THE CLIMAKERS

Guidelines for Policy Makers

INTRODUCTION

A key challenge for the agriculture sector is to feed an increasing global population while at the same time reducing the environmental impact. Agriculture has significant effects on the environment. Agriculture is the only sector that can positively impact the environment. It can trap greenhouse gases within crops and soils or mitigate flood risks by adopting certain farming practices. In this scenario, farmers worldwide have a real interest in promoting the health of the land and the environment. They are one of the most important actors in helping humanity adapt and mitigate climate change.

The following guidelines have been prepared by the CGIAR Research Program on Climate Change, Agriculture, and Food Security (CCAFS) based on the best practices that the farmers in the Climakers members' networks have shared as solutions proposed to mitigate and adapt to climate change.

These guidelines' goal is to provide national Governments with existing solutions in order to support them during the process of implementation of the Paris Agreement at the national level, based on the farmers' needs, expectations, and best practices gathered by the Climakers Initiative. The Initiative was born to tackle the necessity to mitigate or avoid the adverse effects of climate change in both the short and long term, which is one of the most critical threats our food systems face. In response to these challenges, the Farmer Driven Climate Change Agenda – the Climakers - was adopted in 2018 to improve the position of the farmers in the global political discussion on climate change, by creating an alliance with farmers from every corner of the world, the private sector, research institutes, NGOs, multi-stakeholder platforms, and media partners. The farmers involved in the Climakers Initiative are thought as the main actors in the global political process on climate change, following an authentic bottom-up approach through a renewed agenda that is **farmers-driven, science-based**, and **result-oriented**. The ambition of the Climakers Initiative is then influencing the Nationally Determined Contributions (NDCs) and National Adaptation Plans (NAPs), highlighting the differences between regions and countries. Indeed, there is no one-size fits all solution: solutions vastly differ from one region to another.

Farmers within the Climakers Alliance have been consulted to validate these guidelines and provided inputs and comments on the advocacy tool kit.

The guidelines explore three interrelated questions and outline some critical topics and action areas to help inform the National and global decision-making process. The first focuses on analyzing the context and linkage between agriculture and climate change, revealing insights into potential actions for achieving NDCs and NAPs goals. The second question tackles the necessity to integrate a holistic approach in decision-making processes to lead to a better and deeper understanding of local bottlenecks and barriers to adopting adaptation and mitigation actions. Finally, the last one aims to ensure that the decisions made will be sustainable over the long run. We proudly share these guidelines to showcase how best practices farmers are already implementing to mitigate and adapt to climate change, proving that farmers own an essential part of the solution.

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Highlights

- Despite more than 80% of Parties to UNFCCC incorporate the agricultural sector in their NDCs or NAPs, GHG emissions reductions and increases in adaptive capacity opportunities from the food systems, remain largely untapped due to a lack of national integrative and strategic planning hand in hand with farmer communities and local stakeholders.
- Agriculture is one of the sectors with greatest potential to materialise intertwined climate change mitigation and adaptation actions. Therefore, systemic and long-term approaches that integrate farmers' perspective into the co-design of policies at multiple scales are crucial to articulate, finance and enhance actions on the field toward more sustainable, inclusive, healthy and climate-resilient food system approaches.
- Decreasing the bottlenecks and barriers to adoption of the diversity of practices implemented by farmers, recognising key leverage points and acting collectively, can unlock adaptation and mitigation potential at multiple scales, and boost socio-economic and environmental opportunities from climate change policies.

Rationale and Purpose

Setting the stage to start. It is important decision-makers jointly agree on a clear idea of the rationale and purpose of the work that needs to be done to achieve NDCs and NAPs objectives. Exploring the crucial role of agriculture and farmers to contribute to the climate change dialogue and the direct actions needed in the field is always relevant.

A growing number of citizens and their states are becoming more aware of and committed to the urgent need to address in a coordinated and collective manner the challenges posed by environmental deterioration and climate change on the food systems, especially on the farming communities. Among multiple factors, this is explained in part, by the growing knowledge and understanding of the complexity of the socio-economic and environmental network in which agricultural systems operate. Likewise, the increasingly evident cascading effects that our dominant production patterns and consumption decisions trigger. Positively or negatively affecting the dynamics and functions of nature's cycles and agroecosystems that not only provide livelihoods for current and future human generations, but also sustain all life on Earth.

The purpose of these guidelines is to contribute **to building a common ground between the main adaptation and mitigation policies** at national level –named Nationally Determined Contributions (NDCs) and National Adaptation Plans (NAPs)– and the **potential leverage points** for unlocking the most common **bottlenecks and barriers to implementation** of these policies, in the face of climate-related impacts on agroecosystems and farmers' livelihoods. In addition, feed the discussion on the assembly points between climate change policy frameworks and the multiple actions that farmer communities around the world have experienced and experimented with, embodied in sustainable agricultural practices and technologies. These actions do not end in achieving food security and sovereignty, they also reveal opportunities, inform and inspire farmer-driven and nature-based solutions to boost climate change adaptation and mitigation strategies, in harmony with local and global decision-making processes in the transition toward food production models that coexist with nature.

We will explore three interrelated questions as a path to make progress towards this purpose and lay out some critical topics and action areas to help inform decision-making process at national and global levels.

The overall results will indeed take into consideration the marked differences in the level of industrialisation, per capita income, and other socio-economic and agroecological conditions of the farming community in developed and developing countries, which will ultimately influence the effective adoption of mitigation and adaptation practices and technologies.

1. Understanding why agriculture and how it is linked to global policies to tackle climate change

Global warming and climate change are a priority for humanity. Understanding the local context and the nexus between agriculture and climate change, reveal insights into potential actions for achieving NDCs and NAPs goals.

The Intergovernmental Panel on Climate Change (IPCC) - Working Group I (WGI) recently highlighted in the Sixth Assessment Report (AR6) the prevailing need to deploy ¨rapid, sustainable and large-scale¨ actions to reduce Greenhouse Gases (GHG) emissions resulting from human activities[1]. Climate projections indicate that without sound and rigorous science, policies, pledges and targets in place, within the next couple of decades the global temperature can certainly continue to rise beyond the 1.5°C limit determined in the Paris Agreement. Foreseen climate patterns risk to aggravate the increasingly frequent and severe weather events. Tropical cyclones, heavy rainfalls, heatwaves and droughts will continue driving negative effects in every region of the world, including terrestrial and marine ecosystems. Markedly affecting vulnerable countries whose ecosystems and food system activities are highly sensitive to multiple climate risks; face social conflicts; experience food and nutritional insecurity (situation exacerbated by Covid-19 pandemic); and where a large portion of their population depends on agricultural and livestock-based livelihoods [2,3].

The agricultural sector is one of the most vulnerable to climate-related risks, at the same time, it offers the greatest potential to carry out interlinked adaptation and mitigation actions at multiple scales. Achieving the pathway to limit global warming to 1.5oC undoubtedly requires a substantial effort, not only reducing emissions, but also enhancing carbon sinks. A reduction in emissions of around 7.4 Gt CO_2eq yr^{-1} can be attained from different sustainable strategies and practices in agriculture, land-use change, balanced diets and reduced food waste. Likewise, if carbon removals are considered, additional 6.5 Gt CO_2eq yr^{-1} can be added from actions toward restored forests, peatlands and coastal wetlands; improved plantations and agroforestry; enhanced soil carbon sequestration and biochar, totalling 13.9 Gt CO_2eq yr^{-1} equivalent to a significant 27.8% of global mitigation potential[4,5,6].

Nonetheless, the complexity and interconnectivity of the agricultural sector should be considered to bridge the gaps between actual and modelled emissions, as these could vary markedly across developed and developing countries, based on different factors such as the technological level of agricultural systems and value chains, culture-based food preferences and eating habits, infrastructure development, the GHG measurement methods and conversion rates used, and even the way to frame biological carbon cycles in a given crop or animal production system, etc. In parallel, these factors also influence the scope of implementation and impact evaluation of adaptation practices and projects in the agricultural sector. Therefore, synergies and trade-offs are subject to the possibilities and priorities set up by food stakeholders in local contexts[7], and punctual practices and technologies outlined in NDCs, NAPs and similar processes, may deliver differentiated mitigation and adaptation benefits and co-benefits according to specific social and agroecological conditions in which these are implemented or promoted by farmers and governments.

Though NAPs are not necessarily the adaptation equivalent of NDCs, both processes are mutually reinforcing and are vital to achieving the Paris Agreement goals. In this sense, the NAP process can help pinpoint how NDC's adaptation goals can be implemented, while the adaptation component of NDCs can strengthen NAP's outreach capacity, attracting additional financial and technical support for their implementation, particularly for the agricultural sector in developing countries. Aligning these two relevant processes is important to facilitate synergies across national policy frameworks, especially when actions around Sustainable Development Goals (SDGs) and Disaster Risk Reduction (DRR) strategies under the Sendai Framework, among others, are present and critical in the public agenda. In this vein, programmes such as *The Scaling up Climate Ambition on Land Use and Agriculture through NDCs and NAPs* (SCALA) illustrate how more than 10 partner countries and their ministries of agriculture and environment have worked to generate capacities in the identification and design of country-specific strategies and measures in the agricultural sector to meet their Paris Agreement commitments[8].

Therefore, these public efforts entail a robust articulation of objectives, timelines, budget and actors, along with crosscutting analyses and datasets –that should ideally use common metrics and methodologies– to ensure more coherent, efficient and effective financing mechanisms for actions implementation and their standardised measurement, reporting and verification (MRV) processes.

The presentation of these Guidelines to Policy Makers is based on the analysis and scientific assessment of best practices that the farmers are implementing as solutions to climate change mitigation and adaptation. Under the Climakers initiative, more than 70 best practices were collected from the Farmers worldwide and assessed against the criteria of the Climate-Smart Agriculture principles[9,10].

Something that strongly emerged from the Farmers' solutions, is that the way to tackle climate change is different for each country, and in turn for each farming community. Whereas implement actions to ensure food and nutritional security and adaptation –with mitigation co-benefits– are, in general, the priority-setting in developing countries, mitigation toward carbon-neutral economies and, to a lesser degree, adaptation tend to reflect the orientation in developed countries.

A snapshot of the current global status of NDCs submission by document type, indicates that 13 country Parties have submitted the Second NDC, 75 their First NDC, 104 have updated the First NDC, 4 continue with their INDC and 1 have not submitted it yet. Countries –including developing and developed– with First and Updated First NDC represent 45.9% and 45.4% of the global GHG emissions respectively[11]. In the case of the NAPs, although implementation strategies at national level are relatively in early stages, adaptation planning work is under way. Between 2018 and 2021, approximately 43 countries have submitted their NAPs and 167 have undertaken measures in the process to formulate and implement NAPs in both developed and developing country Parties[12,13]. This means that there is still room to harmonise efforts and enhance global commitments, in proportion to the direct responsibilities in the climate crisis to unlock the potential that the food system has to tackle climate change.

2. Where to look for the necessary leverage points to take action

We do need to integrate a holistic approach in decision-making processes. Analysing the agricultural challenges from multiple dimensions hand in hand with stakeholders, lead to a b
etter and deeper understanding of local bottlenecks and barriers to adoption of adaptation and mitigation actions. Likewise, facilitates the evaluation and prioritisation of practices or plans in a given context, making easier to inform and articulate the local needs with their potential opportunities and solutions at all levels.

When a systemic view is integrated in the decision-making process, the leverage points cannot only be found in positive experiences from sustainable practices implementation, these are certainly valuable, but there is also much to learn from other standpoints. Barriers and bottlenecks faced by farmers have much to tell, likewise test a simple variation in the way people and institutions interact, by reshaping a function or in the way a given resource is used, can also point out where the attention needs to be drawn. Therefore, an overview of the complex challenges in the food system, and a glimpse from multiple perspectives (henceforth ¨dimensions¨) and scales (local to regional) provide a sounder understanding of the leverage points and required actions to overcome bottlenecks and barriers to adoption of adaptation and mitigation practices and strategies. The five dimensions addressed below represent an adaptation from various authors[14,15,16,17,18], these include, but are not limited to, climate-related/environmental, economic, educational-technical, behavioural and cultural, and policy-institutional aspects.

Contamination and lack of water in watersheds; excessive, short and unpredictable rainy-dry seasons; floods; hails; sea-level rise; salinity intrusion; temperature increase; drought and prolonged dry periods; strong winds; storms; hurricanes; volcanic eruptions; forest fires; soil erosion; landslides; poor soil health and nutrient depletion; premature ageing of plants; biodiversity and agrobiodiversity loss; and increase in the range, frequency and severity of pests, diseases and invasive plants. These are

just some of the main **climate-related/environmental** challenges experienced by farmer communities around the world that will ultimately affect their territories and livelihoods. But to many, the story does not end here. Across the different value chain stages, farmers deal with additional issues related to the remaining dimensions.

For example, some of the most common problematics in the **economic dimension** expressed by farmers involve the high investment or maintenance costs of certain practices; high and fluctuating agricultural inputs and services costs; income reduction due to a low yield or loss of crops and animals coupled with poor-quality product. On top of that, the low selling price of the product in the market narrows the farmers' profit margins, limiting their possibility to reinvest in the farm out of the main harvesting season. Besides this, given the Covid-19 pandemic, farmers experienced a reduction of the number of available seasonal workers and open markets to sell their produce, and consumers were affected because of a reduced purchasing power, hence reducing farmers' sales volume. Conversely, experiences in Ghana with the market oriented coconut production initiative, the Panambi veve committee in Paraguay, the Farm Africa's Market Approaches to Resilience (MAR) in Ethiopia, the Carbon-Agri methodology in France[9,10], are examples of climate-smart approaches from the plot to the national scale, that encompass value addition and innovative product and market diversification, that enable farmer cooperatives to adapt and respond to economic and climatic shocks, while contribute to carbon-neutral economies.

Parallel to this, constraints from the **educational-technical dimension** exacerbate the above-mentioned issues. The uncertainty about the appropriate time to carry out planting, harvesting and other on-farm management activities due to the variable weather, is increasing. Access to markets, inputs and equipment, as well as tailored financial, agronomic or agro-climatic information services is still being difficult due to their affordability, restricted availability or remote location for farmers. Likewise, the high dependency to foreign and expensive inputs associated to a lack of local suppliers (SMEs), mainly of fertilisers and seeds adapted to local conditions. Additionally, the difficulties in sharing knowledge (horizontal dialogue), information (in a simple and clear language for farmers and stakeholders avoiding jargon) and technical know-how, hamper the peer-to-peer learning and the adoption of practices and technologies to address key issues throughout the value chain. Just to mention a few examples: water scarcity and inefficient use;; and post-harvest obstacles related to warehouse facilities to properly store seeds, animal feed or marketable product surplus. For this reason, Farmers' Advisory services experience in Cambodia, The Klimrek initiative in Belgium or the Climate Calculator in Norway[9,10], demonstrate how strategic partnerships with key actors in the public and private actors can boost farmers capacity to develop or implement digital tools, services and frameworks to facilitate the recognition and adoption of best-bet agricultural practices and technologies.

Regarding the **behavioural and cultural dimension**, the limited association capacity and the lack of support to producer organisations has been a common factor directly linked with the agricultural sector with consequences in other sectors. Additionally, climate change is forcing or accelerating transformations in social dynamics. There are relatively well-known implications that arise from this situation that require special attention, including the rural-to-urban migration, predominately of vulnerable groups and youth population. This phenomenon is in turn driven by the lack of jobs, armed conflict related to land grabbing, territory control or political reasons, etc., nevertheless, an underlying factor that is becoming increasingly relevant refers to climate-related disasters. This driver augments the migrant population, causing them to struggle to access dignified employment opportunities, and reinforces numerous negative cycles such as abandonment of the land and farming, rural ageing, loss of traditional knowledge, deepening of gender and social inequality, and food and nutrition insecurity.

In this context, the **policy-institutional** dimension performs a critical function in terms of ensuring that the necessary enabling conditions exist for citizens and states. Facilitating a framework that materialises any adaptation and mitigation action aimed at addressing climate change, while guaranteeing the other dimensions are always integral to the process. The most common barriers recognised at this level, reflect a lack of regulation around

land-use, land-tenure, and sustainable management of natural resources and economic activities, especially in rural areas and strategic regions for the provision of ecosystem services. In part, explained by diffuse budgets and above all, unclear roles, mandates and responsibilities across all social actors.
In this vein, disarticulation at the intra- and inter-institutional levels in both private sector and government, miscommunication and lack of engagement opportunities and scenarios, for farmers and other agricultural stakeholders to actively participate in the design, implementation, monitoring and evaluation of policies, plans, programs and projects, usually restrict the scope and progress of transformative initiatives. Moreover, trade-offs on investing in short- or long-term development priorities vs. climate adaptation and mitigation become difficult to avoid, especially in developing countries with limited financial capacity.

All previously mentioned barriers and bottlenecks could be heighted if some additional scenarios are present: i) research or available data is either patchy or insufficient to conduct risk-informed adaptation and mitigation planning and MRV processes. ii) there are conflicting political priorities, lack of political will for enforcement, and individual positions and interests are at stake. iii) there is a lack of awareness and competencies in the climate change field, implying that a deficit in technical capabilities, may compromise the possibility of local and national governments and farmers organisations, to not only successfully execute their plans or projects, but also to secure funding from the national and international communities to support such initiatives [14,16,17,19].

3. How to make sure action plans happen

Make things happen. Once leverage points are explored and recognised, co-design and test with stakeholders context-specific actions, with clear steps within a plan, facilitates and encourages their adoption, ensuring that decisions made will be sustainable over the long run.

It is expected that NDCs and NAPs can promote traction for national and international cooperation, through a transparent and participatory framework that legitimises every action to overcome barriers in their implementation processes. With that in mind, several organisations and networks worldwide have developed detailed guidelines (see the specific documentation in the resources section) to illustrate and facilitate the implementation process of these initiatives. As each country will approach the development and implementation of NDCs and NAPs processes in a differentiated manner according to their national circumstances, worth mentioning it is probable that in both cases some common steps can arise: ¨i) groundwork and gap analysis to identify priority activities and ¨buy in¨ level from the government. ii) conduct an assessment of the actors, resources needed, challenges and opportunities. iii) Sequencing activities and strategies incentivising dialogue at all levels within a multi-stakeholder platform, and iii) develop and document the implementation of action plans¨[7].
That said, integrating a ¨roles and responsibilities¨ lens in decision-making to address the identified bottlenecks and barriers, could be relevant to unlock implementation of adaptation and mitigation practices and policies at multiple scales. This may result helpful to organise and recognise who is involved in the process and what are the roles they can play, making clearer their responsibilities and necessary actions, while assist in visualising potential stakeholders partnerships and synergies.

- The public sector includes, but is not limited to, the ministries –agriculture, environment, finance etc.– and the various state agencies from the local to national levels. They are called upon to act in the design, elaboration and enforcement of agriculture and climate change policies. Ensure these policies are responsive and coherent with the national context, for example, in terms of the diversity of agricultural systems, farmer scales and their economic and technology conditions, food preference and eating habits, information available to fulfil agreed adaptation and mitigation targets etc.

Likewise, fostering integration and coordination of actors are major activities to guarantee that adaptation or mitigation projects are successful, particularly for those developed on an inter-institutional basis with participation of multiple sectors and actors. Increase information sharing, harmonise budget headings and legal regulations, and above all, generate physical and virtual spaces to listen and dialogue with farmer organisations and individuals, are just some entry points

that can ultimately avoid overlapping and duplication of efforts, making efficient use of time, personnel, infrastructure and scarce financial resources. This could also deliver co-benefits in two ways: stimulate the process of mobilising and channelling bilateral, multilateral and global funds effectively and, safeguards the transparency of processes reducing the risk of bias when there are agents with the economic or political power to prevent the formulation or implementation of regulations and public policies related to agriculture.

- **Academia and research**, including universities, research and extension institutes and centres, Grass Roots Organisations, NGOs and research divisions within companies etc., work under different levels of cooperation with farmers, private and public institutions. They participate in consultation throughout the NDCs and NAPs processes, and their efforts aim to advice –based on scientific evidence– about the priority mitigation and adaptation practices, technologies and strategies with greatest potential to deliver socio-economic and environmental benefits. They generate or disseminate the required information for filling the gaps on food and nutritional security, adaptation and mitigation issues, for example GHG emission quantification, resilience indicators assessment etc.

These actors should also ensure that data, tools, methodologies and metrics used are accessible and meaningful to farmers and national stakeholders, adequately informing decision-making while making sure these are compatible with international MRV processes. Climate information generation, analysis and dissemination, as well as the instruments for M&E, also demand an open dialogue across actors in order to coordinate activities and ensure that the final users e.g. farmers and decision-makers, can interpret meteorological information and recommendations, translating it into clear on-field practices, such as climate-adjusted cropping calendars for timely sowing and harvesting, and efficient pest and diseases management. Technical Agroclimatic Committees (MTA) or the Climate-smart Villages (CSVs) are examples of participatory approaches where farmers in Colombia, India, Kenya, Viet Nam and more than 18 countries across Africa, Asia and Latin America have actively contributed to this end.

- **The Private sector** comprises a wide spectrum of actors, including the great majority of companies and businesses at all scales. They voluntary join or lead efforts, developing diverse projects to reduce GHG emissions and pollution, increase reliance on renewable energy sources, stimulate the preference for local and sustainable inputs and suppliers, zero-waste, among others. Integration of offsetting schemes and carbon credits to increase carbon capture or compensate negative environmental impacts, supporting financially research and funding climate change-related projects, along with strengthening social and environmental resilience in different forms are common actions. The scope of these actions is also diverse in view of the heterogeneity of actors and sectors involved.

The regulation and standardisation of this type of projects in terms of emissions calculation, performance and M&E indicators measurement in order to inform NDCs and NAPs, need to be adjusted based on the technical capacity and financial resources available in each context. Hence, additional effort is required to make the MRV fully operational for all actors from farmers to governments, here worth mentioning copyrights, patents etc., which are sensitive issues that need to be further discussed so that it does not become a bottleneck in the process. It is also possible to harness on-going and future *corporate social and environmental responsibility programs and sustainability strategies* designed within the companies to integrate adaptation and mitigation practices. Generally, private sector projects in this matter arise from individual endeavours, tough adhering them to broader government programs is an option, reason why Public-Private Partnerships (PPP) also constitute a window of opportunity to leverage actions and initiatives.

- **Financial Sector** represents an arrangement of institutions, services and markets, comprised by many actors, from public and private banks, investment and insurance companies, to rural Microfinance Institutions (MFI) and cooperative credit unions, including state regulatory bodies. Stakeholders in this sector are supposed to be proactive in the creation of contextualised financial services and instruments that facilitate and promote among actors and their projects – from farmers to governments– an accelerated transition to low-carbon economies. Seeking that climate finance sources are guided and used wisely to leverage agriculture finance, mainstreaming climate change adaptation and mitigation into sustainable agricultural investments. To this

end, several instruments can be approached, for example, climate-based index insurances, factoring across the value chain, joint ventures, and farmer-controlled enterprise, as a result of collective ownership models encouraged to form their own cooperatives, farmer associations or collectives. Similarly, direct-to-consumer food marketing (e.g. community supported agriculture).

Agricultural loans are one of the most widespread instruments, hence affordable interest rates and tailored credit conditions that consider crop cycles and market calendars are important for farmers, especially for women who usually do not have land titles. Agricultural public banks and Microfinance Institutions (MFI) are often the nearest actors to the farmers in financial matters. However, electronic mobile money services and similar digital banking platforms are gaining space as practical and plausible options for farmers to make their transactions, making internet connection an essential service to enhance farmers connectivity. It is inevitable that multidimensional challenges –such as internal organisation and democracy, technical skills for business plans design and new technologies appropriation etc.– come along with these processes, however these can be overcome with the adequate coordination, education and technical support from all above-mentioned actors.

Farmers know from first-hand the challenges and opportunities in the territories and citizens in general are more aware, organised and willing to be part of the solution against climate change, even through small-scale actions. Therefore engaging and empowering individual farmers and their communities to actively participate in an inclusive policy design process is indispensable. However, this requires a joint effort among all actors to strengthen self-governance and self-determination of farmer communities and organisations, as this demands *commitment*, in terms of respect, protection and compliance with agreements. Facilitation of the *safety conditions* by guaranteeing access to land and financial resources, without gender-based discrimination. Securing *education*, in regards to quality education opportunities and a proper learning environment with focus in the rural context (linking their ancestral knowledge with scientific findings to generate innovative approaches and tools), as well as, evolving around the dialogue between producer and consumer to transform and promote dietary patterns with positive impacts on human and environmental health. Enabling *economic opportunities*, that allow diversification of farmers' of livelihoods, for example, participation in fair trade markets (with emphasis in local consumption), ecosystems services conservation and sustainable food production projects (incorporating emissions trading programs), digital and technological inclusion (agroclimatic and trading platforms, Apps, modern equipment, alternative energies etc.). Sound farmers' organisation and cooperation enable the conditions to, as mentioned, be part of the design of new laws and policies under climate-related challenges and effectively hold governments to account and support their implementation[20].

Finally, analyse how farmers tackle climate change in their daily management practices across the value chain – unlocking adaptation and mitigation co-benefits at multiple scales– is key to identify and tap emerging opportunities in the collective design of public policies throughout NDCs and NAPs implementation processes.

Practices and technologies that farmer communities are implementing worldwide are capable to bring direct and indirect benefits for food and nutritional security, adaptation and mitigation. The magnitude of these benefits varies across regions, as there is ¨no one-size fits-all solution¨[21]. For this reason, bottom-up approaches integrating farmer experiences must inform and complement the public policies design that generally present a top-down vision. In this sense, a significant effort has been achieved through the Stories from the field compilation (Vol. 1 and Vol. 2 Covid-19 Special edition[9,10]) to incorporate farmers' perspective into the global food system and climate change dialogue. Outlining successful cases of practices and technologies implementation that represent exemplary options of leverage points for moving beyond conventional agriculture toward more sustainable, inclusive, healthy and climate-resilient food system approaches[22]. Simultaneously, these remarkable experiences encourage stakeholders to expand their curiosity and awareness about the vital role that farmers play, by telling the stories of people and communities adversely affected by climate change and that are taking action in the frontline to adapt and mitigate to its impacts, while they feed the world.

Let us start with **water management and conservation** practices. From the plot to the river basin level, the design and

implementation of water harvesting and storage techniques at different scales coupled with different types or pumping and irrigation systems, e.g. drip irrigation, enable farmers to access water year-round for consumption and agricultural production. Improvements in nutrient use efficiency and water use are complementary through fertigation: Fertigation is the process of applying water-soluble fertilizers through irrigation systems to supply plants with their daily water and nutrient needs for their specific growth stage. Microfertigation is generally considered as one of the most promising options for the future of food production today: It allows fertilizer applications rates to be dosed according to plant uptake rates, distributes nutrients directly to the root zone and reduces water use. It has shown to result in high crop yields and up to 90 % of nutrient use and water use efficiency.

As organic and mineral fertilizers are applied into leaky biological systems, they are naturally subject to losses to the environment. Thus it is critical to optimize the nutrient uptake by the plant.
Nutrient Use Efficiency refers to the proportion of nutrients applied from organic and mineral sources that are taken up by the crop; it is a useful indicator to determine the efficiency of fertilizer management in the country, whilst minimizing environmental losses. Site and crop specific Best Management Practices, such as the 4Rs (using the right source, at the right dose, in the right place, at the right time) will improve Nutrient Use Efficiency. Governments can develop specific nutrient use efficiency targets and improvement roadmaps to reduce either the excess of fertilizer use or increase application rates as needed.

This ensures household and regional food security, while strengthens farmers' resilience to prolonged or irregular dry seasons by making efficient use of available water and reducing the energy required for irrigation (e.g. changing from fuel pumps to solar-powered systems). Even in the context of developing countries in Africa, Asia, and Latina America and the Caribbean, where the access to freshwater is rather difficult, this could save time and money considering the cost of the water and its transportation from remote places, which indirectly contributes to reduce GHG emissions. In parallel, farmer communities part of *water user associations* often implement projects for protecting watersheds and water sources by regulating or monitoring its communal use, these initiatives often include delimitation of protected areas and afforestation or reforestation with native trees, activities that also bring co-benefits in terms of carbon sequestration and biodiversity conservation.

We cannot speak of water conservation without addressing **soil management and conservation**. Soil is a living system that integrates physical, chemical and biological characteristics that have to be considered as a unit in order to preserve its long-term fertility and health. Firstly no-till or minimum tillage to avoid soil structure degradation and compaction that reduces its capacity to store water resulting in erosion and loss of its biota. Additionally reduces significantly emissions in the ploughing process. Crop rotation with perennial and annual species and use of cover crops ideally with Nitrogen-fixing plants e.g. legumes help to reduce water and wind erosion and maintain nutrient cycles in the soil. This translates into better yields and more diverse harvests, while reducing emissions associated with the permanent use of synthetic fertilisers. By conserving organic matter in the soil, one of the largest known carbon stocks is also maintained. To secure yield increase and sustainable crop growth, scientific evidence has shown that complementing existing organic nutrients with well adapted mineral fertilizers works best, as mineral fertilizers offer the right doses of required nutrients to optimize plant health. In addition, planning and design drainage systems, terraces, living barriers or stone bunds contribute to reduce vulnerability to landslides, erosion and crop failure due to heavy rains and flash floods and maintain soil moisture in dry seasons among other benefits in biodiversity.

Another cluster of practices linked with soil conservation is **diversification and biodiversity conservation**. In addition to crop rotation and intercropping (polyculture), the introduction of woody species by farmers, as part of silvopastoral or agroforestry systems, live fences, and conservation of natural areas in the farm, have shown to be triple-win practices in terms of diversification of farmers' production, while reducing exposure to market constraints and climate-related risks. Community seed banks are also contributing to maintain agrobiodiversity and preserve local varieties overcoming climate and value chain related issues, such seed supply, post-harvest and marketing. In a similar vein, the integration of aquaculture, poultry or livestock with

crop systems is a no-regret diversification option to generate positive socio-economic and environmental benefits for farmers and society. Besides that, community-based rehabilitation of green corridors and sustainable food and raw material production in forest areas, along with planned agrotourism, have also a great potential to not only preserve ecosystem services including biodiversity for pollination, soil formation and nutrient cycling, but also to maintain carbon sinks and open opportunities for carbon capture projects.

Farmers are also transitioning to the use of **alternative agricultural inputs**. Practices such as biofertilisers, manure and crop residues composting, biofactories –to produce solid and liquid organic and mineral fertilisers and pest and diseases solutions– contribute to food security and adaptation when the reliance to external and usually expensive inputs is minimised. Biological controllers and a range of preventive, ¨push-pull¨ and monitoring practices for pest and diseases management have also demonstrated to protect soil biota and fauna and flora in the agroecosystem, with co-benefits in mitigation due to the reduction of emissions associated to the manufacturing, transportation, application of conventional fertilisers and pesticides. Many farmers in North America and European countries –and increasingly in developing countries– are implementing alternative energies in their farms for different purposes. For example, biogas production systems –from pig or cattle manure and slurry– is recognised as a worthy substitute of fossil fuels for heating, cooking and processing activities, likewise solar energy is integrated in electric fences, heating of animal shelters as well as processing and transportation. Notwithstanding of the technical challenges that this kind of technologies entail in the rural context, mainly in developing countries, the market is constantly evolving and becoming accessible and cost-effective for farmers. This, without mentioning the potential reductions in pollution and GHG emissions.

Specific practices and technologies for value addition on-site as well as for marketing often go hand in hand with leadership and cooperation strategies between farmers and among stakeholders. This synergy will ultimately leverage the opportunities and actions to enable the necessary support to succeed in the implementation process. Additionally, UNDP stated eleven optional policy instruments designed to support the implementation of practices and actions considering the vision of the NDC process[23]:
1) *Regulation and standards* that denote the minimum requirements to accomplish the objective of the practice (reduction of emissions, efficiency in input use, etc.). 2) *taxes and charges* (fuel or carbon taxes, etc.). 3) *Subsidies and incentives from the government to practices aligned to NDCs targets* (direct payment, prices support or tax reduction). 4) *Emissions trading programs. 5) Voluntary agreements or measures* (from public or private sectors or jointly, implying rewards and penalties). 6) *Information instruments for changing behaviours by increasing awareness* (information and education campaigns, participatory certification programs, etc.). 7) *Research, development, and deployment (RD&D) policies* (direct government funding in RD&D activities). 8) *Public procurement policies* (public procurement process based on attributes e.g. GHG emissions). 9) I*nfrastructure programs* (provision or authorisation to develop certain infrastructure). 10) *Implementation of new technologies, processes, or practices* (aligned with mitigation goals). 11) *Financing and investment* (grants and loans).

4. Resources to support decision-making

NDCs:

Implementing Nationally Determined Contributions (NDCs)

Planning for NDC implementation: A Quick-Start Guide

NAPs:

Technical guidelines for the national adaptation plan process

In terms of financing opportunities, decision-makers can explore more than 27 national and international implementing agencies and institutions that channel funds from bilateral (ICF, IKI, NAMA Facility and 5+ sources), multilateral funds and initiatives (GCF, AF, GEF and 20+ sources), as well as over 15 regional and national funds (see the global climate finance architecture in CSA 101 portal below).

Resources

Main reference for the guidelines

The Climakers – Stories from the Field – Volume 1
The Climakers – Stories from the Field – Covid 19 Special Edition
The Climakers – Stories from the Field – Volume 2

Food + Nutritional Security

Food security and nutrition for all
https://gaez.fao.org/
USDA economic Research Service

Adaptation / Resilience

California Landscape – Resources
Climate Adapt
LCLIP: Local Climate Impacts Profile
NAP Global Network – Resource Library
Partnership for Resilience & Preparedness- Resources
Placard - Tools
Rapid Vulnerability & Adaptation Tool (RVAT)
Think Hazard - Tool
UKCIP – Resources
Wizard Tools

Mitigation

Mitigation Options Tool For Agriculture (CCAFS-MOT)
The Cool Farm Tool
The EX-ACT suite of tools

Food Security + Adaptation + Mitigation

Big Facts CGIAR – Resources
CGIAR – Resources
CGSpace – Resources
Climate-Smart Agriculture – CSA 101 Portal
CSA country profiles
Climate Watch - Tool

Data sets and web portals

NOOA – Digital Coast
ERA – Evidence for Resilient Agriculture
FAO Statistic - FAOSTAT
GIZ – Projektdaten
IPCC WGI Interactive Atlas
IRI – Data Library
Resource Watch – Maps and Data
USDA – Food Safety and Inspection Service
WRI – Data and Resources

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