Food and Agriculture Organization of the United Nations

Catalysing climate solutions

An introduction to FAO's work on climate change adaptation in agrifood systems

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Diversity is key to climate change adaptation: How FAO's Commission on Genetic Resources for Food and Agriculture is protecting agrobiodiversity: Dan Leskien (OCBC).

Forestry-based adaptation in the Bolivarian Republic of Venezuela – how traditional knowledge can boost forest conservation and resilience: Milagro Viloria (FAOVE).

From planning to implementation: How the SCALA programme accelerates resilience building by turning NAPs and NDCs into action: Rebecca AbiKhalil (OCBD).

Grazing with trees in Tunisia – adapting livestock production and boosting ecosystem resilience in drylands: Miranda Wadham Smith (NFOD).

How SHARP+ supported project design, implementation and monitoring in Burundi: Sirine Johnston (NSPD).

Participatory climate services for informed adaptation actions in East Africa: Deborah Duveskog (FAOKE).

Strengthening agricultural adaptation through multi-stakeholder approaches in Senegal: Awa Mbodj (OCBD).

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Abbreviations

ABC-Map	Adaptation, Biodiversity, and Carbon Mapping Tool
ACREI	Agricultural Climate Resilience Enhancement Initiaitve
AFOLU	Agriculture, Forestry and Other Land Use
APCNF	Andhra Pradesh Community Managed Natural Farming
CACLIM	Central Asian Countries Initiative for Land Management
CAEP	Climate Action Enhancement Package
CAVA	The Climate and Agriculture Risk Visualization and Assessment
CCK-Hub	Climate Change Knowledge Hub
CIS	Climate Information Services
COP	Conference of the Parties
CRTB	Climate Risk Toolbox
CSA	Climate-smart agriculture
EbA	Ecosystem-based Adaptation
FAST	Food and Agriculture for Sustainable Transformation
FAO	Food and Agriculture Organization of the United Nations
FFS	Farmer Field School
GAMS	Gums for Adaptation and Mitigation in Sudan
GCF	Green Climate Fund
GEF	Green Environment Facility
GGA	Global Goal on Adaptation
GSP	Global Soil Partnership
I-CAN	Initiative on Nutrition and Climate Change
ICPAC	Climate Prediction and Applications Centre
IFAD	International Fund for Agricultural Development
IGAD	Intergovernmental Authority on Development

IPCC	Intergovernmental Panel on Climate Change
JFFLS	Junior Farmer Field and Life School
KJWA	Koronivia joint work on agriculture
M&E	monitoring and evaluation
MOSAICC	Modelling System for Agricultural Impacts of Climate Change
NAP	National Adaptation Plan
NbS	Nature-based Solutions
NDCs	nationally determined contributions
NZAF	Net-Zero Adaptation Finance
PSP	Participatory Scenario Planning
REDD+	Reducing Emissions from Deforestation and Forest Degradation
SAGA	Strengthening Agricultural Adaptation
SCALA	Scaling up Climate Ambition on Land Use and Agriculture through nationally determined contributions and National Adaptation Plans
SDGs	Sustainable Development Goals
SHARP+	Self-evaluation and Holistic Assessment of Climate Resilience of Farmers and Pastoralists
SLA	Service level Agreement
SSTC	South-South triangular cooperation
UN	United Nations
UNDP	United Nations Development Programme
UNFCCC	United Nations Framework Convention on Climate Change
UNICEF	United Nations Children's Fund
WFP	World Food Programme
WHO	World Health Organization
WMO	World Meteorological Organization

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1. Introduction

Climate change impacts agrifood systems worldwide. Extreme weather events and altered temperature and precipitation patterns affect crop yields, fodder availability, fish stocks, and forests. Vulnerable stakeholders in agrifood systems, such as small-scale farmers, fishers, and pastoralists are often among the first to suffer from the negative impacts that jeopardize their livelihoods. The statistics are alarming – between 691 and 783 million people faced hunger in 2022, and about 2.4 billion people were moderately or severely food insecure. At the same time, agrifood systems globally account for an estimated third of total greenhouse gas (GHG) emissions and contribute to widespread environmental degradation, pollution, and biodiversity loss. If not addressed, these climate conditions will have a disastrous effect on people's livelihoods.

The Intergovernmental Panel on Climate Change (IPCC) states that climate change and ecosystem degradation (IPCC, 2022) lead to reduced agricultural productivity and disrupt local and global value chains, posing a significant threat to food security. Estimates suggest that due to global warming, global agricultural economic productivity is around 21 percent lower than its potential (Ortiz-Bobea *et al.*, 2021). Up to 10 percent of the areas suitable for crop and livestock production are expected to be climatically unfavourable by mid-century. According to IPCC, the situation will continue to worsen and the affected areas will reach up to 34 percent by the end of the century (IPCC, 2022).

Adaptation and climate change mitigation have become vital to ensuring that agrifood systems provide food and nutrition security for all (IPCC, 2022).

Adaptation in agriculture means modifying land use, agricultural production, socioeconomic and institutional systems, and policymaking in response to and in preparation for actual or expected climate change variability and its impacts to moderate harmful effects and exploit beneficial opportunities.

The Paris Agreement and the Agenda 2030 for Sustainable Development stress the urgent need to take measures on a global level against the consequences of climate change. They fully support the long-term temperature goal set by the Copenhagen Accord to keep the increase in global temperature to well below 2°C, ideally 1.5°C above pre-industrial levels. (UNFCCC, 2016).

Drastically limiting GHG emissions and mitigating climate change is crucial. However, effectively adapting to the impacts of a changing climate and building resilience is just as important. In view of this, Parties agreed to the Global Goal on Adaptation (GGA).[1] The GGA aims at "enhancing adaptive capacity, strengthening resilience, and reducing vulnerability to climate change, with a view to contributing to sustainable development and ensuring an adequate adaptation response to climate change impacts" (UNFCCC, 2016).

The agriculture and land-use sectors play a fundamental role, and to achieve the targets set by the GGA they require close attention. Demands for food, feed, and fibre are expected to intensify, as a result, the interplay between climate and food security will shape sustainable development for decades. Well-adapted and climate-robust agrifood systems contribute to global sustainability via carbon sequestration, biodiversity conservation, and ecosystem health, and also determine economic and social stability. The agriculture and land-use sectors are key to meeting the adaptation and mitigation targets set by nationally determined contributions (NDCs) and National Adaptation Plans (NAPs).

"We must boost adaptation to climate change, which is not keeping pace despite increasing impacts on vulnerable communities. It needs to include agrifood systems as integral components, a central element of FAO's work. We need adaptation actions grounded in local contexts and priorities, and responsive to the gender and generational dimensions of the agrifood systems' actors."

Maria Helena Semedo, FAO Deputy Director-General Natural Resources and Sustainable Production Stream

The United Nations Framework Convention on Climate Change (UNFCCC) acknowledges the importance of adapting agrifood systems and has expressed its concerns about the impacts of climate change on agriculture and food security in the Paris Agreement preamble. This resulted in the

[1] The UNFCC outlines the objectives of GGA in Article 7.1 of the Paris Agreement.

adoption of the Conference of the Parties (COP) decisions on the Koronivia Joint Work on Agriculture (KJWA) at COP23 (4/CP.23) and the Sharm El Sheikh joint work on implementation of climate action for agriculture and food security (3/CP.27) at COP27.[2]

The United Nations Food Systems Summit+2 Stocktaking Moment in 2023 helped build this momentum. Hosted by the Italian Government in collaboration with the Rome-based agencies the Food and Agriculture Organization of the United Nations (FAO), the International Fund for Agricultural Development (IFAD), and the World Food Programme (WFP), and jointly held with the Global Stocktaking Moment, brought together leaders, policy makers and stakeholders at FAO headquarters from 24 to 26 July 2023. The participants worked towards the creation of inclusive, sustainable, and resilient agrifood systems, taking into consideration their interconnectedness with the environment, climate, and human well-being. The Food System's Summit provided the opportunity for countries to report on the progress they had made since the 2021 Food Systems Summit.

The COP28 Presidency has identified agrifood systems and agriculture as one of the top priorities of its presidential action agenda. Through a series of high-level events, it leverages the increased political willingness of heads of states to participate in the national challenge and commitment to climate change adaptation in agrifood systems. In this context, the COP28 Presidency launched the Emirates Declaration on Sustainable Agriculture, Resilient Food Systems, and Climate Action. Its main objective is to provide a foundation for climate action in agrifood systems through countries and non-state actors.

FAO's global presence and wide-ranging expertise make it a leading player in the areas of agriculture and food security. Following its mandate to build a world without hunger, it helps its member countries develop climate-resilient and low-emission agrifood systems under the guidance of the Strategic Framework 2022-2031. With its four guiding principles: better production, better nutrition, better environment and better life, the framework underlines the significance of adaptation and mitigation measures. In addition, the **FAO Strategy on Climate Change 2022–2031** and its **Action Plan 2022–2025**, are closely aligned with the new strategic framework and reflect the four guiding principles and their interconnectedness. FAO focuses on adaptation solutions requiring a holistic and integrated approach to tackle interrelated global challenges. Furthermore, it stresses the importance of systems thinking to find adequate adaptation solutions to achieve the Sustainable Development

[2] These agenda items both fall under the UNFCCC Subsidiary Body for Scientific and Technology Advice and the Subsidiary Body on Implementation.

Goals (SDGs). In sum, it uses the food systems approach[3] to tackle the nexus of climate change, food, water and energy, bearing in mind that the entire food supply chain is a unified system.

THE CLIMATE CHANGE – FOOD–WATER – ENERGY NEXUS: WHY WE NEED SYSTEMS THINKING TO ADAPT TO THE CLIMATE CRISIS

The "food–water–energy nexus" refers to the interconnected relationship between climate change, food security, water resources, and energy. It highlights the complex and mutually influential interactions among these three critical factors. Understanding this nexus is essential to addressing the challenges posed by climate change on agriculture, food production, and access to clean water and energy. Integrating a nexus approach into the design of adaptation strategies can yield a wide range of benefits, which can then address the complexity and interconnectedness of climate change challenges and their impacts. Adaptation solutions stemming from a nexus approach will be more efficient, effective, inclusive, and flexible, allowing for more successful resilience building and strengthening of the adaptive capacity of communities.

In its latest assessment report, the IPCC states that a wide range of adaptation options can be effective in reducing climate impacts in different socioeconomic and geographical contexts (IPCC, 2022). However, the latest United Nations Environment Programme Adaptation Gap Report (AGR) affirms that adaptation progress is slowing down on all fronts instead of accelerating to keep up with rising climate change impacts (UNEP, 2023). In spite of the increasing necessity for effective actions, adaptation planning and implementation appear to be stagnating. Around 17 percent of all countries still lack an effective adaptation planning instrument, and the number of actions has plateaued over the last decade (UNEP, 2023). Similar trends can be observed in the climate finance sector. In fact, much-needed adaptation finance flows to developing countries declined by 15 percent in 2021, leaving a financial gap between needs and flows amounting to USD 194–366 billion per year (UNEP, 2023).

To effectively bridge the adaptation gap, FAO applies systems thinking and holistic approaches to connect its actions and support mechanisms across different levels and sectors. FAO's support enables its Members to implement adaptation solutions that build resilience among communities,

[3] A food systems approach considers the food system in its totality, including all its elements, relationships, and related effects. It is not confined to one single sector, sub-system (e.g. value chain, market) or discipline, but considers all relevant causal variables of a problem and all social, environmental, and economic impacts of the solutions to achieve transformational systemic changes. FAO, 2018. **https://www.fao.org/3/ca2079en/CA2079EN.pdf**

stakeholders, and ecosystems, thus facilitating the sustainable production of safe foods for healthy and nutritious diets.

FAO has recently developed mutually reinforcing strategies on themes including nutrition, the private sector engagement, gender equality, mainstreaming biodiversity across agricultural sectors, corporate environmental responsibility, and science and innovation. Starting at the local level, it implements strategies in collaboration with local communities and stakeholders from different agricultural subsectors. At the national and sub-national level, it closes the gaps in adaptation planning and policy instruments by helping governments formulate and implement their NDCs and NAPs. Globally, it drives international initiatives, partnerships and networks that advocate for effective climate policies and mobilize adaptation finance and investments into resilience building in the agriculture sectors.

FAO inspires countries and multi-stakeholder networks to scale good or best-case solutions, which in turn reinforces South-South and triangular collaboration (SSTC). This paper presents a collection of FAO's adaptation actions from around the world and across sectors. It introduces FAO's work on the local, national and global level and gives illustrative examples showcasing FAO projects, initiatives, and partnerships working towards climate change adaptation in agrifood systems. By supporting the implementation of practical solutions, FAO shows how change and transformation are possible.

2. FAO in action: how FAO supports climate change adaptation in agrifood systems

FAO builds on the guiding principles of the Strategy on Climate Change 2022-2031 to achieve its vision of climate-resilient, and sustainable agrifood systems, by actively supporting, developing, and implementing effective climate adaptation actions. The core of these principles is to empower farmers, livestock keepers, fishers, aquaculturists, and forest-dependent people, and to promote country-driven climate action. It furthermore stresses the importance of global advocacy and international partnerships while employing context-specific multi-stakeholder approaches to climate change adaptation. To ensure that adaptation solutions unfold their maximum transformative potential, FAO emphasizes vertical and horizontal integration. This means working across different levels of governance, from global to local levels in collaboration with stakeholders from different sectors and sub-sectors.

On the local level, FAO is working closely with farmers and other stakeholders, lending special attention to Indigenous communities, small-scale producers, women, youth, local and marginalized communities, and people in vulnerable situations. It aims to identify and support the implementation of the best-suited adaptation solutions tailored to specific contexts and situations, capacity-building and training for the local population being some of its most important entry points. FAO delivers field interventions in over 130 countries worldwide.

Thanks to its experience with supporting country-level NAP formulation and implementation, continued progress is being made towards adaptation in national climate change strategies, policies and plans. So far, 21 countries receiving support have started integrating adaptation into national, subnational and local-level development plans. In addition, 11 FAO-supported countries are developing a strategy for mobilization of the private sector to catalyse investments in climate change adaptation, and 21 countries are in the process of identifying measures to strengthen gender responsiveness in NAP formulation and implementation.

The majority of the adaptation elements in all new or updated NDCs include adaptation in the agricultural sectors, which demonstrates the growing commitment among countries to build resilience in their agrifood systems. Together with the NDC Partnership, FAO has supported 21 countries under the Climate Action Enhancement Package (CAEP) in response to the technical requests made for enhancing ambition and accelerating the implementation of their NDCs. Additionally, over ten FAO projects and initiatives support 61 countries across all regions of the world, providing technical guidance, policy advice and tools and technologies for the formulation, implementation and tracking of NDCs.

At the global level, FAO is one of the main international players in the agriculture and food security field. Its expertise and influence contribute to informing international agreements and guidelines that highlight the importance of climate-resilient agrifood systems. FAO strongly advocates for the integration of agriculture and food security into global climate policies, emphasizing how agrifood systems can play an essential role in solving the climate crisis and achieving the SDGs. Moreover, it shares its technical expertise through successful global partnerships and networks and provides policy advocacy to address the critical nexus between climate change, agriculture, and food security.

The local level: practical adaptation solutions from the field – scaling up climate action on the ground

At the local level, FAO is working with different agricultural subsectors and systems to co-develop innovative adaptation actions together with farmers, pastoralists, Indigenous communities, fisherfolk, and aquaculturists, and other stakeholders. This approach has reduced the vulnerability of various communities and value chains, and notably improved food security and adaptive capacity. Furthermore, it has provided co-benefits for climate change mitigation and inclusive sustainable development. Putting local communities in the driver's seat has proven to be a more effective way to create efficient adaptation strategies. Thanks to this approach, they are better tailored to specific local contexts and needs, unlock valuable traditional knowledge, and enable inclusive group-learning processes. Therefore, FAO continues to leverage the transformative potential of locally-led actions through Farmer Field Schools (FFS) and other holistic approaches to building adaptive capacity and resilience.

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FARMER FIELD SCHOOLS FOR ADAPTATION

The FFS approach is implemented in over 100 countries and is one of the most well-established and extensive approaches, globally. In fact, every year between 400 000 and 1 million farmers are trained through FFS worldwide. The participatory education approach based on group-learning and local knowledge systems uses experimental learning techniques to strengthen land-users' decision-making capacity. Since successful climate change adaptation requires farmers and herders to take the lead and become experts in their own farming practices, the FFS are one of FAO's main entry points to developing activities that enhance food security and nutrition, and to supporting climate adaptation and mitigation. In Eastern and Western Africa in particular, it is scaling up the FFS approach to facilitate dynamic, locally-led climate action, and reduce the vulnerability of local communities. In climate change enhanced FFS, participants learn basic science around rainfall, wind, temperatures, and their impact on agricultural systems, facilitated in collaboration with agricultural and meteorological departments. This allows for the development of best-fit scenarios for on- and off-farm climate action, increasing farmers' resilience against climate shocks, and strengthening and diversifying livelihoods for a sustainable future.

In regions where young people constitute a big part of the population in particular, rural youth are essential stakeholders in the pursuit of effective climate change adaptation. FAO considers their active participation indispensable to the development and promotion of sustainable practices and innovative solutions contributing to a more climate-resilient future. In this context, it developed Youth and Junior Farmer Field and Life Schools (JFFLS), to teach vulnerable children and young people topics related to youth employment, migration, green jobs, climate change, farming and business. The JFFLS target young people up to 35 years old, and to date, more than 25 000 young women and men have participated in JFFLS in over 20 countries.

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FAO'S FOCUS ON GENDER-TRANSFORMATIVE ACTION

FAO considers women's empowerment and gender equality to be a key part of achieving the SDGs and are intrinsically important for the well-being of women and men. SDG 5 has called to achieve gender equality and empowerment for all women and girls by 2030, and FAO is working towards achieving that goal. Despite the increasing attention placed on gender since the Fourth World Conference on Women, held in Beijing in 1995, there are still large gaps in achieving gender equality in agrifood systems (FAO, 2023). For example, since the outbreak of the COVID-19 pandemic, the gap between women's and men's food insecurity has increased by 4.3 percent, with significantly higher food insecurity among rural women (FAO, 2023a). Closing these gaps would greatly improve food security and nutrition, and increase economic growth. FAO acknowledges that efficient, inclusive, resilient, and sustainable agrifood systems depend on the empowerment of women and gender equality, and has therefore included gender mainstreaming as one of the guiding principles of the Strategy on Climate Change 2022–2031. It considers gender inclusion as a central cross-sectoral "accelerator" for successful climate action, and promotes gender-transformative and participatory climate action. FAO's Policy on Gender Equality 2020–2030 reflects this philosophy, and its commitment to promoting gender equality is an integral part of its mandate and contribution towards the implementation of the 2030 Agenda and the SDGs.

In all the regions of the world, FAO has empowered local stakeholders to co-design and implement climate change adaptation solutions that include for instance, agroecological practices, Ecosystem-based Adaptation (EbA) in forestry systems, Nature-based Solutions (NbS) for adapted pastoralist techniques, introducing new seed variants and irrigation techniques, and entering untapped value chains and markets. Promoting and implementing practical solutions and concrete adaptation actions, FAO partners with local governments and other organizations to ensure the longevity and sustainability of its impacts, provide tools, data, and resources, and assist in finance mobilization for local projects. The following selection of cases studies gives an insight into FAO's work on the ground and shows the variety of different projects and approaches FAO implements to assist local stakeholders in building resilience and adapting to climate change.

PARTICIPATORY CLIMATE SERVICES FOR INFORMED ADAPTATION ACTIONS IN EAST AFRICA

The Greater Horn of Africa is at a high risk of experiencing extreme weather events, which have a severe impact on the region's predominantly rain-fed agriculture. The risks associated with droughts and floods to rural agro-pastoral livelihoods are enormous. Despite efforts to mitigate these risks, persistent and worsening food and nutrition insecurity remains a major concern. Climate information and services (CIS) are vital to planning and implementing successful climate change adaptation actions, however, the dissemination and access to CIS is often sparse in rural areas. FAO has collaborated with the International Fund for Agricultural Development (IFAD), the World Meteorological Organization (WMO), the Intergovernmental Authority on Development (IGAD), Climate Prediction and Applications Centre (ICPAC) in Kenya, Uganda, and Ethiopia to launch the Agricultural Climate Resilience Enhancement Initiative (ACREI) with the aim to strengthen resilience through climate services. At the centre of the ACREI model is the careful and well-structured integration of multiple participatory and user-centred approaches to maximize the impact and cost-effectiveness of local climate action.

At the district level, ACREI uses Participatory Scenario Planning (PSP) to bring together stakeholders to review seasonal weather forecasts across different scientific and traditional knowledge channels. PSP also supports early warning systems at the local level, enabling anticipatory action and avoiding climate shocks. At the larger community level, ACREI supports climate adaptation planning processes through a series of inclusive community meetings engaging women, youth, and other vulnerable groups. Additionally, ACREI facilitates participatory climate analyses building on the Participatory Integrated Climate Services for Agriculture approach. This helps farmers make informed decisions about their seasonal agricultural management options based on seasonal weather records and traditional weather forecasting mechanisms. Throughout all stages, the linking of agricultural and meteorological departments is key to ensure continuous access among farmers to weather information, historical records, seasonal forecasts and within-season weather updates. The ACREI initiative demonstrates the benefits of CIS for local adaptation planning and resilience building, as well as the importance of designing CIS-based interventions in a maximally inclusive and participatory manner.[4]

[4] For further reading see: WMO, 2023. Agriculture Climate Resilience Enhancement Initiative (ACREI). **https://public.wmo.int/en/projects/agricultural-climate-resilience-enhancement-initiative.**

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FORESTRY-BASED ADAPTATION IN THE BOLIVARIAN REPUBLIC OF VENEZUELA – HOW TRADITIONAL KNOWLEDGE CAN BOOST FOREST CONSERVATION AND RESILIENCE

Protecting existing forests, restoring degraded ones, and implementing sustainable forest management practices are all critical components of climate change adaptation efforts. In this context, integrating the knowledge and traditional practices of Indigenous and local communities in forest management can enhance the effectiveness of adaptation strategies while respecting the rights and needs of these communities. In the Bolivarian Republic of Venezuela, FAO, the Ministry of Popular Power for Ecosocialism, and the Indigenous Kariña community implemented the Global Environment Facility (GEF)-funded project Sustainable Forest Management and Forest Conservation from an Ecosocial Perspective.[5]

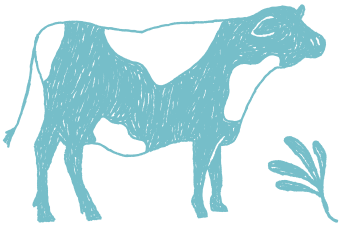
In the Imataca reserve, located in Bolivar, collaboration with the local Indigenous Peoples has generated innovative forest management practices such as the National Integrated Forest Information System. This tool allows for data collection, systematizing, and processing for forest evaluation and monitoring, including biodiversity monitoring and identifying endangered species. The project has also resulted in comprehensive land and forest management plans, including climate change mitigation and adaptation aspects. In addition, it promotes the formulation and implementation of public policies that integrate Indigenous communities into the joint administration of the country's forest heritage, an important step towards inclusive adaptation approaches and the leverage of valuable traditional knowledge.

Moreover, the project supported the creation of "Tukupu," the Bolivarian Republic of Venezuela's first Indigenous forestry company, which co-manages 54 403 hectares of forest. Mainly led by women of the Kariña community, this initiative has started setting up sustainable timber exploitation contracts with private companies. The project provides training on carpentry and diversified livelihood strategies. Using their ancestral knowledge, its leaders have managed to reforest and maintain the forest for future generations and created a flagship example of forest-based climate change mitigation and adaptation solutions.

[5] For further reading see: FAO and Ministerio del Poder Popular para el Ecosocialismo 2022. Boletín Informativo-Ordenación forestal sustentable y conservación de bosques en la perspectiva ecosocial. Caracas, FAO. https://www.fao.org/3/cc0872es/cc0872es.pdf

"We know that we are owners of all this territory, but we did not know how we could work and manage our forests. Therefore, the people from FAO helped and guided us and, with their accompaniment, we created Tukupu."

Cecilia Rivas, a Kariña woman



GRAZING WITH TREES IN TUNISIA – ADAPTING LIVESTOCK PRODUCTION AND BOOSTING ECOSYSTEM RESILIENCE IN DRYLANDS

Drylands constitute almost 48 percent of the world's surface and are particularly vulnerable to climate change. Reforesting drylands can be a beneficial approach to combating land degradation, mitigating climate change, and restoring ecosystems. However, such large-scale afforestation may also lead to the dispossession and displacement of local communities and can result in instability, climate injustice and the loss of livelihoods for smallholder farmers and pastoralists. Silvopastoralism is a nature-based solution offering a land management approach that integrates grazing, tree cultivation, and land restoration. This improves community and ecosystem resilience through improved water cycle and drought management, increased land cover, carbon mitigation, and biodiversity preservation.

FAO, the International Center for Agricultural Research in the Dry Areas (ICARDA) and the General Directorate of Forests of Tunisia implemented the joint project Sustainable Silvopastoral Restoration to Promote Ecosystem Services to boost silvopastoral productivity and resilience by reseeding ecosystems with Sulla. This is a native biannual forage legume species providing feed as grazing biomass for livestock and other services such as water conservation and increased soil fertility through nitrogen fixation. The project resulted in a significant biomass increase at Sulla reseeding sites, and livestock feeding costs almost halved from approximately USD 0.3 per day per head to USD 0.12.

FAO's recent publication, **Grazing with trees–A silvopastoral approach to managing and restoring drylands**, showcases these promising results and aims to promote silvopastoralism globally in partnership with the "International Year of Rangelands and Pastoralists 2026" (FAO, 2022a). It illustrates how local pastoral communities are key to achieving the adaptation and mitigation synergies of silvopastoral livestock management. It has also launched an e-learning course to scale up and disseminate silvopastoral practices, attracting so far over 1 100 participants.[6]

[6] For further reading see: FAO, 2023: FAO elearning Academy. **https://elearning.fao.org/course/view.php?id=942**

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ADAPTING THE EASTERN CARIBBEAN FISHERIES SECTOR TO CLIMATE CHANGE – SEEKING SOLUTIONS TO SARGASSUM ALGAE BLOOMS

Small Island Developing States are highly vulnerable to climate change due to their small size, isolation, susceptibility to sea-level rise and extreme weather events, limited land and water resources, and economic dependence on climate-sensitive sectors such as agriculture and fisheries. The Caribbean Island of Tobago, in Trinidad and Tobago, has been particularly impacted by the changing climate.[7] Due to rising sea temperatures, and the increase in Sahara dust clouds and fertilizer that is released into the ocean, the Caribbean shoreline has been completely inundated with Sargassum since 2011. This large influx of algae is causing significant harm to the environment, coastal ecosystems, and biodiversity. Furthermore, it has serious consequences for the region's fisheries sector, as fish populations decrease dramatically, and the remaining stocks become harder to access with the blooms damaging fishing gear, boat engines and other fishing assets. The decrease in catches impacts not only the livelihood of fisherfolk but it furthermore weakens the entire value chain, including processors, retailers, and consumers (Desrochers *et al.,* 2022).

Antonio Horsford, a 44-year-old fisher from the coastal community of Buccoo in Tobago, has been fishing for more than 20 years. "Sargassum is a pest. I catch flying fish for a living, and it drives them away. I have had to change two engines because the sargassum seeds flooded the engine. It's costly for a fisherman."

Through the Climate Change Adaptation in the Eastern Caribbean Fisheries Sector Project, FAO is working on a multistakeholder approach to support Caribbean communities with climate change adaptive management. In Tobago, this means working together with fisherfolk, policymakers and scientists to improve the forecasting, monitoring and detection of Sargassum and supporting best practices for Sargassum removal and clean up. Additionally, FAO is promoting the repurposing of Sargassum into commercial products, providing additional income and employment opportunities for small and medium businesses. Sargassum is already being used to create bricks, shoe soles, soaps, plant stimulants, and paper. Larger corporations are exploring the possibility of converting Sargassum into renewable energy, bioplastics, and compost.

[7] For further reading see: FAO, 2023. **https://www.fao.org/in-action/climate-change-adaptation-eastern-caribbean-fisheries/en/**

This demonstrates how successful adaptation to climate change impacts can not only reduce vulnerability, but also unlock new sustainable value chains and business opportunities for scaling up bioeconomy approaches.[8]

[8] For further reading see: Desrochers, A., Cox, S.-A., Oxenford, H.A. & van Tussenbroek, B. 2022. Pelagic sargassum – A guide to current and potential uses in the Caribbean. FAO Fisheries and Aquaculture Technical Paper No. 686. Rome, FAO. https://doi.org/10.4060/cc3147en

SUPPORTING DROUGHT-ADAPTED FARMING PRACTICES IN TAJIKISTAN

Agriculture in many parts of Central Asia faces water scarcity, a situation exacerbated by climate change. The GEF-funded Central Asian Countries Initiative for Land Management (CACILM-2) project provides solutions for integrated natural resources management in drought-prone and salt-affected agricultural production landscapes in Central Asia and Turkey.

In Tajikistan, growing drought-tolerant crops is one of the most important measures to increase farm incomes and resilience to climate change in the region. Seeds of drought-tolerant crops have been distributed in four target regions of CACILM in Tajikistan. An example of this is a thornless variety of safflower, which is both a source of vegetable oil and a reliable forage base for livestock in arid zones. While not a new crop to Tajikistan, safflower was previously sown in small areas – and only the thorny varieties – which made it difficult to harvest, and additional processing of stems was needed in order to use it as feed for livestock.

The CACLIM project also supported knowledge transfers through FFS in Tajikistan, some of them targeting women specifically. In this region, female heads of households tend to have lower incomes, fewer assets, and less access to paid work and productive resources than male heads of households. The project therefore involved rural women in diverse project activities, to help build their capacity and increase the sustainability and economic well-being of their farms. Women's field schools helped to scale up drought and salt-tolerant crop production to larger areas in the project regions. Together with the new crops and techniques, crop diversification was promoted to reduce the risk of crop failure during the dry years.[9]

[9] For further reading see: FAO, 2023. **https://www.fao.org/in-action/cacilm-2/en/**

An experienced gardener in the Jomi district in Tajikistan was selected by the CACILM project to establish a nursery to grow and distribute seedlings of crops adapted to drought and salinity in the pilot region and beyond. He now has 5 100 seedlings in his nursery. Each seedling is like his own child, and the farmer's care for each one is a nurturing process. When other interested farmers come to his nursery, he says "these are my nurslings."

A farmer in Vakhsh district in Tajikistan has been one of the most committed participants of one of the Women's Field School initiated by the CACILM project. She uses the knowledge acquired from experts to practice on her 1.5-hectare family farm.

"To be successful, you need to know how to choose the right seed varieties for our conditions and use the right cultivation techniques," she says. You have to love your land and work hard. I learned all of this through my participation in the Women's Farmer Field School."

ADAPTING IRRIGATION TO CLIMATE CHANGE – SUPPORTING GAMBIAN SMALLHOLDERS IN SUSTAINABLE WATER MANAGEMENT

In West and Central Africa, agriculture sectors are mainly constrained by uneven water distribution. In addition, climate change dramatically exacerbates the region's vulnerability and farmers are exposed to changing rainfall patterns, dry spells, droughts, and floods. The increasing intensity and frequency of these events require sustainable water and irrigation management techniques to boost the adaptive capacity of smallholder production systems. Funded by IFAD and implemented by FAO, the Adapting Irrigation to Climate Change project aims to improve sustainability and adaptation of small-scale irrigation systems across key agro-ecological zones in West and Central Africa. In the Gambia, where most of the agricultural production relies on rainfall, the development of irrigation and drainage systems is key to unlocking the country's agricultural potential and increasing resilience along value chains.

The project successfully implemented a series of water-related adaptation measures by enhancing small-scale irrigation techniques, such as drip irrigation systems, mobile-powered low-lift pumping units in tidal areas, and the construction of water retention structures such as contour buds to reduce water run-off. These installations were paired with several NbS, such as hedge planting, soil fertility improvement, and agroforestry, to improve ecosystem services to restore natural water cycles and water quality and flow. In parallel, the project improved local livelihoods by building stakeholders' capacity in market mechanisms, production diversification and the use of tools and machinery. The combination of these interventions significantly contributed to improved water management and agricultural resilience among smallholder farmers, and alleviated the issue of inconsistent water availability. The project also applied similar approaches in other countries in the region, such as the Niger, Côte d'Ivoire, and Mali (FAO, 2019a).


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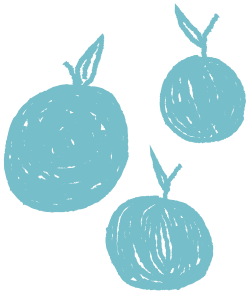

BUILDING SMALLHOLDER FARMERS' RESILIENCE TO CLIMATE IMPACTS WITH AGROECOLOGICAL FARMING IN INDIA

Smallholder farmers are particularly vulnerable to the impacts of climate change. In Andhra Pradesh, India, the Andhra Pradesh Community-managed Natural Farming (APCNF) programme is a state-wide programme, aiming to transition 6 million farmers from conventional chemical farming towards natural farming by 2031. On the basis of FAO's FFS approach, APCNF has been training 274 master trainers on natural farming since 2022. Training topics focused on restoring soil health, intensive polycropping, agroforestry, and crop livestock integration, all of which are very important elements of adaptation with likely co-benefits for climate change mitigation. To increase farmers' independence from external inputs, small-scale farmers were provided with better financial returns to avoid debts, and additional training on non-chemical farming and pest management. Given the increasingly erratic rainfall patterns due to climate change, innovative approaches such as 365-day green cover and pre-monsoon dry sowing are very important, and have been included in the trainings.

A foresight study (AgroEco2050) was launched in 2020 in partnership between FAO, the Government of Andhra Pradesh, and CIRAD to explore the macro-economic implications of different scenarios for food and agriculture in the state of Andhra Pradesh by 2050. AgroEco2050 aimed to clarify and quantify two different visions of what agriculture, food, nature, jobs and welfare in Andhra Pradesh might look like by 2050. One vision was based on the intensification of conventional industrial farming, while the other was based on taking natural farming to scale. The goal was to compare and understand the implications of these two different pathways and verify their coherence. This approach allowed for creative collaboration among diverse stakeholders, from India and abroad (scientists, farmers, government, civil society, and private sector) through multiple workshops from 2019 to 2023, bringing their unique knowledge and visions to the discussion.[10]

[10] For further reading see: FAO. 2021. Bringing climate change adaptation into farmer field schools – A global guidance note for facilitators. Rome, FAO. **https://doi.org/10.4060/cb6410en**


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The national level: developing countries' capacities for climate action

Along with supporting local actors on the ground, FAO also assists its members' governments on the national levels. Its country level support is designed to assist countries in integrating climate change considerations into their agrifood systems, ensuring sustainable and resilient practices that contribute to food security, poverty reduction, and environmental conservation. FAO's strengths lie in its ability to provide a combination of technical expertise, capacity building, and policy guidance, tailored to aid member states to identify, prioritize, and achieve their climate objectives for agrifood systems. By providing technical assistance and training, it enhances the knowledge and skills of member countries for implementing climate-resilient agricultural practices. For example, it offers data, research, and assessments to inform evidence-based policies, and helps countries integrate climate considerations into their national agricultural, environmental and development strategies. In addition, it facilitates access to climate finance mechanisms and collaborates with international partners, emphasizing the importance of climate-smart and agroecological approaches.

FAO's distinctive contribution to country support for climate change adaptation extends beyond technical assistance and capacity building. It encompasses an integral role in negotiations, policy development, and strategic planning, and plays a pivotal role in advocating for the interests of its member countries in international climate negotiations. By providing a platform for countries to voice their concerns and share experiences, FAO fosters a collaborative environment where climate priorities specific to agrifood systems are highlighted. This diplomatic engagement assists member countries in shaping international agreements and guidelines that align with their national agricultural and environmental objectives. Its policy advice is instrumental in assisting countries to integrate climate change considerations into their national agricultural and rural development policies. Especially nationally determined contributions (NDCs) and National Adaptation Plans (NAPs) are key instruments in shaping the trajectory for climate adaptation actions of a country. Established under the UNFCCC Cancun Adaptation Framework in 2010, NAPs are prepared by developing countries to address the challenges of climate change adaptation and systematically integrate climate adaptation considerations into their national development planning and decision-making processes. By assisting countries with the design

and implementation process of their NDCs and NAPs, FAO ensures that climate change impacts on agrifood systems are addressed. This allows for leveraging opportunities for sustainable adaptation and mitigation action through responsive policies and plans at the national level. The two projects described in the following are excellent examples of how FAO engages with governments and other stakeholders to develop, implement and scale NDCs and NAPs, effectively building adaptive capacity in agrifood systems.

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STRENGTHENING AGRICULTURAL ADAPTATION THROUGH MULTI-STAKEHOLDER APPROACHES IN SENEGAL

Effective implementation of national adaptation commitments intensely relies on multi-sectoral and multi-actor approaches. Funded by the government of Quebec, the Strengthening Agricultural Adaptation (SAGA) project has been operating in two countries particularly vulnerable to climate change: Senegal and Haiti. Activities on local and national level are designed around four components: policy support, civil society, research, and dialogue. In Senegal, SAGA successfully helped build partnerships between government agencies, civil society, and research organizations (from the local to the international level). The project supported vulnerability assessments in three target regions, namely Kolda, Thiès and Louga, by consulting farmers and key local stakeholders and using a common national methodology under the coordination of the Environment and Classified Establishments Division of the Ministry of the Environment.

Based on the results of the vulnerability studies in the three regions, SAGA supported the development of two regional adaptation action plans for the agriculture sector. These action plans were developed following workshops that prioritized adaptation options, organized in collaboration with the Division of Environment and Classified Establishments of the Ministry of the Environment and the Regional Committees on Climate Change of Louga, Thiès, and Kolda. These workshops also led to the development of medium and long-term adaptation project ideas designed to address the identified vulnerability constraints in each region.

FAO's support for climate action on a national level also seeks to support the mainstreaming of climate change into national policies. As part of the finalization of Senegal's NAP, SAGA provided technical support for the maturation and socioeconomic evaluation of projects prioritized in the NAP-Agriculture. These projects will be included in the 2024 budget of the Senegalese state by the General Division of Planning and Public Policies of the Ministry of Economy and Finance. One project addresses the resilience of small producers through water management in one region (funded with 30 billion F CFA). Another programme addresses climate risk management and the promotion of good practices for agricultural systems resilience on a national level. The next step involves finalizing these projects with sectoral ministries (execution schedule, institutional arrangements, monitoring and evaluation).[11]

[11] For further reading see: FAO, 2023. **https://www.fao.org/in-action/saga/en/**; Tounkara, A., Ciss, P.N., Ngom, M. and Camara, I. 2022. Évaluation de la vulnérabilité du secteur agricole aux changements climatiques et identification d'options d'adaptation dans la zone des Niayes au Sénégal. Rome, FAO. **https://www.fao.org/documents/card/fr/c/cc0688fr**; Faye, A., Tounkara, A., Ciss, P.N., Ngom, M. and Camara, I. 2022. Évaluation de la vulnérabilité du secteur agricole aux changements climatiques et identification d'options d'adaptation dans la zone de Kolda au Sénégal. Rome, FAO. **https://www.fao.org/documents/card/fr/c/cc0571fr**


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de l'adaptation pour la sécurité alimentaire et la nutrition"
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FROM PLANNING TO IMPLEMENTATION – HOW THE SCALA PROGRAMME ACCELERATES RESILIENCE BUILDING BY TURNING NAPS AND NDCS INTO ACTION

Climate actions need to significantly increase in scope and scale to cope with the severe climate change impacts on agrifood systems. The Scaling up Climate Ambition on Land Use and Agriculture through nationally determined contributions and National Adaptation Plans (SCALA) project works in 12 countries located in Asia, Latin America, and Africa. Its aim is to translate the climate ambitions set out in NDCs and NAPs into concrete climate action on the ground, building adaptive capacity and resilience, reducing emissions, and contributing to achieving the SDGs. Since 2021, FAO and the United Nations Development Programme (UNDP) have been co-leading the EUR 20 million programme funded by the German Ministry for the Environment, Nature Conservation, Nuclear Safety and Consumer Protection. SCALA is an excellent example of the work that FAO is doing to incorporate agriculture into adaptation planning and accelerating the shift from planning to action. The three main objectives of the project are: i) to identify and appraise transformative climate action; ii) integrate agriculture-related priorities into national plans and budgets; and iii) increase private sector engagement.[12]

SCALA uses System-Level Assessments (SLAs), a valuable tool providing information about national contexts. In Nepal, SLAs on community seedbanks and climate-smart commercial rice and livestock farms are laying the groundwork for developing sustainable farm guidelines. Mongolia used SLAs to evaluate the impact of new livestock tax laws and the potential for adaptive fruit and berry trees. In Uganda's cattle corridor, SLAs provide information on pastoralists' resilience, which feeds into district-level planning, emphasizing transformative and inclusive climate action.

In Egypt, SCALA uncovered climate risks, vulnerabilities, and adaptation prospects and contributed to the country's efforts of integrating agriculture into the NAP. Through sub-sectoral assessments, SCALA also worked with Egyptian government bodies to develop country-specific adaptation indicators. These indicators will inform the NAP's monitoring and evaluation (M&E) framework and improve Egypt's overall capacity to adapt to climate change. SCALA actively supports partnerships and builds on multistakeholder collaboration. In Thailand, SCALA is working with a UNDP-led project on marine and coastal resilience and supports

[12] For further reading see: FAO & UNDP (United Nations Development Programme). 2023. Private sector mapping, outreach, and engagement in climate-responsive agrifood systems – SCALA private sector engagement guidance series. Rome, FAO. https://doi.org/10.4060/cc4689en

climate-smart agriculture (CSA) strategies. SCALA will play a major role in supporting the Government of Thailand to update its Climate Change Action Plan on Agriculture, which will provide the opportunity to better incorporate gender and social inclusion and promote women's participation in CSA.

Furthermore, SCALA highlights the importance of the private sector's engagement in effective climate adaptation solutions. For instance, in Côte d'Ivoire, the programme examines innovative financial mechanisms to reduce vulnerability, while in Ethiopia, SCALA works to fit the private sector in to boost climate-resilient agriculture in selected watersheds.[13]

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[13] For further reading see: FAO, 2023. https://www.fao.org/in-action/scala/en; FAO, 2023, https://www.fao.org/in-action/scala/resources/webinars/detail/agriculture-in-national-adaptation-plans-training-material/en

The global and regional level: strengthening global and regional climate policy and governance

In addition to local and national climate action, adapting sustainable and inclusive agrifood systems to climate change at the global and regional level is of major importance. The vital role of agrifood systems is a priority for the global climate change agenda, and FAO is one of its key actors. Overall, the global discourse on climate change adaptation in agrifood systems reflects a growing awareness of the multifaceted challenges of climate change, and the need for a concerted effort to build resilience and ensure global food security. According to the Global Stocktake Report published in 2023, 84 percent of the Parties have installed at least one adaptation planning instrument, and over 170 countries have included adaptation in their climate policies and planning processes. FAO actively promotes and facilitates global climate action, for instance, by supporting the two-year Glasgow-Sharm el-Sheikh work programme on the Global Goal of Adaptation. This work programme informed the Global Stocktake of 2023 and aimed at helping countries to better understand, conceptualize and ultimately achieve the GGA. At COP27, FAO made a significant contribution to the adoption of the Sharm el-Sheikh joint work on the implementation of climate action on agriculture and food security. This work programme builds on the KJWA, a landmark decision that focuses on: making agrifood systems a substantial part of the climate solution by addressing soils; nutrient use; water; livestock; methods for assessing adaptation; and the socioeconomic and food security dimensions of climate change. The Sharm el-Sheikh joint work emphasizes and promotes holistic adaptation actions that respect the national and local circumstances, where vulnerable groups and smallholder farmers are in the foreground.

Moreover, FAO has partnered with the World Health Organisation (WHO), other UN agencies, and the Egyptian COP27 presidency to develop another multistakeholder, cross-sectoral flagship initiative, namely the Initiative on Nutrition and Climate Change (I-CAN). Through collaborative approaches, I-CAN accelerates transformative action to address the nexus of climate change and nutrition. I-CAN seeks to increase the uptake of adaptation actions related to food security, biodiversity, and nutrition in NDCs and NAPs, by helping its member countries deliver climate policies designed to improve nutrition and healthy diets.

FAO will continue supporting the work of UNFCCC and negotiation streams, subsidiary, and constituted bodies (such as the Adaptation Committee, Least Developed Countries Expert Group), and the enhanced transparency framework and global stocktake under the Paris Agreement.

In addition to participating in and supporting the preparation and implementation and drafting of global frameworks that raise adaptation ambitions and actions in the agriculture sectors, FAO promotes strong international and multi-country partnerships to reinforce the global network and foster cross-regional learning and exchange. Stronger international collaboration can boost innovation and research, encourage cross-sectoral approaches, support capacity building and manifest concerted global efforts to reach the goals of the Paris Agreement.

Following are three examples of successful FAO partnerships working in different sectors and with different approaches to tackle climate change impacts and empower governments, partners and stakeholders to boost resilience among stakeholders.

COLLABORATION FOR NDCS – FAO AND THE NDC PARTNERSHIP

FAO plays a significant role in the NDC Partnership. The NDC Partnership brings together more than 200 Members in over 120 countries to create and implement climate actions that help achieve the Paris Agreement and the SDGs. Once national governments have identified their NDC mitigation and adaptation priorities and the type of support they need for implementation, the NDC Partnership offers tailored packages with expertise, technical assistance, and funding. This ensures that developing countries have access to the necessary resources to translate their NDCs into practical actions, leading to equitable and sustainable development. The NDC Partnership emphasizes the need for transformative action that focuses on both climate change mitigation and adaptation. FAO has been an active partner of the NDC Partnership, extensively collaborating with NDC Partnership initiatives such as the CAEP, whose role is to strengthen countries' transparency and their ability to measure, report, and verify emissions. Furthermore, The CAEP aims to monitor and evaluate adaptation actions in the AFOLU sector according to the Enhanced Transparency Framework. This initiative supports the development of specific mitigation and adaptation strategies for inclusion in the new round of NDCs, and assists with formulating NDC frameworks and roadmaps. Moreover, the Thematic Working Group on Agriculture, Food Security and Land Use under the NDC Partnership is a country-led peer-to-peer network where countries and international organizations can confer and share experiences and challenges related to climate change impacts, and the implementation of NDCs. FAO and two co-chairs, Australia and Uruguay, in close collaboration with the Support Unit of the NDC Partnership, are the facilitators of this network.

FAO, in collaboration with the NDC Partnership, has provided extensive support to Columbia throughout the climate resilience and sustainability process. Thanks to FAO's technical support, the agricultural sector has benefited from the strategies set to meet NDC commitments. Also, the CAEP has played an important role vis-à-vis the improved goals set by Colombia's NDCs. The collaboration between FAO and the NDC Partnership has catalysed initiatives leading to the development of financial, market, and agricultural risk management tools, significantly reducing the sector's vulnerability to climate shocks, and boosting Columbia's resilience and adaptive capacity while ensuring that sustainable development needs are met.

DIVERSITY IS KEY TO CLIMATE CHANGE ADAPTATION – HOW FAO'S COMMISSION ON GENETIC RESOURCES FOR FOOD AND AGRICULTURE IS PROTECTING AGROBIODIVERSITY

Genetic diversity is crucial for food security and climate change adaptation of agrifood systems. It offers a genetic reservoir for developing climate-resilient crops and livestock. Unfortunately, climate change threatens the survival of the strategic reservoir of the genetic resources for food and agriculture needed to adapt production systems to future challenges. Genetic resources for food and agriculture are key to the adaptability and resilience of production systems, in addition to improving yields and diversifying nutritional options. They provide the flexibility necessary to adapt crops, livestock, forest trees, and aquatic organisms to changing environmental conditions, including the spread of pests and diseases.

FAO's Commission on Genetic Resources for Food and Agriculture is the only permanent intergovernmental body addressing all components of biological diversity in food and agriculture. The Commission concentrates its efforts on three key areas of work, and conducts country-driven global assessments to evaluate the status of genetic resources for food and agriculture. In response to the identified gaps and challenges, the Commission created global policies such as the **Global Plan of Action for the Conservation, Sustainable Use and Development of Forest Genetic Resources** (Global Plan of Action), through which governments can make a commitment to take action. It also oversees and provides assistance for the implementation of these policies in each country, monitors the outcomes, and guides the preparation of the state of the world reports that are based on country reports. Given the importance and urgency to protect genetic diversity in agrifood systems, climate change is one of the main topics of the Commission's work plan.

The Commission's **Framework for Action on Biodiversity for Food and Agriculture: The State of the World's Biodiversity for Food and Agriculture**, identifies more than 50 individual actions relevant to climate change adaptation and mitigation. Recognizing the dire need to enhance climate change adaptation action in national policy contexts, the Commission also adopted the **Voluntary guidelines to support the integration of genetic diversity into climate change adaptation planning** and in 2023 initiated a process for their review and updating. The guidelines stress the importance of genetic resources for climate change adaptation and offer a step-by-step process to integrate them into national adaptation planning. Thus, as an intergovernmental body with 179 Members, the Commission plays a critical role in collective climate change adaptation action. Its vision, that is, valuing and conserving biodiversity for food and agriculture and promoting its use in support of global food security and sustainable development, is more relevant than ever before for present and future generations.

THE GLOBAL SOIL PARTNERSHIP – PROTECTING SOIL HEALTH AND DECARBONIZING AGRICULTURAL SOILS

Soil conservation and management are key for climate change adaptation and food security, as they enhance soil resilience, water retention, and nutrient availability. Climate change impacts soils through increased temperatures, altered precipitation, extreme weather events, sea-level rise, and shifts in plant growth. These changes can lead to soil erosion, compaction, nutrient loss, and reduced fertility, which makes adapting soils to climate change vital to global food security. Given that soil organic carbon is the largest terrestrial carbon pool, adaptation strategies that focus on increasing organic carbon storage in soils can have significant mitigation co-benefits by increasing carbon sequestration and improving overall soil health. The importance of healthy soils for climate change adaptation, mitigation, and food security has gained international recognition, and is reflected in COP decisions such as the KJWA (FAO, 2020a). FAO is committed to increasing awareness of the importance of soil management and conservation and, consequently, established the Global Soil Partnership (GSP) in 2012. The GSP's mandate is to improve governance of the limited soil resources of the planet in order to guarantee healthy and productive soils for a food-secure world. As an interactive and responsive partnership open to governments, regional organizations, institutions and other stakeholders, the GSP facilitates and contributes to the generation of knowledge and technology, and the exchange for the sustainable management of soils and their resources (FAO, 2022b).

The RECSOIL (recarbonization of global soils) initiative is an example of the GSPs collaborative work. This initiative aims to boost soil health through the maintenance and enhancement of soil organic carbon stocks. Working closely with farmers and farmer associations, RECSOIL supports locally adapted good practices, furthermore, it encourages soil recarbonization by providing technical support and financial incentives. Upon completion of an implementation cycle, farmers receive support to access carbon markets and carbon credit schemes under the "carbon market path," which provides additional incomes and encouragement for future sustainable management. RECSOIL comes with a practical toolkit that includes guidelines, knowledge products, protocols, assessment tools and more, to actively support farmers in creating sustainable, resilient soils (FAO, 2019b).

In the context of creating successful and equitable partnerships for climate action, SSTC models have become a successful alternative to traditional north-south development cooperation. These models promote more equal partnerships, self-reliance, and the adaptation of locally relevant best practices, making them a valuable approach in the framework of international development and climate change adaptation and mitigation. FAO plays a leading role in the South-South cooperation (SSC) and the triangular cooperation (TrC) for agricultural development and food security. The Organization has helped connect SSC country demand and supply, as well as ensure the quality of the exchange. Its SCC strategy sets out four key objectives: i) facilitating the exchange of development solutions; ii) promoting knowledge networks and platforms; iii) providing upstream policy support; and iv) fostering and enabling environment. Moving forward, FAO's vision is to increasingly engage in the SSC and TrC partnerships to meet the growing demands for effective collaboration, and ensure the exchange of knowledge and best practices for climate change adaptation and resilience building in agrifood systems.

South-South and triangular cooperation (SSTC) is the mutual sharing and exchange of key development solutions – knowledge, experiences and good practices, policies, technology, and resources – between and among countries in the global south. SSTC refers to partnerships between two or more developing countries in collaboration with a third partner, typically a developed country/traditional donor, emerging economy and/or multilateral organization to share key development solutions – knowledge, capacity, expertise, experiences and good practices, policies, technology and resources

3. Accelerating climate action by linking adaptation solutions across sectors

FAO's engagement in climate change adaptation is characterized by its dynamic and interconnected approach, simultaneously engaging on local, national, and global fronts. Its efforts are synergistic across all levels of governance, as opposed to working in isolation. In addition to direct actions, FAO's support transcends sectoral boundaries and scales, offering data and scientific research, cross-sectoral expertise, finance mobilization techniques, and a wide range of tools to assist with assessments and project processes, to enhance adaptation efforts and ensure they are evidence-based and context-specific. This integrated, multi-layered method validates FAO's comprehensive and holistic approach towards climate adaptation in agrifood systems.

Harnessing innovation: tools and technologies as adaptation triggers

FAO is leading the way towards enhancing agricultural innovation with tools, digital appliances, new methods for vulnerability and resilience assessment, and hazard projection techniques. It has developed, tested, and deployed a range of tools and support mechanisms that facilitate access to data and information, enabled capacity building and informed decision-making, and fostered inclusion and empowerment of vulnerable and marginalized groups, including smallholder farmers, Indigenous Peoples, and women. The tools are tailored to various groups of users such as policy makers, researchers, farmers, pastoralists, and other

actors and stakeholders along the agricultural value chains to support effective resilience building:

- **The Adaptation, Biodiversity, and Carbon Mapping (ABC-Map)** tool is a geospatial app assessing the environmental impact of national policies, plans and investments in the agriculture, forestry, and other land use change (AFOLU) sector. The adaptation component of ABC-Map understands geophysical and climate change hazards and exposure to their effects, thus supporting vulnerability assessments for identifying adaptation priorities for policymakers and project planners.

- **FAO's Modelling System for Agricultural Impacts of Climate Change (MOSAICC)** provides policymakers with valuable information on climate change impacts. MOSAICC was developed within the framework of the EU/FAO the "Improved Global Governance for Hunger Reduction" programme. It assesses crop production systems, water and forest resources and national economies under changing climatic conditions.

- **The Climate and Agriculture Risk Visualization and Assessment (CAVA)** framework is an approach to climate services and modelling designed to inform users about climate change projections. CAVA consists of a freely accessible platform offering users data on climate change impacts in agriculture and an R package,[14] providing access to direct high-resolution climate model outputs.

- Launched in 2022, the **Climate Risk Toolbox (CRTB)** was developed by the FAO Risks team and the FAO AgroInformatics team to support the design of climate-resilient agricultural investment projects and plans, by allowing users to conduct climate risk screenings through advanced climate-related geospatial information and data.

- Introduced in 2014, the **Self-evaluation and Holistic Assessment of Climate Resilience of Farmers and Pastoralists (SHARP+)** tool assesses climate resilience among small farming households to pinpoint areas needing intervention, shape project activities, and monitor and evaluate the adaptive capacity and resilience of communities.

The following case study gives insight into the practical application of the SHARP+ tool and illustrates how the tool has been successfully used to inform climate change adaptation actions.

[14] R is a free software for statistical computing and graphics. The CAVA R package (CAVA analytics) empowers users with direct access to high-resolution climate model outputs and means for easily working and calculating climatic indicators on multi-model ensembles.

HOW SHARP+ SUPPORTED PROJECT DESIGN, IMPLEMENTATION AND MONITORING IN BURUNDI

In Burundi, SHARP+ informed the "Food-IAP: Support for Sustainable Food Production and Enhancement of Food Security and Climate Resilience in Burundi`s Highland" project, with the aim to establish a multisectoral approach to tackling environmental degradation and food insecurity in five high-plateau provinces. SHARP+ was used at two different project stages: i) a baseline data collection in 2016 that supported the design of the project and its target activities; and ii) a concluding evaluation in 2023 that monitored the project's actions by observing trends in resilience scores over time. The results SHARP+ generated helped pinpoint central themes for FFS, a key component of the project, which focused on agroforestry, alternative livelihoods, and activities enhancing production and nutrition. These approaches were able to boost the adaptive capacity of its beneficiaries significantly. In the project conclusion analysis, SHARP+ revealed a notable upturn in resilience scores from 2016 to 2023, underscoring the project's positive impact on bolstering the community's adaptive capacities and overall well-being during the evaluated period. SHARP+ has significantly contributed to designing appropriate and effective climate change adaptation actions and monitoring, evaluating, and showcasing positive results that can be used for upscaling and expanding the project.[15]

[15] For further reading see: Hernández Lagana, M., Phillips, S. and Poisot, A. 2022. Self-evaluation and holistic assessment of climate resilience of farmers and pastoralists (SHARP). A new guidance document for practitioners. Rome, FAO. https://doi.org/10.4060/cb7399en; FAO, 2023. https://www.fao.org/in-action/sharp/resources/sharp-tablet-application/en/


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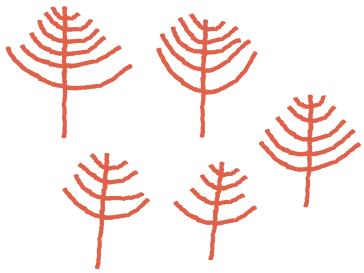
Mobilizing funding and unlocking financial resources

Effective adaptation action on any scale needs financial support and sustainable investment. While NAPs and NDCs are beginning to recognize the importance of funding climate action in agrifood systems, there is still a significant gap between finance flowing into agrifood system adaptation and the financial needs in the sector to build resilience and catalyse transformative action.

FAO's 2023 flagship report **The Impact of Disasters on Agriculture and Food Security 2023** demonstrates and underlines how investing in climate change adaptation can have profitable return rates.

Although global climate finance is increasing, especially from developed to developing countries, only a small and declining share of these funds flow into agriculture and land use sectors. Financing the transformation of sustainable food and land use systems, including supporting producers to adapt to climate change and improve their practices, will require massive public and private investments. At COP27, FAO contributed to the Egyptian Presidency by launching the Food and Agriculture for Sustainable Transformation (FAST) Initiative, with the objective to increase the quality and quantity of climate finance towards agrifood systems transformation, enhancing adaptation action, and maintaining the Paris Agreement's goals of limiting global warming below 1.5 °C. FAO was tasked to make this initiative operational, and succeeded in creating the FAST Partnership, to be launched at a high-level inception meeting at COP28. FAO is also committed to supporting countries with accessing climate finance through funding channels, such as the Green Climate Fund (GCF), GEF, the Adaptation Fund and through bilateral funding and support. FAO's GEF portfolio alone holds USD 1.3 billion covering 280 projects. The two following examples showcase the transformative impact of FAO's collaboration with GEF and GCF. Partnering with the two entities has enabled the implementation of effective climate change adaptation projects and initiatives.

FAO'S WORK WITH TRANSFORMATIVE GCF PROJECTS – CLIMATE CHANGE MITIGATION AND ADAPTATION ACTION IN THE SUDAN'S GUM ARABIC BELT



Transitioning towards climate change-adapted and resilient agrifood systems is key to improving the livelihoods of rural communities that depend on natural resources for their well-being. The GCF is the world's largest climate fund mandated to help developing countries attain the NDCs ambitions to achieve low-emissions, and climate-resilient pathways. By investing in land use, forests, and ecosystems, the GCF mobilizes financial flows for transformative climate action. Since 2016, as a GCF Accredited Entity, FAO has been working alongside National Designated Authorities to develop funding proposals for projects that help countries transform their national climate goals into actions. Currently, the GCF-FAO portfolio holds USD 1.2 billion funding 83 readiness projects, 20 transformative projects, and 8 projects with FAO and GCF as implementing partners. In the Republic of the Sudan, the collaboration between FAO and GCF has boosted the adaptive capacity of around 1.58 million people depending on gum Arabic production. 98 percent of the Sudanese agriculture is rainfed and thus heavily exposed to climatic variables. Average temperatures in the area increased by almost 2° C between 1989 and 2016, more than double the global average. Temperature-driven moisture loss and natural resource degradation threaten food security and the livelihoods of smallholder farmers and pastoralists, who are among the most vulnerable groups within the Sudanese population. With the aim of enhancing rural smallholder households' resilience to climate change through climate-resilient gum agroforestry and rangeland restoration, the GCF approved USD 10 million for the FAO-led "Gums for Adaptation and Mitigation in Sudan (GAMS)" project. The project operates in eleven localities in the states of North, West and South Kordofan and is aligned with the national Reducing Emissions from Deforestation and Forest Degradation (REDD+) strategy and the Great Green Wall initiative (FAO, 2020b).

THE FAO-GEF PARTNERSHIP FOR PEOPLE AND THE PLANET – THE NET-ZERO ADAPTATION FINANCE PROJECT FOR SUSTAINABLE AGRIFOOD SYSTEMS

As a partner agency for the GEF, FAO supports countries worldwide to address the complex challenges at the nexus between the environment, agriculture, forestry, marine and freshwater resources. FAO's global GEF portfolio currently exceeds USD 1 billion, assisting more than 120 countries in projects that respond to local priorities, deliver global environmental benefits, and advance the SDGs. The FAO-GEF Partnership for People and the Planet has built up an extensive portfolio with projects spanning the local, national, regional, and global levels.

An example of such a project is the Net-Zero Adaptation Finance (NZAF) project. Approved in 2023, the global project, proposed by Winrock International and FAO, aims to increase climate change adaptation aspects into net-zero and low-carbon development projects. With a strong focus on the agriculture, forestry, and land use sectors in LDCs, the project provides blended finance to assist net-zero projects with the integration of adaptation and resilience-building components.

The eighth GEF replenishment cycle (GEF-8), from July 2022 to 2026, leverages the success of the FAO- GEF Partnership by offering new opportunities for collaboration and impact, leveraging FAO's extensive technical expertise, strong field presence and in-country alliances. FAO's ability to convene diverse stakeholders, facilitate partnerships and mobilize resources will support countries in designing and delivering projects that achieve sustainable, scalable results.[16]

[16] For further reading see: GEF, 2023. https://www.thegef.org/projects-operations/projects/10933; FAO, 2023. **https://www.fao.org/gef/projects/en/**

Access to the latest available science and databases: FAOSTAT, publications and research

Climate action and adaptation solutions can only be effective if they build on the latest available science and up-to-date and accurate data and information. FAO is collecting, generating, and granting open access to a comprehensive knowledge data base on climate change and agrifood systems. FAOSTAT is FAO's statistical database and online platform: it is a comprehensive source of global, regional, and national agricultural statistics and data related to food and agriculture. FAOSTAT provides a wide range of information on various aspects of agriculture, including crop production, livestock, fisheries, forestry, and food trade. It is often used for research, policy analysis, and decision-making related to food security, agriculture, and rural development and is therefore a valuable tool for informing adaptation action design and implementation. The database is continually updated and maintained by FAO to provide the most current and accurate agricultural statistics and information.

In addition to providing the latest data, FAO supports its member countries by building capacity through the publication of relevant research. FAO's publication data base provides access to papers spanning a wide range of topics related to agrifood systems, climate change adaptation and mitigation, sustainable development, social equity and inclusion, and many more. It publishes the results from local case studies and projects, research reports, technical guidelines, policy briefs and frameworks, sectoral and global level assessments as well as training materials and manuals to disseminate knowledge and deliver the basis for science-informed climate action. In the context of climate change adaptation, FAO has produced: **Addressing agriculture, forestry and fisheries in National Adaptation Plans – Supplementary guidelines (NAP-Ag Guidelines)** to help national decision-makers better understand the needs and existing disparities of adaptation in the agriculture sectors, and support stakeholders in the formulation of their NAPs. The NAP-Ag Guidelines respond to and follow the structure of the UNFCCC NAP Technical Guidelines, providing support for developing countries to reduce the vulnerability of their agriculture sectors and boost adaptive capacity in agrifood systems. They are complemented by specific sectoral guidelines: **Addressing forestry and agroforestry in National Adaptation Plans: Supplementary guidelines** and **Addressing fisheries and aquaculture in National Adaptation Plans.**

The recent FAO publication **Using metrics to assess progress towards the Paris Agreement's Global Goal on Adaptation** provides a comprehensive metric framework to assess adaptation progress in agricultural sectors. The framework aligns indicators for the SDGs and Sendai Framework for Disaster Risk Reduction with reporting adaptation. This approach ensures comparability and aggregability of the information, while the framework provides enough flexibility to define context-specific

FAO further offers practical trainings, e-learning courses and webinars to a broad audience. These courses feature content about policy frameworks and UNFCCC processes, project design and implementation – including data analysis and monitoring and evaluation – climate change-adapted farming and herding techniques, and other. Under the SCALA project, FAO has recently published a comprehensive training package about country-level NAP design and implementation: **Addressing Agriculture in National Adaptation Plans: Training materials.** The training package includes practical examples from Latin America, Asia and Africa and was used in an FAO-hosted training for trainers' workshop about addressing agriculture in NAPs in Egypt.

The following example demonstrates how FAO values learning and capacity building. Featuring the Climate Change Knowledge Hub, it shows how FAO makes information and training material available and accessible to a wide audience.

FAO'S CLIMATE CHANGE KNOWLEDGE HUB

FAO's Climate Change Knowledge Hub (CCK-Hub) is an online portal that gathers existing knowledge and resources on climate change in the agriculture and land use sectors to enhance countries' capacity to deliver on their climate and sustainable development goals to achieve food security for all. The CCK-Hub is a response to the KJWA and the Sharm el-Sheik joint work on implementation of climate action on agriculture and food security appeal for a holistic approach to centralized knowledge production about climate change. With the objective to facilitate knowledge and experience sharing between countries and promoting access to consolidated information resources, the CCK Hub offers four interactive features to its users: i) the "Communities" feature allows the creation of platforms, fora and communities to enhance discussion and exchange among relevant stakeholders; ii) the "Learning Corner" offers webinars, training materials and e-learning courses; iii) The "Youth" section promotes youth-related topics and projects and fosters collaboration between international youth organizations working on climate change; iv) the Hub's "Resources" section contains more than 1 000 publications, tools, learning modules, policy briefs, case studies and more, produced by FAO and other organizations.

4. Conclusion

This publication describes the extensive repertoire and effectiveness of FAO's climate change adaptation solutions. It further illustrates the enormous potential of agrifood systems to adapt and build resilience, while ensuring food and nutrition security for all, leaving no one behind. Thanks to FAO's continued commitment to supporting its Member States, the sustainable transformation of their agrifood systems will make a significant contribution to the Global Goal on Adaptation, and the collective temperature target under the Paris Agreement. FAO's Strategic Framework 2022-2031, the Strategy on Climate Change 2022-2031, and its complementary Action Plan 2022-2025 are guides for a wide range of projects, programmes, and initiatives funded by a variety of sources from GEF, GCF, bilateral funds and multilateral development banks.

These initiatives empower millions of smallholder farmers, forest-dependent communities, fisherfolk, pastoralists, Indigenous Peoples, youth, and women with adaptive techniques to strengthen their resilience and safeguard their livelihoods.

FAO's collaboration with governments and other partner organizations such a UN Agencies, Civil Society, the private sector, and most importantly national agencies, has given a powerful boost to country-driven commitments such as NDCs and NAPs, and helped scale up climate change adaptation in agrifood systems into national policies and long-term plans. As a global player, its role in advancing climate change adaptation efforts is paramount. It will continue to firmly promote agriculture as a priority for the global climate agenda, while emphasizing the potential of agrifood systems to address climate change.

The landmark decision of the KJWA at COP23 in 2017 recognized this unique potential, and FAO has led the way to supporting the implementation of its roadmap. The results are now the basis for a

new implementation path under the four-year Sharm el-Sheikh joint work on implementation of climate action on agriculture and food security, set up during COP27. To achieve the goals set out in global roadmaps, plans, and decisions, FAO builds on partnerships and collaborations to accelerate synergies and ensure that climate solutions are holistic, inclusive, multifaceted, and cross-sectoral. Collaborative initiatives such as the FAST partnership and the I-CAN initiative, are successful examples. Determined to bridge the climate finance gap, it is intensifying its efforts to mobilize adaptation finance flows, de-risk sustainable investment opportunities, and partner with public and private sector actors. FAO will continue to pave the way for collective action.

With only seven years left to complete the Agenda 2030 and SDGs, FAO is committed to immediate, better, collaborative action for climate change adaptation in agrifood systems at local, national, and global levels.

FAO will continue to take on an even stronger role as a global convening force to advance efforts in this regard, together with the support of our Members and partner institutions.

5. Publication highlights of FAO's work related to adaptation of agrifood systems to climate change

FAO has produced a large body of knowledge about adapting agrifood systems to climate change. The following selection can only be illustrative, indicating the breadth of FAO's work.

Please check the following portals for a complete list of relevant publications:

- **FAO's Climate Change Knowledge Hub**
- **FAO's resources related to climate change**

Selected FAO publications considering specific national contexts

FAO. 2021. *Public Expenditure Analysis for Climate Change Adaptation and Mitigation in the Agriculture Sector: A Case Study of Kenya: Experiences of Integrating Agriculture in Sectoral and National Adaptation Planning Processes.* Rome, FAO. **https://www.fao.org/documents/card/en/c/CB3045EN**

FAO. 2022. *Building Resilience to Climate Change-Related and Other Disasters in Ethiopia: Challenges, Lessons and the Way Forward.* Rome, FAO. **https://doi.org/10.4060/cc1210en**

FAO, Alliance of Bioversity International and CIAT, and Lao People's Democratic Republic Ministry of Agriculture and Forestry (MAF). 2022. *Atlas of Agricultural Livelihoods and Climate Risk of the Lao People's Democratic Republic 2019–2020.* Rome, FAO, Ministry of Agriculture and Forestry (MAF), Lao People's Democratic Republic, Alliance of Bioversity International/CIAT. **https://doi.org/10.4060/cc1143en**

FAO, Ministry of the Environment, Undersecretariat of Fisheries and Aquaculture. 2021. *Lessons learned and public policy recommendations on adaptation to climate change in artisanal fisheries and small-scale aquaculture in Chile. Policy brief.* Santiago, FAO. **https://doi.org/10.4060/cb6536en**

Selected FAO publications giving guidance on nationally determined contributions (NDCs) and National Adaptation Plans (NAPs)

Brugere, C. & De Young, C. 2020. *Addressing fisheries and aquaculture in National Adaptation Plans. Supplement to the UNFCCC NAP Technical Guidelines.* Rome, FAO. **https://doi.org/10.4060/ca2215en**

Crumpler, K., Angioni, C., Prosperi. P., Roffredi, L., Salvatore, M., Tanganelli, E., Umulisa, V., Wolf, J. & Bernoux, M. (forthcoming). *Agrifood systems in Nationally Determined Contributions: Global Analysis.* Rome, FAO.

FAO. 2015. *Voluntary Guidelines to Support the Integration of Genetic Diversity into National Climate Change Adaptation Planning.* Rome, FAO. **https://www.fao.org/documents/card/en/c/290cd085-98f3-43df-99a9-250cec270867/**

FAO. 2017. *Addressing Agriculture, Forestry and Fisheries in National Adaptation Plans - Supplementary Guidelines.* Rome, FAO. **www.fao.org/3/a-i6714e.pdf**

Meybeck, A., Gitz, V., Wolf, J. & Wong, T. 2020. *Addressing forestry and agroforestry in National Adaptation Plans – Supplementary guidelines.* Bogor/Rome, FAO and CIFOR. **https://doi.org/10.4060/cb1203en**

Selected FAO publications highlighting the topic's relevance and addressing cross-cutting issues

FAO. 2016. *Climate change and food security: Risks and responses.* Rome, FAO. **https://www.fao.org/3/i5188e/I5188E.pdf**

FAO. 2021. *In Brief to The State of Food and Agriculture 2021. Making agrifood systems more resilient to shocks and stresses.* Rome, FAO. **https://doi.org/10.4060/cb7351en**

FAO. 2022. *Managing risks to build climate-smart and resilient agrifood value chains. The role of climate services.* Rome, FAO. **https://doi.org/10.4060/cb8297en**

Tracking and indicators

Distefano, E., Rai, N. & Wolf, J. 2023. *Using Metrics to Assess Progress towards the Paris Agreement's Global Goal on Adaptation: Transparency in Adaptation in the Agriculture Sectors.* Rome, FAO. **https://doi.org/10.4060/cc2038en.**

FAO. 2017. *Tracking Adaptation in Agricultural Sectors. Climate change adaptation indicators.* Rome, FAO. **https://www.fao.org/documents/card/en/c/1f571627-0253-4d9d-b596-6170d00d3d9f/**

Creating co-benefits and nexus work

Alvar-Beltrán, J., Elbaroudi, I., Gialletti, A., Heureux, A., Neretin & L. Soldan, R. 2021. *Climate Resilient Practices: typology and guiding material for climate risk screening.* Rome, FAO. **https://www.fao.org/3/cb3991en/cb3991en.pdf**

Crumpler, K. & Meybeck, A. 2020. *Adaptation in the agriculture sectors: leveraging co-benefits for mitigation and sustainable development.* Rome, FAO. **https://www.fao.org/publications/card/es/c/CA9195EN/**

FAO. 2021. *Climate change, biodiversity and nutrition nexus – Evidence and emerging policy and programming opportunities.* Rome, FAO.
https://doi.org/10.4060/cb6701en

FAO. 2022. *The role of genetic resources for food and agriculture in adaptation to and mitigation of climate change. FAO Commission on Genetic Resources for Food and Agriculture*. Rome, FAO.
https://doi.org/10.4060/cb9570en

Addressing social inclusion and gender

FAO, IFAD, UN Women, & WFP. 2022. *Rural Women's Economic Empowerment through Climate-Resilient Agriculture: Experiences and Ways Forward from the Joint Programme on Rural Women's Economic Empowerment.* New York.
https://www.fao.org/3/cc2108en/cc2108en.pdf

Mwenge Kahinda, J., Bahal'okwibale, P. M., Budaza, N., Mavundla, S., Nohayi, N.N., Nortje, K. & Boroto, R.J. 2021. *Compendium of community and indigenous strategies for climate change adaptation – Focus on addressing water scarcity in agriculture.* Rome, FAO.
https://doi.org/10.4060/ca5532en

Safa Barraza, A. & Berthelin, L. 2022. *Climate resilience and disaster risk analysis for gender-sensitive value chains: A guidance note.* Rome, FAO.
https://doi.org/10.4060/cc0051en

Van Uffelen, A., Sinitambirivoutin, M., Tanganelli, E., Gerke, A., Korzenszky, A., Brady, G., Nagano, A. & Bernoux, M. 2022. *Creating resilient livelihoods for youth in small-scale food production – A collection of projects to support young people in achieving sustainable and resilient livelihoods and food security.* Rome, FAO.
https://doi.org/10.4060/cc0225en

Selected sector-specific FAO publications

FORESTRY

Djoudi, H., Dooley, K., Duchelle, A. E., Libert-Amico, A., Locatelli, B., Bessike Balinga, M. & Brockhaus, M. *et al.* 2022. Leveraging the Power of Forests and Trees for Transformational Adaptation. SSRN Scholarly Paper. Rochester. **https://doi.org/10.2139/ssrn.4268299.**

FAO. 2023. The world's mangroves 2000–2020. Rome, FAO. **https://doi.org/10.4060/cc7044en**

FAO, IUFRO and USDA. 2021. *A guide to forest-water management. FAO Forestry Paper No. 185.* Rome, FAO. **https://doi.org/10.4060/cb6473en**

Libert-Amico, A., Duchelle, A.E., Cobb, A., Peccoud, V. & Djoudi, H. 2022. *Forest-based adaptation: transformational adaptation through forests and trees.* Rome, FAO. **https://doi.org/10.4060/cc2886en**

Meybeck, A., Rose, S. & Gitz, V. 2019. *Climate change vulnerability assessment of forests and forest-dependent people – A framework methodology.* FAO Forestry Paper No. 183. Rome, FAO. **https://doi.org/10.4060/ca7064en**

FISHERIES AND AQUACULTURE

Bahri, T., Vasconcellos, M., Welch, D.J., Johnson, J., Perry, R.I., Ma, X. & Sharma, R., eds. 2021. A*daptive management of fisheries in response to climate change. FAO Fisheries and Aquaculture Technical Paper No. 667.* Rome, FAO. **http://www.fao.org/3/cb3095en/CB3095EN.pdf**

Barange, M., Bahri, T., Beveridge, M.C.M., Cochrane, K.L., Funge-Smith, S. & Poulain, F. 2018. *Impacts of Climate Change on Fisheries and Aquaculture: Synthesis of Current Knowledge, Adaptation and Mitigation Options*. Rome, FAO. **http://www.fao.org/3/i9705en/I9705EN.pdf**

Comte, A. 2021. *Recent advances in climate change vulnerability/risk assessments in the fisheries and aquaculture sector. FAO Fisheries and Aquaculture Circular No. 1225.* Rome, FAO. **https://doi.org/10.4060/cb4585en**

Cook, K., Rosenbaum, K. L. & Poulain, F. 2021. *Building resilience to climate change and disaster risks for small-scale fisheries communities. A human-rights-based approach to the implementation of Chapter 9 of the Voluntary Guidelines for Securing Sustainable Small-Scale Fisheries in the Context of Food Security and Poverty Eradication.* Rome, FAO. **https://www.fao.org/3/cb7616en/cb7616en.pdf**

Watkiss, P., Ventura, A. & Poulain, F. 2019. *Decision-making and economics of adaptation to climate change in the fisheries and aquaculture sector. FAO Fisheries and Aquaculture Technical Paper No. 650.* Rome, FAO. **http://www.fao.org/3/ca7229en/CA7229EN.pdf**

LIVESTOCK

FAO. 2020. I*n brief. Five practical actions towards resilient, low-carbon livestock systems*. Rome, FAO. **https://www.fao.org/3/cb2007en/CB2007EN.pdf**

FAO. 2021. *Enhancing climate action in the livestock sector – Policy brief.* Rome, FAO. **https://doi.org/10.4060/cb7348en**

Haddad, F.F., Ariza, C. & Malmer, A. 2021. *Building climate-resilient dryland forests and agrosilvopastoral production systems: An approach for context-dependent economic, social and environmentally sustainable transformations. Forestry Working Paper No. 22.* Rome, FAO. **https://doi.org/10.4060/cb3803en**

Reppin, S., Kamana, R., Mushayija, J.P., Vianney Muhinda, O. & Uwizeye, A. 2022. *Consultation on national climate actions in livestock systems to support the Nationally Determined Contributions in Rwanda – Workshop report. Musanze, Rwanda, 14–16 December 2021.* FAO Animal Production and Health Report No. 15. Rome, FAO. **https://doi.org/10.4060/cc0027en**

Spiller, D., Franceschini, G., Henry, M., Cinardi, G., Falcucci, A., Wisser, D. & Petri, M. 2023. *An analysis of the effects of climate change on livestock – A case study in the Lao People's Democratic Republic.* Rome, FAO. **https://doi.org/10.4060/cc7320en**

PLANT PRODUCTION AND LAND AND WATER

Amarasingha, R., Marambe, B., Suriyagoda, L., Punyawardena, R., Herath, H., Jayawardena, S. & Jayakody, P. *et al.* 2021. *Climate change impacts on crops in Sri Lanka.* Rome, FAO. **https://doi.org/10.4060/cb5152en**

Batchelor, S. & Schnetzer, J. 2018. *Compendium on climate-smart irrigation: concepts, evidence and options for a climate-smart approach to improving the performance of irrigated cropping system.* Rome, Global Alliance for Climate-Smart Agriculture. **https://www.fao.org/3/CA1726EN/ca1726en.pdf**

FAO. 2023. *Building resilience into watersheds – A sourcebook.* Rome. **https://doi.org/10.4060/cc3258en**

IPPC Secretariat. 2021. *Scientific review of the impact of climate change on plant pests – A global challenge to prevent and mitigate plant pest risks in agriculture, forestry and ecosystems.* Rome. FAO on behalf of the IPPC Secretariat. **https://doi.org/10.4060/cb4769en**

FAO & ICBA. 2023. *Thematic 1: Farmers' guidelines on soil and water management in salt-affected areas.* Rome, FAO. **https://doi.org/10.4060/cc4200en**

6. List of tools

Reporting to the UNFCC

- Biennial transparency report (BTR) guidance and roadmap tool
- Greenhouse Gas Data Management (GHG-DM) tool

NDC Toolbox

- Adaptation, Biodiversity and Carbon Mapping (ABC-Map)
- Nationally Determined Contribution Expert Tool (NEXT)
- NDC Tracking Tool

Measuring, reporting and verification (MRV) and risk assessment

- Climate and Agriculture Risk Visualization and Assessment (CAVA)
- Climate Risk Toolbox
- The Global Livestock Environmental Assessment Model interactive (GLEAM-i)
- Earth Map
- Ex-Ante Carbon Balance Tool (EX-ACT)

Monitoring and evaluation (M&E)

- Modelling System for Agricultural Impacts of Climate Change (MOSAICC)
- Self-evaluation and Holistic Assessment of climate Resilience of farmers and Pastoralists

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FAO. 2022b. *Global Soil Partnership Action Framework 2022-2020.* **https://www.fao.org/fileadmin/user_upload/GSP/tenth_PA/GSP_Action_Framework_FINAL.pdf**

FAO. 2023a. *The status of women in agrifood systems.* Rome. **https://www.fao.org/interactive/women-in-agrifood-systems/en/**

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Glossary

Adaptation

In human systems, the process of adjustment to actual or expected climate and its effects, in order to moderate harm or exploit beneficial opportunities. In natural systems, the process of adjustment to actual climate and its effects; human intervention may facilitate adjustment to expected climate and its effects (IPCC, 2021).

Adaptation in agriculture means modifying land use, agricultural production, socioeconomic and institutional systems, and policymaking in response to and in preparation for actual or expected climate change variability and its impacts to moderate harmful effects and exploit beneficial opportunities.

Adaptive capacity

Adaptive capacity is a system's ability to respond, recover and address the adaptation deficit. Adaptive capacity is essentially linked to the existence of the knowledge, policies, institutions that can help a system become resilient, where resilience is the capacity to absorb, respond and transform in the face of climate shocks and disturbances (FAO, 2016). Resilience is a broader state or attribute, while adaptive capacity can be considered as the capabilities that can be harnessed to enable resilient (food) systems (FAO, 2014).

Agriculture sectors

For FAO, the term agriculture sectors refers to crop-based farming systems and livestock systems, including rangelands and pasturelands, forestry and fisheries, including capture fisheries (fish caught from wild stocks in marine, coastal, offshore and freshwater ecosystems) and aquaculture (breeding, rearing and harvesting plants and animals in all

types of aquatic environment). Forests are land spanning more than 0.5 hectares with trees higher than 5 metres and more than 10 percent canopy cover, or trees able to reach these thresholds in situ (FAO, 2017).

Agroecology

Agroecology is a holistic and integrated approach that simultaneously applies ecological and social concepts and principles to the design and management of sustainable agriculture and food systems. It seeks to optimize the interactions between plants, animals, humans, and the environment while also addressing the need for socially equitable food systems within which people can exercise choice over what they eat and how and where it is produced. Agroecology is concurrently a science, a set of practices and a social movement and has evolved as a concept over recent decades to expand in scope from a focus on fields and farms to encompass the entirety of agriculture and food systems. It now represents a transdisciplinary field that includes the ecological, socio-cultural, technological, economic, and political dimensions of food systems, from production to consumption (**FAO, 2023a**).

Climate extreme (extreme weather or climate event)

The occurrence of a value of a weather or climate variable above (or below) a threshold value near the upper (or lower) ends of the range of observed values of the variable. For simplicity, both extreme weather events and extreme climate events are referred to collectively as 'climate extremes' (IPCC, 2019).

Climate resilience

FAO defines climate resilience of agricultural systems as "the ability to prevent disasters and crises as well as to anticipate, absorb, accommodate, or recover from them in a timely, efficient, and sustainable manner. This includes protecting, restoring, and improving livelihoods systems in the face of threats that impact agriculture, nutrition, food security and food safety" (FAO, 2014).

Climate services

Climate services refers to information and products that enhance users' knowledge and understanding about the impacts of climate change and/or climate variability so as to aid decision-making of individuals and organizations and enable preparedness and early climate change action. Products can include climate data products (IPCC, 2021).

Climate-smart agriculture

An approach to guide actions to transform and reorient agricultural systems to effectively support development and ensure food security under a changing climate through sustainably increasing agricultural productivity and incomes; adapting and building resilience to climate change; and mitigating greenhouse gas emissions (FAO 2023b).

Climate variability

IPCC defines climate variability as variations in the mean state and other statistics (such as standard deviations or the occurrence of extremes) of the climate on all spatial and temporal scales beyond that of individual weather events. Variability may be due to natural internal processes within the climate system (internal variability), or to variations in natural or anthropogenic external forcing (external variability) (IPCC, 2019).

Ecosystem-based adaptation

EbA has been defined as an overall strategy that integrates the use of biodiversity and ecosystem services to help people adapt to the adverse impacts of climate change. It includes the sustainable management, conservation, and restoration of ecosystems to provide services that help people adapt to both current climate variability and climate change (Colls *et al.*, 2009; **CBD, 2015**).

Ecosystem services

Ecological processes or functions having monetary or non-monetary value to individuals or society at large. These are frequently classified as

(1) supporting services such as productivity or biodiversity maintenance, (2) provisioning services such as food or fibre, (3) regulating services such as climate regulation or carbon sequestration, and (4) cultural services such as tourism or spiritual and aesthetic appreciation (IPCC, 2021).

Global Goal on Adaptation

The UNFCCC Paris Agreement set a Global Goal on Adaptation (GGA) under Article 7.1 for enhancing adaptive capacity, strengthening resilience, and reducing vulnerability to climate change, with a view to contributing to sustainable development and ensuring an adequate adaptation response to climate change impacts. The GGA was decided to drive and enhance global adaptation ambition setting and action to give an equal weight to the long-term goal to limit global warming to 1.5 °C as referred to in Article 2 (UNFCCC, 2016).

Global Stocktake

Established under Article 14 of the Paris Agreement, the GST is designed to "assess the collective progress towards achieving the purpose of [the Paris] Agreement and its long-term goals." In other words, it will evaluate progress at the global – not individual country – level and identify overall trends that should inform countries' national climate commitments (NDCs), which they are required to update at least every five years. The current GST will inform NDCs to be brought forward in 2025 (UNFCCC, 2016; 2023).

Indigenous knowledge

Indigenous knowledge refers to the understandings, skills and philosophies developed by societies with long histories of interaction with their natural surroundings. For many Indigenous Peoples, Indigenous knowledge informs decision-making about fundamental aspects of life, from day-to-day activities to longer term actions. This knowledge is integral to cultural complexes, which also encompass language, systems of classification, resource use practices, social interactions, values, rituals and spirituality. These distinctive ways of knowing are important facets of the world's cultural diversity (IPCC, 2021).

Koronivia Joint Work for Agriculture

The Koronivia Joint Work for Agriculture (KJWA) is a landmark decision that was reached at COP23 in November 2017 on the next steps for agriculture within the UNFCCC. The decision officially recognizes the unique role that agriculture can play in tackling climate change while considering the vulnerability of the sector to climate change and approaches to achieving food security (**FAO, 2020a**).

Local knowledge

Local knowledge refers to the understandings and skills developed by individuals and populations, specific to the places where they live. Local knowledge informs decision-making about fundamental aspects of life, from day-to-day activities to longer term actions. This knowledge is a key element of the social and cultural systems which influence observations of, and responses to climate change; it also informs governance decisions (IPCC, 2021).

Maladaptive actions (Maladaptation)

Actions that may lead to increased risk of adverse climate-related outcomes, including via increased GHG emissions, increased vulnerability to climate change, or diminished welfare, now or in the future. Maladaptation is usually an unintended consequence (IPCC, 2021).

Monitoring and evaluation

Monitoring and evaluation (M&E) is a continuous management function to assess whether progress is made in achieving expected results, spot bottlenecks in implementation and highlight any unintended effects (positive or negative) of an investment plan, programme or project and its activities. M&E facilitates learning from past successes and challenges and those encountered during implementation (FAO, 2023c).

National Adaptation Plans

Established in 2010 under the UNFCCC, the process to formulate and implement National Adaptation Plans (NAPs) enables countries to identify medium- and long-term adaptation needs, and to develop and implement programmes to address those needs. It is the main UNFCCC-led instrument for coordinating and driving actions of all actors and stakeholders in pursuit of adaptation goals and outcomes at the national level. As a continuous, progressive and iterative process, it follows a country-driven, gender-sensitive, participatory and fully transparent approach in adaptation planning. The NAP, to be produced periodically, is the main output of the longer-term process of planning. As of 13 November 2023, 49 developing countries had submitted their NAPs to the UNFCCC (UNFCCC, 2023).

Nationally determined contributions

A UNFCCC mechanism for countries that have joined the Paris Agreement to outline their plans for reducing GHG emissions. Some countries' nationally determined contributions (NDCs) also address how they will adapt to climate change impacts, and what support they need from, or will provide to, other countries to adopt low-carbon pathways and build climate resilience. According to Article 4 (paragraph 2) of the Paris Agreement, each Party shall prepare, communicate and maintain the successive NDCs it intends to achieve. In the lead-up to the COP21 in Paris in 2015, countries submitted their intended NDCs, which, unless they decide otherwise, become their first NDC to join the Paris Agreement (IPCC, 2019).

Nature-based solutions

The United Nations Environment Assembly has adopted in 2022 a resolution that contains a definition of 'nature-based solutions' as "actions to protect, conserve, restore, sustainably use and manage natural or modified terrestrial, freshwater, coastal and marine ecosystems which address social, economic and environmental challenges effectively and adaptively, while simultaneously providing human well-being, ecosystem services, resilience and biodiversity benefits" (UNEA, resolution 5/5 of 2 March 2022, "Nature-based solutions for supporting sustainable development").

Paris Agreement

The Paris Agreement under the United Nations Framework Convention on Climate Change (UNFCCC) was adopted on December 2015 in Paris, France, at the 21st session of the Conference of the Parties (COP) to the UNFCCC. The agreement, adopted by 196 Parties to the UNFCCC, entered into force on 4 November 2016. One of the goals of the Paris Agreement is "Holding the increase in the global average temperature to well below 2°C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5°C above pre-industrial levels", recognizing that this would significantly reduce the risks and impacts of climate change. Additionally, the Agreement aims to strengthen the ability of countries to deal with the impacts of climate change (IPCC, 2021).

Sendai Framework for Disaster Risk Reduction

The Sendai Framework for Disaster Risk Reduction (SFDRR) 2015–2030 outlines seven clear targets and four priorities for action to prevent new – and reduce existing – disaster risks. The voluntary, non-binding agreement recognizes that the state has the primary role to reduce disaster risk but that responsibility should be shared with local government, the private sector and other stakeholders, to substantially reduce disaster risk and loss of lives, livelihoods, health and the economic, physical, social, cultural and environmental assets of persons, businesses, communities and countries (IPCC, 2019).

Sharm El Sheikh joint work on implementation of climate action for agriculture and food security

COP27 marked a critical step for the implementation of the KJWA process with the adoption of decision 3/CP.27 on the "Sharm el-Sheikh joint work on implementation of climate action on agriculture and food security". The new four-year Sharm el-Sheikh joint work builds on the outcomes of the KJWA, and previous activities under the UNFCCC addressing issues related to agriculture as well as future topics. It brings issues related to agriculture and food security under the UNFCCC to the level of implementation. The Sharm el-Sheikh joint work recognizes the

fundamental priority of safeguarding food security and ending hunger and the particular vulnerabilities of food production systems to the adverse impacts of climate change. It highlights the role of farmers, including smallholders and pastoralists, as key agents of change, recognizing that solutions are context-specific and consider national circumstances (**FAO, 2023d**).

South-South cooperation

South-South cooperation is the mutual sharing and exchange of key development solutions – knowledge, experiences and good practices, policies, technology, know-how, and resources – between and among countries in the global south (FAO).

Sustainable Development Goals

The 17 global goals for development for all countries established by the United Nations through a participatory process and elaborated in the 2030 Agenda for Sustainable Development, including ending poverty and hunger; ensuring health and well-being, education, gender equality, clean water and energy, and decent work; building and ensuring resilient and sustainable infrastructure, cities and consumption; reducing inequalities; protecting land and water ecosystems; promoting peace, justice and partnerships; and taking urgent action on climate change (IPCC AR6).

Triangular cooperation

Triangular cooperation (TrC) refers to partnerships between two or more developing countries in collaboration with a third partner, typically a developed country/traditional donor, emerging economy and/or multilateral organization to share key development solutions – knowledge, capacity, expertise, experiences and good practices, policies, technology, and resources (FAO).

Vulnerability

IPPC explains vulnerability in terms of susceptibility to harm and as a function of exposure, sensitivity and adaptive capacity (IPCC, 2014). Drawing on the conceptual framings of livelihoods and poverty frameworks, it can also be defined in terms of the "degree to which a system is susceptible to injury, damage or harm" (Smit and Pilifosova, 2003).

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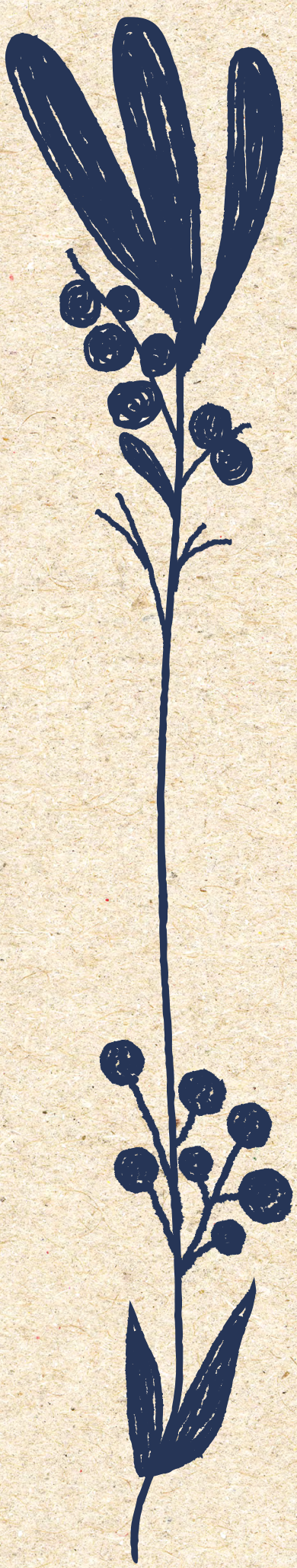

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