

National level indicators for gender, poverty, food security, nutrition and health in Climate-Smart Agriculture (CSA) activities

Working Paper No. 195

CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS)

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Agriculture and
Food Security**



Working Paper

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Abstract

At the global, regional and national levels, governments, donors, research institutions, non-government organizations and private companies are more strategically linking climate change and agriculture development activities, through initiatives such as the Global Alliance for Climate-Smart Agriculture (CSA). In this context, it is necessary to have robust metrics and indicators for measuring progress towards CSA-related goals. This requires strategic selection of indicators to assess the type of impact (negative/positive) of adaptation and mitigation activities on specific societal groups (e.g. ethnic groups, women, youth, etc.) to ensure livelihoods are positively impacted by CSA interventions.

Gender, poverty, food security, nutrition and health indicators have not been extensively used in CSA programming and planning to date. In this paper, we review a range of gender, poverty, food security, nutrition and health indicators relevant for national planning processes for CSA promotion and scale out. We focus on the CSA Country Profiles (CPs) developed by the International Center for Tropical Agriculture (CIAT) in collaboration with the CGIAR research program on Climate Change, Agriculture, and Food Security (CCAFS). The CSA CPs are being developed as an instrument to open dialogues on the baseline situation, identifying opportunities, and challenges for CSA in various countries. The CPs are generated by the CGIAR CCAFS program with national partners, especially those involved in CSA related planning processes, to feed into analytical multi-stakeholder processes to prioritize CSA investment portfolios for scale-up and scale out.

Using a ranking system based on data relevance, availability, and applicability to multiple national contexts, we identified a set of indicators that respond to the need for better integration of gender, poverty, food security, nutrition and health concerns when approaching CSA. Strengthened integration of poverty reduction, food security and gender equality indicators into CSA assessments, including the CPs, has been identified by CCAFS as a priority to strengthen the focus on resilience/adaptation efforts, specifically highlighting evidences of gender differences. It can also serve to highlight potential gaps in availability of and access to resources and capacities to adopt CSA practices and technologies among different societal groups (women, men, youth, ethnic groups). Rather than re-invent new indicators, it is important that, where possible, existing national-level indicators can be repurposed for tracking CSA impacts over time on poverty reduction, food security and gender equality outcomes.

Keywords

Gender; Poverty, Food Security, Nutrition, Agriculture; Climate Change; Indicators; Statistics; Climate-Smart Agriculture; Empowerment

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Climate change, agriculture, gender and food security

Challenges facing sustained agricultural production, increasing population and demand, and volatility in food prices have placed food and nutrition security as key global concerns (Brown 2012; Gerland et al. 2014; Campbell et al. 2014; Hertel 2016). The effects of climate change on agricultural productivity are already impacting efforts to improve food and livelihood security (World Bank 2013; Dawson et al. 2016). The impacts of climate change on men, women, households, and communities will differ depending on adaptive capacity, which in turn depends on incomes and resources to adjust and adapt to climate change. Differential impacts may also occur depending on cultural and gender norms within a society that dictate who controls resources and benefits associated with different activities (Twyman et al. 2014; Bryan et al. 2016).

Significant efforts are underway to develop and deploy climate smart agriculture (CSA) practices, programs and policies to enhance the adaptive capacity and mitigation potential of agricultural systems (Campbell et al. 2014; FAO 2010, 2013; Howden et al. 2007; Wollenberg et al. 2012; Harvey et al. 2014). The Food and Agriculture Organisation of the United Nations (FAO) defines three pillars of CSA, as agriculture that sustainably increases productivity, enhances resilience (adaptation), reduces/removes greenhouse gas emissions (GHGs) (mitigation), and enhances the achievement of national food security and development goals (FAO 2013). CSA approaches involve a wide portfolio of CSA practices, many of which may be climate smart in one context (biophysical, agrozone or socio-economic), but fail to be climate smart in other contexts (Campbell et al. 2014; Rosenstock et al. 2016; Campbell et al. 2016). For example conservation agricultural practices often combine the practices of reduced soil disturbance; crop rotation; and continuous soil cover. Whilst some of these practices may be appropriate for some farming contexts, in other contexts adequate soil cover materials may not be available (Giller et al. 2009; Giller et al. 2014).

The impacts of climate change will not affect all people and communities equally. Given the context specific nature of CSA practices, an important component of scale up options will be the identification of potential trade-offs between CSA portfolios and food security goals for different categories of farmers (Jost et al. 2016; Neufeldt et al. 2013). Climate change adaptation strategies should be tailored to suit the differing circumstances of men, women, communities and vulnerable groups to ensure intended outcomes are equitably achieved (Twyman et al. 2014). One way to look at climate change effects on people and communities is to disaggregate by social constructed roles of people. Gender disaggregated data is one way to do this, although this distinction only provides a partial picture of how climate change can have differential effects on women and men.

Gender is important for both implementing and monitoring CSA, and relates in different ways to each of the three pillars of CSA (World Bank et al 2015). Murray et al. (2016) highlights the increasing need for more in depth analysis of gender constraints faced by both women and men in terms of their ability to adopt CSA options. The importance of gender in agriculture, and gender in relation to climate change adaptation and mitigation in the agri-sector is increasingly recognized (Alston 2014; Edvardsson Björnberg and Hansson 2013; Brody et al. 2008; Jost et al. 2016). Household needs and preferences, along with access to assets (such as

land), or resources (such as credit), attitudes to change, sources of information and capacity to receive information all differ (Pandolfelli et al. 2008; Villamor et al. 2014). Gender issues arise when such differences lead to inequalities.

There is evidence to suggest a link between gender equality within households and more successful development outcomes (Farnworth and Colverson 2015; World Bank 2012; OECD 2010). Peterman et al (2014) highlight that gender inequalities and a general lack of attention to gender in agricultural development can contribute to lower productivity, lost income, and increased levels of poverty, as well as under nutrition (Peterman et al. 2014). Gender is a key dimension that links agriculture to improved nutrition and health (Meinzen-Dick et al. 2012). Changes in agriculture production can result in increased quantities of produce or an increased diversity of food available for a household's own consumption, potentially benefiting all in the household. There are examples of linkages between agriculture and health outcomes, where some homestead food production models can contribute positively to nutritional outcomes (Von Braun et al. 2012). Key questions are who makes decisions about what to produce, who has control of rural assets so as to adapt production to climate change, and who controls the use of income from increased production.

CSA initiatives are likely to be more responsive to the needs of farmers when an understanding of differentiated roles and resource access are included in CSA planning processes. Gender roles vary significantly from one cultural setting to another, and intersect with other social variables such as ethnicity, religion and social class (Pandolfelli et al. 2008; Momsen 2010). Gender inequalities in labour distribution for agriculture, land access, or benefits derived from the sale of agricultural produce can affect the ability of women and men to respond to climate change. Examining gender inequalities often raises awareness of other factors that affect individual or households ability to respond to climate change. Beuchelt & Badstue (2013) emphasize the importance of maintaining a gender and social equity perspective when planning, implementing and monitoring CSA interventions in order to ensure that gender inequalities do not persist, are entrenched or aggravated (Beuchelt and Badstue 2013).

To more effectively increase agricultural productivity, reduce poverty and vulnerability among rural populations while increasing food and nutritional security, attention to gender-related differences is necessary. Climate change can offer both opportunities and trade-offs for rural men and women. It has been suggested that successful CSA roll-out and adoption is unlikely to reach those who require support, without more attention paid to gender constraints (Bernier et al. 2015; World Bank et al. 2015; Beuchelt and Badstue 2013).

Improved understanding of the cultural and behavioral factors, along with an understanding of the gender norms that influence the uptake of practices and technologies, is necessary (Beuchelt and Badstue 2013; Jost et al. 2016). Such an analysis can help if coupled with planning on how to overcome institutional and institutional behavioral change barriers to those engaged in CSA scale-up.

Table 1 highlights some gender-related challenges, opportunities and issues relating to the adoption and scale up of CSA practices and technologies. Gender-related challenges can occur at the field level (e.g. production, land ownership, labour) but also permeate via

institutional systems (e.g. a bias in support to certain groups) and policies (e.g. laws on land ownership or mandates to collect sex -disaggregated data).

Table 1. Gender-related challenges, opportunities and issues that can impact the success of CSA programs and policies

Challenge	Gender-related issues	Sources
Productivity gap between males and females	- Different land ownership/user rights to resources and assets between women and men. For example unequal access of men and women to credit, farm inputs, labour, extension services, weather services and market information affect productivity. Women may have different endowments and land entitlements.	(FAO 2011; O'Sullivan et al. 2014; Demetriades and Esplen 2008; Doss 2001; Quisumbing et al. 2014)
Information and participation gaps at local level	- Women may have less access to information/services on CSA. - Women and men use different information channels and prioritize different kinds of information. - Women and men interact with different institutions at the local level. - Unequal influence over use of income and farming system components.	(WorldBank-FAO-IFAD 2015; Beuchelt and Badstue 2013; Doss 2001)
Access to economic and biophysical resources	- Lack of evidence-base that convinces both women and men on the localised biophysical factors that influence CSA. - Women may have reduced incentives to take up practices and innovations, because they do not get the benefits (increased income) from their labour or efforts.	(O'Sullivan et al. 2014; FAO 2011; Doss 2001; Quisumbing et al. 2014; Cramer et al. 2016; Jost et al. 2016; Perez et al. 2015; Tall et al. 2014)
Labour burden and availability in smallholder sector	- Increased perceived labour burden for women associated with a new CSA practice. - Women, as primary caregivers, tend to work longer hours than men. - Climate change could increase time spent on household activities (e.g. fuelwood collection) - Male out-migration may increase women's agricultural responsibilities.	(Carr and Hartl 2010; WorldBank-FAO-IFAD 2015; O'Sullivan et al. 2014; Masanjala 2007; Doss 2001)
Gender-specific impacts of CSA practices & technologies	- Female farmers and female-headed households may have less time to invest in CSA practices. - Introduction of new or existing CSA technologies may have unexpected positive or negative impacts on women smallholders. - Labour-intensive CSA practices may disrupt existing labour burdens, roles and distributions.	(Beuchelt and Badstue 2013; Doss 2001; Paris and Pingali 1995; Jost et al. 2016)
Gender & knowledge gap at institutional and policy level	- Knowledge gaps concerning financing/investment opportunities capable of promoting gender-sensitive CSA. - Lack of sex disaggregated data and gender-inclusive indicators leads to weak-evidence base for CSA to transform gender roles and relations. - Voice of women who are representative and accountable may be missing at institutional and policy levels.	(World Bank et al. 2015; MacGregor 2010)
Opportunity	Gender-related issues	Sources
Improved CSA practices and technologies can mitigate climate risks	- Climate-proofing of crops and value chains controlled by women farmers will strengthen resilience. - Poorer rural women and men may display increased innovation when their capacity to experiment is strengthened. - Labour-saving CSA technologies adopted by women that involve less time, drudgery, and energy costs for women.	(World Bank et al. 2015; Shiferaw et al. 2014; Jost et al. 2016; Waters-Bayer et al. 2015)

Labour saving technologies	- Technologies adopted by women to improve their own situations, when they involve less time, drudgery, and energy for women, and allow women to maintain and exert control over income from value chains.	(Beuchelt and Badstue 2013; Doss 2001; Wettasinha et al. 2015; World Bank et al. 2015)
Policy and institutional entry points available to catalyze gender-responsive, CSA.	- Equitable land rights for women and men are implemented - Equitable multi-stakeholder involvement/collective action necessary to ensure information and technology are inclusive. - Inclusive consultation and participatory prioritization of CSA involving many categories of stakeholders. - Mechanisms and supporting policies for financing of CSA must take into account differential access for some groups. - Disaggregated evidence base and knowledge-sharing platforms for gender-responsive CSA.	(World Bank et al. 2015; Doss 2001; Doss 2014; Shames et al. 2014; Jost et al. 2016)

The need for national level indicators for CSA outcomes

Indicators are important for determining the measure of progress that has been achieved. Indicators help to improve the evidence base to assist in policy and decision making (Lin et al. 2007; Austen et al. 2000), and monitor progress in relation to CSA in each country. Some indicators can provide evidence regarding the impact of different CSA practices and policies on farmers and rural communities. A range of indicators have already been developed and compiled, including 378 CSA-related indicators gathered from several international development agencies/ institutions (FAO, DFID, GIZ, IFAD-ASAP, World Bank, USAID and CCAFS; Quinney, 2016). Climate readiness indicators are under development to provide guidance to countries. For instance, Wollenberg et al, (2015) have highlighted examples of climate readiness indicators that can be used for (1) governance and stakeholder engagement; (2) knowledge and information services; (3) climate-smart agricultural strategy and implementation frameworks; (4) national and sub-national capabilities; and (5) national information and accounting systems (Wollenberg et al. 2015).

Gender indicators for CSA outcomes

This CCAFS Working paper aims to identify a range of existing national indicators that can be used to improve integration of gender, poverty, food security, nutrition and health issues into CSA CPs.

Gender indicators (GIs) in agriculture require both qualitative and quantitative interpretation on changes in the status and roles of women and men (i.e. measuring progress towards gender equality). For example, useful GIs may measure differences in access to and control over resources for agricultural activities amongst women and men; differences in ability to respond to economic opportunities and investments offered by CSA; or differences in ability to influence change or respond to changes. Many such indicators do not yet exist. Some such indicators are being developed, and being tested by CCAFS and other organizations, so that a better understanding of the relative roles and status of women and men over time in relation to the CSA practices they use.

The integration of indicators (that provide a snapshot or baseline on gender equality issues) into CSA assessments can contribute to initial discussions to evaluate options for CSA interventions or investment. Such integration can also help to inform the baseline analysis, inform targeting and prioritizing, and in later evaluation of outcomes associated with CSA scale up. The incorporation of GIs relating to CSA into national statistics collection and also into CSA plans, policies and programs will be necessary for gender-sensitive roll-out and scale-up of CSA technologies and practices.

GIs typically incorporate sex-disaggregated indicators, which allow the measurement of differential outcomes for men and women (e.g. school enrollment, literacy levels, child mortality) (Moser 2007). Rather than solely presenting facts about women, a GI should ideally provide evidence of changes in gender gaps (Rao 2016) and/or evidence on the status of women or men over time, relative to some agreed normative standard or explicit reference group (Johnston 1985). For example, one category of women can be compared to another category of women, or a comparable category of men. Indeed, gender indicators should be more than data disaggregated by sex. GIs should ideally be used to track gender-related changes in society over time and geography.

GIs are promoted within development circles to ensure that gender-related changes in a society over time are better measured and monitored (Moser 2007). The portfolio of gender indicators has been increasing since the 1995 4th World Conference on Women which recommended that national, regional and international statistical services ensure that statistics related to individuals are collected, compiled, analyzed and presented by sex and age (United Nations, 1996).

A Global Gender Statistics Programme, implemented by the UN Statistics Division (UNSD) and coordinated by a UN Inter-Agency and Expert Group on Gender Statistics (IAEG-GS) aims to improve coherence among existing initiatives on gender statistics through international coordination, as well as to strengthen national capacity for the production, dissemination and use of gender relevant data (Nations 2014). The Millennium Development Goals (MDG) and the current Sustainable Development Goals (SDGs) are accelerating the production of higher quality data disaggregated by sex, age, economic status, race and ethnicity and geographic location, along with other indicators which can be used to measure inequality within society (UN Women 2015).

International agencies and international statistical institutes also play a role in harmonization of statistical data collection and inter-operability of datasets. Large-scale surveys are also funded and commissioned through multilateral organisations such as the UN or the World Bank. For example, the Living Standards Measurement Study (LSMS) is a household survey focused on generating high-quality data, as well as improving survey methods within a country to inform evidence-based policymaking. Every three years, the International Conference on Agricultural Statistics (ICAS) is organized under the auspices of the International Statistical Institute (ISI) Committee on Agricultural Statistics to bring together research and share practice in the field of agriculture statistics. ICAS responds to the changing needs for agricultural statistics (e.g. development of an indicator framework for relevant SDGs). Methodological challenges and proposals for future agriculture census rounds are discussed along with topics such as measuring the social dimensions of agriculture. Although it is improving, the extent of disaggregation of agricultural data

according to sex, gender and other social variables remains inconsistent, both across and within countries. Furthermore, agricultural data needed to inform policy is still typically collected for production variables and only sometimes provides data at the household level (Doss 2014).

Climate Smart Agriculture Country Profiles (CSA CPs)

CSA CPs provide an overview of the agricultural challenges in specific countries with the objective of informing CSA planning for adaptation and mitigation to climate change in the agricultural sector. The CPs are developed by the International Centre for Tropical Agriculture (CIAT), the CGIAR research program on Climate Change, Agriculture and Food Security (CCAFS), in partnership with the World Bank, national research institutes (e.g. CATIE), and USAID's Bureau for Food Security. The CPs were generated as internal World Bank (WB) knowledge products, as briefs for those with an interest in financing CSA activities (CIAT-CCAFS-World Bank 2016).

The CSA CPs emerged from the need to outline the current status and opportunities for climate smart agriculture (CSA) practices and policies in a particular country. CPs provide a broad overview baseline on the state of CSA in the country as a tool to facilitate decision-making on how investment could more effectively target and scale CSA nationally. Each CP provides a snapshot overview of agricultural, economic, institutional, policy and financial considerations relating to CSA. Each CP also identifies opportunities and barriers for widespread adoption of existing and promising CSA technologies and practices (CIAT-CCAFS-World Bank 2016).

Each CP typically consists of the following sections; (1) National context: key facts on agriculture and climate change; (2) CSA technologies and practices; (3) Institutions and policies for CSA; and (4) Financing CSA. Each section is based on qualitative and quantitative information gleaned from literature review, statistical datasets, consultations, interviews and group discussions with in-country technical experts and decision makers (CIAT; CCAFS; World Bank, 2016).

The process of developing the CSA CP involves conducting a situation analysis and taking stock of existing CSA actions. This requires a review of current literature and collection of data from national and international databases. Further, expert interviews and surveys are also conducted with key stakeholders. These stakeholders can be divided into three groupings: (1) policy and decision makers at the national and local level; (2) Technical experts (Key producer associations, extension offices, academia, and research institutes); and (3) International partners and donor organizations (CIAT; CCAFS; World Bank, 2016).

CSA CPs are developed to ensure there is evidence on what CSA activities and capacity already exists in a country and to inform the future potential for CSA. Agricultural and investment decision makers wish to have evidence on (1) the ongoing CSA activities in country/region; (2) the demand for CSA in a country/region; (3) how likely it is that investment in CSA will have an impact at scale (Corner-Dolloff et al. 2014). However, in many instances comparable data on the performance of CSA practices are missing, with few clear metrics to evaluate CSA practices. The CSA CPs address this knowledge gap by

providing an analytical framework to guide evidence-based selection of CSA practices (Corner-Dolloff et al. 2014). The CSA CPs guide the integration of CSA in national and sub-national policy and planning (CIAT 2014; Quinney et al. 2016; CIAT-CCAFS-World Bank 2016).

Identification of national-level indicators for improving gender, poverty, food security, nutrition and health outcomes from CSA planning, implementation and scale-out

This Working Paper focuses on how gender, poverty, food security, nutrition and health indicators can be integrated into CSA CPs and other CSA planning processes at the national level. The working paper aims to identify existing national level indicators regarding gender, poverty, food security, nutrition and health that can be integrated into CPs, and also to consider possible approaches for greater consideration of such indicators in decision-making, planning and prioritization regarding CSA practices and technologies.

To identify existing national level indicators, a list of available and potentially suitable indicators was compiled from existing databases (World Bank Databank; FAOSTAT; and UN Databases). Initially, a 'long' list of indicators was identified following the Sustainable Development Goal (SDG) framework. The long list of indicators was then divided into two sets of indicators that dealt with; (1) Gender, Poverty and Livelihoods, and (2) Food Security, Nutrition and Health. In total, 41 indicators were identified in the long list, which were split across 21 food security, nutrition and health indicators, and 30 gender, poverty and livelihood indicators (See Appendix 1 for the full list of indicators in the 'long list' and their sources).

As 41 indicators was considered too lengthy for integration into the CPs, a prioritization process was developed to refine the 41 to 15 'core' indicators that would align to the objectives of the CSA CPs and that could be effectively used in assessments of different national enabling environments for CSA adoption and scale out in the future. The aim was to refine the list to 7 indicators for the domain of food security, nutrition and health indicators, and 8 indicators for the domain of gender, poverty and livelihood indicators.

A scoring system was devised for the prioritization process, where the list was ranked by a panel of inter-disciplinary experts (n = 8) from the International Centre for Tropical Research (CIAT), and the National University of Ireland Galway (NUI Galway). Each person was required to choose 10 indicators from the portfolio of 41 indicators in Appendix 1 and to rank them in order of priority from 1 (least preferred) to 10 (most preferred). The scores of each of the ranking panel were summed and used to generate a ranking score to prioritize national indicators for inclusion in the CSA CPs.

The three level tier system devised for the SDGs (UNSTATS 2016; <http://unstats.un.org/>) was also taken into account as an important consideration for selection of indicators for inclusion in the CSA CPs, whereby indicators are categorized into the following three tiers:

Tier 1: Indicator conceptually clear, established methodology and standards available and data regularly produced by countries.

Tier 2: Indicator conceptually clear, established methodology and standards available but data are not regularly produced by countries.

Tier 3: Indicator for which there are no established methodology and standards or methodology/standards are being developed/tested.

From the initial list of 41 indicators, the panel prioritized a core set of 15 indicators for inclusion in CSA CPs, based on criteria such as the availability of recent (or regularly updated) statistics for the indicator, tier level, and perceived relevance of the indicator to the scope and objectives of the CSA CPs. The set of 7 indicators for gender, poverty and livelihoods that were prioritized are presented in Table 2, while the 8 indicators for food security, nutrition and health are presented in Table 3.

Table 2. Selected gender, poverty and livelihood indicators

Indicator	Metric	Metric description	Indicator Source	Indicator Tier Level
Poverty gap at \$1.90 a day	%	Poverty gap at \$1.90 a day (2011 PPP) is the mean shortfall in income or consumption from the poverty line \$1.90 a day (counting the non poor as having zero shortfall), expressed as a percentage of the poverty line. This measure reflects the depth of poverty as well as its incidence. As a result of revisions in PPP exchange rates, poverty rates for individual countries cannot be compared with poverty rates reported in earlier editions.	World Development Indicators -World Bank (Development Research Group) - http://databank.worldbank.org/data/reports.aspx?source=world-development-indicators	N/A
Population below national poverty line	%	National poverty headcount ratio is the percentage of the population living below the national poverty lines. National estimates are based on population-weighted subgroup estimates from household surveys.	World Development Indicators -World Bank (Global Poverty Working Group) http://databank.worldbank.org/data/reports.aspx?source=world-development-indicators	Tier 1
Gender Inequality Index (GII)	Range (0 -1)	The Gender Inequality index measures gender inequalities in three aspects of human development; (1) reproductive health (measured by maternal mortality ratio and adolescent birth rates); (2) empowerment, measured by proportion of parliamentary seats occupied by females and proportion of adult females and males aged 25 years and older with at least some secondary education; and (3) economic status, expressed.	United Nations Development Program (Human Development Report Office): http://hdr.undp.org/en/data	N/A
Distribution of female agricultural land holders	%	The percentage of female agricultural holders out of total agricultural holders.	FAO- (Agricultural Census data from National Statistics Offices/Ministries of Agriculture): http://www.fao.org/gender-landrights-database/data-map/statistics/en/	N/A
Percentage of male/female children aged 5-14 years engaged in the worst forms of child labour (specifying the agriculture sector)	%	Statistic is based on the nationally-representative household survey datasets.	Understanding Children's Work Programme- (UNICEF): http://www.ucw-project.org/Pages/ChildLabIndicator.aspx Survey Details Available at: http://www.ucw-project.org/Pages/survey_list.aspx	Tier 1
Share of seats in parliament for women	%	Women in national parliament: the percentage of parliamentary seats in a single or lower chamber held by women.	World Development Indicators - World Bank http://databank.worldbank.org/data/reports.aspx?source=world-development-indicators Data compiled by the Inter-Parliamentary Union http://www.ipu.org/WMN-e/classif.htm	N/A

Indicator	Metric	Metric description	Indicator Source	Indicator Tier Level
Average monthly earnings of women and men employed in agriculture activities	Local Currency	Calculated using the mean nominal monthly earnings of employees by sex and economic activity (Local currency).	ILO - ILOSTAT (Sources include: National Accounts; Admin records; Economic or establishment census; Establishment surveys; Household surveys; Official sources; Population Census) http://www.ilo.org/ilostat/faces/ilostat-home/home?_adf.ctrl-state=ggixzvf0v_104&_afzLoop=109766434818093#!	N/A

Table 3. Selected food security, nutrition and health indicators

Indicator	Metric	Metric description	Indicator Source	Indicator Tier-Level
Prevalence of undernourished of population	%	Population below minimum level of dietary energy consumption (also referred to as prevalence of undernourishment) shows the percentage of the population whose food intake is insufficient to meet dietary energy requirements continuously. Data showing as 5 signifies a prevalence of undernourishment below 5%.	World Development Indicators - World Bank (FAO): http://databank.worldbank.org/data/reports.aspx?source=world-development-indicators	Tier 1
Prevalence of stunting, height for age, female (% of children under 5)	%	Prevalence of stunting is the percentage of children under age 5 whose height for age is more than two standard deviations below the median for the international reference population ages 0-59 months. For children up to two years old height is measured by recumbent length. For older children height is measured by stature while standing.	World Development Indicators - World Bank (World Health Organisation, Global Database on Child Growth and Malnutrition): http://databank.worldbank.org/data/reports.aspx?source=world-development-indicators	Tier 1
Prevalence of severe wasting, weight for height, female (% of children under 5)	%	Severe wasting prevalence is the proportion of children under five whose weight for height is more than three standard deviations below the median for the international reference population ages 0-59.	World Development Indicators - World Bank (World Health Organization, Global Database on Child Growth and Malnutrition): http://databank.worldbank.org/data/reports.aspx?source=world-development-indicators	Tier 1
Access to electricity (% of population)	%	Access to electricity is the percentage of population with access to electricity. Electrification data are collected from industry, national surveys and international sources.	World Development Indicators - World Bank (Sustainable Energy for all (SE4ALL) database from World Bank, Global Electrification database): http://databank.worldbank.org/data/reports.aspx?source=world-development-indicators	Tier 1

Indicator	Metric	Metric description	Indicator Source	Indicator Tier-Level
Access to electricity, rural (% of rural population)	%	Access to electricity, rural is the percentage of rural population with access to electricity	World Development Indicators World Bank (Sustainable Energy for all (SE4ALL) database from World Bank, Global Electrification database): http://databank.worldbank.org/data/reports.aspx?source=world-development-indicators	N/A
Access to non-solid fuel (% of population)	%	Access to non-solid fuel is the percentage of population with access to non-solid fuel.	World Development Indicators - World Bank (Sustainable Energy for all (SE4ALL) database from WHO Global Household Energy database): http://databank.worldbank.org/data/reports.aspx?source=world-development-indicators	N/A
Mortality rate, under-5, female (per 1,000 live birth)	#	Under-five mortality rate, female is the probability per 1,000 that a newborn female baby will die before reaching age five, if subject to female age-specific mortality rates of the specified year.	World Development Indicators World Bank (UN Inter-agency Group for Child Mortality Estimation - UNICEF, WHO, World Bank, UN DESA Population Division): http://databank.worldbank.org/data/reports.aspx?source=world-development-indicators	Tier 1
Mortality rate, under-5, male (per 1,000 live births)	#	Under-five mortality rate, male is the probability per 1,000 that a newborn male baby will die before reaching age five, if subject to male age-specific mortality rates of the specified year.	World Development Indicators World Bank (UN Inter-agency Group for Child Mortality Estimation - UNICEF, WHO, World Bank, UN DESA Population Division): http://databank.worldbank.org/data/reports.aspx?source=world-development-indicators	Tier 1
Fertility rate, total (births per woman)	#	Total fertility rate represents the number of children that would be born to a woman if she were to live to the end of her childbearing years and bear children in accordance with age-specific fertility rates of the specified year.	World Development Indicators World Bank (1. United Nations Population Division. World Population Prospects, 2. Census reports and other statistical publications from national statistical offices, 3. Eurostat: Demographic Statistics, 4. United Nations Statistical Division. Population and Vital Statistics Report (various years), 5. U.S. Census Bureau: International Database, and 6. Secretariat of the Pacific Community: Statistics and Demography Programme): http://databank.worldbank.org/data/reports.aspx?source=world-development-indicators	Tier 1
Literacy rate, youth female (% of females ages 15-24)	%	Youth literacy rate is the percentage of people ages 15-24 who can both read and write with understanding a short simple statement about their everyday life.	World Development Indicators World Bank (United Nations Educational, Scientific, and Cultural Organization (UNESCO) Institute for Statistics): http://databank.worldbank.org/data/reports.aspx?source=world-development-indicators	N/A

Indicator	Metric	Metric description	Indicator Source	Indicator Tier-Level
Literacy rate, youth male (% of males ages 15-24)	%	Youth literacy rate is the percentage of people ages 15-24 who can both read and write with understanding a short simple statement about their everyday life.	World Development Indicators World Bank (United Nations Educational, Scientific, and Cultural Organization (UNESCO) Institute for Statistics): http://databank.worldbank.org/data/reports.aspx?source=world-development-indicators	N/A

The following section discusses the justifications for inclusion of each of these core indicators in CSA CPs, along with their strengths and limitations.

Gender and Poverty Indicators

The poor are likely to be more vulnerable to climate change impacts and shocks, while lacking the resources necessary for climate change resilience (Beg et al. 2002). In the agriculture sector, recovery from shocks takes longer for resource-poor farmers, as it is difficult to recover assets, and pay back associated debt (Heltberg et al. 2009). Hence, the population living on less than US\$ 1.90/day is a key poverty indicator which is based on primary household survey data obtained from government statistics agencies and World Bank country department (World Bank 2015). The indicator provides an annual national baseline of the proportion of the national population under this income level. At present this indicator is not disaggregated by age or sex, which limits its usefulness in terms of measuring gender disparities. This indicator is most useful when used in conjunction with other studies on national poverty. With this indicator, poverty is largely viewed in monetary terms. However, this indicator does give an indication of the ratio of those who do not have sufficient income to put them above some adequate minimum national threshold. It is quite likely that those below the national poverty baseline may not have access to credit, and thus opportunities to invest in CSA options. This group may also be less likely to be able to take risks with new CSA technologies. This indicator can remind those engaged in the CSA CP prioritization process that poverty must be kept in the CSA planning agenda; and consider during the prioritization process whether CSA interventions can be better geared towards those on very low incomes.

Depending on the country context, climate change impacts have the potential to affect the proportion of the population that are above, or below, the national poverty line. For instance, the 2016 State of Food and Agriculture report estimates that climate change could increase the numbers of people living in extreme poverty by between 35-122 million by 2030, with smallholder farmers in sub-Saharan Africa being most impacted (FAO 2016b). The percentage of the population below the national poverty line can also provide a useful indication of the extent of economic vulnerability of the population to climate change shocks and impacts. However, while this may be relevant for in-country planning processes (reflecting the need to adopt country-relevant thresholds for poverty level assessments), the

national poverty line can differ between countries making inter-country comparisons based on this measure difficult. At present this indicator is not sex-disaggregated.

Though the gendered experience of climate change is not always a disadvantage for women, women can face disproportionate negative impacts relative to men as a result of entrenched social structures and power relations, in some instances making it more difficult for women to adapt to climate change (Bhattarai et al. 2015). For example, without having title to land, women may be less inclined to change land use or may require permission of their husbands to do so. Carr and Thompson (2014) highlight that contemporary views on vulnerability to the impacts of climate change is shaped by roles, responsibilities and entitlements associated with various markers of social status and expectation, including gender class and caste (Carr and Thompson 2014). Hence, it is of significant importance to have some understanding of gender relations within the country context in which CSA adaptation actions are planned.

A composite indicator is a collection of indicators that are compiled into a single index, on the basis of an underlying model of the multi-dimensional concept that is being measured (OECD 2004). At the country level, composite indicators for gender inequality and women's empowerment in agriculture can be useful both as baselines and for planning and monitoring of roll-out and adoption of CSA practices and technologies.

A specific composite indicator prioritized for inclusion in the CSA CPs is the **Gender Inequality Index (GII)**. The GII is an inequality index, and a composite measure reflecting inequality in achievements between women and men in three dimensions: reproductive health, empowerment and the labour market. These three dimensions are considered three important aspects of human development. Reproductive health is measured by maternal mortality ratio and adolescent birth rates; empowerment is measured by proportion of parliamentary seats occupied by females and proportion of adult females and males aged 25 years and older with at least some secondary education; and economic status, is expressed as labour market participation and measured by labour force participation rate of female and male populations aged 15 years and older. The GII is built upon the same framework as the Inequality Adjusted Human Development Index (IHDI) — to better expose differences in the distribution of achievements between women and men. The higher the GII value the more disparities between females and males and the more loss to human development. Data is currently available for 155 countries. The GII reminds those engaged in planning and prioritization processes for CSA and other interventions, that for women to benefit from innovations or CSA roll-out, disadvantages faced by women must be overcome.

The **distribution of female agricultural land holders** is an important indicator for inclusion in CSA CPs as it provides an overview of the percentage of female agricultural holders out of total agricultural holders. The data are derived from agricultural censuses and are available from the FAO Gender and Land Rights Database (FAO 2016a). Data on the share of female agricultural landowners out of total landowners is a related indicator, but concerns legal ownership. However, definitions of ownership vary and an ownership indicator may not count land that is not formally titled. Indeed, ownership may not reflect the right to use, sell inherit, or use land as collateral. Hence, we considered that the percentage of female agricultural

holders out of total agricultural holders is a better indicator to include in the CSA CP as it is an indicator of management of agricultural holdings.

Agricultural land holders are likely to influence the use of new CSA practices on their land holdings. Typically, the agricultural holder is the person who makes the major decisions regarding resource use and exercises management control, with technical and economic responsibility for the holding. The holder may or may not also be the owner of the land (FAO 2016b). Although this indicator is the most prevalent of gender and land indicators, the indicator is measured at the holding level and does not capture management within the holding (FAO 2016a). If a holding consists of several plots of land, in some cases different household members may be responsible for different plots. Generally with this indicator, only one holder is identified per holding. Another challenge is that this indicator may underestimate the management role of household members other than that of the person designated as the official holder. For example, married women often hold some responsibility for the family farm or manage some plots within the holding, but their husbands will typically be identified as the head of the household and the single holder. In this situation, married women's shares of management responsibility will not be reported in the indicator. Some countries adapt a threshold for minimum size of the holdings included in their census, leaving out holdings that fall below a certain value. In some contexts women are more likely to manage agricultural holdings below the threshold, thus reducing the percentage of female agricultural holders captured.

The percentage and number of children aged 5-14 years engaged in the worst forms of child labour in the agriculture sector by sex is a useful indicator for inclusion in CSA CPs because engagement in child labour is indicative of poverty in rural areas. Whilst, it is common for boys and girls to assist in rural areas with various agricultural tasks, and at certain periods of the year (e.g. harvesting), child labour (as opposed to helping out) is typically located in areas where there are large numbers of the working poor. Child labour indicators are also indicative of levels of mechanization and can reflect demands for migrant or seasonal work. This indicator may also have significance if the labour demand for new CSA practices is initially high or if the CSA practice displaces labour provided by children.

Household vulnerability to climate change or weather-related shocks can intersect with demand for child labour in rural areas. For sample, in times of crisis households may be required to use child labour in order to cope (Oluoko-Odingo 2011). Indeed, links between child labour and low or non-school attendance can be strong (Murray and Quinn 2009). Education outcomes are particularly important for girls as they can help decrease infant, child and maternal mortality rates. In the context of climate change, education is one of the primary ways to reduce vulnerability (Muttarak and Lutz 2014). Education can directly influence risk perception, knowledge, and skills acquisition. Girls often spend significantly more time on household chores and caring duties than boys (Murray 2013; Murray et al. 2010).

For example girls often are involved in cleaning, cooking, childcare, collecting water and firewood, combined with agricultural activities, such as sowing, harvesting and livestock holdings. If boys and girls lack basic education it decreases the range of options or jobs

available later in life, and can affect health, living conditions and ability to critically assess options available. There are major social gains to be had from investing in the education of girls, as educated girls are more likely to marry later, have fewer and healthier children, and have decision-making power within their households. Education can also indirectly influence vulnerability by reducing levels of poverty, improving health and increasing access to information and other resources. Educated individuals, households, and societies prepare, respond, and recover from disaster (including climate induced disasters) more quickly (Muttarak and Lutz 2014).

Data on child labour in agriculture is included in child labour modules in labour force surveys commissioned by the ILO and published as global estimates. UNICEF collects data on children's work through the Multiple Indicator Cluster Surveys (MICS, <http://www.ucw-project.org/>). Approximately 385 datasets on child labour are available from 112 countries, generally disaggregated by sex. Indeed, a resolution concerning statistics of child labour from the 18th International Conference of Labour Statisticians reinforces the ILO Recommendation that comes with ILO Convention 182 on the Worst Forms of Child Labour. Included in this resolution is that statistical data on the nature and extent of child labour should include data disaggregated by sex (amongst other disaggregated data such as age) (Diallo et al. 2013).

The **share of seats in parliament for women** can provide a proxy indicator of women's empowerment and the level of gender equality in a country. Data on women in parliament is compiled by the Inter-Parliamentary Union on the basis of information provided by National Parliaments. At least 193 countries are classified by descending order of the percentage of women in the lower or single House. Increasing women's representation in government is necessary to achieve gender parity in a country and is indicative of an evolution in voter confidence in women's ability to successfully compete and serve in the country's highest elected positions. However, whether female politicians are more likely to concentrate on issues that matter more to women is open to debate. Many believe that women would be actively involved and advocate more in gender-salient issues. Studies conducted in India suggest that whether the political figure is male or female does have an impact on the policy decisions (Chattopadhyay and Duflo 2004; Clots-Figuerasa 2012). This indicator (the share of seats in parliament for women) does not give any indication of how involved female members of parliament are in terms of policy formation in agriculture. Yet, this indicator may however give a general indication of rates of women's participation at decision-making levels.

Gender disparities with regards to poverty are rooted in unequal access to economic resources. The **average monthly earnings of women and men employed in agriculture activities** compiled by the ILO, is relevant to CSA CPs as it provides average monthly earnings of female and male employees by occupations related to agriculture. Data are disaggregated by occupation according to the latest version of the International Standard Classification of Occupations (ISCO) available for that year. Unfortunately this indicator only refers to formal employment, and many agricultural workers are in the informal sector, working as unpaid family workers, own-account workers, on a piece rate, or as casual labourers. Another challenge is that it is difficult to determine whether earnings are high or low for women and men working in agricultural related activities, without a reference point

(national average earning). However this indicator is useful for providing an overview of wages in the agricultural sector, particularly if compared to a national average. In many countries a lower proportion of women than men have their own cash income (United Nations 2015), meaning they will have less resources to invest in CSA practices. While this indicator will not measure women's control over their own income, it should still give an indication to the level of income relative to men's.

The World Bank also publishes an indicator on employment by economic activity, providing the percentage of male / female employment in the agriculture sector (World Bank 2016). This indicator can be useful as it indicates the importance of agriculture as an income strategy for women. This indicator will not include women and men working on family farms who are not remunerated for their work or those who work in the informal agricultural sector. Hence, this indicator is likely to under-estimate participation in the agricultural sector (Deere 2005).

Food security, nutrition and health indicators

The **prevalence of people undernourished** within a country provides a measure of the vulnerability of the population to climate change impacts on their nutritional intake. Nutrition indicators are suggested for inclusion in the CSA CPs due to the importance of nutrition to child survival, growth and development, and more longer term impacts on school readiness, educational attainment, and improved employment and health outcomes as the child progresses into adulthood (Maluccio et al. 2009; Wheeler and Von Braun 2013). Climate change will influence nutrition in a number of ways. It may reduce food security; increase disease levels and change disease patterns; and impact on water availability and sanitation. In turn, nutritional status and diet will impact people's capacity to adapt and mitigate the impacts of climate change (Thomson and Fanzo 2015). When food availability is impacted by climate related stresses Watts et al (2015) note that women and girls nutrition tends to suffer more than their male counterparts. This is due in part to women and girls starting from a lower baseline, but also because they are often last in the household food hierarchies. In addition, a lower nutritional status can mean a lower agricultural output due to a reduction in labour (Watts et al. 2015).

Stunting refers to situations where an individual is below two standard deviations from median height for age of the reference population. The **prevalence of child stunting** in a country provides a measure of the extent of undernutrition of children. In 2010, an estimated 171 million children were stunted, predominantly in Africa and Asia (Smith and Haddad 2015; De Onis et al. 2012). The causes of stunting are complex (poor feeding practices, maternal undernutrition, sanitation) and can include an interplay between early undernutrition and recurrent infections. Wasting (or acute malnutrition) refers to situations where an individual is below two standard deviations from median weight for height of reference population. In 2011, an estimated 52 million children under the age of five suffered from wasting, predominantly in Asia.

The **prevalence of child wasting** provides a measure of low energy intake amongst the youngest in society and is indicative of a lack of access to food energy amongst poor households. Nutrient losses due to diarrhea (e.g. due to water-borne diseases) can aggravate wasting. The impacts of climate change on sanitation and clean water supplies are of relevance to efforts to reduce both stunting and wasting (Howard et al. 2010). The inclusion of stunting and wasting estimates in each Country Profile is recommended as it highlights the challenge to ensure that CSA practices and technologies should ideally improve the nutritional and sanitary status of children, in a manner that contributes to reducing stunting rates.

The **percentage of population with access to electricity** is a useful measure of the level of access to modern energy sources. While electricity can be generated with different carbon footprints (e.g. energy from fossil fuels versus from hydropower) access to electricity is considered a prerequisite for sustainable energy and decarbonisation routes for the energy sector. The IEA's World Energy Outlook 2015 highlights that 1.2 billion people are without access to electricity, with over 95% of those living without electricity are in sub-Saharan Africa and Asia (IEA 2015).

The **percentage of the population with access to electricity in rural areas** is a key indicator of the state of rural development in each country. Over 80% of the people who lack access to electricity are located in rural areas (IEA 2015), highlighting that the sustainable energy for all goals have to take into consideration a major urban-rural divide (Eastwood and Lipton 2000). Transitions to climate-smart agriculture (CSA) particularly in the smallholder sector will need access to rural energy, ideally clean (renewable) energy sources. Where there is an energy gap in rural areas, there are likely to be additional challenges for the introduction of more efficient climate-smart agricultural practices and technologies (Murray et al. 2016). A range of initiatives are underway in different regions that focus on gender issues in the production and use of modern energy and clean energy technologies (Habtezion 2013).

The **percentage of the population with primary reliance on non-solid fuels for cooking** is an important gender-related indicator for climate smart agriculture (Casillas and Kammen 2010). Over 2.7 billion people rely on the traditional use of biomass sources for cooking, which causes harmful indoor air pollution, impacting on the health of household members (IEA 2015). As cooking in the majority of cultures remains entrenched as a female role, the percentage of the population that do not have access to clean cooking facilities (e.g. more efficient fuels and cooking stoves, which have lower energy footprints and emissions) (MacCarty et al. 2008; Bhattacharya and Salam 2002). While improved cooking stoves can be considered a climate-smart technology, there are significant barriers to the long-term adoption of improved cooking stoves and a lack of consensus as to whether the expected co-benefit impacts on household energy use, indoor pollution and health are being realized (Hanna et al. 2012; Grieshop et al. 2011).

The **under-five mortality rate** (deaths per 1,000 live births) indicator concerns the number of children who die by the age of five, per thousand live births per year (Black et al. 2003). The world average of under-five mortality is decreasing, with wide discrepancies between developed countries and developing countries. The reduction of child mortality is a universally supported development goal. Under-five mortality rates are influenced by poverty, education, particularly of mothers (as well as by the availability, accessibility and quality of

health services). Other influencing factors include environmental risks including access to safe water and sanitation. Under-five mortality levels is also influenced by nutrition. The under-five mortality rate is a key development indicator over time, where CSA practices and technologies should reduce climate-related risks that could aggravate or accelerate mortality rates (McMichael et al. 2006).

The **total fertility rate** describes the total number of children the average women in a population is likely to have based on current birth rates throughout her life. This indicator is considered a better index of fertility than the crude birth rate (which measures the annual number of births per thousand population) because it is independent of the age structure of the population. However this indicator is a poor estimate of actual completed family size. This indicator does not necessarily predict how many children young women now will eventually have, as their fertility rates in years to come may change from those of older women now. While fertility rates have been used to indicate poverty levels, fertility rate in relation to gender is considered to indicate an aspect of women's empowerment. i.e., the ability to plan their children through access to birth control and/or ability to negotiate with their husband the number of children they want (Upadhyay et al. 2014). In addition, as a summary of current fertility levels, this indicator may help to predict the availability of labour in rural areas, if compared with the replacement rate. The replacement rate is the number of children each woman needs to have to maintain current population levels. In developed countries, the necessary replacement rate is about 2.1 or sometimes 2.3 due to higher childhood death rates. This indicator is of relevance to CPs as some countries are expected to experience large population growth over the coming years, which has major ramifications for food security. Total fertility rates are dropping in other countries, resulting in declining populations. However it is worth remembering that different cultural groups within a country can display different total fertility rates. On the whole total fertility rates can be useful indicator of future population growth or decline for a country. Fertility rates do not take into account life expectancy, educational enrolments and employment, and are typically not geographically defined (i.e. urban/rural). In addition, in the context of CSA it can be worth considering that family size is often used as an indicator of vulnerability or dependency of households (Wiebelt et al. 2013; Nkonde et al. 2014). Global data comes from census reports and is compiled by the United Nations Population Division.

The **youth literacy rate**, disaggregated by sex, (youth age 15-24) is collated by UNESCO's Institute for Statistics. Data is collated mostly using surveys within the last ten years which are self-declared by the persons in question. Literacy is an important indicator because beyond being able to read, write and use arithmetic, it concerns a progression of skills or a continuum of learning in enabling individuals to achieve their goals (Bernhardt et al. 2014). Literacy is considered essential for individuals to make more informed decisions, develop their knowledge and potential, and to participate fully in their community and wider society. Thus literacy and education is central for individuals to be able to critically assess new technology options, interact with extension/technology providers, or adopt new CSA practices or technologies (Manfre et al. 2013). Many schools in the developing world experience a high dropout rate amongst secondary school aged girls. The gender gap in literacy and education hinders youth development and has already been stressed above under the child labour section. There can be significant literacy gaps in some countries between urban and rural areas (Zhang 2006), where average literacy rates may occlude high levels of rural

illiteracy which can hamper the potential for scale-out of CSA practices and technologies. For instance, while text-based weather and market information received on phones can be of use to smallholder farmers, the provision of such services is predicated on the ability of the recipient smallholders to be able to read such text messages.

Discussion and Conclusions

To maintain the focus on the third CSA pillar of food security and poverty reduction for CSA scale-up and scale-out, it will be important to measure progress using selected national indicators on gender, poverty, food security, nutrition and health. A range of existing national-level indicators are identified in this paper as a starting point for inclusion in CSA CPs so that gender, poverty, food security, nutrition and health-related issues can be better considered and monitored in the context of CSA scale-up in each country. The proposed indicators can be useful for those planning, implementing and assessing the impact of CSA, particularly when supplemented by project level and household level data.

A number of indicators are necessary to adequately reflect gender, poverty, food security, nutrition and health considerations. While indicators provide a general snapshot of the situation in a country, sometimes more information is required to better understand the underlying drivers and context behind the indicator. For example, whilst the women in parliament indicator may demonstrate leadership of women and allows for comparison across countries, it does not demonstrate whether women as leaders, actively address gender issues in agriculture.

When some of the indicators in this paper are integrated into CSA assessments (such as the CSA CP), they can help to highlight issues that may affect response to climate change and acceptance of CSA practices. For example indicators can highlight issues regarding access to fuel or electricity, which in turn can affect women's time or facility to adapt a particular CSA practice. Likewise literacy rates amongst male and female youth can provide an indication of ability to conceptualise, assess and understand the range of technical options available for CSA, as well as assess the financial or legal implications.

Poverty indicators can reveal how populations live and consequently their ability to respond to climate change. Such indicators can also demonstrate whether poverty is being reduced over time, but may not indicate how particular groups are more affected by poverty (e.g. some ethnic groups or geographic regions); or poverty levels at different times of the year. The nutrition and health indicators can serve to reveal how the population is suffering from particular deprivations – such as undernourishment, stunting, or the death rates of children under 5.

Arising from the preparatory work undertaken for this paper, many of the suggested indicators are now included in the CSA CPs. Although not currently included in the current set of CSA CPs, the worst forms of child labour in agriculture indicator may be a useful future indicator of poverty levels. This indicator also highlights rural populations requirements for manual labour in rural areas and is an indication of a lack of affordable mechanisation. Moreover this indicator is disaggregated by sex.

While sex-disaggregated indicators would be ideal for inclusion in CSA planning and activities, in many instances while such indicators exist or have been developed, they may not be available or up to date for all countries. Examples of additional sex-disaggregated indicators that could be considered include WHO health indicators such as Years of Life Lost (YLL) and Disability Adjusted Life Years (DALY) which provide measures of premature deaths, and also deaths arising due to poor health or disability (WHO 2015). In addition, where they are available indicators of micronutrient (e.g. iodine, vitamin A, iron and zinc) deficiencies can be considered for inclusion in CSA planning and activities, to help ensure that any CSA activities have a positive impact on micronutrient deficiencies (CGIAR Consortium 2015).

Other indicators that could be considered for inclusion in CSA CPs include indicators relating to water and sanitation, proportion of adults (disaggregated) that have access to a bank account; and the share of agricultural researchers who are female. These may provide information on preconditions for health and nutrition (water and sanitation); and the ability to borrow and save (bank account). Whether or not female agricultural researchers would focus more than their male counterparts on CSA that improves gender, poverty, food security, nutrition and health outcomes is debatable. Nonetheless, in some cultural contexts it may be important to have female agricultural researchers (and female agricultural advisors).

A useful index designed to measure the empowerment, agency, and inclusion of women in agricultural sector projects and programmes is the Women's Empowerment In Agriculture Index (WEAI). The WEAI is a survey-based index constructed using interviews of primary male and primary female adults in the same household. It was developed by IFPRI, USAID, and OPHI in 2012, to measure the greater inclusion of women in the agriculture sector, as a result of the US Government's Feed the Future Initiative (Alkire et al. 2012). The WEAI is a composite indicator composed of two sub-indexes. The first sub-index is the five domains of empowerment, which assess women's empowerment across these five general areas (see Appendix 3). The second sub-index is the gender parity index, that measures women's empowerment relative to that of men by comparing the five domains of empowerment profiles of women and men within the same household (Malapit et al. 2014). The WEAI indicators are weighted. As with many project or programme surveys, not all regions of a country will be covered. However the WEAI may grow in importance in the future as more agriculture programmes are asked to determine how they support empowerment. In the context of national-level indicators, it should be noted that the WEAI does not collect data at the national level per se, as it is moving towards a project level framework. It also differs from agreed national-level indicators, which are generally defined via inter-governmental processes and collected by national governments.

An additional indicator that could be considered for inclusion in the CSA CPs is the proportion of male and female adults with an account at a bank or with a mobile money service provider. Property as collateral for credit is important in many countries, so tends to affect females more than males. Both male and female farmers face structural barriers in funding access for climate smart agricultural practices (e.g. unfavorable loan terms for particular categories of farmers, or proximity of financial institutions, which affects those with less mobility). An indication of male and female farmers with access to a mobile or

'smart' phone is also a useful measure, although such data can become rapidly obsolete unless it is collected frequently.

Other indicators that could be worth monitoring in the context of CSA would be data on how agri-research and information reaches smallholder farmers, particularly women. For instance, the Agricultural Science and Technology Indicators (ASTI) program at the CGIAR has an indicator on the share of agricultural researchers who are women, available by country. Similar to the *share of seats in parliament for women* indicator, such indicators do not guarantee a focus on gender issues in agriculture. A parallel indicator could ask research institutions and funding bodies (including donors) to track funds for gender-related research and how such research links with climate change adaptation or mitigation in the agri-sector. UN Women are advocating for systems to track and make public allocations for gender equality and women's empowerment. Nonetheless, challenges remain for the development and use of indicators. Household poverty data that is measured based on income or household consumption does not yet account for distribution within households, obscuring intra-household assessments of poverty at the individual level (United Nations 2015). This can result in a gender blind spot for assessment of poverty (United Nations 2015).

Sex-disaggregated data (separating data into male and female) is an important step in the development of GIs in agriculture. While agriculture census data are collected and disaggregated by male and female-headed households, this type of data provides limited data for gender analyses. Yet, such data can raise awareness of agricultural production and output differences amongst households, considering differences in male and female-headed households relate to many context specific disparities and factors. Male- and female-headed households may not be easily comparable because male-headed households may have access to family adult labour (female and male), while female-headed households have more limited access to such labour. Hence, female-headed households are often more labour and resource constrained than male-headed households (Doss 2013). Furthermore, analysis based on household headship does not take into account women in male headed household and therefore provides only a partial picture of gender inequalities (Deere, Alvarado and Twyman 2012).

The MDGs and the SDGs has spurred national statistical offices to improve the level and quality of their collection of indicators regarding gender, poverty, food security, nutrition and health, including sex-disaggregated data. For instance, methodological guidelines for the production of sex-disaggregated data are available for national statistical agencies with regard to the production of household census data, and agricultural census data (FAO 2015; UNECE 2015; UNECE 2010). The United Nations publication, *The World's Women* (2015), has highlighted the scale of the problem reporting that significant gaps exist with regards to the availability of data, the quality of data, and the comparability of data for even basic indicators. Tayyib et al (2013) indicate that while there is significant attention paid to gender in health and social statistics, the vast majority of agricultural indicators are gender blind (Tayyib et al. 2013). Gender gap in agriculture documentation persists for a number of reasons including: inadequate methods of data collection, poorly understood or poorly agreed definitions as well as the invisibility of women's agricultural work, which tends to be unpaid and located in the informal sector. However, the reduced costs of computers and data storage are making statistical datasets much more widely accessible and inter-operable.

This paper concludes that the integration of gender, poverty, food security, nutrition and health issues into CSA planning and scale-up can be improved by taking the set of national-level indicators currently available, and ensuring in so far as is possible that they are disaggregated by age, sex, and location. We consider that it is not necessary to generate a completely new set of indicators with regard to gender, poverty, food security, nutrition and health, as there are existing indicators that are being collected at the national level that can be usefully repurposed.

The process of scaling-up, monitoring and evaluation of CSA that more effectively ensures gender, poverty, food security, nutrition and health outcomes will be made easier if there are an agreed upon set of cross-comparable and time-series indicators when it comes to conducting both national and subnational analysis. The inclusion of existing national-level gender, poverty, food security, nutrition and health indicators in the CSA CPs will provide a basis to maintain a focus on the productivity and food security components of CSA.

Appendix 1: Complete list of indicators, sources, and tier levels

The Table in Appendix 1 contains the full list of indicators considered, the original sources of those indicators, and current Tier level. Each indicator that is included in the Sustainable Development Goal indicators has an associated Tier level based on level of methodological development and data availability of the indicator.

Tier 1: Indicator conceptually clear, established methodology and standards available and data regularly produced by countries.

Tier 2: Indicator conceptually clear, established methodology and standards available but data are not regularly produced by countries.

Tier 3: Indicator for which there are no established methodology and standards or methodology/standards are being developed/tested.

Indicator	Source	Available at:	Tier Level
1) Women's Empowerment In Agriculture (WEAI) index	IFPRI, Oxford Poverty and Human Development Initiative (OPHI), and USAID's Feed the Future	IFPRI: http://www.ifpri.org/topic/weai-resource-center	N/A
2) Gender Inequality Index	HDRO; UN Maternal Mortality Estimation Group; UNDESA; IPU; UNESCO; ILO	United Nations Development Program: http://hdr.undp.org/en/composite/GII	N/A
3) Distribution of female agricultural land holders	Eurostat; World Programme for the Census of Agriculture	FAO: http://www.fao.org/gender-landrights-database/data-map/statistics/en/	N/A
4) Poverty headcount ratio at national poverty lines	World Bank, Global Poverty Working Group	World Bank: http://databank.worldbank.org/data/reports.aspx?source=world-development-indicators	Tier 1
5) Proportion of countries with systems to track and make public allocations for gender equality and women's empowerment	UN Women; OECD	UN Women: http://gender-financing.unwomen.org/en/resources?resourcetypes=4a49f301014e486cb0b16389d3939f8c	Tier 3

Indicator	Source	Available at:	Tier Level
6) Proportion of adults (15 years and older) with an account at a bank or other financial institution or with a mobile money- service provider	World Bank & UNCDF	World Bank: http://datatopics.worldbank.org/financiaalinclusion/	Tier 1
7) Poverty headcount ratio at \$1.90 a day (2011 PPP)	World Bank, Development Research Group	World Bank: http://databank.worldbank.org/data/reports.aspx?source=world-development-indicators	N/A
8) Average monthly earnings of female and male employees by occupations (related to Agriculture)	ILO	ILO: http://www.ilo.org/ilostat/faces/help_home/data_by_subject?_adf.ctrl-state=rq68a30x3_9&_afLoop=274920953241979#!	N/A
9) Average hourly earnings of female and male employees by occupations (related to Agriculture)	ILO	ILO: http://www.ilo.org/ilostat/faces/help_home/data_by_subject?_adf.ctrl-state=rq68a30x3_9&_afLoop=274920953241979#!	N/A
10) Percentage of children aged 5-14 years engaged in child by economic activity labour and sex	ILO; UNICEF (statistics are based on the nationally-representative household survey datasets listed in the survey catalogue)	UNICEF: http://www.ucw-project.org/Pages/ChildLabIndicator.aspx UCW website, section on child labour indicators: http://www.ucw-project.org/Pages/ChildLabIndicator.aspx Single country report (ILO) http://www.ilo.org/ipec/ChildlabourstatisticsSIMPOC/Questionnairesurveysandreports/lang--en/index.htm also http://www.ucw-project.org/Pages/country_reports.aspx	Tier 1
11) Mean years of schooling (ISCED 1 or higher), population 25+ years, female	UNESCO, National population census; household and/or labour force surveys	UNESCO: http://data.uis.unesco.org/Index.aspx?queryid=242	N/A
12) Proportion of seats held by women in national parliaments (%)	Inter-Parliamentary Union	World Bank: http://databank.worldbank.org/data/reports.aspx?source=world-development-indicators	N/A

Indicator	Source	Available at:	Tier Level
13) Prevalence of undernourished of population	FAO	World Bank: http://databank.worldbank.org/data/reports.aspx?source=world-development-indicators	Tier 1
14) GDP per capita, PPP (constant 2011 international \$)	World Bank, International Comparison Program database	World Bank: http://databank.worldbank.org/data/reports.aspx?source=world-development-indicators	N/A
15) GNI per capita, PPP (constant 2011 international \$)	World Bank, International Comparison Program database	World Bank: http://databank.worldbank.org/data/reports.aspx?source=world-development-indicators	N/A
16) Total government spending in social protection and employment programmes as a proportion of the national budgets and GDP	ILO; World Bank	No Data	Tier 3
17) Proportion of total adult population with secure tenure rights to land, with legally recognized documentation and who perceive their rights to land as secure, by sex and by type of tenure	UN-Habitat, FAO, UNSD, World Bank, UN-Women, UNEP IFAD	No Data	Tier 3
18) Maternal mortality ratio (national estimate, per 100,000 live births) Maternal Deaths per 110,000 live Births	UNICEF, State of the World's Children, Childinfo, and Demographic and Health Surveys	World Bank: http://databank.worldbank.org/data/reports.aspx?source=world-development-indicators	N/A
19) Adolescent birth rate (15 to 19) per 1,000 women in that age group	United Nations Population Division, World Population Prospects.	World Bank: http://databank.worldbank.org/data/reports.aspx?source=world-development-indicators	Tier 1

Indicator	Source	Available at:	Tier Level
20) Mean years of schooling (ISCED 1 or higher), population 25+ years, male	UNESCO, Mainly national population census; household and/or labour force surveys	UNESCO: http://data.uis.unesco.org/Index.aspx?queryid=242	N/A
21) Access to electricity (% of population)	World Bank, Sustainable Energy for All (SE4ALL) database from World Bank, Global Electrification database	World Bank: http://databank.worldbank.org/data/reports.aspx?source=world-development-indicators	Tier 1
22) Annual growth rate of real GDP per employed person	ILO; World Bank; UNSD	World Bank: http://data.worldbank.org/indicator/SL.GDP.PCAP.EM.KD	Tier 1
23) Life Expectancy at birth, female (years)	UN Pop Division; Census & statistical publications; Eurostat; UN Stat; US Census Bureau; Secretariat of the Pacific Community.	World Bank: http://databank.worldbank.org/data/reports.aspx?source=world-development-indicators	N/A
24) Life Expectancy at birth, male (years)	UN Pop Division; Census & statistical publications; Eurostat; UN Stat; US Census Bureau; Secretariat of the Pacific Community.	World Bank: http://databank.worldbank.org/data/reports.aspx?source=world-development-indicators	N/A
25) Proportion of children and young people: (a) in grades 2/3; (b) at the end of primary; and (c) at the end of lower secondary achieving at least a minimum proficiency level in (i) reading and (ii) mathematics, by sex	UESCO-UIS; OECD	NA	Tier 3

Indicator	Source	Available at:	Tier Level
26) Percentage of population in a given age group achieving at least a fixed level of proficiency in functional (a) literacy and (b) numeracy skills, by sex	UNESCO-UIS; World Bank; OECD	World Bank: http://microdata.worldbank.org/index.php/catalog/step	Tier 2
27) Roads, paved (% of total roads)	DATA no longer available	http://data.worldbank.org/indicator/IS.ROD.PAVE.ZS	N/A
28) Adjusted net enrollment rate, primary, female (% of primary school age children)	United Nations Educational, Scientific, and Cultural Organization (UNESCO) Institute for Statistics	World Bank: http://databank.worldbank.org/data/reports.aspx?source=world-development-indicators	N/A
29) Adjusted net enrollment rate, primary, male (% of primary school age children)	United Nations Educational, Scientific, and Cultural Organization (UNESCO) Institute for Statistics	World Bank: http://databank.worldbank.org/data/reports.aspx?source=world-development-indicators	N/A
30) Literacy rate, adult female (% of females ages 15 and above)	United Nations Educational, Scientific, and Cultural Organization (UNESCO) Institute for Statistics	World Bank: http://databank.worldbank.org/data/reports.aspx?source=world-development-indicators	N/A
31) Literacy rate, adult male (% of males ages 15 and above)	United Nations Educational, Scientific, and Cultural Organization (UNESCO) Institute for Statistics	World Bank: http://databank.worldbank.org/data/reports.aspx?source=world-development-indicators	N/A
32) Prevalence of moderate or severe food insecurity in the population, based on the Food Insecurity Experience Scale (FIES)	FAO collected through Gallup World Poll 2014	FAO: http://www.fao.org/in-action/voices-of-the-hungry/data-download/en/	Tier 1

Indicator	Source	Available at:	Tier Level
33) Prevalence of stunting (height for age <-2 SD from the median of the WHO Child Growth Standards) among children under five years of age (disaggregated by sex)	WHO; UNICEF; World Bank	World Bank: http://databank.worldbank.org/data/reports.aspx?source=world-development-indicators	Tier 1
34) Prevalence of wasting (weight for height <-2 SD from the median of WHO Child Growth Standards) among Children under the age of five (disaggregated by sex)	WHO; UNICEF; World Bank	World Bank: http://databank.worldbank.org/data/reports.aspx?source=world-development-indicators	Tier 1
35) Mortality rate, under-5, female (per 1,000 live birth)	UNICEF, WHO, World Bank, UN DESA Population Division	World Bank: http://databank.worldbank.org/data/reports.aspx?source=world-development-indicators	Tier 1
36) Adolescent fertility rate (births per 1,000 women ages 15-19)	United Nations Population Division, World Population Prospects	World Bank: http://databank.worldbank.org/data/reports.aspx?source=world-development-indicators	Tier 1
37) Fertility rate, total (births per woman)	UN Pop Division; Census & statistical publications; Eurostat; UN Stat; US Census Bureau; Secretariat of the Pacific Community	World Bank: http://databank.worldbank.org/data/reports.aspx?source=world-development-indicators	Tier 1
38) Adults (ages 15+) and children (ages 0-14) newly infected with HIV	UNAIDS	World Bank: http://databank.worldbank.org/data/reports.aspx?source=world-development-indicators	Tier 1
39) Access to non-solid fuel (% of population)	World Bank, Sustainable Energy for all (SE4ALL) database from WHO Global Household Energy database.	World Bank: http://databank.worldbank.org/data/reports.aspx?source=world-development-indicators	N/A

Indicator	Source	Available at:	Tier Level
40) Access to electricity (% of population)	World Bank, Sustainable Energy for All (SE4ALL) database from World Bank, Global Electrification database.	World Bank: http://databank.worldbank.org/data/reports.aspx?source=world-development-indicators	Tier 1
41) Access to electricity, rural (% of rural population)	World Bank, Sustainable Energy for All (SE4ALL) database from World Bank, Global Electrification database.	World Bank: http://databank.worldbank.org/data/reports.aspx?source=world-development-indicators	N/A

Appendix 2: Scoring system used for prioritization of national level indicators for inclusion in Climate-Smart Agriculture (CSA) Country Profiles (CPs).

Please choose ten indicators and rank score 1 - 10 (10 considered most preferred)				
Indicator	P#1	P#2	P#3	Total Score
1) Gender Inequality Index				
2) Distribution of female agricultural land holders				
3) Poverty headcount ratio at national poverty lines				
4) Proportion of countries with systems to track and make public allocations for gender equality and women's empowerment				
5) Proportion of adults (15 years and older) with an account at a bank or other financial institution or with a mobile money- service provider				
6) Poverty headcount ratio at \$1.90 a day (2011 PPP)				
7) Average monthly earnings of female and male employees by occupations (related to Agriculture)				
8) Average monthly earnings of female and male employees by occupations (related to Agriculture)				
9) Percentage of children aged 5-14 years engaged in child by economic activity labour per sex				
10) Mean years of schooling (ISCED 1 or higher), population 25+ years, female				
11) Proportion of seats held by women in national parliaments (%)				
12) Prevalence of undernourished of population				

13) GDP per capita, PPP (constant 2011 international \$)				
14) GNI per capita, PPP (constant 2011 international \$)				
15) Total government spending in social protection and employment programmes as a proportion of the national budgets and GDP				
16) Maternal mortality ratio (national estimate, per 100,000 live births) Maternal Deaths per 110,000 live Births				
17) Adolescent birth rate (15 to 19) per 1,000 women in that age group				
18) Mean years of schooling (ISCED 1 or higher), population 25+ years, male				
19) Access to electricity (% of population)				
20) Growth rate of GDP per employed person (constant 1990 \$)				
21) Life Expectancy at birth, female (years)				
22) Life Expectancy at birth, male (years)				

Please choose ten indicators score them 1 - 10 (10 considered most preferred)

Indicator	P#1	P#2	P#3	Total Score
1) Prevalence of moderate or severe food insecurity in the population, based on the Food Insecurity Experience Scale (FIES)				
2) Prevalence of stunting (height for age <-2 SD from the median of the WHO Child Growth Standards) among children under five years of age (disaggregated by sex)				
3) Prevalence of wasting (weight for height <-2 SD from the median of WHO Child Growth Standards) among Children under the age of five (disaggregated by sex)				
4) Prevalence of undernourished of population				
5) Under-five mortality rate (deaths per 1,000 live births) (disaggregated by sex)				

6) Mortality rate, under-5, female (per 1,000 live birth)				
7) Fertility rate, total (births per woman)				
8) Life Expectancy at birth, male (years)				
9) Poverty headcount ratio at \$1.90 a day (2011 PPP)				
10) Adults (ages 15+) and children (ages 0-14) newly infected with HIV				
11) Literacy rate, adult female (% of females ages 15 and above)				
12) Literacy rate, adult male (% of males ages 15 and above)				
13) Mean years of schooling (ISCED 1 or higher), population 25+ years, female				
14) Mean years of schooling (ISCED 1 or higher), population 25+ years, male				
15) Maternal mortality ratio (national estimate, per 100,000 live births) Maternal Deaths per 110,000 live Births				
16) Access to electricity, rural (% of rural population)				
17) Access to electricity (% of population)				
18) Access to non-solid fuel (% of population)				
19) Distribution of female agricultural land holders				
20) Percentage of children aged 5-14 years engaged in child by economic activity (agriculture) labour per sex				

Appendix 3: Women’s Empowerment in Agriculture Index (WEAI)

The WEAI is a tool composed of two sub-indexes: one measures the five domains of empowerment for women, and the other measures the gender parity in empowerment within the household. It is an aggregate index based on individual-level data on men and women. Survey questions are asked about five (identified) domains of empowerment (below) to the principle male and female in the household. The Gender Parity Index (GPI) compares men and women their households. Based on both sub-indexes, the WEAI is an aggregate index that shows the degree to which women are empowered in their households (and communities) and the degree of inequality between women and men within the household.

Women’s Empowerment in Agriculture Index		
Five domains of Empowerment		
Domain	Indicator	Weight
Production decision-making	Input in productive decisions	1/10
	Autonomy in production	1/10
Access to productive resources	Ownership of Assets	1/15
	Purchase, sale, or transfer of assets	1/15
	Access to and decision on credit	1/15
Control over us of income	Control over us of income	1/5
Community leadership	Group member	1/10
	Speaking in public	1/10
Time Allocation	Workload	1/10
	Leisure	1/10

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