Presenter notes for

Module 2: Climate smart agriculture and priority setting for investments

This module is suggested to last for one hour and 15 minutes. The presentation should be delivered in an interactive way, with participants encouraged to ask questions and share experiences throughout the presentation. Make sure to leave some time at the end for questions and answers.

SLIDE 2: MODULE OBJECTIVES

- Introduce participants to the premise of climate-smart agriculture (CSA) and other climate-resilient agriculture approaches.
    - Note that most of the focus will be on CSA given that these materials were created (with funding from BMZ through GIZ) by the CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS) and CSA is a major focus of that organization.
- Describe different CSA technology options
    - Including weather-based practices, water, seed/breed, carbon/nutrient and institutional/market-based activities
- Provide case-study examples of successful CSA technology options in Africa
    - Participants will also be encouraged to share their own experiences and knowledge of CSA policies and interventions in their own countries
- Discuss technical tools for ex-ante analysis of CSA options in agriculture
    - In the related activity that follows this module presentation, participants will be given a chance to do a hands-on activity using the Evidence for Resilient Agriculture (ERA) online tool

SLIDE 3: PART 1—CLIMATE-SMART AGRICULTURE AND OTHER CLIMATE-RESILIENT AGRICULTURE APPROACHES

The first part of this presentation will focus on the background and examples of CSA. The second part will dive into priority setting using evidence-based decision making.

SLIDE 4: CSA DEFINITION

Climate-smart agriculture (CSA) is an approach for transforming and reorienting agricultural development under the new realities of climate change. The most commonly used definition is provided by the Food and Agricultural Organization of the United Nations (FAO), which defines CSA as "**agriculture that sustainably increases productivity, enhances resilience (adaptation), reduces/removes GHGs (mitigation) where possible, and enhances achievement of national food security and development goals**". In this definition, the principal goal of CSA is identified as food security and development; while productivity, adaptation, and mitigation are identified as the three interlinked pillars necessary for achieving this goal.

Until the late 2000s, the issue of climate change in agriculture was mostly focused on mitigation, i.e., how agriculture can reduce the amount of greenhouse gas emissions entering the atmosphere. But there were growing concerns from developing countries on how to adapt agriculture and farming to the changing climate.

This has led to two distinct work streams within the UNFCCC negotiation process: **mitigation** and **adaptation**. They each have specific concepts, approaches and methodologies. Despite these two different work streams within the UNFCCC, there were efforts within the scientific community to highlight synergies between adaptation and mitigation within agriculture.

There are synergies and co-benefits between mitigation, adaptation and food security, and the agriculture sector has the ability to produce "triple wins" when it comes to these three areas.

In 2010, FAO introduced the concept of climate smart agriculture at the Global Conference on Agriculture, Food Security and Climate Change in the Hague.

SLIDE 5: WHY CSA? (1/2)

Climate smart agriculture has the power to address the relationship between climate change and agriculture. It can also help address food security, malnutrition and poor distribution of food.

Despite the attention paid to agricultural development and food security over the past decades, there are still about 800 million undernourished and 1 billion malnourished people in the world. At the same time, more than 1.4 billion adults are overweight and one third of all food produced is wasted. Before 2050, the global population is expected to swell to more than 9.7 billion people. At the same time, global food consumption trends are changing drastically, for example, increasing affluence is driving demand for meat-rich diets. If the current trends in consumption patterns and food waste continue, it is estimated we will require 60% more food production by 2050. CSA helps to improve food security for the poor and marginalized groups while also reducing food waste globally.

The relationship between agriculture and climate change is a two-way street: agriculture is not only affected by climate change but has a significant effect on it in return. Globally, agriculture, land-use change and forestry are responsible for 19-29% of greenhouse gas (GHG) emissions. Within the least developed countries, this figure rises to 74%. If agricultural emissions are not reduced, agriculture will account for 70% of the total GHG emissions that can be released if temperature increases are to be limited to 2°C. The mitigation options available within the agricultural sector are just as cost-competitive as those established within the energy, transportation and forestry sectors. And they are just as capable of achieving long-term climate objectives. For this reason, mitigation is one of the three pillars of climate-smart agriculture.

SLIDE 6: WHY CSA? (2/2)

CSA is an approach designed to address the relationship between agriculture and poverty. Agriculture continues to be the main source of food, employment and income for many people living in developing countries. Indeed, it is estimated that about 75% of the world's poor live in rural areas, with agriculture being their most important income source. As such, agriculture is uniquely placed to propel people out of poverty. Agricultural growth is often the most effective and equitable strategy for both reducing poverty and increasing food security.

SLIDE 7: WHAT IS CSA?

The key characteristics of CSA are:

i. **CSA addresses climate change:** Contrary to conventional agricultural development, CSA systematically integrates climate change into the planning and development of sustainable agricultural systems.

ii. **CSA integrates multiple goals and manages trade-offs:** Ideally, CSA produces triple-win outcomes: increased productivity, enhanced resilience and reduced emissions. But often it is not possible to achieve all three. Frequently, when it comes time to implement CSA, trade-offs must be made. This requires us to identify synergies and weigh the costs and benefits of different options based on stakeholder objectives identified through participatory approaches.

The three pillars of CSA, as seen in the figure on the slide, are:

i. **Productivity (top circle):** CSA aims to sustainably increase agricultural productivity and incomes from crops, livestock and fish, without having a negative impact on the environment. This, in turn, will raise food and nutritional security. A key concept related to raising productivity is sustainable intensification.

ii. **Adaptation (bottom left circle):** CSA aims to reduce the exposure of farmers to short-term risks, while also strengthening their resilience by building their capacity to adapt and prosper in the face of shocks and longer-term stresses. Particular attention is given to protecting the ecosystem services which ecosystems provide to farmers and others. These services are essential for maintaining productivity and our ability to adapt to climate changes.

iii. **Mitigation (bottom right circle):** Wherever and whenever possible, CSA should help to reduce and/or remove greenhouse gas (GHG) emissions. This implies that we reduce emissions for each calorie or kilo of food, fiber and fuel that we produce. That we avoid deforestation from agriculture. And that we manage soils and trees in ways that maximizes their potential to acts as carbon sinks and absorb CO2 from the atmosphere.

SLIDE 8: ADDITIONAL CHARACTERISTICS OF CSA (1/3)

CSA maintains ecosystems services: Ecosystems provide farmers with essential services, including clean air, water, food and materials. It is imperative that CSA interventions do not contribute to their degradation. Thus, CSA adopts a landscape approach that builds upon the principles of sustainable agriculture but goes beyond the narrow sectoral approaches that result in uncoordinated and competing land uses, to integrated planning and management.

CSA has multiple entry points at different levels: CSA should not be perceived as a set of practices and technologies. It has multiple entry points, ranging from the development of technologies and practices to the elaboration of climate change models and scenarios, information technologies, insurance schemes, value chains and the strengthening of institutional and political enabling environments. As such, it goes beyond single technologies at the farm level and includes the integration of multiple interventions at the food system, landscape, value chain or policy level.

SLIDE 9: ADDITIONAL CHARACTERISTICS OF CSA (2/3)

CSA is context specific: What is climate-smart in one-place may not be climate-smart in another, and no interventions are climate-smart everywhere or every time. Interventions must consider how different elements interact at the landscape level, within or among ecosystems and as a part of different institutional arrangements and political realities. The fact that CSA often strives to reach multiple objectives at the system level makes it particularly difficult to transfer experiences from one context to another.

As will be covered in Module 5 later in the training, **CSA can also be used to engage women and marginalized groups.** To achieve food security goals and enhance resilience, CSA approaches must involve the poorest and most vulnerable groups. These groups often live on marginal lands which are most vulnerable to climate events like drought and floods. They are, thus, most likely to be affected by climate change. Gender is another central aspect of CSA. Women typically have less access and legal right to the land which they farm, or to other productive and economic resources which could help build their adaptive capacity to cope with events like droughts and floods (Huyer et al. 2015). CSA strives to involve all local, regional and national stakeholders in decision-making. Only by doing so, is it possible to identify the most appropriate interventions and form the partnerships and alliances needed to enable sustainable development.

SLIDE 10: CSA FREQUENTLY ASKED QUESTIONS (FAQs)

There are some questions that come up frequently when people are discussing CSA. One of these is whether a practice needs to achieve all three pillars to be considered climate-smart. It is NOT necessary for a practice or technology to meet all three pillars of increasing productivity, contributing to adaptation and lowering GHG emissions. Mitigation has often been considered a co-benefit in many African countries. This has been changing over time with the introduction of low carbon climate resilient strategies. The main requirement for something to be considered CSA is that it responds to aspects of the changing climate and addresses at least two of the pillars.

People also will sometimes question how CSA practices are different from other agricultural development approaches that have been around for a longer time. The key with CSA is that it is not prescriptive and it must be tailored to the local context. It does share some characteristics with other approaches, and CSA is not mutually exclusive of other approaches.

Allow the participants to ask their own questions about CSA so that any outstanding questions or issued can be discussed and cleared.

SLIDE 11: ACTIONS TO ACHIEVE CSA

CSA will not occur in a vacuum, and it is not the sole responsibility of individual farmers to take up the call to implement CSA. A wide range of stakeholders must work together to help create an enabling environment to nurture CSA.

- National and local institutions need to be strengthened. These include national agricultural research institutions, local farmers' organizations, extension services, agriculture and climate information services, and others.
- Financing options should be broadened to help farmers and others along the agricultural and food value chain adopt CSA practices. Climate finance is a broad topic and is covered more in depth in Module 3 of this training.
- CSA requires enabling policies to be in place. This can include things such as climate-smart subsidies and national climate change policy that addresses the agriculture sector.

These three aspects combine to help support implementation of CSA practices and technology adoption on the ground and in the field.

SLIDE 12: OTHER APPROACHES RELATED TO BUILDING CLIMATE RESILIENCE IN AGRICULTURE

CSA is the main approach presented in this module because the training was originally designed and implemented in partnership with the CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS), which promotes the CSA approach in all its programs.

Other approaches that can also be used to address climate issues in agriculture include agro-ecology, sustainable intensification, nature-based solutions, ecosystem-based adaptation and conservation agriculture.

Helpful guides to each of these can be found through the links below.

- The 10 principles of Agroecology: http://www.fao.org/3/i9037en/i9037en.pdf
- Sustainable intensification: Sustainable intensification in agricultural systems; What is sustainable intensification?; Sustainable Intensification: A New Paradigm for African Agriculture
- Nature-Based Solutions for agricultural water management and food security
- Ecosystem-based adaptation for smallholder farmers
- Conservation agriculture: from CIMMYT, from Biovision, from FAO

SLIDE 13: OTHER APPROACHES RELATED TO BUILDING CLIMATE RESILIENCE IN AGRICULTURE

While these other approaches are not the focus on this module, the participants can use this opportunity to discuss any ways that these approaches are being used in their countries. There is no single tactic that will fit all contexts, so a pluralistic approach is needed.

Ask participants discuss what is being implemented in their countries, ask them to relate the activities to the three pillars of CSA.

SLIDE 14: TYPES OF CLIMATE-SMART AGRICULTURE OPTIONS

CSA practices can be categorized into 5 different types:

1. Weather-smart practices
2. Water-smart practices
3. Seed/breed-smart practices
4. Carbon/nutrient-smart practices

5. Institutional/market-smart activities

Note that the macro level actions are especially important for the scaling of the farm level practices and technologies.

This part of the presentation will review a few examples from these categories.

SLIDE 15: WEATHER-SMART PRACTICES

In this category, the most often discussed practice is **climate information services (CIS).** The frequency and severity of extreme climate events - such as droughts, dry spells, heatwaves, storms and floods – is increasing globally under climate change. Small-scale farmers are especially vulnerable to weather variability, which can occur both between-seasons and within a season. Farmers who practice rainfed farming are particularly vulnerable to rainfall variability. As a result, most small-scale farmers rely upon traditional 'coping strategies' that have evolved over generations through long experience of natural variations, combined with their specific responses to the season as it unfolds. Such strategies are 'risk spreading' in nature. That is, they are designed to mitigate the negative impacts of poor seasons but usually fail to exploit the positive opportunities of average and better than average seasons. However, with enabling institutional support and policies, climate information (historical, monitored, and predicted), and the aid of advisories, this uncertainty can be reduced and farmers can be enabled to better manage risks and take advantage of favorable climate conditions when they occur.

Two examples of CIS are the use of the Participatory Integrated Climate Services for Agriculture (PICSA) approach in 14 countries and CIS in Senegal.

These approaches deal with the changing weather patterns and increased variability seen with climate change.

Scaling up climate services for agriculture in Senegal

In Senegal, the CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS) has worked closely with the National Meteorological Agency (ANACIM) to develop locally relevant climate information services, and enhance the capacity of partners to communicate information to farmers and help them incorporate it into their training. The work began at a pilot scale in 2011, with farmer training and planning workshops in Kaffrine. The pilot revealed a strong demand for climate information, and requests were made to scale up beyond the initial pilot. Rural radio was used to scale up into new regions in Senegal, accessed through a partnership with the Union of Rural Radio (URAC), a federation of NGOs and Institute of Agricultural Research of Senegal (ISRA). CCAFS scientists worked with ANACIM to provide seasonal and 10-day forecasts tailored for farmers. A special program communicated this information through URAC's radio station network. Journalists from 40 radio stations were trained to understand and communicate climate information. The interactive radio programming allowed listeners to share feedback, including additional information, views, and requests for clarification.

Relationship to CSA

While there is clear evidence that farmers in Senegal both demand and use weather information, the extent to which this has contributed to CSA objectives through increased resilience and productivity requires further investigation.

Impacts and lessons learned

A recent evaluation estimated that 560,000 rural households now have access to climate information services in Senegal as a result of this effort. The study showed that farmers are changing their management practices in response to the information, but more work is needed to understand the extent of these changes and their impact on farmers' livelihoods. Evidence suggests that the pilot effort connected with strong demand among farmers, by providing locally downscaled information, in a process that engaged rural communities in meaningful dialog with climate and agricultural experts. Partnering with URAC to equip radio stations to deliver climate information proved an effective and low-cost way to respond to demand and provided substantial access to local farmers, as it spans across all 14 administrative regions and operates in local languages, and utilizes an interactive format to engage listeners.

SLIDE 16: WEATHER-SMART PRACTICES

Another type of weather-smart CSA practice is **index-based insurance**. Small-scale farmers and pastoralists in low-income countries are often trapped in poverty because they are unable to make investments in improved agricultural practices due to weather-related risks. Agricultural insurance, an attractive approach to managing such risks, normally relies on direct measurement of the loss or damage suffered by each and every farmer. However, field loss assessment is costly and time consuming, particularly where there are a large number of small-scale farmers or pastoralists who can ill afford the inevitable delay in payments.

Index-based insurance, on the other hand, is a feasible alternative because it uses a weather index, such as rainfall, to determine payouts for clearly defined hazards. The payouts can be made quickly and with less administrative costs and lower premiums than is typical for conventional crop insurance.

A good example of index-based insurance is the Kenya Livestock Insurance Program. See info here and here for more details.

Contribution of these practices to CSA

The provision of weather information and associated advisories as well as index-based insurance contributes to CSA from several important perspectives:

- **Productivity:** Since climate-related risk is often a barrier to adopting climate-smart technologies and to making the transition toward more productive agriculture, effective climate services are part of the enabling environment for the transition toward more climate-smart agricultural systems. More adequate and timely weather information can help farmers take decision on timing and variety of crops increasing productivity. Index insurance, often coupled with access to credit, allows farmers to take additional risks and to invest in improved practices that increase productivity and food security, even in a situation of adverse weather conditions.

- **Adaptation through risk management:** The effective use of weather information services contributes to resilience by enabling farmers to better manage the negative impacts of weather-related risks in poor seasons while also taking greater advantage of average and better than average seasons.
- **Mitigation:** By better matching the use of fertilizer and other production inputs with year-to-year climatic conditions, the existing evidence suggests that climate services can contribute to mitigation by supporting more efficient use of fertilizers

SLIDE 17: WATER SMART PRACTICES

Agriculture is the largest consumer of the world's freshwater resources, requiring 70% of available supply of which almost 40% are used for rice production. As the world's population rises and consumes more food and industries and urban development expands, water scarcity is becoming an increasingly important issue; improved water management systems are a must.

Improved water management in rainfed and irrigated agricultural systems can take place across different scales, including (i) farm level, (ii) irrigation systems or catchment level, and (iii) national or river basin level.

Under rainfed agriculture, improved water management can be achieved through water harvesting, soil management practices that result in the capture and retention of rainfall and through soil fertility and crop management innovations that enhance crop growth and yield and hence water use efficiency or through supplemental irrigation of dry-land crops.

In irrigated systems, improved water management for greater water use efficiency is achievable at many stages in the process of irrigation, from the source of the water, through conveyance and application systems, scheduling and the availability of water in the root zone of the plant. In the Sahel areas of West Africa, farmers have successfully used zai or tassas (improved traditional planting pits), contour bunds and half-moon structures to capture water. Crops such as sorghum, millet and cowpeas are successfully planted with these techniques by employing other conservation agriculture techniques such as the application of animal manure or compost with grain yields exceeding 200% relative to control fields in Burkina Faso and Niger.

SLIDE 18: WATER SMART PRACTICES

Water-smart practices contribute to the three pillars of CSA in the following ways:

- **Productivity:** In the absence of other limitations to crop growth, all innovations which aim to reduce crop water stress through the improved capture and retention of rainfall or the improved scheduling and application of irrigation water will boost crop productivity.

- **Adaptation through short-term risk management:** Many water management innovations (e.g. supplemental irrigation and rainfall capture) are specifically designed to reduce or eliminate the risk of crop water stress and yield reduction.

- **Adaptation through longer term risk management:** The implications of climate change for water management are context specific. However, in many regions, it will likely include increased water demand and reduced water availability. Under such scenarios, especially where human populations are projected to increase substantially, all innovations which increase water availability or target reduced water use through greater water use efficiency in rainfed agriculture or irrigations systems are an important longer-term adaptation mechanism.

- **Mitigation:** Flooded rice systems emit substantial amounts of the greenhouse gas (GHG) methane (CH_4). Alternate wetting and drying cycles in such systems not only save water, but also result in greatly reduced methane emissions. In addition, irrigation strategies that reduce the amount of water required can reduce energy consumption for pumping, thereby reducing emissions.

SLIDE 19: NUTRIENT/CARBON SMART PRACTICES

Forestry and agroforestry

Forestry and agroforestry play an important role in global efforts to tackle climate change. Forests are home to nearly 60 million indigenous people and support a much bigger number by providing a variety of ecosystem services (food, fuel, water, carbon sequestration, biodiversity, etc.). For example, the FAO estimates that 2.4 billion people cook using wood fuel, and that wood energy is a major source of primary energy in developing regions. Climate change threatens the delivery of these ecosystem services, and can consequently impact rural livelihoods. Agriculture, forestry, and other land use sectors account for a quarter of global emissions. Forests and trees on farms are an important carbon sink and this potential can be increased through afforestation efforts. Deforestation is the major cause of emissions from the forestry sector, and agriculture remains the key driver of deforestation.

In smallholder systems in developing countries, farms and forests are often part of complex rural landscapes, which collectively fulfil the livelihood needs of the rural populace. This means that efforts of climate-smart agriculture (CSA) should adopt integrated approaches when developing interventions. Increasing the resilience of forest systems to maintain and enhance the flow of ecosystem services, mitigating emissions from the sector by reducing deforestation and increasing forest cover, and agroforestry are some of the possible interventions, but these need to be considered in the context of the wider landscape.

Actions in the forestry and agroforestry sectors can contribute to all three CSA pillars:

- **Productivity:** The production of ecosystem services, including provisioning services (food, fibre, fuel, etc.) can be improved by using a CSA approach. For example, by adopting agroforestry practices on farms, farmers are able to harvest tree products, supplement their diets, and also develop additional income streams. Integrating trees in farming systems can also improve soil quality, leading to higher and more stable crop yields. Sustainable forest management (SFM), where, for example, local communities are given concessions to harvest timber and non-timber products, likewise adds to the productive portfolio of small-scale farmers.

- **Adaptation:** Healthy and diverse ecosystems are more resilient to natural hazards. Trees on farms can be used as shelterbelts and windbreaks, and play an important role in protecting against landslides, floods and avalanches. Trees also stabilize riverbanks and mitigate soil erosion. Agroforestry practices increase the absorptive capacity of soil and reduce evapotranspiration. The canopy cover from trees can also have direct benefits: reducing soil temperature for crops planted underneath, and reducing runoff velocity and soil erosion caused by heavy rainfall.

- **Mitigation:** Actions that increase tree cover (afforestation, reforestation, and agroforestry) and reduce deforestation and degradation, increase carbon sequestration through increased biomass both above and below ground.

SLIDE 20: NUTRIENT/CARBON SMART PRACTICES

Soil management practices

Maintaining or improving soil health is essential for sustainable and productive agriculture. 'Healthy' soil will help to push sustainable agricultural productivity close to the limits set by soil type and climate. Key aspects of 'healthy' soil include the following:

- A comprehensive soil cover of vegetation.
- Soil carbon levels close to the limits set by soil type and climate.
- Minimal loss of soil nutrients from the soil through leaching.
- Zero or minimal rates of rainfall run-off and soil erosion.
- No accumulation of contaminants in the soil.
- Agriculture, which does not rely excessively on fossil energy through inorganic fertilizers.

In many regions of the world, soil health is severely threatened by human and livestock population increases. This has resulted in the intensification of soil cultivation in existing high potential areas, the expansion of farming into forests and marginal environments with fragile soils, and the over stocking and overgrazing of natural pastures. Combined with the constraints that small-scale farmers face with regard to the availability and cost of organic and inorganic nutrient inputs, these factors have resulted in the wide scale decline of soil health and, hence, productivity in those regions.

An example of this approach is the landscape-based adaptation in Doyogena, Ethiopia.

Improved soil management aims to enhance soil health and contributes to CSA from several important perspectives:

- **Productivity:** All interventions that improve soil fertility, soil water availability and reduce the loss of nutrient-rich topsoil through erosion, will straightforwardly improve productivity.

- **Adaptation:** In many parts of the world, intense rainfall events are already a common occurrence and result in a high risk of rainfall run-off and soil erosion, especially on sloping land. Climate change projections suggest that the frequency and severity of such events are very likely to increase. There is a wide range of soil management interventions, which help reduce the risk of run-off and soil erosion, ranging from field or farm level interventions such as contour ploughing or contour tillage with tied ridges, micro-catchments and surface mulching, to landscape level approaches such as land terracing, contour stone bunds or reforestation.

- **Mitigation:** Soil management can help mitigate climate change as well through a range of interventions. Soils are an important below ground 'sink' for carbon sequestration, and soil management interventions can help to harness this characteristic. For example, the organic matter additions recommended in Conservation Agriculture, the inclusion of trees in crop fields, and the improved grazing management of natural pastures are all practices that help to increase the sequestration of carbon. The emission of the greenhouse gas (GHG) nitrous oxide from inorganic fertilizer use can also be reduced through integrated approaches to the management of nitrogen fertilizer. For example, Integrated Soil Fertility Management advocates reduced amounts and more strategically placed inorganic nitrogen fertilizer. Rice lowlands with submergence are known to maintain much higher soil C then lowlands which go through wetting and drying cycles used in rice-wheat cultivation or uplands with maize-wheat rotations.

SLIDE 21: SEED/BREED SMART PRACTICES

Crop production for food, fibre and animal feed is practiced within a very diverse range of farming systems. Each is subject to widely differing socio-economic, climatic and soil conditions. For example, some are rain-fed while others are irrigated. Increasing attention is now being given to the wide range of crop production practices that can be considered as 'climate-smart' either from an adaptation perspective, or for their mitigation potential.

- **Productivity:** Crop productivity can be increased through the breeding of higher yielding crop varieties, though crop and crop nutrient management, and through the choice of crop species that have higher yield potentials under given environmental conditions.

- **Short-term adaptation through climate risk management:** Some crop interventions can substantially reduce the risk of yield reduction or crop failure. For example, crops can be bred for greater drought tolerance and shorter-duration varieties can both be used for 'terminal drought escape'. Similarly, breeding for resistance to the pests and diseases that are triggered by weather events provides another important source of climate risk reduction. Plant breeding for drought, pest and disease resistance becomes more important since the risk of drought is projected to increase in many regions and the distribution and severity of pest and disease outbreaks will also change as climates change.

- **Longer-term adaptation through change:** As the world continues to warm, longer-term adaptation will become necessary. This can be achieved through development and planting of heat-tolerant, drought-tolerant or salinity-tolerant crop varieties, or by switching to crops that have higher tolerance to temperatures and the greater risk of drought. For example, cereals like millets and sorghum are the hardiest crops for harsh, hot and dry environments. Farmers who currently grow maize may have to switch to these alternative cereals in the future. Another adaptation strategy is the substitution of potentially vulnerable annual crops with more hardy perennials. Furthermore, in regions which are already marginal for crop production, farmers may well have to adapt more radically by abandoning cropping for livestock production.

- **Mitigation:** The mitigation potential of crop production largely stems from soil and water management, or the agroforestry system under which crops are grown. However, perennial crops are able to sequester greater amounts of carbon below ground than annual crops.

SLIDE 22: INSTITUTIONAL/MARKET SMART ACTIVITIES

Policy engagement: The creation and implementation of appropriate policies and an enabling environment is essential for achieving the widespread adoption of climate-smart agriculture (CSA). At the national level, climate change policies are generally expressed through national and regional strategies and plans including National Adaptation Programmes of Action (NAPAs), National Adaptation Plans (NAPs) and Nationally Appropriate Mitigation Actions (NAMAs). Agriculture and food security plans are often included in national development and poverty reduction strategies; trade, financial, agricultural and environmental national policy documents are also relevant. Importantly, 'policy' should not only be defined as 'government policy'. It should also include the policies and strategies of other actors, such as private sector actors and investors, regional and intergovernmental organizations, national and international civil society organizations, farmer organizations, and others.

In general, the objective in CSA policy engagement is to guide policies and remove components that act as disincentives for adopting CSA, such as public subsidies, while reallocating resources to programmes that provide incentives for the adoption of CSA. Policy tools and instruments, such as rural credit programmes, input and output pricing policies, subsidies, support for investment with public-good benefits, property rights, research and extension services, as well as safety net programs, can all be used to increase the incentives for the involved actors including farmers to modify production systems and build capacities for CSA. An effective engagement in CSA policy requires a thorough understanding of power structure and policy decision making process on climate change at the national and local levels. Formulating CSA policies also requires a good knowledge of information needed by policy makers. To this end it is critical that specific information be tailored to the need of policy makers for an effective decision-making process that ensures a good linkage between science and policy.

Policy formulation and guidance tools include participatory assessments, multi-stakeholder scenarios and use of simulation models, multi-criteria analysis, participatory power mapping, companion modelling and participatory game design, methods to calculate participatory social returns on investment etc. Such methods can be used to provide concrete insights, while also being compatible with the systemic, inclusive approach needed for the improvement of CSA policy environments.

Contribution to CSA: The guidance of policies, strategies and investments can have significant impact on the feasibility of scaling up CSA by removing barriers, creating capacities, empowering the vulnerable and making key resources available. Climate adaptation and mitigation policies can help provide the incentives for adaptation of specific CSA approaches, both for short-term risks and long-term impacts. More mainstream agriculture and development policies can include CSA-specific interventions, as well as interventions that bolster climate resilience and sustainable agriculture more generally. For instance, broader approaches can raise livelihoods and capacities by increasing productivity or improving various food system conditions, such as storage and access to market.

Institutional arrangements

Institutions are key to agricultural development and resilient livelihoods. They are not only an organizing force for farmers and decision-makers, but are also the main means through which climate-smart agricultural practices can be scaled up and sustained. As such, appropriate institutional arrangements are fundamental for the implementation of almost any other entry point discussed on this website.

Contribution to CSA: There are numerous possible ways to understand institutional support to climate-smart agriculture (CSA). Natural resource management and common property approaches often focus on informal institutions defined as local practices, rules and norms. Informal institutions encompass moral norms, rules and regulations, used both within and across organizations and communities. Informal institutions are often addressed in community-based approaches dealing with collective action and decision-making as well as with access, rights and control over resources. However, local institutions are important in almost any agricultural development setting as it determines who may participate, how and to what extent. E.g. cultural practices and norms may dictate women's access to information and innovation critical to the implementation of CSA practices and technologies.

Value chains

Supply chains link the stakeholders that bring a product from the initial input supply stage, through the various phases of production, to its final market destination – and value chains add and distribute value along this supply chain. One way to describe food value chains are "farm-to-fork" which means that a food product moves from farmers who grow and harvest it, – through intermediaries including producers' organizations, processors, transporters, wholesalers and retailers – and down to consumers, though the pre-farm part of the value chain – manufacture and distribution of inputs such as seed, fertilizer, water, energy, new livestock and veterinary products – is also critical.

Value chain approaches bring relevant stakeholders together from different parts of the value chain and its policy environment, to make decisions in a coordinated way. Value chain approaches have become popular for solving problems such as inclusion of smallholders in modern value chains, or improving chain of custody and relevant outcomes such as food safety. Using value chain approaches in adaptation also makes a lot of sense. For example, it may be good for producers to shift to a crop or fish variety that is less susceptible to climate change; but the ability to market the new product will need change among consumers, retailers and logistics managers.

Contribution to CSA

- **Productivity:** Interventions focused on storage can help reduce post-harvest losses and deliver multiple benefits to productivity and farmer livelihoods, such as in the case of the Effective Grain Storage Project (EGSP). Access to markets can also increase incomes and improve livelihoods; for example, the Adapting to Markets and Climate Change Project in Nicaragua (NICADAPTA) will increase incomes and productivity by 20%.

- **Adaptation:** Successful value chain interventions that achieve poverty-alleviation goals will be beneficial to climate change adaptation, as they build farmers' assets and institutional linkages. For example, it is expected that 20,000 families in the coffee value chain in Nicaragua will improve their resilience through the NICADAPTA project.

- **Mitigation:** Value chain interventions can be designed to deliver mitigation benefits at multiple levels within the value chain; for example, in input production, logistics, transport, and reducing post-harvest losses. In Kenya, climate-smart feeding and husbandry practices disseminated to 600,000 farmers are expected to mitigate 1.2 million tCO_2e by 2018. In Nicaragua, the NICADAPTA project will reduce 2 million tonnes of CO_2e. Emissions data for different stages of the supply chain from these cases have not been found, and should be a priority for future studies.

SLIDE 23: INSTITUTIONAL/MARKET SMART ACTIVITIES

Given that the policy level interventions are critical for scaling up, here provide some examples for the participants and allow them to contribute their own experiences.

SLIDE 24: CASE STUDIES OF SUCCESSFUL CSA

Ask the participants to share examples from their own countries of successful projects that have used CSA principles and achieved gains in one or more of the three pillars. Encourage dialogue among participants to share details of the projects, how they came about, how they were financed, what kind of adoption rates were achieved, etc.

SLIDE 25: PART 2: PRIORITY SETTING FOR CSA OPTIONS

The second part of this module will go over a few tools that can help decision makers evaluate different CSA options and incentivize those that will have the best results. Before we start reviewing some of these tools, first we will go through the importance of considering different contexts in which CSA is evaluated.

SLIDE 26: CLIMATE HAZARDS AND RISKS

Prioritizing actions in agriculture has to begin with a situational analysis of the types of climate hazards and risks being faced by farmers in whatever context is being assessed. The response options have to be appropriate depending on the changes being experienced.

The graph on the slide shows that some countries will experience temperature increases alongside precipitation decreases and others will experience precipitation increases according to the climate models. Other aspects such as increasing pests and diseases must also be taken into account.

SLIDE 27: PRIORITY SETTING FOR CSA OPTIONS

No country is starting from scratch when selecting CSA options to implement. The CAADP agreement has led to countries creating National Agriculture Investment Plans (NAIPs) which prioritize specific subsectors or value chains. Plenty of other policies and instruments can offer guidance on types of activities and interventions. It is important to consider these strategies and plans that have already been created because there should be cohesion and alignment with them and the CSA options under consideration.

SLIDE 28: CSA COUNTRY PROFILES IN AFRICA

Another possible source of information on CSA options are the CSA country profiles that have been created for 14 African countries through support from the World Bank and USAID. These profiles assess the ‘smartness’ level and degree of adoption for a long list of practices relevant to each particular country.

The profiles are led by a team from CIAT who works with local agriculture research institutes and other stakeholders to evaluate the agricultural snapshot of the country, future climate impacts, ongoing and promising CSA practices, and more. The process used to compile these profiles can be done in a relatively short time frame, and the results are useful in helping to evaluate national climate change action plans and their relevance to the agriculture sector.

SLIDE 29: CSA INVESTMENT PLANS (CSAIPS)

Building on the CSA country profiles, the CSA Investment Plans (CSAIPs) are vehicles that can help attract funding and investments to drive large scale implementation of climate actions in agriculture. These are only available for a small number of countries as of mid-2020.

SLIDE 30: ECONOMIC EVALUATION TOOLS: ECONOMICS OF DIFFERENT POLICIES

There is a long list of policy options for helping food systems adapt to the changing climate. Economic evaluation tools, such as cost-benefit analysis, can help assess the value for money of undertaking these endeavours.

With limited resources, governments have difficult choices to make when it comes to where and how to invest for the best returns and more effective development interventions. Understanding the most critical climate risks that the agriculture sector is facing can help guide planning. Knowing rates of return for money invested in smart subsidy programs, improved climate forecasts and agricultural advisories, better market linkages, and other interventions can help guide decision making.

Such evaluations can be done at the farm-level, district level, or national level. There are farm-level budgets that can be used to calculate whether different CSA options will affect a farm’s income level. At a medium scale, spreadsheet input-output models can help assess the situation at a district or county scale. The country level becomes more complex and multi-criteria dynamic optimization models are needed.

SLIDE 31: PRIORITY SETTING FOR CSA OPTIONS

The presentation now moves into a specific tool that can be used to assess best-bet options for CSA: the online Evidence for Resilient Agriculture (ERA) database. The rest of the presentation will talk about how it can be used, and participants will have a chance to test it out and become familiar with its capabilities in the associated activity that takes place after the presentation.

SLIDE 32: THE CHALLENGE FOR DECISION MAKERS

Solid evidence on CSA practices is needed to be able to evaluate options and make the right decisions in specific contexts to avoid causing negative effects. The challenge is that there are many practices to evaluate, many goals to try to achieve simultaneously, and many varying contexts within a country and across the continent. The ERA database was compiled to help decision makers use available evidence from agricultural research trials to make data-driven decisions.

SLIDE 33: THE IMPORTANCE OF CONTEXT

This box plot is from a study in West Africa published in 2012 that evaluated the maize yield variation under different management practices.

As you can see in this graph, different practices have very different results in yield. This is within a grain-based farming system.

SLIDE 34: PRIORITY SETTING FOR CSA OPTIONS

From the last slide we saw that different practices can have different results in a specific system. Here, we see that the same practice can have different results in different agroecosystems.

This box plot is from a study published in 2014 that evaluated the effect of conservation agriculture on maize yield. Conservation agriculture is often thought to be climate-smart because it can help manage water efficiency, reduce production costs, and improve soil characteristics.

As you can see in this graph, conservation agriculture is not always beneficial. The results depend on the environment in which it is practiced. In dry areas, it can increase maize yields, but in humid contexts there is actually a reduction in yield. Keeping the biophysical context in mind is very important when considering CSA. What is climate smart in one area is not necessarily so in another area.

SLIDE 35: HOW TO DETERMINE THE BEST-BET OPTIONS TO SCALE UP?

Getting to the point of choosing which options will work best requires several steps. We've seen that the context really makes a difference, and the outcomes achieved from those options can be dependent on the context. We need data/evidence from research, but planning and carrying out field trials is a long and involved process. For CSA options, though, it is important to make data-based decisions. Promoting the wrong options for small-scale farmers can have drastic consequences for households and communities who are dependent on agriculture for their livelihoods.

SLIDE 36: TRADE-OFFS AND SYNERGIES

As we discussed earlier in the module, not every option will be a triple win. There may be times when synergies can be achieved, but it is also possible that trade-offs will have to be made. For example, agroforestry may lead to improved soil quality and sequestered carbon (mitigation) but it may also result in lower yields of staple crops in some instances. These trade-offs need to be weighed during selection of best-bet options.

SLIDE 37: DETERMINING BEST-BET OPTIONS USING SCIENTIFIC EVIDENCE

We know the importance of making evidence-based decisions, but how is it possible to go through all of the studies that have been published? Luckily, a team at the World Agroforestry Center has done this for us as part of their work within the CCAFS research program.

Through a long process that has lasted several years, they have searched through the literature, combing through thousands of published studies, and extracted data from 1700 papers that have formed the basis of ERA.

SLIDE 38: DETERMINING BEST-BET OPTIONS USING SCIENTIFIC EVIDENCE

It is now possible to use all of this scientific evidence to make data-driven decisions. Results from different studies in different locations can now be probed to have a better understanding of what might work and where. The upcoming activity will give you a chance to work with a partner and explore the ERA tool.

SLIDE 39: KEY MESSAGES

1. Climate-smart agriculture can help countries meet several of their development goals and NDC commitments

CSA focuses on both adaptation and mitigation, as do most NDCs. It also is aimed at improving food security, which is often a major development goal.

2. Many CSA practices are context-specific and need to be evaluated for each agro-ecosystem where they will be applied.

There is no prescribed set of practices that will be climate smart everywhere. Individual practices and technologies need to be evaluated in different contexts, keeping in mind such factors as gender, socioeconomic concerns, and other social issues.

3. There are many models and prioritization tools that can help evaluate CSA options to know which will provide the best return on investment.

Evidence-informed decision making can lead to better returns on investment and better development outcomes.

SLIDE 40: THANK YOU

Thank all the participants for their attention and open up the floor for questions and discussion.