experts might be harder to identify and reach, it is important to ensure that their perspectives are included.

To address all of these different needs, it is recommended to consider intersectionality and to organize separate meetings with different groups of farmers. It is also important to then tailor the training and information sessions to their specific educational and knowledge levels, plan them at a time and venue that is convenient and accessible for all, and respond to their different needs and priorities related to SSM. Moreover, it is recommended to identify and involve women's and youth groups and gender experts to make sure that their perspectives are included, and that they participate in planning.

4.1.3 | Gender-sensitive livelihood analysis for sustainable soil management

This type of gender analysis (Box 7) tries to answer the following questions:

- Who does what?
- Who uses what?
- Who controls what?

It analyses the specific gender roles, the different access to and control over natural and productive resources, the services for women and men to meet their basic needs and generate a living income, and their main sources of expenditures and income. Livelihood analysis considers the gender dimensions, and the differences between various socioeconomic groups with respect to labour and time use and decision-making patterns, which also affects the uptaking of technologies and practices for SSM.

Box 7 | Checklist for a gender-sensitive livelihood analysis for sustainable soil management

- How do women, men, girls and boys make their living? Are there any differences between various socioeconomic groups?
- How do the livelihood systems of women and men from different socioeconomic and ethnic groups compare?
- What are the most important sources of income for women and men? What are their main sources of expenditure?
- How does soil degradation and management affect the livelihoods of women and men, and their opportunities for development and resilience building?
- What are the likely impacts of poor soil health and soil degradation on the livelihoods of rural people? Are certain sectors or socioeconomic groups more or less vulnerable than others? Why?
- Are SSM practices and technologies equally available to both female and male farmers, and will their uptake be affected by the local sociocultural context?
- What are the specific perceptions of women and men regarding availability of technologies and good practices and promising approaches for SSM?
- How diversified are the livelihoods of women and men? What specific SSM practices have they applied in response to changing climatic conditions and soil degradation?
- What kind of support (financial and non-financial services) do women and men farmers need to adopt SSM practices and technologies?
- What are the main differences between women and men from different socioeconomic groups with respect to labour and decision-making patterns on SSM?
- What kind of labour-saving technologies and practices related to SSM can be introduced to reduce the work burden of women farmers?

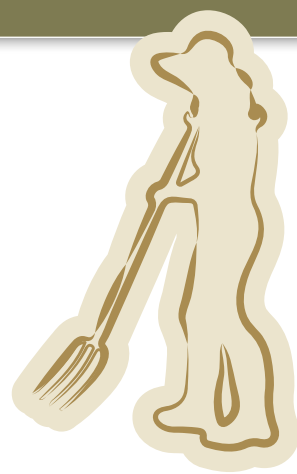
4.1.4 | Gender-sensitive needs assessment for sustainable soil management

This type of gender analysis, defined in Box 8, is used to identify the specific needs and priorities of women and men from different socioeconomic groups, to set priorities for action, to collect data disaggregated by sex and age for planning, and to determine the anticipated impact of the intervention on women and men most affected by the risk of soil degradation and climate change. It is important to distinguish between practical and strategic gender needs. There is no absolute division between these two types of needs. In some cases, a project may address practical needs, whereas in a different context the same project would seek to meet the strategic needs of women and men. Suggested interventions for both practical and strategic gender needs are discussed in Box 9.

Box 8 | Definition of practical and strategic gender needs

Practical gender needs relate to women and men's basic and material needs for their day-to-day survival, and refer to their living conditions, for example: access to resources and services, decent employment opportunities, education, financial services and local institutions, among others, including both short-term and urgent needs such as healthy and nutritious food, safe water and income. In meeting these needs, the existing division of labour between women and men is accepted and gender roles are not challenged. These needs can be satisfied without changing the status of women and men in the household and the community, and in some cases, enforce traditional gender roles. The practical needs are related to improvements in the conditions of women and men, by promoting the efficient use of resources, rather than by supporting women's empowerment or the achievement of gender equality.

Strategic gender needs challenge the existing gender identities and relationships between women and men in favour of equity for all. They are usually long-term interests, and therefore sustainable and continuous needs (namely, social structures). After meeting the strategic needs, the division of labour between women and men would no longer be broadly determined by gender. Similarly, restrictions on access to and control of resources and benefits would be independent of gender issues. Strategic needs are related to the position of women and men (for example, working position, role in household and farmers' organizations, social structure and participation in decision-making) in the pursuit of empowerment and gender equity.



Box 9 | Possible interventions to meet the gender needs for sustainable soil management

Interventions to meet practical gender needs:	Interventions to meet strategic gender needs:
• Introduce labour-saving and innovative practices to reduce women's work burden, such as good quality fertilizers and pesticides, practices and mechanization allowing for reduced soil disturbance (direct seeding, minimum tillage) and good quality and efficient irrigation. • Strengthen women's capacity on soil ecosystem services, focusing on aspects such as the soil health–human health relationship, soil nutrition, soil pollution, soil productivity, climate change regulation and soil organic carbon capture, nutrients balance, control of floods, water filtering and provisioning, and soil biodiversity. • Provide equal access to soil analysis of physical, chemical and biological parameters. • Invest in the capacity of both women and men as extension staff or soil doctors. • Employ women extensionists to support women's adoption of SSM practices. • Provide access to internet, smart and higher education, and technical training for women and girls. • Invest in formal training and informal education for women and men. • Integrate soil health incentives for SSM practices, such as RECSOIL (recarbonization of global soils),[3] targeting women. • Identify and disseminate gender-sensitive technologies and practices for SSM such as sustainable use of fertilizers (mineral, organic and biofertilizers), permanent surface cover, crop diversification (association, rotation, intercropping and green barriers, including leguminous species, controlled vehicle traffic and appropriate grazing intensities, and avoid regular use of fire).	• Invest in women's leadership and negotiation skills and knowledge management. • Conduct an assessment of gender-related needs for SSM and identify possible solutions to overcome the specific barriers faced by women and men. • Provide primary education for both girls and boys. • Identify alternative mechanisms of collateral to increase women's access to financial services. • Increase women´s access to alternative financial mechanisms for those who lack collaterals, like RECSOIL. • Raise gender awareness of advisory services, regional and national soil partnerships and other technical networks. • Formulate and monitor gender-sensitive indicators for SSM, to be included in the land management strategies. • Increase women's access to markets and trade opportunities linked to soil health and soil ecosystem services protection. • Increase women's participation in decision-making and planning (such as through quota systems or the appointment of a gender focal point). • Support gender champions by raising awareness about their work towards gender equality and women's empowerment related to SSM. • Develop systems for measuring women's unpaid farming labour, family-run enterprises and unpaid household and care work (related to health care, nutrition and food provisioning for households, water and fuel collection and care for children, the elderly and persons with disability).

[3] RECSOIL is a global mechanism for scaling up SSM, led by the Global Soil Partnership, with a focus on soil organic carbon and supporting the provision of incentives for farmers who agree to implement good practices.

4.2 | Gender-responsive and gender-transformative approaches to SSM

Increasing attention is given to different gender-responsive and gender-transformative approaches, which can be adapted and applied also to SSM interventions (Box 10).

Box 10 | Definition of gender-responsive and gender-transformative approaches

Gender-responsive approaches (GRAs) recognize and address the specific needs and priorities of women and men, based on the social construction of gender roles.

Gender-transformative approaches (GTAs) are adopted to advance gender equality and to empower women and girls. These approaches critically examine, question, and change discriminatory gender norms, attitudes, behaviours and social structures that create and perpetuate inequalities. They aim at transforming unequal power relations, discriminatory formal and informal institutions – and the mindset of individuals and organizations – in order to improve the lives of both women and men in rural communities.

The adoption of gender-transformative approaches in the work related to SSM can be very relevant to overcoming existing gender-related barriers and discrimination that rural women face when accessing resources, services and local institutions. GTAs give women equal opportunities to participate in and benefit from any type of intervention and strategy adopted to build sustainable and resilient soil health. This implies investing in the technical, leadership and negotiation skills of both women and men and ensuring their equal economic opportunities and access to innovative technologies and good practices related to sustainable soil management. It is also important to assess and address the different challenges of women and men and engage both in dialogue and planning at household and community levels to overcome inequalities and conflicts, and to build more equitable intrahousehold workloads and shared decision-making mechanisms.

The GTAs are often used to create more opportunities for sustainable and resilient rural livelihoods, building on the experience of the farmer field schools (FFSs), the Global Soil Doctors Programme, savings, and revolving loan groups, as well as women's increased engagement in producers' organizations. A gender-responsive territorial and landscape development approach can also be adapted to build SSM.

As part of the empowerment activities, functional adult literacy, business skills training, revolving loans and new income-generating activities are also created. The following sections describe some relevant experiences developed in recent years for future scale-up by different stakeholders.

4.2.1 | The Dimitra Clubs approach

The Dimitra Clubs are informal groups of women, men and youth – mixed depending on the community – who meet regularly to discuss and identify their priorities and challenges. They make informed choices and take collective action to solve existing problems and challenges that women and men farmers face, while using their own resources and available services. This gender-sensitive participatory Dimitra Clubs approach of FAO enriches SSM projects by promoting active community involvement, supporting the access to information and collective action intentionally designed to boost gender equality and women's empowerment, as well as contributing to reducing rural poverty, and enhancing the resilience of rural livelihoods and agrifood systems.

The Dimitra Clubs – active in the Sahel region and Central and East Africa (Burundi, Burkina Faso, the Central African Republic, the Democratic Republic of the Congo, Ghana, the Niger, Madagascar, Mali and Senegal) – are often equipped with wind-up, solar-powered radios and mobile phones. Community radio stations also collaborate by broadcasting information requested by clubs, as well as participate in their debates and achievements, so as to inspire other communities. Due to their credibility with the community and village leaders, the clubs serve to boost rural people's participation in local governance and rural women's leadership status, improve their access to local decision-making processes and facilitate more equitable gender power relations. The clubs have contributed to successful transformative changes, such as breaking food taboos, combating early marriage and gender-based violence, improving girls' education, improving dialogue between women and men at household and community levels, and reducing the work burden of women.

In central Mali, the Dimitra Clubs in Kedou village in Mopti identified soil erosion as the greatest threat to the precious 10 percent of land suitable for crop cultivation. To protect this land, the clubs involved the villagers in building stone barriers by placing rows of stones along contour lines to avoid soil erosion. Additional stone barriers helped conserve water reservoirs, due to the concerns about silting of the village dam, which is considered a critical source of water for the sizeable production of shallots and other local crops in the village (FAO, IFAD and WFP, 2020).

4.2.2 | Farmer field school approach and the Global Soil Doctors Programme

Farmer field school is an approach based on people-centred learning. It uses participatory methods to create an environment conducive to learning where the participants can exchange knowledge and experience. Practical field exercises using direct observation, discussion and decision-making encourage learning-by-doing. This approach is used in the Global Soil Doctors Programme to provide technical capacity on SSM while at the same time empowering women and transforming gender norms.

While a growing range of technical topics are being addressed through FFSs, integrated soil management is a crucial topic. The GSP has produced methodologies, educational materials and manuals adapted for local contexts and different productive systems (FAO, 2022c).

Through the FSS approach and the Global Soil Doctors Programme, female and male farmers can share and learn about the soils they farm on. This can include analysis of the soil's physical, biological and chemical characteristics, soil fertility, identification and prioritization of SSM problems and solutions, management of soil organic matter, and soil moisture retention techniques. These techniques can consist of ditches, contour farming and furrows, stone lines, grass strips, pits and bunds, mulching, cover crops and conservation tillage.

Farmer field schools have proven to not only strengthen the technical skills and decision-making capacities of farmers, but also to significantly influence the community as well as intrahousehold dynamics. They strengthen community relations and the capacity of listening to the opinion of others, to formulate and express personal points of view, and to find a common solution together through the process of communication and learning. Farmer field schools play an important role in reinforcing the technical and functional capacity of participants, and simultaneously by contributing to inclusive community development, women's empowerment and gender equality. By addressing the specific needs and vulnerabilities of women and men, and by building mutual trust between them within the community, both the field farmer school (FFS) approach and the Global Soil Doctors Programme are considered gender-transformative approaches for their ability to support positive changes in attitudes, behaviours and practices, thereby transforming gender relations (FAO, 2020).

The Farmers' Field and Business Schools (FFBSs) have been established by CARE International in Bangladesh, Ethiopia, Ghana, India, Malawi, Mali, and the United Republic of Tanzania. While building the technical skills on SSM and manure preparation, among other topics, the FFBSs have proved to be particularly successful in engaging with the government and traditional leaders to improve women's access to land and to change harmful social norms. The involvement of spouses was also a key element of success for simultaneously empowering women and men in the same household. Demonstration plots and discussions on social topics engage the entire community, while dialogue sessions on gender and nutrition contribute to positive changes in relationships at the household level (FAO, 2020).

The farmer field and life school (FFLS) and junior farmer field and life school (JFFLS) were established in Uganda by FAO. Besides building the technical skills regarding soil and water conservation and manure management by women, men, girls and boys, they provided a safe space for them to talk and learn together about topics (such as gender roles and relations, women's time burden and gender-based violence) that are not directly related to the group's original purpose. Providing household support instead of individual support to women, avoids conflict within households and strengthens the productive capacities of both women and men. Couples who learn together often end up applying their learning in all spheres of their life. Skills and knowledge learned together were employed in planning, budgeting, financial management, decision-making, health services and children's education. The grouping effect of the FFLS and JFFLS approach helped reduce stigma, strengthen social reintegration, and empower individuals affected by HIV/AIDS or GBV and their families. It also proved to be a powerful tool for peacebuilding, reconciliation, and reconstruction of social cohesion between different ethnic groups, as well as among returnees (FAO, 2020).

4.2.3 | Gender-responsive territorial development approach to SSM

Other important aspects to consider are the weak land governance structures, the mixtures of different uncodified customary rules, the values and practices on tenancy and management arrangements, and conflicting statutory and legal arrangements. To overcome these challenges, it is recommended to adopt a convergent and people-centred gender approach to increase and improve the provision of goods and services in a sustainable and equitable manner between women and men. This requires considering gender equality, territorial development, legal aspects and natural resources management. Gender plays a critical role in these dynamics, since women and men tend to use natural resources according to the roles and responsibilities determined by their gender, and their economic and social status. Therefore, a sound gender-responsive territorial diagnosis must be conducted so that an open dialogue can be established with the engagement of both women and men so they can negotiate access and use of natural resources, based on the same available information (FAO, 2018) (Box 11). Issues related to land, soils and other natural resources are highly complex and need to be addressed with extreme sensitivity.

5 | Suggested actions to integrate gender equality in sustainable soil management

Some suggested actions to integrate gender equality in sustainable soil management are as follows:

- Strengthen the capacity to collect, analyse and use sex-disaggregated data regarding the use and impact of SSM practices and technologies. This includes the local and indigenous knowledge of women and men farmers, their different access to and control over resources and services, and their specific tasks in SSM to better understand soil conditions and trends in soil functions, and target gender-responsive interventions in order to increase the productivity, protect the environment and ensure sustainable interventions.
- Address gender issues and monitor negative and positive gender-related impacts of policies, programmes and projects aimed at sustainable soil management, using an inclusive and participatory approach, and creating an enabling environment to facilitate the equal access for women and men to land and other productive resources, services, local institutions and organizations.
- Strengthen the capacities of academic institutions on how to conduct gender-sensitive soil research to support national research programmes and policymakers, in order to work better with different land users and to address the specific constraints that women and men face in increasing the ecosystem services provided by soils (such as soil productivity).
- Design gender-responsive sustainable soil management and supportive agricultural and environmental policies and programmes.
- Support investments and positive incentives aimed at promoting sustainable soil management and gender equality.
- Invest in women's leadership and technical skills in SSM.
- Implement successful measures, techniques and good practices for preventing or minimizing soil degradation and supporting soil rehabilitation and soil restoration, including large-scale climate finance and development projects.
- Design inclusive and gender-responsive education and extension programmes.
- Ensure a thematic balance across SSM challenges and gender-responsive measures in the analysis and proposed policy recommendations, data and case studies in order to address issues such as soil erosion by water and wind, soil organic carbon loss, soil nutrient imbalance, soil salinization, soil contamination and acidification, loss of soil biodiversity, soil sealing and compaction, and waterlogging, while considering the gender implications.
- Apply available gender mainstreaming tools and gender-responsive and gender-transformative approaches in SSM projects.

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The Global Soil Partnership (GSP) is a globally recognized mechanism established in 2012. Our mission is to position soils in the Global Agenda through collective action. Our key objectives are to promote Sustainable Soil Management (SSM) and improve soil governance to guarantee healthy and productive soils, and support the provision of essential ecosystem services towards food security and improved nutrition, climate change adaptation and mitigation, and sustainable development.

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Increasing efforts are needed to ensure that policies and programmes supporting agriculture development and food security recognize the importance of sustainable soil management and address discriminatory gender norms and conditions that perpetuate gender inequalities and marginalize women and girls.

The Technical guide for addressing gender equality issues in sustainable soil management is designed to provide an easily accessible and understandable reference on how to apply the Voluntary Guidelines for Sustainable Soil Management (VGSSM) for building healthy soils and to contribute to the achievement of gender equality and the empowerment of women in all aspects of sustainable soil management.

ISBN 978-92-5-137806-9

9 789251 378069

CC5289EN/1/04.23