



Food and Agriculture
Organization of the
United Nations

FAO'S WORK ON CLIMATE CHANGE

United Nations
Climate Change
Conference 2016

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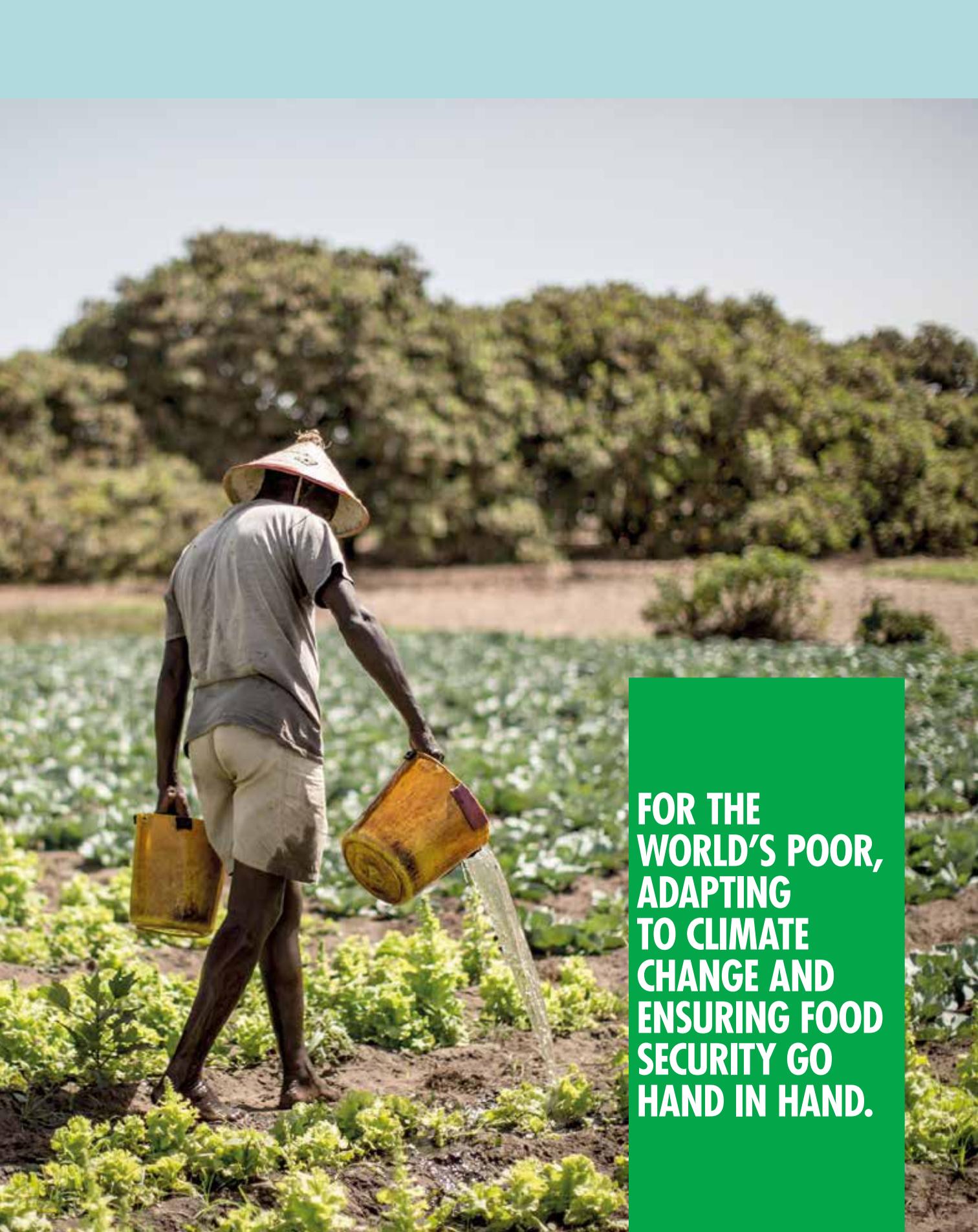
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PUBLICATIONS

SENEGAL

A farmer watering vegetables.
©FAO/Marco Longari





**FOR THE
WORLD'S POOR,
ADAPTING
TO CLIMATE
CHANGE AND
ENSURING FOOD
SECURITY GO
HAND IN HAND.**

INTRODUCTION



We can end extreme poverty and hunger by 2030. We know what works and we have the tools but climate change threatens to derail our efforts.

“HUNGER, POVERTY AND CLIMATE CHANGE NEED TO BE TACKLED TOGETHER”.

JOSÉ GRAZIANO DA SILVA,
FAO Director-General

The Food and Agriculture Organization of the United Nations (FAO) estimates that almost 800 million people in the world today are chronically hungry.

By 2050, population growth and dietary changes will drive food needs up by 60 percent. Climate change is already putting pressure on food systems and rural livelihoods around the globe.

Drought, floods and hurricanes, ocean acidification and rising

sea levels and temperatures put people's lives at risk. Agricultural production and livelihoods are increasingly jeopardized, as crops, livestock, fish resources and productive assets, such as irrigation systems and livestock shelters, come under threat.

Natural disasters, many of which are exacerbated by climate change and increasing in frequency and intensity, cause havoc in these fragile ecosystems. Achieving FAO's

GUATEMALA

Photo of an FAO project to increase subsistence production and food supply to the market in order to reduce the impact of food-price rises on the most vulnerable population groups in 16 municipalities.
©FAO



vision of a world without hunger requires enhanced and concerted action to reduce climate change impacts on food security and nutrition.

In 2015, the 193 member states of the United Nations adopted the 2030 Agenda for Sustainable Development, a set of 17 interlinked goals, to guide the actions of governments, international agencies and civil society. The 17 Sustainable Development Goals (SDGs)

aim to end poverty and hunger while restoring and sustainably managing natural resources.

At the 21st Conference of the Parties to the United Nations Framework Convention on Climate Change, the landmark Paris Agreement – now newly entered in force – saw countries make unprecedented commitments to adapt to and mitigate climate change. Significantly, the Paris Agreement 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”. This is echoed in country commitments where the agricultural sectors stand out as a priority.

Addressing climate change today will determine how well future generations prosper and are fed, and whether food security will be a reality for everyone.

KEY MESSAGES

Climate change already affects agriculture and food security – without urgent action, millions more people will be at risk of hunger and poverty.

Climate change is disproportionately affecting the world's poorest and most vulnerable countries, including Small Island Developing States, landlocked countries, arid- and semi-arid areas and countries where people are dependent on natural resources. The farming, pastoralist, fishing and forest communities that provide the bulk of the planet's food are hardest hit by climate change. For these communities, adaptation to climate change means food security. In fact, the number of poor could increase by between 35 and 122 million by 2030 if a "business as usual" approach is followed.

Our ability to eradicate hunger by 2030 depends on ensuring that the whole agricultural supply chain, food systems and their dependent communities are healthy, productive, sustainable and resilient to climate change. This takes into consideration climate justice, linking development to

human rights to achieve a human-centred approach, safeguarding the rights of the most vulnerable people, and sharing the burdens and benefits of climate change and its impacts equitably and fairly.

Food security goes hand in hand with achieving the SDGs. The elimination of hunger and malnutrition is fundamental to all other forms of socio-economic development. The detrimental impacts of climate change on food security and nutrition will further undermine our ability to achieve these goals unless we act now.

Climate financing and agricultural investments are critical to a global transformation to sustainable agricultural practices.

Almost 80 percent of the world's poor live in rural areas, and most depend on agriculture for their livelihood.

Climate change will severely compromise their ability to earn a living from agriculture, forestry and fisheries. Investments in productive, inclusive and resilient agricultural development are critical to safeguarding the incomes and food security of the world's rural poor in the face of a changing climate.

Channelling public and private investments into agricultural sectors, including through flows of climate finance can harness their transformative potential. Pursuing climate-resilient development pathways that can simultaneously contribute to reducing greenhouse gas (GHG) emissions will require integrated approaches and substantial, long-term investment in agriculture. These are costs that smallholders cannot bear on their own.

Shifting to sustainable food and agriculture can maximize co-benefits of climate change adaptation and mitigation.

FAO invests in critical areas to support food security and climate change adaptation and mitigation. With the right policies and actions, FAO has seen both improvements and co-benefits in different areas.

The first is in improved capacities, including leveraging advances in science and technology. To achieve resilient agricultural production systems that can withstand extreme weather events, farmers must have access to a diverse range of hardy, efficient and nutritious varieties of crops, trees and fish/livestock breeds.

AGRICULTURE IS KEY: IT CAN ADDRESS POVERTY, HUNGER AND CLIMATE CHANGE SIMULTANEOUSLY.



The conservation and sustainable use of biodiversity for food and agriculture play a critical role in the fight against hunger, by ensuring environmental sustainability, while increasing food and agriculture production.

The second area is in natural resource management, such as reducing waste, deforestation and overfishing. The third is in improved soil health and fertility, and the fourth is in the increase in ecosystem services and a reduction in fossil-fuel use. All these improvements have the potential to abate emission trajectories, while ensuring human and ecosystem well-being.

Boosting resilience also means preventing and/or preparing for climate-related shocks – a core prerequisite for

climate change adaptation and sustainable development.

Paris Agreement commitments underpin a global transformation to sustainable food and agriculture, but require action on a broad front.

A recent FAO assessment of 189 countries' climate pledges, or Intended Nationally Determined Contributions (INDCs), indicates that developing and less-developed countries urgently need support. More than 90 percent refer to the agricultural sectors (crops, livestock, forestry, fisheries and aquaculture) and related adaptation and/or mitigation actions in their INDCs. These actions largely determine whether

the world achieves the long-term goals of the Paris Agreement.

To fulfil all their intended commitments, countries are requesting support from the international community. FAO provides technical expertise, capacity development and knowledge; it supports countries through government ministries, and works with funding mechanisms and other potential donors interested in financing climate action.

At the 2016 FAO Regional Conference in Africa and the Near East, the Ministers of Agriculture adopted a **Ministerial Declaration on food security and the agricultural sectors in a changing climate**, calling for urgent action to support countries from the region to **adapt**.

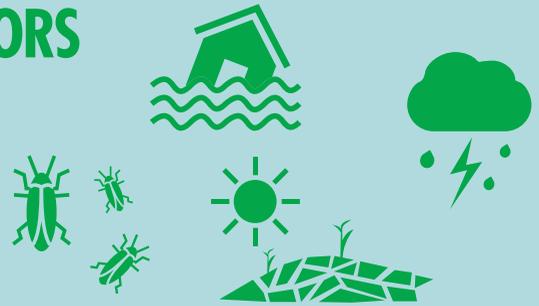
FACTS AND FIGURES

AGRICULTURE, FORESTRY, FISHERIES AND AQUACULTURE MUST PLAY A CENTRAL ROLE IN ADDRESSING CLIMATE CHANGE AND ADAPTING TO ITS IMPACTS.

- ➔ **Seventy-five percent of the world's poor and food-insecure people** rely on agriculture and natural resources for their livelihood.
- ➔ FAO estimates that **agricultural production must rise by about 60 percent** by 2050 in order to feed a larger and richer population. Climate change is putting this objective at risk.
- ➔ The Intergovernmental Panel on Climate Change (IPCC) warns that declining crop yields may already be a fact and that **decreases of 10–25 percent or more may be widespread by 2050.**
- ➔ **Livestock keepers are among the most vulnerable** to climate change, which affects animals both directly, through extreme events such as droughts, and indirectly, through reduced yields and increased risks to animal health.
- ➔ Rising temperatures are predicted to **reduce potential catches of many fish species** in the tropics by 40–60 percent, and in high latitudes by 30–70 percent, by 2055 as a result of species redistribution.
- ➔ While emissions from deforestation have fallen, **deforestation and forest degradation still account for about 10–11 percent of global GHG emissions.**
- ➔ While more carbon is stored in soil than in the atmosphere and plant life combined, **over one-third of the world's soils are degraded**, and organic matter has been lost.
- ➔ **Livestock contributes to almost two-thirds of agricultural GHG emissions, *sensu stricto***, and 78 percent of agricultural methane emissions.
- ➔ Climate change may transfer **risks of food-borne diseases** from one region to another, with new health threats.
- ➔ FAO estimates that the **potential to reduce emissions from livestock production** and methane in particular is about 30 percent of baseline emissions.
- ➔ Currently, **one-third of all food produced is either lost or wasted.** The global costs of food wastage amount to about USD 2.6 trillion per year, including USD 700 billion of environmental costs and USD 900 billion of social costs.
- ➔ **Global food loss and waste generate about 8 percent of total GHG emissions** per year.
- ➔ Rising temperatures combined with changes in rainfall and wind patterns are expected to cause increases in plant pests and disease infestations. **Better agricultural water management can effectively contribute to reducing GHG emissions.**

PRIORITIZING AGRICULTURE SECTORS IN CLIMATE CHANGE ADAPTATION

Changing climatic conditions and more frequent extreme weather events will negatively affect the livelihoods of rural people and food and nutrition security.



Natural hazards and disasters in developing countries



Countries have made agriculture sectors a priority for climate action

Out of 130 countries that included adaptation in their Intended Nationally Determined Contributions...

95% refer to crop and livestock production



83% refer to forest



46% refer to fisheries and aquaculture



Adaptation requires an enabling environment and support for agricultural producers



Adaptation should be a **country-driven, evidence-based, gender-sensitive and flexible process**

All key stakeholders dealing with natural resources must work together



To meet all adaptation needs, **climate finance should be 6 to 13 times greater by 2030** from both domestic and international sources

FAO supports capacity building for transformational change in agriculture and natural resources management through...

Knowledge and data on impact and vulnerability	Sustainable approaches, practices and use of natural resources	Policy harmonization, coordination and intersectoral cooperation	Leveraging climate finance
Gender mainstreaming	Conservation of biodiversity including genetic resources	Disaster risk reduction	Monitoring and evaluation framework

SUPPORT TO COUNTRIES TO DEAL WITH THE IMPACTS OF CLIMATE CHANGE

No other sector is more sensitive to climate change than agriculture.

No other sector contributes so directly to the provision of food and livelihoods. The agricultural sectors – including crops, livestock, fisheries and forestry – absorb about 22 percent of the economic impact caused by medium- and large-scale natural hazards and disasters in developing countries. Considering the vital role of these sectors to global food production and livelihoods, it is critical to integrate agriculture within adaptation efforts and financing.

Concrete steps to address the risks of climate change impacts include:

- ▶ Working with countries to develop enabling environments that support farmers to adopt tools

and practices that enhance the adaptation of production systems to climate-related shocks.

- ▶ Developing climate change impact and vulnerability assessments for crops, livestock, fisheries and forestry, as well as those who depend on these sectors for their livelihoods.
- ▶ Supporting improved natural resource management, e.g. sustainable land and water management, soil conservation, and resilient crops, trees and breeds.
- ▶ Improving weather and climate forecasting, predicting changes in aquatic ecosystems (e.g. salinity, oxygen and pH) and communicating these to farmers.
- ▶ Enhancing early warning systems, rapid reaction mechanisms and contingency planning for natural disasters, as well as for transboundary plant pests and diseases.
- ▶ Developing disaster risk management capabilities.

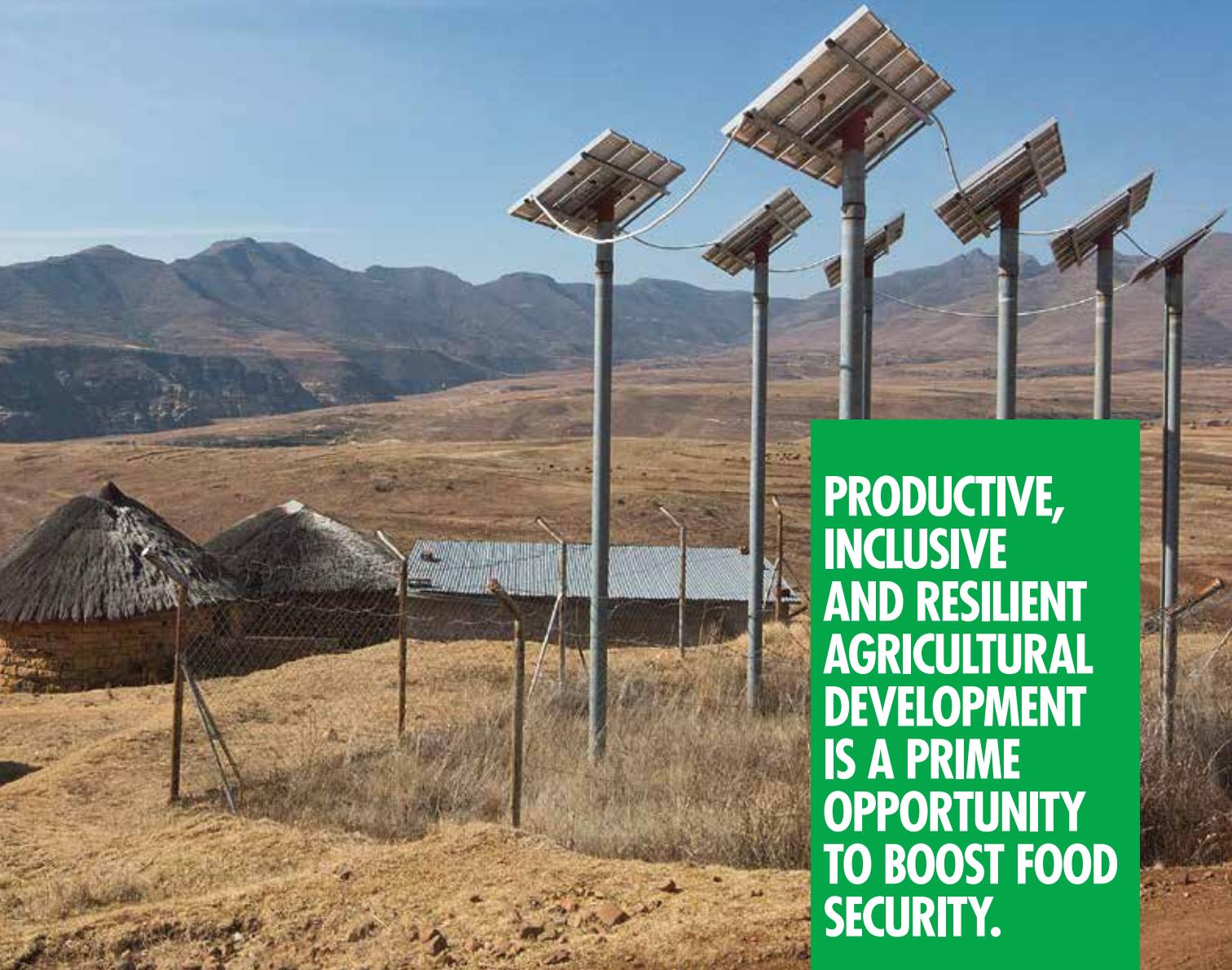
Understanding how a changing climate affects the agricultural sectors is the first step in adapting to climate change.

Agriculture is highly sensitive to climate change. Even a 2 °C rise in global mean temperatures will destabilize current farming systems. Climate change has the potential to transform food production, especially the patterns and productivity of crop, livestock, forestry and fishery and aquaculture systems.

Climate change projections can be uncertain because of the natural variability in the climate system. These uncertainties are compounded when data collection is incomplete or unreliable. However, national climate planning can only be effective if it is possible to forecast changes in the agricultural sectors, acknowledge vulnerabilities and

LESOTHO

Solar power generates energy for Komeng village, Leribe district.
©FAO/Rodger Bosch



**PRODUCTIVE,
INCLUSIVE
AND RESILIENT
AGRICULTURAL
DEVELOPMENT
IS A PRIME
OPPORTUNITY
TO BOOST FOOD
SECURITY.**

understand communities' adaptive capacities. In response to this need, FAO provides methods and tools for carrying out impact assessments of climate change and the monitoring of natural resources and GHG emissions.

The following section looks at the data, methods and tools that provide fundamental information for climate change adaptation planning, as well as reporting on GHG emissions from the agricultural sectors.

DATA, METHODS AND TOOLS

➔ **For inventories and measurement of emissions**

Taking stock of GHG emissions from the agricultural sectors allows countries to monitor progress in reaching climate action commitments.

The data are also useful for countries to assess their current status of emissions and consider potential areas of action.

Database on GHG emissions from agriculture, forestry and other land-use sectors. The GHG emissions database on FAOSTAT is a global inventory of GHG emissions from all agricultural activities, including crop production, livestock and forestry and land-use changes. The emissions database is a useful resource that provides a coherent and internationally neutral data platform.

http://faostat3.fao.org/browse/G1*/E

Global Forest Resources Assessments (FRA). The FRA 2015 is the most comprehensive

assessment of forests to date, evaluating all the benefits that come from forest resources. It examines the current status and recent trends for about 100 variables covering the extent, condition, uses and values of forests and other wooded land. In addition to the FRA, FAO assists countries in strengthening their national forest monitoring systems. Global and national data on forests, forest conditions and trends provide a basis for identifying vulnerabilities to climate impacts and for assessing progress in climate change adaptation and mitigation efforts.

www.fao.org/forest-resources-assessment/en/

Open Foris. Open Foris is a set of open-source software tools developed by FAO to facilitate flexible and efficient data collection, analysis and reporting. The different modules can be used for forest inventories, land use and land-use change assessment and climate change reporting.

www.openforis.org.

Livestock Environmental Assessment and Performance (LEAP) Partnership. This multistakeholder partnership develops harmonized metrics and methodologies to define and measure environmental

performance and GHG emissions in livestock supply chains. LEAP's work programme has developed accounting rules for the quantification of GHG emissions from livestock supply chains.

www.fao.org/partnerships/leap/en/

Global Livestock Environmental Assessment Model (GLEAM).

This model was developed by FAO to support the assessment of adaptation and mitigation scenarios in the livestock sector. It calculates livestock production, GHG emissions and mitigation potential with IPCC Tier 2 methods. An open and user-friendly version is available for download to support governments, project planners, producers, industry and civil society organizations in the preparation of national inventories and in *ex-ante* project evaluation for the assessment of intervention scenarios in animal husbandry, feed and manure management.

www.fao.org/in-action/enteric-methane/en/

Ex-Ante Carbon-balance Tool (EX-ACT). This FAO system provides *ex-ante* estimates of the impact of land use and land-use changes and natural resource management on GHG emissions



and carbon balance. Public and private partner initiatives currently promote the progressive integration of carbon balance appraisals and monitoring services at project and policy level. EX-ACT is a powerful decision-making tool to ensure investments in the agricultural sectors are climate-proofed.

www.fao.org/tc/exact/en/

Learning tool on Nationally Appropriate Mitigation Actions (NAMAs) in the agriculture, forestry and other land-use sectors. Through this

**FAO HAS THE
EXPERIENCE
AND THE TOOLS
TO SUPPORT
COUNTRIES TO
ASSESS, DEVELOP
AND IMPLEMENT
CLIMATE ACTIONS.**

tool, FAO supports the efforts of developing countries in the identification, development and implementation of country-specific mitigation actions in the context of national sustainable development. The tool has been designed for those working in the agricultural sectors who want to deepen their understanding of NAMAs and increase their capacity to contribute to national and global climate change mitigation goals.

[www.slideshare.net/
FAOoftheUN/tag/namatool](http://www.slideshare.net/FAOoftheUN/tag/namatool)

DATA, METHODS AND TOOLS

➔ **For assessing risks and vulnerabilities**

To identify what steps to take to adapt to climate change, understanding the vulnerability of people's food security to climate change is essential. Climate change impacts can be reduced by reducing vulnerabilities.

Modelling System for Agricultural Impacts of Climate Change (MOSAICC).

This system of models and utilities is designed to carry out interdisciplinary climate change impact assessments on agriculture through simulations. The main components are: a statistical portal to downscale Global Circulation Model (GCM) data to weather station networks; a hydrological model to estimate water resources for irrigation in major basins; two water balance-based crop models to simulate crop yields under climate change scenarios; and a model to assess the effect of changing yields on national economies. This system allows for a better integration of scientific information in the design of agricultural

development projects and decision-making or policy formulation.

www.fao.org/climatechange/mosaicc/en/

AquaCrop. FAO's AquaCrop is a crop water productivity model that simulates the yield response to water of herbaceous crops. It is particularly suited to addressing conditions where water is a key limiting factor in crop production.

www.fao.org/nr/water/aquacrop.html

Agricultural Stress

Index System (ASIS). The development of early warning systems is essential to strengthen decision-making at all levels in order to reduce the impacts of extreme weather events, such as dry spells, droughts, frosts and tropical cyclones. Using data on vegetation and land surface temperature, the FAO's ASIS monitors vegetation indices and detects hotspots where crops may be affected by drought. The system contributes greatly to the food security monitoring work of Global Information and Early Warning Systems on Food and Agriculture (GIEWS).

www.fao.org/giews/en/

Self-evaluation and Holistic Assessment of climate Resilience of farmers and Pastoralists (SHARP).

This tool helps farmers and pastoralists assess and prioritize resilience aspects of their livelihoods in a participatory manner. The survey is paper and Android-tablet-based, and assesses governance, environmental, social, economic and agricultural practices using a combination of self-assessment and academic reviews of livelihood components. SHARP is used both as a monitoring and evaluation tool, as well as a learning method, integrated into agropastoral/farmer field schools in sub-Saharan Africa. The tool provides immediate results (offline) in the field and has the ability to analyse results online in more detail.

www.fao.org/in-action/sharp/data/en/

Assessment tool for the potential impact of climate change on breed distribution. Livestock breeds raised in a given production environment over a long period tend to acquire characteristics that enable them to thrive in local conditions and meet the needs of the people that keep them. For breeds raised in extensive farming, climate is a fundamental element in the production environment. The present geographic distributions of about 8 800 livestock

BOOSTING RESILIENCE MEANS PREVENTING AND PREPARING FOR CLIMATE SHOCKS – A REQUISITE FOR CLIMATE CHANGE ADAPTATION.

breeds, as recorded in the Domestic Animal Diversity Information System (DAD-IS), are used to model currently suitable areas to which these breeds are adapted, taking several temperature and humidity parameters into account, and areas suitable under future conditions. Those future habitats are modelled using the “Hadley Global Environment Model 2”. Such analyses can potentially contribute to more informed decision-making on breed management in a changing climate.

www.fao.org/breed-distribution-model/en/

Assessments of Climate Change Impacts and Mapping of Vulnerability to Food Insecurity under Climate Change to Strengthen Household Food Security with Livelihoods’ Adaptation Approaches (AMICAF). Aimed at strengthening household food security through livelihood adaptation approaches, the assessment is currently being implemented in the Philippines and Peru. Funded by the Ministry of Agriculture, Forestry and Fisheries of Japan, its main objective is to connect climate change impact assessment, food insecurity vulnerability analysis and livelihood adaptation approaches. www.fao.org/climatechange/amicaf/en/

Global assessment of fisheries and aquaculture compliance with the Code of Conduct for Responsible Fisheries.

Implementation of the Code is monitored by the Committee on Fisheries (COFI) through global questionnaires that cover each article of the Code and are sent to all FAO Members twice a year. A progress report, consisting of statistical results compiled from the responses, is prepared for each session of COFI. This global assessment can also be used by Members to review and improve their fisheries and aquaculture performance. This instrument can also be used to address Members’ preparedness and adaptation to climate change.

www.fao.org/fishery/code/en

Global early warning system for transboundary plant pests and diseases. FAO has 65 years of experience in operating the global Desert Locust early warning system, which can be adapted to other transboundary plant pests and diseases. The system monitors locusts, weather and ecological conditions and provides forecasts, warnings and alerts to countries as part of the preventive control strategy to reduce the frequency, duration and magnitude of plagues. www.fao.org/ag/locusts

EIGHT ACTIONS ON THE GROUND

**UNLESS ACTION
IS TAKEN NOW,
THE IMPACTS
OF CLIMATE
CHANGE ON
FOOD SECURITY
WILL JEOPARDIZE
PROGRESS
TOWARDS THE
KEY SDGs OF
ENDING HUNGER
AND POVERTY
BY 2030.**



THE LAO PEOPLE'S DEMOCRATIC REPUBLIC

The Ou River, a Mekong tributary. The Mekong River Commission in Southeast Asia is one of the largest-scale and most complex examples of integrated transboundary forest and water management programmes.
©FAO/Jeremy Broadhead



EIGHT ACTIONS ON THE GROUND

To respond to the increasing pressures that countries face as a result of the impacts of climate change, the FAO climate change project portfolio has grown rapidly in recent years. In the period from 2009 to 2016, well over 300 FAO projects and programmes explicitly addressed climate change adaptation and mitigation in the agricultural sectors. Through its extensive network of climate change professionals, FAO supports countries in a wide range of climate change issues from policy design, to improved practices and capacity development.

1 Irrigation and drought management

Climate change will affect the extent and productivity of irrigated agriculture, as water availability is expected to decrease in areas already under water-stress or in areas of irrigated land that rely on snowmelt and high mountain glaciers. Rising temperatures will translate into increased crop water demand across the globe as well as increased frequency and severity of drought.

While drought is difficult to forecast, its impacts can be significantly mitigated. This can be achieved through a more proactive, risk-based management approach. FAO, together with the World Meteorological Organization (WMO), United Nations Convention to Combat Desertification (UNCCD) and other partners, works with countries to implement such an approach through well-coordinated national drought policies and the implementation of related action plans. This involves awareness raising and building national capacities to carry out assessments and implement preparedness plans that incorporate emergency response programmes. It also involves upscaling climate-smart agricultural practices in drought-prone landscapes.

As one of its core areas of expertise, FAO has developed a range of tools and approaches for irrigation management. MASSCOTE, for example, is a multilanguage training package for the modernization and rehabilitation of large-scale irrigation schemes.

Estimating how much more water agriculture will need in the future requires understanding both the connections between water, food and diets and the water productivity of the agriculture production system.

FAO works with countries to help ensure an enabling environment for farmers to adopt well-adapted crops, trees, livestock and fish. This and good agricultural practices enhance the adaptation of production systems to drought, water scarcity and other climate-related shocks.

Water scarcity and water-related issues are among the leading challenges to long-term food security, ending hunger and reducing poverty. This is reflected in country pledges, where 88 percent mention water in the adaptation section. As a response, FAO has developed the **Global Framework on Water Scarcity** – an initiative launched at the 2016 United Nations climate change conference in Morocco (COP22).



NIGER

Women preparing a field for the next rainy season by digging half-moon dams to save water.
©FAO/Giulio Napolitano

With the world population expected to grow to 9.7 billion people by 2050, a surge in food demand of some 60 percent will lead to unprecedented pressure on, and competition for, already vulnerable water resources. Securing access to water – especially in water-scarce countries – is crucial for achieving food security and improving rural and urban livelihoods.

Water scarcity, sustainable agriculture and food security are intrinsically interrelated and should be addressed holistically. The FAO framework will help countries, communities and businesses to scale up successful practices to meet the threats posed by water scarcity to agricultural production and to secure food supply in the face of climate change, while conserving ecosystems and the services they provide and respecting the sustainable use of landscapes. ►

REGIONAL WATER SCARCITY INITIATIVE IN THE NEAR EAST AND NORTH AFRICA

In support to the FAO Global Framework on Water Scarcity, the Regional Water Scarcity Initiative in the Near East and North Africa is a regional network of partners that works to provide member countries with opportunities to learn and share practices in the sustainable use and management of water. Partners are already using lessons learned from this exchange to formulate a Regional Collaborative Strategy.

Water accounting, food-supply cost curve, gap-analysis and regular monitoring of agricultural water productivity are some of the advanced tools that the Initiative uses to quantify the 'benefits' and the 'costs' of alternative policy options to address food insecurity while sustaining water resources.

Making use of the expertise of FAO and its partners, the Initiative advises governments and the private sector on the adoption of modern technologies and institutional solutions to increase the efficiency and productivity of water use in agriculture for the benefit of millions of farmers and rural communities in the region. In particular, it supports major ongoing policy processes, including the "Arab Water Security Strategy 2010-2030" and the "Regional Initiative for the Assessment of Climate Change Impacts on Water Resources and Socio-Economic Vulnerability in the Arab Region".

EIGHT ACTIONS ON THE GROUND

2 Climate-resilient agroforestry systems

In line with the vision for sustainable food and agriculture developed in support of its strategic objective to “Make agriculture, forestry and fisheries more productive and more sustainable”, FAO promotes climate-smart agriculture (CSA) as a way to increase productivity, adapt and build the resilience of food systems and, wherever possible, reduce GHG emissions. Agroforestry uses both traditional and modern land-use systems where trees are managed together with crops and/or animal production systems in agricultural settings. They are dynamic, ecologically based, natural-resource management systems that diversify and sustain production in order to increase social, economic and environmental benefits for land users on all levels.

The FAO project Climate-Smart Agroforestry Systems for the Dry Corridor of Central America supports farmers in Guatemala and Honduras to increase the uptake of climate-resilient agroforestry systems through the farmer field school approach. The systems, Kuxur Rum in Guatemala and Qesungual in Honduras, were developed based on traditional farming practices in both countries.

3 Sustainable forest and land management

Reducing emissions from deforestation and forest degradation (REDD) is an effort to create financial value from the carbon stored in forests, offering incentives for developing countries to reduce emissions from forested lands and invest in low-carbon paths to sustainable development. "REDD+" goes beyond deforestation and forest degradation to include the role of conservation, sustainable management of forests and enhancement of forest carbon stocks.

Article 5 of the Paris Agreement recognizes the central role of forests in reducing emissions to keep global warming well below 2 °C through the reduction of emissions from deforestation and forest degradation.

Through the UN-REDD Programme, FAO is now supporting 64 Partner Countries in moving towards REDD+ readiness and participates actively in the UN Framework Convention on Climate Change (UNFCCC) processes. The programme is characterized by its strong stakeholder involvement in the nationally-led REDD+ processes, which include civil society, indigenous peoples and other forest-dependent communities, and the private sector.

FAO also assists countries in developing and delivering the “pillars” of the Warsaw Framework related to national forest monitoring systems, forest reference emission levels/forest reference levels and safeguards information systems.

Under the UN-REDD Programme, FAO's technical assistance includes:

- Assistance to countries to prepare for and implement REDD+ as a means of delivering on their climate pledges.
- Help in building institutional and technical capacity in countries to design and implement national forest inventories.
- Assistance with the implementation of policies and measures identified by countries as crucial for reducing their emissions from forests and land-use change.
- Supporting governance assessments, legal preparedness, land tenure reform, social and environmental safeguards, and sustainable forest management.
- Assistance in developing investment plans for the forestry sector.
- Facilitation of South–South exchanges and generation of knowledge through collection and sharing of best practices, as well as guidance material and software applications for forest monitoring and for national forest and GHG inventories. ►

UN-REDD PROGRAMME SUPPORT

Pillars of UNFCCC Warsaw Framework for REDD+



National Strategies / Action Plans (NS/AP)



National Forest Monitoring Systems (NFMS)

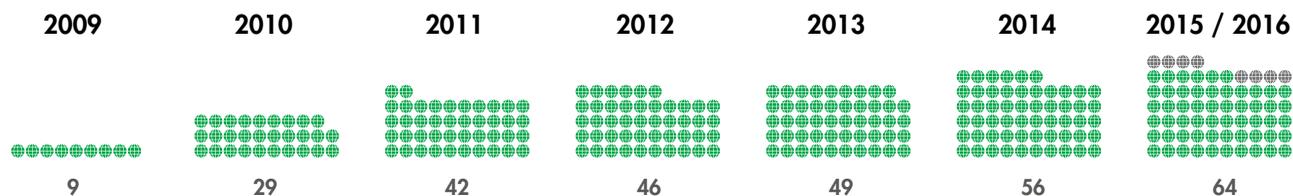


Forest Reference Emission Levels / Forest Reference Levels (FREL/FRL)



Safeguards / Safeguards Information Systems (SIS)

Number of partner countries



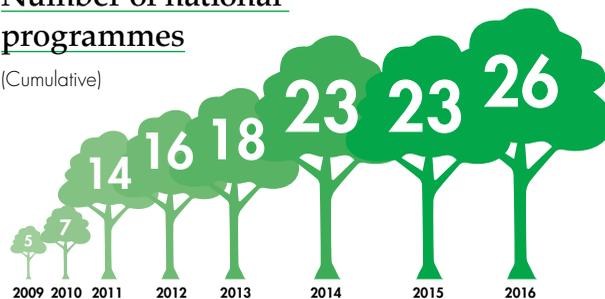
Number of countries that have received targeted support

(Cumulative)



Number of national programmes

(Cumulative)



Number of countries that have received backstopping



Support to country needs assessments



Countries with community-based REDD+



Support to knowledge management



Source: FAO, 2016.

EIGHT ACTIONS ON THE GROUND

► Addressing deforestation in Central Africa

Central Africa is home to the second-largest tropical rainforest area in the world with over 240 million hectares. Despite the fact that the annual rate of natural forest loss is declining in Africa, the region still records the highest forest losses on the planet. The 2015 FRA revealed an annual loss of about 3.1 million hectares of natural forests in Africa between 2010 and 2015.

Central African governments face tough challenges in addressing poverty, food security and climate change, which puts pressure on their tropical forests. To address these issues, the new Central African Forest Initiative (CAFI) was launched at the UN Sustainable Development Summit in 2015. This fund is a joint collaboration between FAO, the United Nations Development Programme, the World Bank, six Central African countries, as well as a coalition of donors from France, Germany, Norway and the United Kingdom of Great Britain and Northern Ireland. The participating Central African countries: Cameroon, the Central African Republic, the Democratic Republic of the Congo, Equatorial Guinea, Gabon and the Republic of Congo will develop investment frameworks to support the sustainable use and conservation of their forest resources, notably

through the implementation of REDD+ activities. These frameworks will play a vital role in climate change mitigation and poverty alleviation in the region.

Forest and landscape restoration

Restoring degraded forest and other lands can bring about very significant gains in carbon stocks, as well as increasing the resilience and adaptive capacity of local people to the threats of climate change.

Today, an estimated 2 billion hectares of the world's land is degraded. Efforts to restore the productivity and the supply of ecosystem goods and services from these degraded areas have significantly increased in recent years. Restoration of degraded land is supported by global processes such as the Bonn Challenge, New York Declaration on Forests, Aichi Biodiversity Targets, SDGs and the Paris Agreement, and the theme features prominently in many countries' climate pledges.

Drylands Restoration Initiative

Drylands are particularly vulnerable to climate change and climate variability, and support for restoration of these areas is on the increase. FAO's Dryland Restoration Initiative supported the preparation of the "Global guidelines for the restoration of degraded forests and landscapes

in drylands – Building resilience and benefiting livelihoods".

4 Towards resilient and efficient fisheries and aquaculture

Oceans and freshwater aquatic systems are critical to global food security and key to regulating the world's climate. With about one-third of human-induced emissions ending up in the oceans, they act as the planet's largest active carbon sink.

Climate change, ocean acidification and changes in waterbodies' physical and chemical characteristics are adding to the sense of urgency to ensure resilient socio-ecological systems. To better understand and respond to these phenomena, FAO supports its Members and partners to mitigate and adapt effectively to the impacts of climate change in fishery, aquaculture and aquatic ecosystems. It does so through policy development, practical demonstration and capacity building. The Voluntary Guidelines for Securing Sustainable Small-Scale Fisheries in the Context of Food Security and Poverty Eradication address ways of building resilience to climate change and variability

FAO advances knowledge through global assessments on the vulnerability of fisheries and aquaculture sectors, regional



assessments (e.g. in the Benguela Current and in the Gulf of Guinea large marine ecosystem fisheries) and through national and community-level assessments in Bangladesh, Myanmar and Seychelles.

FAO's Blue Growth Initiative (BGI) promotes approaches

for fisheries and aquaculture practices to reconcile economic growth with the need to manage aquatic resources sustainably while maintaining social rights and responsibilities. The BGI facilitates climate change mitigation and adaptation through the restoration and management of oceans and

inland waters, improving energy use along the value chain for fisheries and aquaculture products, and supporting innovative technologies and financing to ensure the sustainability of these interventions.

www.fao.org/zhc/detail-events/en/c/233765/

EIGHT ACTIONS ON THE GROUND

▶ 5 Reducing enteric methane for improved food security and livelihoods

For an estimated 800 million resource-poor farmers, livestock are a pathway out of poverty. Ruminant livestock are, however, a large contributor to GHG emissions. In particular, enteric fermentation, the complex digestive process that allows ruminants to digest grass and other low-quality feeds, generates methane as a by-product. Farming systems that are more productive generally have higher total methane emissions but much lower emissions per unit of product (also referred to as 'emissions intensity'). The problem is that ruminant production systems with low productivity lose more energy per unit of animal product than those with high productivity. The solution is to identify and implement low-cost or no-cost technologies that increase productivity across production systems, strengthen farmer livelihoods and increase food security while reducing methane emission intensity.

FAO and the Global Research Alliance on Agricultural GHG emissions are collaborating on a project funded by the Climate and Clean Air Coalition focusing on Argentina, Bangladesh, Benin, Burkina Faso, Ethiopia, Kenya, Mali, Niger, Senegal, Sri Lanka,

Uganda, the United Republic of Tanzania, and Uruguay. The project will bring about changes in ruminant livestock production systems by targeting resource-use efficiency that results in increased livestock productivity, greater food security and reduced enteric methane emissions per unit of product.

FAO coordinates efforts and provides tools for the assessment of production systems, identifying options looking at feed, animal health or manure management, and quantifying the potential to increase productivity and reduce emission intensity. Based on these findings, FAO works with countries to identify investment opportunities for implementation at scale.

www.fao.org/in-action/enteric-methane/en/

6 Better planning and budgeting for climate change adaptation

In most sub-Saharan African countries, the agricultural sectors, including crops, forestry and fisheries, represent the highest share of gross domestic product. They are also the main source of livelihood for the poorest and most vulnerable people. However, studies show that these sectors are among the most exposed to the threats of climate change. Evidence-based

national policies that encompass social, economic, agricultural and environmental policies and include disaster risk-reduction strategies are crucial. They help to increase resilience and food security, as well as facilitating transformational change.

The FAO Economics and Policy Innovations for Climate-Smart Agriculture (EPIC) programme works with national ministries to review and align national policies on food security, agriculture and climate change. Currently active in Malawi, Viet Nam and Zambia to support evidence-based policy-making for CSA, the programme has recently expanded the application of the CSA approach to agricultural policy in other partner countries including Kyrgyzstan, Mozambique and Tajikistan.

In 2015, building on work done on National Adaptation Programmes of Action (NAPAs), FAO launched the pilot programme Integrating Agriculture into National Adaptation Plans (NAP-Ag). Implemented in partnership with the United Nations Development Programme, it supports 11 countries across Africa, Asia and Latin America to identify and integrate climate adaptation measures, disaster risk reduction, and gender mainstreaming into relevant national planning and budgeting processes.

www.fao.org/in-action/naps/en/



7 Genetic diversity and climate change

Genetic resources for food and agriculture encompass the diversity of plants, animals, forests, aquatic resources, micro-organisms and invertebrates that play a role in food and agricultural production.

While these life forms are themselves threatened by climate change, their genetic makeup makes them key players in addressing the challenges such changes present. They play a significant role in the adaptation to, and mitigation of, the consequences of climate change in support of efforts to achieve food security and nutrition objectives. For example, plant genetic resources may provide seeds that can tolerate or thrive amid greater aridity, frost, flooding, or soil salinity.

Policies that anticipate future needs and plan the management of genetic resources as a pivotal reservoir and tool can help build more resilient agricultural and food production systems.

The FAO Commission on Genetic Resources for Food and Agriculture provides an intergovernmental forum for the discussion and development of knowledge and policies relevant to biodiversity for food and agriculture. Its global plans of action for genetic resources provide the international policy frameworks for the sustainable management of these resources, including climate change adaptation. At its 2016 session, its members approved the Voluntary Guidelines to Support the Integration of Genetic Diversity into National Climate Change Adaptation Planning. ▶

MOROCCO

Fishermen returning to the port of Diky after fishing.
©FAO/Abdelhak Senna

EIGHT ACTIONS ON THE GROUND

KYRGYZSTAN

Farmers harvesting melons.
©FAO/Sergey Kozmin



8 Saving food and avoiding waste

Food loss and waste is a major contributor to climate change, accounting for about 8 percent of global GHG emissions as well as being a misuse of resources, including water, land, energy, labour and capital. Food losses also undermine adaptation and resilience measures through reduced food availability and income. Sustainable intensification of crop production aims to increase efficiency in the way crops are produced. This climate-friendly approach to produce more with less input is promoted by FAO and known as “Save and Grow”.

FAO supports more than 50 countries in the area of food loss and waste to help ensure more productive, resilient and low-emission food systems. It provides technical support to countries to help identify loss levels and promotes cooperation among stakeholders to reduce food loss and waste. This includes the Global Initiative on Food Loss and Waste Reduction (SAVE FOOD), a unique partnership with the private sector that comprises more than 700 companies and organizations active in reducing food loss and waste. SAVE FOOD drives innovation, promotes interdisciplinary dialogue and generates solutions across the entire value chain “from farm to fork”. Featured in the Global

Climate Action Agenda at the 2015 Paris climate conference, SAVE FOOD follows an integrated approach involving farmers, industry, policy-makers and civil society to make significant progress in reducing food loss and waste as a key pathway to cut emissions and boost resilience in food systems.

As well as hosting an active Community of Practice on Food Loss and Waste Reduction, FAO has also developed a suite of assessment tools including a methodology for food loss measurement, the EX-ACT VC tool for multi-impact appraisal across the value chain, and the Global Food Loss Index for SDG 12.3. www.fao.org/food-loss-reduction/en/

LEVERAGING RESOURCES TO UNLOCK AGRICULTURE'S POTENTIAL

Investments in agricultural development can deliver greater climate, economic, social and environmental co-benefits than almost any other sector.

The ability to respond to the impacts of climate change calls for a major shift from input-intensive approaches to more sustainable and resilient food systems.

This change has a cost – a cost that poor farmers, pastoralists, fishers, foresters and indigenous communities, especially those living in developing countries – are unable to shoulder.

For many countries, learning how to access and use international financing options effectively represents the first step in the long-term transition to climate-resilient development pathways.

FAO helps countries establish the necessary policy, technical and financial means to mainstream climate change considerations into agriculture, forestry and fisheries and to provide the basis to move towards sustainable agricultural

development and food systems. It also supports the development of national strategies and investment proposals that can support food security under the realities of climate change. The current dynamics in international climate finance offer new and innovative opportunities for investing in sustainable agriculture with the potential to use global financing and turn public and private agriculture funding into sound climate-proof investments.

FAO assists its Members to mobilize financing from the Global Environment Facility, the designated financial mechanism assisting developing countries in implementing their obligations under a number of multilateral environmental agreements or conventions. The facility provides financing according to its six focal areas, plus two funds supporting adaptation to climate change.

The Green Climate Fund (GCF) promotes low-emission and climate-resilient development pathways with an aim to provide support to developing countries to limit or reduce their GHG emissions and to adapt to the impacts of climate change.

The GCF has defined key investment priorities that target many challenges directly relevant to the mandate and work of FAO, including providing support to reduce emissions from

deforestation and land use, and enhancing the resilience of people's livelihoods and food security. Importantly, FAO was accredited to the GCF at its fourteenth board meeting in October 2016 as a grant-implementing entity for medium-sized projects (USD 50–250 million) with a medium level of environmental and social risk. FAO is now scaling up support to its Members to work with the GCF to drive transformative change in the agricultural sectors.

**THE BENEFITS
OF ADAPTATION
FAR OUTWEIGH
THE COSTS OF
INACTION**

BUILDING ON GLOBAL MOMENTUM

In the years to come, countries will require support to refine and achieve the commitments made in their voluntary climate-related pledges as part of the Paris Agreement.

With a view to translating country commitments into action, FAO will aid countries by: (i) providing technical support, information and tools; (ii) helping government agencies and other partners to harmonize climate change and disaster-risk reduction policies and strategies; and (iii) acting as a trusted facilitator and neutral source of technical data among global climate-related institutions and forums. FAO can offer countries, development partners and civil society a neutral platform for dialogue and advocacy.

FAO places particular emphasis on country support in climate change adaptation and mitigation:

① Generating and analysing climate, environmental, agricultural and socio-economic data to underpin the evidence base.



BANGLADESH

Fruit sapling distribution, Boro Modok 2, Bandarban district. ©FAO/Lino Prue

② Carrying out cross-sectoral and multi-objective analyses, assessing trade-offs between food security, adaptation and mitigation as well as costs and benefits of changes in smallholder agricultural practices.

③ Promoting the development and coordination of policy and investment frameworks at the national and regional levels.

④ Supporting international negotiations and processes on policy

and finance, including the analysis of food security implications of climate change policies and agreements; and strengthening the agricultural focus of emerging international climate change financing instruments, including the GCF.

⑤ Developing the capacity of relevant institutions and stakeholders in the agricultural, climate change and related sectors, especially at the national level, in order to strengthen the quality of decision-making.

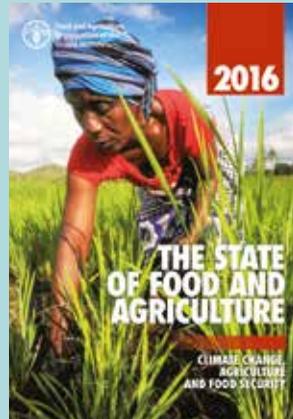
PUBLICATIONS

Voluntary guidelines to support the integration of genetic diversity into national climate change adaptation planning



FAO, Rome, 2015
32 pp.
(also available in French, Spanish, Chinese, Russian and Arabic)

These voluntary guidelines address the genetic resource dimension of adaptation planning. They were developed under the aegis of FAO's intergovernmental Commission on Genetic Resources for Food and Agriculture and approved by FAO Conference in 2015. They aim to assist countries in managing genetic resources as a vital reservoir and tool to adapt agriculture and build resilience into agricultural and food production systems.



The State of Food and Agriculture 2016

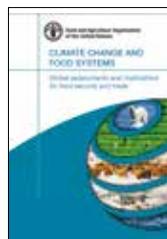
Climate change, agriculture and food security

This report provides an analysis of current and future impacts of climate change, indicating viable paths governments, food producers and other actors should pursue in order to respond to them. To help put planned contributions

FAO, Rome, 2016, 173 pp. (also available in Arabic, Chinese, French, Russian and Spanish)

to adaptation and mitigation into action, this report identifies strategies, financing opportunities, and data and information needs. It also describes transformative policies and institutions that can overcome barriers to implementation.

Climate change and food systems: global assessments and implications for food security and trade



FAO, Rome, 2015
357 pp.

This publication collects the findings of a group of scientists and economists who have taken stock of climate change impacts on food and agriculture at the global and regional levels over the past two decades. The evidence presented describes how global warming will affect where and how food is produced, and the study discusses the significant consequences for food

security, health and nutrition, water scarcity and climate adaptation. The publication also highlights the implications for global food trade.

The impact of disasters on agriculture, livelihoods and food security



FAO, Rome, 2015
77 pp.

This study assesses the impact of medium-to-large-scale natural hazards and disasters on the agricultural sectors in developing countries between 2003 and 2013, focusing on direct physical damage and indirect economic losses. The findings of the study should serve to support national and international efforts to reduce damage and losses caused by disasters and strengthen the resilience of the agricultural sectors, in line with resilience targets set under the Sendai Framework for Disaster Risk

PUBLICATIONS

Reduction, the Sustainable Development Goals, and the Universal Climate Change Agreement.

Cambio climático y sostenibilidad del banano en el Ecuador: Evaluación de impacto y directrices de política.

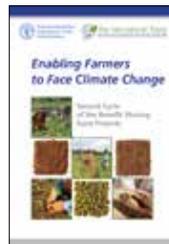


FAO, Rome, 2015
198 pp.

At the request of the Ecuadorian Government, FAO undertook a technical assistance study to generate an integrated assessment of climate impacts on the banana value chain in support of Ecuador's initiatives on sustainable and climate-adapted strategies. Both biophysical and socio-economic analyses were

carried out by a team of FAO and international experts.

Enabling farmers to face climate change



FAO, Rome, 2014
70 pp.

This publication provides an overview of the characteristics and main activities of the projects being implemented as part of the second project portfolio of the Benefit-sharing Fund of the International Treaty on Plant Genetic Resources for Food and Agriculture. This second portfolio consists of 22 projects being implemented in 33 countries across Africa, Asia, the Near East, Latin America and the Caribbean. The publication also aims to share achievements, best practices and lessons learned during the projects' implementation.

Emerging activities to combat climate change

Use of FAO Data and IPCC GHG Inventory Guidelines for Agriculture and Land Use



FAO, Rome, 2014
44 pp.

This FAO-IPCC-IFAD report summarizes the findings of a joint workshop held at FAO headquarters in November 2014. It provides information on access and use of FAO data and analysis tools for agriculture, forestry and other land use, in support of national reporting processes under the UNFCCC, including greenhouse gas inventories, biennial update reports, and national mitigation planning.

Climate-Smart Agriculture: A call for action



FAO, Rome, 2015
120 pp.

This publication is a summary of a workshop



FAO, Rome, 2016, 60 pp.

The Agriculture Sectors in the Intended Nationally Determined Contributions: Analysis

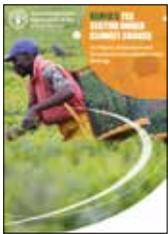
To date, 189 countries have already submitted Intended Nationally Determined Contributions (INDCs) to the UNFCCC.

With the adoption of the Paris Agreement in December 2015,

the INDCs will guide country-level climate action for the coming years. They include not only targets, but also concrete strategies for addressing the causes and responding to the consequences of climate change. FAO has analysed the INDCs to assess the role of the agricultural sectors. The results show that in all regions, these sectors will play a pivotal role in accomplishing the intended goals and actions for responding to climate change by 2030. The analysis should provide a basis for identifying priorities for international support for climate action in the agriculture sectors.

held in Bangkok, Thailand, in June 2015 to promote the mainstreaming and scaling-up of climate-smart agriculture in the region. Included in the report are successful case studies to address food security under adverse circumstances.

Kenya's tea sector under climate change



FAO, Rome, 2015
184 pp.

Following the Intergovernmental Group Meeting on Tea in New Delhi in 2010, FAO was requested by the Government of Kenya to assist with a climate change impact assessment of the tea sector in Kenya and to help develop a new strategy to address such impacts. This report is the outcome of a two-year project in Kenya and includes findings from an integrated climate impact assessment.

Making it count: increasing the impact of climate change and food security education programmes



FAO, Rome, 2015
54 pp.

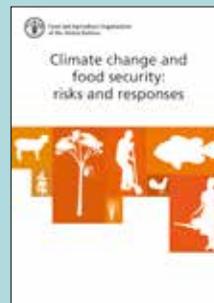
The evidence is clear: to change behaviour, 'environmental education' needs to change its focus – with less emphasis on knowledge and raising awareness and more on competency, action skills and problem solving. Based on the educational and psychological research reviewed in this report, key objectives are proposed for planning or evaluating educational programmes designed to achieve behaviour change.

Estimating greenhouse gas emissions in agriculture

A manual to address data requirements for developing countries



FAO, Rome, 2015
193 pp.
(also available in French and Spanish)



FAO, Rome, 2016, 98 pp.

Climate change and food security: risks and responses

The world has committed to eradicate extreme poverty and hunger by 2030, but climate change is undermining the livelihoods and food security of the rural poor, who constitute almost 80 percent of the world's poor. The effects of climate

change on our ecosystems are already severe and widespread. Climate change brings a cascade of impacts from agroecosystems to livelihoods. Climate change affects agroecosystems directly, which in turn has a potential impact on agricultural production, which drives economic and social impacts, which affect livelihoods. In other words, impacts translate from climate to the environment, to the productive sphere, to economic and social dimensions. Therefore, ensuring food security in the face of climate change is among the most daunting challenges facing humankind. Action is urgently needed now to reduce vulnerability and increase the resilience of food systems in order to ensure food security and good nutrition for all.

This manual seeks to guide the staff of national statistical offices and environmental ministries and agencies in compiling statistics related to GHG emissions and removals. In particular, it provides information on accessing and using the FAOSTAT Emissions database.

Global guidelines for the restoration of degraded forests and landscapes in drylands



FAO, Rome, 2015
171 pp.

PUBLICATIONS

Drylands cover almost half of the earth's land surface and are home to one-third of the global population. They face extraordinary challenges, including those posed by desertification, biodiversity loss, poverty, food insecurity and climate change. Up to 20 percent of the world's drylands are degraded, and people living there are often locked into a vicious circle of poverty, unsustainable practices and environmental degradation.

Adapting to climate change through land and water management in Eastern Africa

Results of pilot projects in Ethiopia, Kenya and Tanzania



FAO, Rome, 2014
180 pp.

This publication presents the results and lessons learned from the FAO-Sida-supported pilot project "Strengthening capacity for climate change adaptation in land and water management" in Ethiopia, Kenya and the United Republic of Tanzania.

Coping with water scarcity in agriculture: a global framework for action in a changing climate

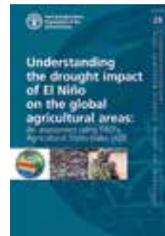


FAO, Rome, 2016
4 pp.

Water use is growing at more than twice the rate of population increase, and a 60 percent surge in food demand is expected by 2050. This fact sheet outlines the need for the global framework for action in a changing climate, 'Coping with water scarcity in agriculture'. This framework will promote and support partnerships to harness the knowledge and experiences of stakeholders and enable targeted actions for the sustainable use of water in agriculture, thereby addressing the challenges for agricultural production and livelihoods posed by climate change.

Understanding the drought impact of El Niño on the global agricultural areas

Available methodologies and their relevance for the sector.



FAO, Rome, 2015
52 pp.

During El Niño episodes, the normal patterns of tropical precipitation and atmospheric circulation become disrupted, triggering extreme climate events around the globe and affecting the intensity and frequency of hurricanes. Disasters create poverty traps that increase the prevalence of food insecurity and malnutrition.

Forests and Climate Change in the Caribbean



FAO, Rome, 2014
39 pp.

This publication provides an overview of the actual

and potential impacts of climate change on forests and forest dependent people in six Caribbean countries – Dominica, Grenada, Jamaica, Saint Lucia, Saint Vincent and the Grenadines, and Trinidad and Tobago. It also examines the major issues and developments related to climate change impacts and responses in the region related to forests. It highlights opportunities for regional action to address gaps and needs.

Planning, implementing and evaluating climate-smart agriculture in smallholder farming systems

The experience of the MICCA pilot projects in Kenya and the United Republic of Tanzania

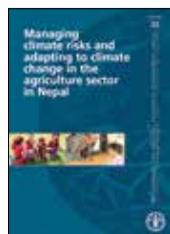


FAO, Rome, 2016
92 pp.

The pilot projects of FAO's Mitigation of Climate Change in Agriculture (MICCA) Programme in Kenya and the United Republic

of Tanzania have promoted climate-smart agriculture (CSA) and have been integrated into ongoing development programmes. The approach was to develop packages of CSA practices based on participatory assessments and expert consultations. Farmers who participated reported that the main benefits of CSA were higher yields, greater farm income and increased food availability.

Managing climate risks and adapting to climate change in the agriculture sector in Nepal



FAO, Rome, 2014
162 pp.

Projected future scenarios of climate suggest that climatic conditions in Nepal will worsen, which may imply even more frequent occurrences of climate-related

Gender in Climate-Smart Agriculture

Module 18 for the Gender in Agriculture Sourcebook.



World Bank, FAO, IFAD, 2015, Rome, 96 pp.

This module provides guidance and a comprehensive menu of practical tools for integrating gender in the planning, design, implementation and evaluation of projects and investments in climate-smart agriculture (CSA). The module emphasizes the importance and ultimate goal of integrating gender in CSA practices, to reduce gender inequalities and ensure that men and women can equally benefit from any intervention in the agricultural sectors to reduce risks linked to climate change.

extremes and negative impacts on food production. However, by adopting the right measures, it is possible to manage the climate risks and adapt to the challenges posed by increasing climate variability and climate change.

Climate change guidelines for forest managers



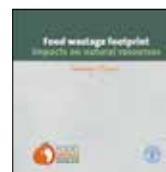
FAO, Rome, 2013
130 pp.
(also available in French and Spanish)

These guidelines aim to assist forest managers to better assess and respond to climate change challenges and opportunities at the forest management unit level. The actions they propose are relevant to all kinds of forest managers – individual forest owners, private forest enterprises, public-sector agencies, indigenous groups and community

forest organizations. They are applicable in all forest types and regions and for all management objectives.

Food waste footprint – impacts on natural resources

Summary report

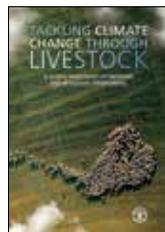


FAO, Rome, 2013
63 pp.

This FAO study provides a global account of the environmental footprint of food waste along the food supply chain, focusing on impacts on climate, water, land and biodiversity. A model has been developed to identify: (i) the magnitude of food waste impacts on the environment; and (ii) the main sources of these impacts, with a view to identifying “environmental hotspots” related to food waste.

PUBLICATIONS

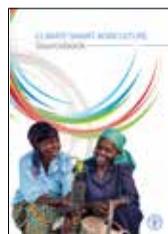
Tackling climate change through livestock



FAO, Rome, 2013
139 pp.
(also available in French)

As renewed international efforts are needed to curb greenhouse gas emissions, the livestock sector a significant emitter of greenhouse gas, has the potential to significantly reduce its emissions.

Climate-Smart Agriculture Sourcebook



FAO, Rome, 2013
570 pp

The aim of the sourcebook is to guide policy-makers, programme managers, sectoral experts, academics, extensionists and practitioners in their efforts to make the

agricultural sectors more climate-smart, more sustainable and more productive, while responding to the challenges of climate change. The sourcebook illustrates the concept, details CSA approaches in and across different subsectors, and outlines enabling frameworks.

Learning tool on Nationally Appropriate Mitigation Actions (NAMAs) in the agriculture, forestry and other land use (AFOLU) sector



FAO, Rome, 2015
162 pp.

This learning tool consists of a set of slides in different modules for independent study. The tool reviews pathways to identify NAMAs (i.e. fast track and in-depth analyses) and different options to monitor and assess mitigation actions, and reduce greenhouse gas emissions in the agriculture and land use sectors. It also

describes interventions needed to overcome barriers and presents sources of data and funding.

Status of the World's Soil Resources



FAO and ITPS, Rome, 2015
608 pp.

This report highlights that more carbon resides in soil than in the atmosphere and all plant life combined. Climate, soils, biophysical and socio-economic systems are interconnected in complex ways, and examining the status of global soils has highlighted the potential of soil as a carbon sink. Sustainable management of soils is essential not only to reduce GHG emissions from soils, but also to increase soil carbon sequestration, especially in degraded soils. The relationship between climate change and soil carbon resources is therefore a key concern

not only for agricultural production but also for human society.

Assessing climate change vulnerability in fisheries and aquaculture

Available methodologies and their relevance for the sector.



FAO, Rome, 2015. 98 pp.
(also available in French, Spanish)

This document provides an overview of vulnerability assessment concepts and methodologies. It sheds light on the different vulnerability assessment methodologies that have been developed, and examines how these are conditioned by the disciplinary traditions from which they have emerged. It also analyses how these methodologies have been applied in the context of fisheries and aquaculture, with illustrative examples of their application.

Fisheries in the drylands of sub-Saharan Africa – “Fish come with the rains”

Building resilience for fisheries-dependent livelihoods to enhance food security and nutrition in the dryland



FAO, Rome, 2016
52 pp.

Some of the most important inland fisheries in the world are found in semi-arid regions. This publication documents the general resilience of many fish resources to climatic variability, with a focus on the drylands of sub-Saharan Africa. It reviews the importance of fisheries and aquaculture to the livelihoods of drylands communities, discusses future threats to human resilience and identifies investment opportunities.

Climate change adaptation in fisheries and aquaculture



FAO, Rome, 2014
34 pp.

This publication contains a selection of current and recent climate change adaptation activities and measures in the fisheries and aquaculture sector.

Climate change implications for fisheries and aquaculture

Summary of the findings of the Intergovernmental Panel on Climate Change Fifth Assessment Report



FAO, Rome, 2016
54 pp.

This report aims to facilitate the use of the Intergovernmental Panel on Climate Change's

Fifth Assessment Report by those concerned with the fisheries and aquaculture sector and their dependent communities.

Fuel and energy use in the fisheries sector

Approaches, inventories and strategic implications

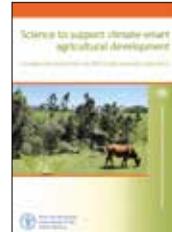


FAO, Rome, 2015
107 pp.

This publication addresses the utilization of fuel energy by the global fisheries industry. It explores the complete supply chain from aquatic raw materials to consumption, including capture fishing, aquaculture, post-harvest activities, distribution and retail presentation. It provides initial data to demonstrate a range of critical characteristics and trends, with implications for sector development and relevant policy and strategic investment needs.

Science to support climate-smart agricultural development

Concepts and result from the MICCA pilot projects in East Africa

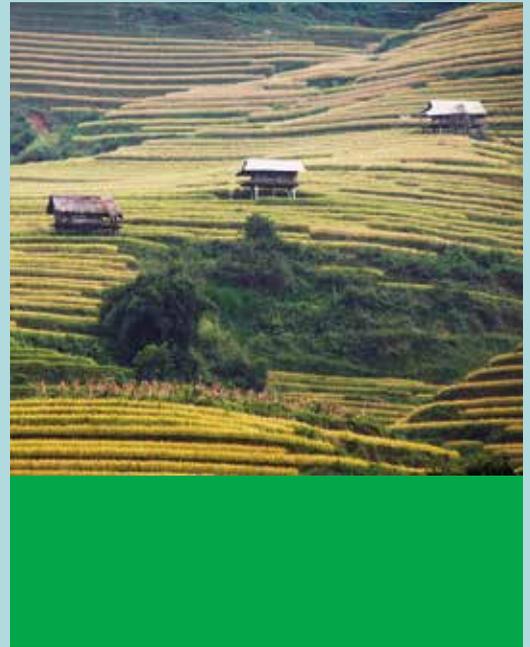


FAO, Rome, 2014
34 pp.

The publication reports on the concepts driving the scientific activities of the MICCA's pilot projects in East Africa. It provides the research results, describes the analytical approaches used and concludes with key messages relevant to discussions on Climate-Smart Agriculture. In partnership with the World Agroforestry Centre (ICRAF), the East Africa Dairy Development Project (EADD) and Care International, the MICCA pilot projects mainstream Climate-smart Agriculture in the regions by identifying, verifying and scaling up farm management practices.

FAO'S WORK ON CLIMATE CHANGE

United Nations
Climate Change
Conference 2016



The Food and Agriculture Organization of the United Nations (FAO) estimates that almost 800 million people in the world today suffer from hunger and malnutrition. Meanwhile, population growth is expected to increase the global demand for food by about 60 percent by 2050 (compared with 2006 levels).

Unless action is taken now to make agriculture more sustainable, productive and resilient, climate change will compromise food systems throughout the world. Disasters, many of which are exacerbated by climate change, are increasing in frequency and intensity. These and slow-onset changes such as temperature and sea-level rise play havoc with ecosystems and the natural resources on which millions of people depend for their livelihoods and well-being.

Climate change jeopardizes our ability to achieve the 2030 Agenda's Sustainable Development Goals as well as the implementation of the Paris Agreement. Reaching these goals requires heightened and concerted action to reduce climate change impacts on food security and nutrition.

This publication presents FAO's key messages on climate change and food security. It includes examples of FAO's support to countries so they are better able to adapt to the impacts of climate change in the agricultural sectors. It also brings together FAO's most up-to-date knowledge on climate change, including the tools and methodologies used to support countries' climate commitments and action plans.