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Climate change: A challenge for gender equity and future possibilities

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ABSTRACT

Climate change describes a change in average conditions like temperature, rainfall etc. in a region over a long period of time. Agriculture is vulnerable to climate change, the statement holds more truth particular to India as a large population (65%) depend on agriculture for their livelihood. Climate change affects different dimensions of food security *viz*. food availability, food accessibility, food consumption and food systems stability. Women farmers currently account for 50-80% of all food production in developing countries. In agricultural livelihood, women and men experience climate change impacts differently due to their socially constructed roles and tasks. Climate change effects have heightened existing gender disparities by contributing to the greater climate change vulnerability of women. Rural women also depend more than men on ecosystem services for food security. They are heavily involved in agricultural production and natural resources management. A direct relationship between gender equality, women's empowerment and climate change can be observed in broader view. The adverse effects and impacts of climate change on agriculture could erode gains made toward gender equality. On one hand, women are extremely vulnerable to climate change effects, which in turn aggravate existing gender disparities. On other hand, women have unique knowledge and skills that can make the response to combat climate change more effective and sustainable. Empowerment of farm women is vital for the effectiveness of climate change projects and policies implementation. Climate Smart Agriculture is an approach to develop the techniques, policies and framework to achieve sustainable agricultural development for food security in climate change. It stands on 3 major pillars: (1) sustainably increasing agricultural productivity and incomes (2) adapting and building resilience to climate change and (3) reducing and/or removing GHG emissions. Taking a gender responsive approach to CSA signifies that needs, priorities and realities of men, women are recognized and adequately addressed. In longer term, major changes are needed for reducing the constraints, women and men may face in terms of resources accessibility, services and information. Beyond CSA practices, the institutions involved in climate change adaptation and mitigation need to partner with women's community-based organizations to go beyond agricultural productivity and support income generation, loans access, improved nutrition and health services.

Key words: Climate change, Climate smart practices, Gender equity, Farm women

Climate change is an incessant process over time. Global warming caused by human activities accelerates the rate of change of weather parameters in long-term contemplation. During the last 30 years extreme events; such as drought, flood, cyclone, heat and cold waves, thunder storms and whirlwinds are occurring more frequently. Changes in temperature, rainfall and seasonality have significantly affected the agricultural production in many regions of the world (Bana *et al.*, 2014; Singh *et al.*, 2020a, 2020b). This include some of the least developed

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countries, thus even endangering child and women health, as well as overall health and functional capacity of adults too. Directly or indirectly it impacts on all sectors of human life. Recently, the Brown to Green Report (Climate Transparency Organization, 2019) indicated that, G20 countries are together responsible for approximately 80% of the global Green House Gas (GHG) emission responsible for global warming. As global warming continues the frequency and severity of weather-related disasters will increase. Climate variability, degradation of land and other natural resources are altering rural landscapes globally (Jakhar *et al.,* 2018a, 2018b; Choudhary *et al.,* 2020). The damage appears to have done in a number of regions of the world over the past many decades. There are ample evidences that climate change is having serious effects on agricultural production and livelihoods of millions of farmers across the globe. These G20 countries lost 16,000 human lives and $ 142 billion during 1998-2017 (on an average/year) with India reporting highest number of casualties with considerable economic losses (Mahapatra, 2020). The effects of climate change on production, ecosystem and livelihoods differ by region, necessitating the importance of in-depth local analysis (Choudhary *et al.,* 2014; Bana *et al.,* 2014).

The climate change effects could derail progress made towards sustainable development and reverse headway toward achievement of the Millennium Development Goals (MDGs) (UNDP, 2010). The 2011 Human Development Report (HDR) discerns that global temperatures and sea levels continue to rise and the probability of natural disasters shows increase (the average annual number has doubled in past 25 years). These changes and the loss of ecosystems have threatened the livelihoods in many countries ranking low on the Human Development Index (HDI) (UNDP, 2011). Moreover, these changes could aggravate long-lasting environmental threats such as deforestation, water scarcity and land degradation that affects poorest the most. For example, approximately 350 million people, mostly poor living near forests and rely on these resources for their livelihoods (Toulmin *et al.,* 2009). The poor and marginalized sections of society are most vulnerable to climate change, since their livelihoods are highly dependent on natural resources which are sensitive to climate changeability (FAO, 2011a).

Women farmers currently account for 50-80% of all food production in developing countries. About 2/3rd of the female labour force in developing countries and more than 90% in many African countries are engaged in agricultural work (FAO Focus, 2011). Women suffer loss both in income and harvests which are their sole sources of food and income. Cascading effect of increase in food prices makes food further inaccessible to poor people particular women, whose health has been found to decline more than male health during the time of food shortages (Muralikrishnan *et al.,* 2020). Furthermore, women are excluded from decision-making process on land use, accessibility and resources critical for their livelihood (FAO, Focus, 2011). To minimise the effect of climate change, it is important that the rights of rural women are safeguarded with regard to food security, non-discriminatory access to resources and equitable participation in decision-making (UN2009.org/women watch). With this background an attempt has been made in this review paper to critically appraise the effect of changing climate on farm women.

Climate change and agriculture

Agriculture is vulnerable to climate change; the statement holds more truth particular to India as a large population (65%) depends on agriculture for their livelihood. Increase in atmospheric and surface temperature increases evaporation rate at the earth's surface (IPCC, 2007) which leads to more vigorous hydrologic cycle, influences precipitation. The frequent temperature change intensities the frequencies of extreme events and changes soil moisture status (Mahapatra, 2020). The frequency of droughts is expected to rise. Longer drought period increases the moisture stress in crops and decreases the crop productivity (IFPRI, 2019; Hamim and Choudhary, 2019). Many scientists have reported that irrigated agriculture would be severely affected by climate change due to increased crop water requirement, decreased water availability

and shorter crop duration (Rejani *et al.* 2016; Jakhar *et al.*, 2017a, 2017b; Hamim and Choudhary, 2019; Kumar *et al.*, 2016, 2020). Climate change affects different dimensions of food security *viz*. food availability, food accessibility, food utilization and food systems stability (FAO, 2008). The basic resources at farm level are land and water. The success of agriculture depends on water availability. According to the Agenda 21 of the 1992 UN Conference on Environment and Development in Rio de Janerio, *"Sustainability of food production increasingly depends on sound and efficient water use and conservation practices consisting primarily of irrigation development and management with respect to agriculture, livestock, inland fisheries and agro-forestry"*. Achieving food security in many countries including India, agriculture must not only provide food for rising population, but also save water for other uses" (Mahapatra, 2020).

Climate change affects farming across the production cycle, starting with land preparation sowing, weeding, harvesting, processing and storing of produce. Since 1960s, India's cereal production in has increased significantly as a result of Green Revolution. Securing these gains is becoming more difficult in the context of depleting water resources; soil degradation, increasing input costs and climate change (Aryal *et al.*, 2014). Although the projections with regard to the effects of climate change on agriculture are highly conflicting, the majority of the studies predict that; if global warming continues relentless crop production in India could fall by 10-40% by 2080-2100 (Aggarwal, 2008; IPCC, 2007; Parry *et al.*, 2004). Therefore, it is recommended that the existing farming system and land management practices must undergo a paradigm shift to make them climate smart so as to adapt to climatic variability, sequester atmospheric carbon, reduce GHGs emission for sustainably with higher productivity (Sapkota *et al.*, 2014).

All changes in agricultural production have considerable effect on the situation of women, given their vital role in food production across the globe. Climate change could affect the existence of millions, especially in rural agricultural and coastal areas of Asia, Africa and Latin America. Such prospects are alarming since agriculture is recognized as mainstay in addressing poverty and food security. While noting that the food and agriculture sector's contribution to climate change was over 30% of annual GHG emissions, it is vital to ensure food security when temperatures and sea level are rising, extreme events becoming more frequent and seasonal trends are difficult to predict (Butler, 2008).

Climate change and gender gap

"Gender" refers to qualities or characteristics that society attributes to each sex. People are born female or male, but learn to be women and men. Perceptions of gender are deeply rooted, vary widely both within and between cultures, and change over time (FAO, 2009). But in most societies, gender determines power and resources for females and males. The tendency in society for women is to have a more disadvantaged position in comparison to men. For example; cultural norms, gender and seniority were found to shape the processing of climate information among different groups in African countries (Moser, 1993; Boyd, 2002, Roncoli, 2006). Gender equality is a state in which women and men enjoy equal rights, opportunities and entitlements in life. It denotes equal participation of women and men in decision-making, equal ability to exercise their human rights, equal access to control resources, equal share in benefits of development, equal opportunities in employment and in all other aspects of their livelihoods (FAO, 2009). When gender equality is low gender gap is high and *vice-versa*.

Women contribute significantly in the production of food worldwide. It is reported that more than half of the food produced in the developing world can be accounted for women and they constitute a majority of the workforce in agriculture (Saito and Spurling, 1992; Bhattacharya and Rani, 1995). Women in most South-Asian economies are actively involved in managing farm households and working as labourers in agriculture. They also participate substantially in the construction and maintenance of irrigation systems (Van Koppen, 1998). According to an estimate by the United Nations

Development Programme US$ 11 trillion worth of women contribution remains invisible (UNDP, 1995). A study, based on 31 countries farm data suggests that women work longer than men and half of their work is on economic activities. However, most of the work is unpaid, and their contribution is largely overlooked in agricultural policies and programs (Khandker, 2020). The gender gap in agriculture is perceived worldwide. In the context of Climate-Smart Agriculture (CSA), this gap bears a larger message. It means that men and women are not starting off on a level playing field to combat climate change. This can have serious consequences for the adoption and sustainability of climate smart practices. If this gap is not taken into contemplation in the development of site-specific CSA options, this could reinforce existing inequalities.

As gender equality is a fundamental human right, there are other obligations for promoting it in climate and development policies. Women account for 75% of the world's 876 million illiterate adults. Close to 70% of those who live on less than $1 per day are women. Women work 2/3rd of the world's working hours, yet receive only 10% of the world's income. Women own only 1% of the world's property in spite they dominate in world food production (50 to 80%), women own less than 10% of land globally (Huyer *et al.*, 2015). Women do not have easy access to funds to cover weather related losses or adaptation technologies. Women face gender barriers to land accessibility, financial services, social capital and technology support, which makes them vulnerable to food insecurity. In Africa, the proportion of women affected by climate-related crop changes could range from 48% (Burkina Faso) to 73% (Congo). There are 2 million deaths per year related to the burning of biomass fuel indoors (mainly women and children) and about 36% of these deaths are in low HDI countries (Huyer *et al.*, 2015).

In agricultural livelihood, women and men experience climate change impacts differently due to their socially constructed roles and tasks. In developing countries, climate change affects the availability of surface water due to which rural women, responsible for fetching water have to cover greater distances to collect the water. Studies have shown strong links between climate-related disasters and female mortality, with women and children more than 14 times more likely than men to fatalities during a disaster (DFID, 2013). Women often have limited rights than men, limited mobility and less access to resources, information and decision-making. Consequently, they are significantly more vulnerable to the impacts of climate change and have lesser capacities to adapt and expand their livelihood options.

Climate change effects have heightened existing gender disparities by contributing to the greater climate change vulnerability of many women (IPCC, 2013). The report elaborates that an individual's vulnerability and adaptive capacity to climate change is subject to different factors. These factors are deeply differentiated across gender lines (Jakhar and Das, 2020). Table 1 shows the distinguished impacts of climate change on farm women. It incite the social, economic, political and environmental factors that magnifies vulnerability and challenges to adaptive capacity. The gender differentiated impacts of climate change are more distinct among rural women. Because they heavily depend on biomass from agriculture, farm wastes, fuel wood and other forest resources than men for their energy needs and livelihoods (Suri *et al.*, 2012). Rural women also depend more than men on ecosystem services for food security. Asfaw and Maggio (2017) in their study in Malawi, Africa found that areas where extreme weather events significantly reduce consumption and nutrition, the effects are more pronounced where land area owned by women is higher. This proposes that, when climate variability is high, women involved in agriculture are much more vulnerable and less able to cope with impacts. The gendered differences on natural resources dependence and ecosystem services explicates differentiated adaptive capacities, risk exposure and vulnerability to biodiversity losses. In many areas, women have limited access to agricultural advisory services and formal farm institutions. This further narrows their opportunities to learn about coping strategies under CSA. Women are more vulnerable to climate change also because

Table 1: Differentiated impacts of climate change on women

Climate change impacts	Impacts intensifying gender inequalities
Crop failure	Household food provision Increasing work load
Fuel shortage	Household fuel provision
Water scarcity	Household water provision Contaminated water More time in water collection
Natural disasters	Crop management

Source: FAO, (2016)

they are often poorer, receive less education, and are not involved in decision-making processes that affect their lives. Cultural norms related to gender sometimes limit the ability of women to make quick decisions (Nellemann *et al.,* 2011). Additionally, women tend to possess fewer assets and depend more on natural resources for their livelihoods (FAO, 2011b).

Rural women tend to have limited or less financial, physical and human resources than men, consequently they have fewer options for responding to the effects of climate change. Also, poor women tend to rely more on natural resources than men, so with direct hit by climate change, women's livelihood is grimly affected. There is a need for a better understanding on how these factors define the differences in the specific constraints smallholder men and women farmers face during making choices regarding adaptation and adoption of CSA practices. A thoughtful concern on these gender based differences in CSA practices is likely to make these interventions more effective for both men and women farmers to cope with the impacts of climate change and build resilient and inclusive agricultural system.

A direct relationship between gender equality, women's empowerment and climate change can be observed in larger view. On one hand, women are extremely vulnerable to climate change effects, which in turn aggravate existing gender disparities. On other hand, women have unique knowledge and skills that can make the response to climate change more effective and sustainable. Therefore, Climate change policies should take account of gender-based vulnerability as well as unique contribution that women can make to advance gender equality and women's empowerment. As the world moves towards post-Kyoto regime, it is essential that climate initiatives at all levels should pay keen attention for linkages between gender and climate change by engaging women all levels of the decision-making process. Adaptation strategies which do not take into account the gender gaps, resources accessibility and vulnerabilities are less likely to succeed.

Coping practices for farm women

In the climate change deliberations, adaptation is increasingly being seen as a key policy priority. Adaptation at an accelerated pace on target is crucial for ensuring the development of vulnerable populations. Approximately 1.4 billion rural people from developing countries who depend on small-scale farming will be most exposed to climate change impacts due to pre-existing disparities. Mitigation is also a strong pillar for climate change response. The gender related inequities for rights over resources *viz.* land, water, livestock, pastures and fisheries (Huyer *et al.,* 2016). Therefore climate change mitigation policies can represent a significant opportunity to acknowledge and remunerate them for providing environmental services that benefit us all. International agricultural commodity prices are rising due to various factors: an increased demand for food due in emerging countries like India and China; rapid migration to cities; poor harvests in some countries and the conversion of land use from cereals to biofuel crops (FAO, 2009). These factors are forcing us for new adaptation strategies to cope up with climate change. Empowerment of farm women is vital for the effectiveness of climate change projects and policies implemen-

tation. Studies have demonstrated that gender equality and women's empowerment are central to development, environmental sustainability and achievement of the MDGs (World Bank, 2012).

A study of 25 developed and 65 developing countries shown that country enhanced participation of women is crucial in addressing the adverse impacts of climate change. This is due to the fact that women play vital role in dealing with disasters by effectively mobilizing communities in risk management. Thus their greater participation will enhance risk management and its reduction (Carvajal *et al.,* 2008). Although there is a greater thought to incorporate gender perspectives in climate change policies, but still considerable gender-based barriers across the major international and national policy processes. Elsie *et al.*, (2018) in their study in Guinea Savanna agroecological zone in Ghana, West Africa noted the adaptation measures adopted by heads of farm households to counter climate change impacts. They found that female heads of farm households relied mainly on borrowed money as a coping measure, while male heads depended primarily on livestock sale. Staggered planting and harvesting dates, crop diversification, and use of improved crop varieties were the major adaptation strategies adopted by farmers. Building check dams, dugouts, post-harvest processing, capacity-building, improved access to markets and credit could enhance the adaptive capacity to mitigate projected climate change impacts on their livelihood activities and household well-being.

Gender sensitive water management

For reducing the impacts of climate change, women should play a greater role in managing water. This is important since they have important contribution and stake in both domestic and agricultural water use. Unfortunately women perspectives in water management are rarely considered while framing policies and programs (Wahaj and Harti, 2007). Effective participatory water institutions are needed to improve water management in India as well as world. This can't be achieved without women involvement. Always there is insufficient representation, participation, and involvement of women in water institutions. Women involvement in farming and water management decisions is jointed with men but not independent. Findings indicate that the views of women and men differ on many aspects hence women inclusion is important. Gender equality in water user associations (WUA, Pani panchayat) would enhance their social and economic standing, achieve greater gender balance and will expand their awareness of water management.

Gender-sensitive indicators of Climate Smart Agriculture (CSA)

Gender-sensitive indicators of a particular CSA practice include counts of the numbers of women and men engaged in testing or applying practices; they also measure long-term change (World Bank, FAO and IFAD, 2015). These changes include women's increased control on assets, participation in decision-making, knowledge, changes in behaviour, approach, awareness, empowerment, and improved economic status and food security and nutrition of women and men. Further, for enhancing the CSA practice's performance, women need to be actively involved in defining indicators and implementation (Huyer *et al.,* 2015).

Gender-responsive CSA

Climate-Smart Agriculture (CSA) is an approach to develop the techniques, policies and framework to achieve sustainable agricultural development for food security in climate change. It encompasses three dimensions of sustainable development *i.e.,* social, economic and environmental addressing food security and climate challenges. It stands on 3 major pillars: (1) sustainably increasing agricultural productivity and incomes (2) adapting and building resilience to climate change and (3) reducing and/or removing GHG emissions. Taking a gender responsive approach to CSA signifies that needs, priorities and realities of men and women are recognized and adequately addressed. In the concept, design, field application and adoption CSA can equally benefit both men and women (World Bank, FAO and IFAD, 2015). Furthermore, it is pursued that there needs to be a consideration of ongoing socio-economic changes

for gender in the society. An example of a socio-economic change is the move of more women into agriculture as men migrate.

A gender-responsive approach means the monitoring and assessment of CSA needs to include gender-sensitive indicators. These indicators help in tracking the progress in bridging the agricultural gender gap (Huyer *et al.*, 2015). Additional gender receptive CSA measures can include: attention to gender issues in CSA policymaking; building an evidence base on gender in CSA; developing financial instruments and introducing institutional change for capacity building and commitment for gender equality and women's empowerment (Lipper *et al.*, 2014, Habtezion, 2012). As elucidated the gender gap in agriculture is of high significance to CSA. It potentially puts women and men in unequal positions in terms of participation and benefit from site-specific CSA options. The CSA

Table 2: Criteria for evaluating whether a gender-responsive approach is used in CSA-sensitive practices

Criteria	Explanations of criteria
1. The development and application of the practice have been informed by gender analysis	*Gender analysis:* At the outset of the work to develop or introduce a practice, an analysis of who has what and why, who does what and why, who makes decisions and why, and who needs what and why is carried out to develop an understanding of the site-specific gender, cultural and socio-economic context. This analysis explores differential vulnerability of men and women to risk, opportunities and benefits, power relations within the household and the community, willingness to take on risk, and modes of access to sources of information. Findings of this analysis inform the application of the practice. For additional guidance on carrying out gender analysis in the context of climate change and agriculture, see FAO and CCAFS, 2012.
2. All work related to the practice has involved the participation and engagement of men and women, in particular those who implement the practice	*Participation and engagement:* Female and male farmers are involved in developing, adapting, testing and adjusting practices to meet their needs, preferences, and opportunities. Communities and experts work together to understand local problems, climate projections and available assets and services, and to identify and test potential solutions, reducing existing gender inequalities and discrimination. Institutions are strengthened to continue fostering stakeholder engagement. For additional guidance on promoting participation in the context of climate change (CARE, 2019).
3. Efforts are made to reduce the constraints to uptake of the practice	*Constraints to uptake of practices are addressed:* Findings of the gender analysis are used to understand where there may be constraints to uptake the practice, such as unequal roles in decision-making, unequal access to information or credit, and unequal ownership of land. By promoting an equitable access to resources and participation in household decision-making, all potential end-users can benefit from information and capacity development related to the opportunities of CSA sensitive practices.
4. The practice results in immediate benefits for men and women	*Immediate benefits:* The practice itself is designed to produce benefits for both men and women. These benefits include improvements in agricultural yields; reduction in the time, energy and labour spent by food producers, particularly women on their agricultural activities; and increases in women's access to and control of agricultural inputs and income.
5. The practice results in long-term benefits for men and women	*Long-term benefits:* The practice itself contributes to longer-term changes in equality between men and women. It may enhance men's and women's resilience and agricultural productivity; increase women's control of resources; and increase participation of women and youth and other easily marginalized groups in decision-making at household and community levels.

Source: Nelson and Huyer (2016)

sensitive practices should be identified, designed and implemented in a way that takes into account the local, existing differences and inequalities between men and women, and contributes to the promotion of gender equality (Table 2). A gender-responsive approach will realize more effective and equitable outcomes, reduced project risks and lower gender gap in outcomes of climate change activities (Green Climate Fund, 2015). Furthermore the gender considerations of some CSA-sensitive practices are presented Table 3. The majority of the CSA initiatives gender gap hinders women's possibilities to benefit from CSA, however it is noted that the intersection of gender and CSA is compound and multifaceted.

It is commonly observed that men and women under an agricultural unit pursue distinct but interconnected livelihoods options. The family unit incorporate different technology and production management options. Thus, it is important that how these differences (shaped by social norms and intra-household decisions) affect men's and women's participation as well as adoption of sustainable practices. Simultaneously awareness regarding importance of gender equality for productivity improvement is needed. Evidence establishes that equal gender relations within agricultural households and communities lead to better development outcomes *viz*. farm productivity and family nutrition (World Bank, FAO and IFAD, 2015). In tangible terms, gender sensitive measures at project and policy-level scales are needed. Efforts suggested by FAO to address gender in the context of *Pillar 1 Sustainable increase agricultural productivity and incomes include:*

- Systematic gender analysis to identify where there may be differences in men's and women's productivity.
- Resolution of the challenges women experience in accessing, using and supervising farm labour.
- Improvement in women's access to productive inputs and resources extension and technologies (FAO, 2011).
- Enhancement in women's use of agricultural inputs.
- Improving their tenure of natural resources, as women's lack of access to secure land

Table 3: Potential gender considerations of various CSA sensitive practices

CSA-sensitive practices	Gender impact		Requirements for adoption of practice				
	Women's control of income from practice	Relative amount of time until benefits are realized	Potential for women to benefit from increased productivity	Female and youth labour availability	Female access to and control of land	Female access to water for agriculture	Female access to cash and spending ability
Conservation agriculture	Low	High	High	Low-Medium	High	Low	Low
Improved home gardens	High	Low	High	High	High	High	High
On-farm tree planting	Low	High	Medium	High initially; Low later	High	High	Medium
Small-scale irrigation	Low-Medium	Low	High	Medium	High	High	Medium
Livestock genetic improvement	Low-High	High	High	Low-High	Low	High	Medium

Source: World Bank, FAO and IFAD, (2015)

tenure is a major constraint in adopting CSA (Goldstein and Udry, 2008; Quisumbing and Kumar, 2014).

- Using participatory approach for income-generating prospects for women to achieve positive outcomes for the whole family. For eg. Rangeland rehabilitation project in the Syrian Arab Republic (IFAD, 2012; FAO, 2013).

Pillar 2. Adapt to and build resilience to climate change

Climate change impacts and associated adaptive strategies are not gender-neutral. As described vulnerability is often determined by socio-economic factors, livelihoods, access to knowledge, information, services and support these all differ along lines of gender. Also men and women may have different coping strategies. Studies has shown that one of the important effects of environmental stress in agricultural systems is the increase of women's workloads and decreases in poor households assets (Agwu and Okhimamwe, 2009; Goh, 2012; Jost *et al.*, 2015). Meanwhile, men and women taking up new CSAP are likely to develop resiliency to the climate change effects. In most of the cases, women have less access to climate information, such as climate agro-advisories through SMS or radio, in comparison to men (Kyazze *et al.*, 2012; FAO, 2013 and Tall *et al.*, 2014). In Kenya, rapid adoption of drought-resistant crops and varieties was among women whose husbands were away and not making the day-to-day decisions (Twyman *et al.*, 2014; Goering, 2015). Addressing gender inequalities in the context of adaptation and resilience means developing an understanding of the ways in which distinct socio-economic groups respond to climatic change. As resilience practices and approaches are developed, it is critical that these are accessible to all gender so that potential increase in workload is minimized.

Pillar 3. Reduction in GHG emissions

The definition of CSA includes reducing and removing GHG often comes as a co-benefit of activities enhancing productivity, resilience, efficiency, reducing waste and losses along the food chain. The ability to adopt CSA practices that also reduce GHG emissions appears to be affected by gender inequalities. For example, in sub-Saharan Africa, insecure land tenure, workload, heavy tools, lack of capital and limited farm inputs posed major barriers to the adoption of CSA practices like conservation agriculture and agroforestry by women farmers. While pursuing these mitigation practices it must be acknowledged that women and men are in different starting positions to take-up *viz*. agroforestry may be less accessible or offer fewer incentives to those with weaker land rights and soil water conservation may be difficult if hiring labour is not possible. Other practices like improved cooking stoves, biomass for energy and biogas can be more attractive to women. Proposed mitigation actions therefore should connect the experiences expertise and realities of women and men alike.

Challenges to adoption of a gender-responsive approach

Lack of political commitment or leadership on gender equality as well as lack of gender awareness or resistance mainstream gender into the work, can prevent the uptake of a gender-responsive CSA. Poor capacity building, funding and cultural barriers limit women's participation and leadership can also pose barriers (Bryan et al., 2016). While addressing gender equality it is perceived as an "add-on" to main activities and not given due importance as it requires. Limited availability of gender expertise in team members, poor monitoring, reduced funds dedicated to gender-related activities may impede the gender mainstreaming activities. To overcome these, awareness-raising on why gender equality matters in CSA should be carried out at the beginning of the planning process. Training and capacity building, gender-responsive budgets, and incentives can be useful in overcoming logistical challenges. Analysis of results, lessons learned and benefits using a gender-responsive approach will improve the adoption of CSA.

Conclusion

Climate change can aggravate the existing gender inequalities in agriculture and related occupations. However, if the importance of women role play in agriculture is recognized and they are provided with equal accessibility to

resources and services, climate change can also offer significant opportunities for women to become agents of change. The CSA practices need to change in order to adapt and to mitigate climate change. In the longer term, broader changes are needed for reducing the constraints women and men may face in terms of resources accessibility, services and information. Lastly, more knowledge and information is needed on gender roles in shaping the lives in engaging with CSA. A number of tools to assess and address gender inequalities and unlock the potential of rural women to become agents of change in the agriculture sectors are need of the hour to contribute to making the transition to CSA. The important points are as follows:

- To identify the most fitting CSA practices and technologies for a given area, it is essential to analyse its specific socio-economic and institutional setting, the projected climate change scenarios and possible future impacts.
- Integrate gender perspective in mitigation and adaptation initiatives.
- Policy makers and development partners need to bring women into the planning, financing and implementation of climate responses.
- Ensure that adaptive actions build up the asset base of women which determine the extent to which people are affected by climate change and can respond to it.
- The adaptive capacity of women needs to be strengthened. Gender-sensitive planning is needed to help them develop sustainable and resilient livelihoods.
- Mitigation planning needs to be pro-poor and gender conscious.
- Gender-sensitive financing mechanisms supporting adaptation, mitigation, capacity-building and technological cooperation is needed.
- Efforts should be made to ensure that women and men contribute and benefit equally from climate change policies, financing and implementation at all levels.

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