Food and Agriculture
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Climate-Smart Agriculture

Case studies 2018

Successful approaches from different regions

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Contents

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Acronyms

CBO	community-based organization
CIAT	International Center for Tropical Agriculture
CO_2	carbon dioxide
COP	Conference of the Parties [to the UNFCCC]
CSA	climate-smart agriculture
EU	European Union
FFS	Farmer Field School
GAEZ	Global Agro-Ecological Zones
GEF	Global Environment Facility
GGW	Great Green Wall Initiative for the Sahara and the Sahel
GHG	greenhouse gas
GIS	geographic information system
GLEAM	Global Livestock Environmental Assessment Model
LADA-WOCAT	Land Degradation Assessment in Drylands – World Overview of Conservation Approaches and Technologies
NENA	Near East and North Africa
NFI	national forest inventory
NGO	non-governmental organization
OECD	Organisation for Economic Co-operation and Development
SALT	Sloping Agricultural Land Technology
SFM	Sustainable Forest Management
SLM	Sustainable Land Management
UNFCCC	United Nations Framework Convention on Climate Change
WASAG	Global Framework on Water Scarcity in Agriculture

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Introduction

Climate-Smart Agriculture (CSA) is an approach that **focuses on the farmer, fisher and/or herder**. It seeks ways to improve the farmer's productivity and income. It is an approach that helps farmers to adapt to a changing climate and contributes to the mitigation of greenhouse gas (GHG) emissions. The aim of this publication is to provide the best FAO-led examples of how the CSA is not a "one-size-fits-all" approach that can be universally applied but, rather, involves different elements embedded in local contexts.

The ten successful case studies presented here show how the CSA approach has been applied in the regional context to benefit both the agricultural sectors and farming communities. By definition, the CSA approach pursues three pillars: to sustainably increase agricultural productivity and improve farmers' incomes; to build resilience and adaptation to climate change; and to reduce and/or remove GHG emissions, where possible.

While this publication provides a context-specific look at CSA across many different regions, it also showcases different elements of climate-smart agricultural systems. The case studies show how the management of farms, crops, livestock and aquaculture can balance short- and long-term food security needs with priorities for the farmer/producer, as well as build adaption to climate change and contribute to mitigating GHG. Many of the **impacts** outlined in the studies highlight the services provided to farmers, fishers and land managers to enable a better management of climate risks/impacts while providing mitigation options.

The case studies were selected and adapted from the *Climate-Smart Agriculture Sourcebook* Second Edition 2017, and other FAO projects. The aim is to further support policy makers, academics, practitioners (i.e. extension services, non-governmental organizations [NGOs] and farmers) and programme managers who are interested in: successful examples of on-the-ground implementation of CSA approaches; and capturing the synergies between adaptation, mitigation and food security in their work.

Long-term conversion of grassland and forestland to cropland (and grazing lands) has resulted in **global losses of soil carbon.**

Adaptation through changes in food production management – especially planting dates, cultivar choice and irrigation – has the estimated potential to **increase yields by an average of 7–15%.**

Agricultural sectors in developing countries absorb approx. 22% of economic impact caused by medium-/ large-scale natural hazards and disasters. **Integrating adaptation efforts and finance into these sectors is critical.**

TRIPLE WINS

This publication presents different climate-smart approaches for the agricultural sectors[1] to achieve the three pillars of climate-smart agriculture (CSA). It gives ten successful region-specific examples, with varying landscapes and threatened by different climate change impacts across a variety of sectors. **The term "triple wins" is used when a CSA approach is applied and the impacts achieve all three pillars.** CSA does not imply that every practice applied in every location should produce "triple wins". However, it does provide additional insights into how different approaches to agriculture can achieve the three pillars; this, in turn, directly supports the farmers and helps local communities to adapt their land and their sectors to climate change variables.

The three pillars of CSA are:

1. to sustainably increase agricultural productivity and improve the incomes and livelihoods of farmers;

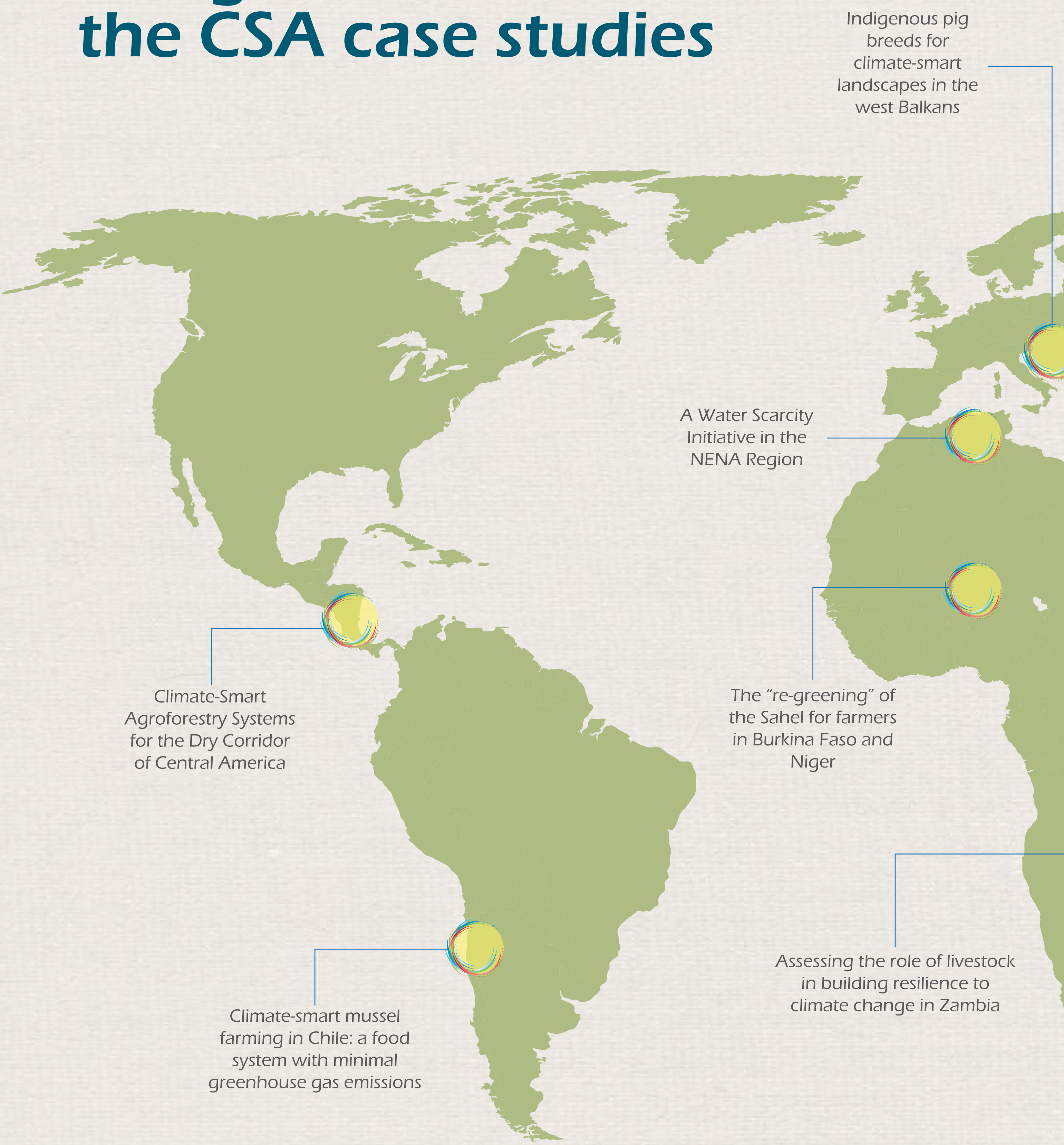
2. to build resilience and adaptation to climate change;

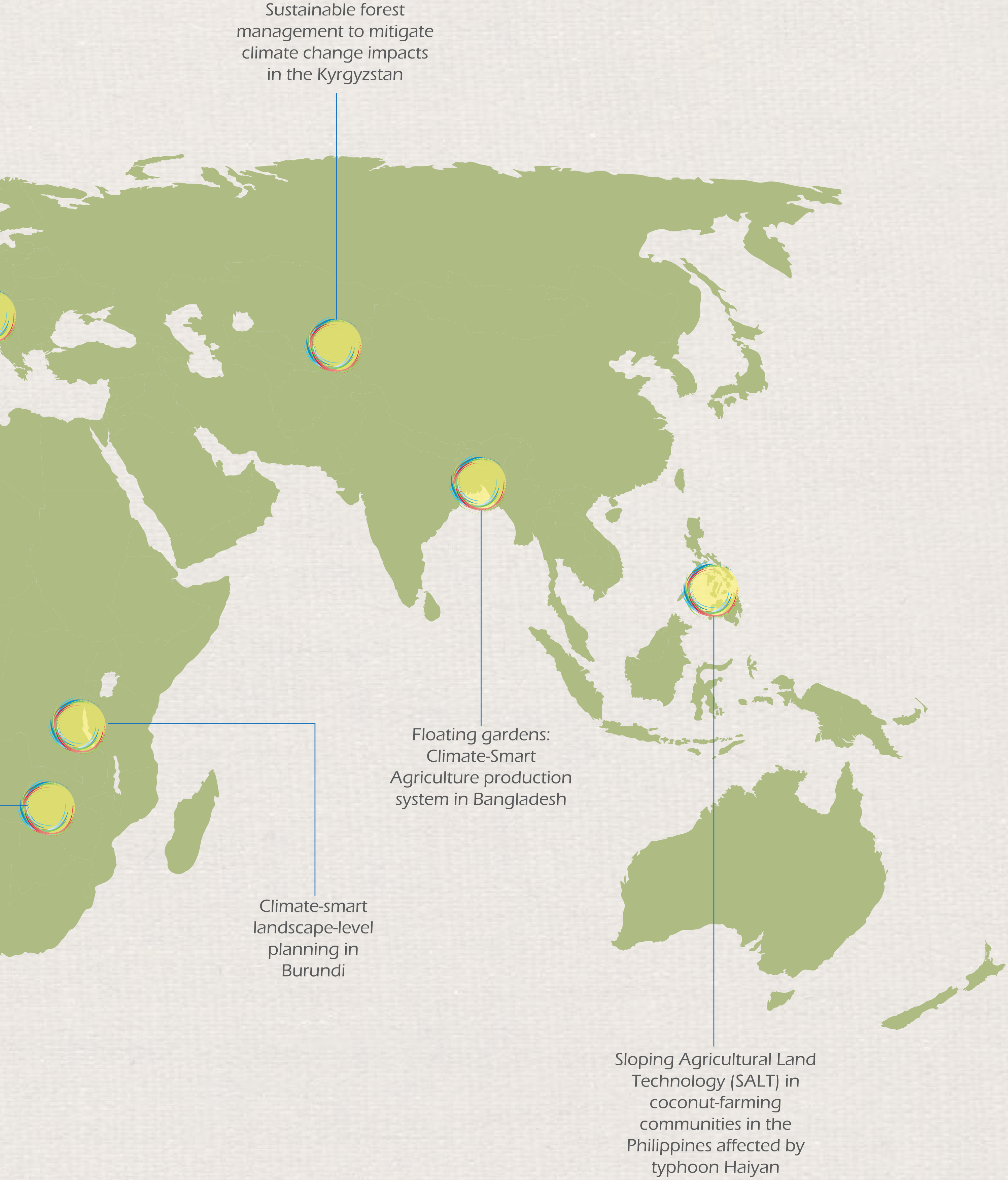
3. to reduce and/or remove GHG emissions, where possible.

Over three-quarters of the world's poor people live in rural areas and many of them depend on agriculture for their livelihoods. Climate change is expected to hit developing countries the hardest. Its effects include higher temperatures, changes in precipitation patterns, rising sea levels and more frequent extreme weather events. The agricultural sectors in developing countries absorb around 22 percent of the economic impact caused by medium-/large-scale natural hazards and disasters. Regardless of whether climate change impacts are experienced over the course of several years or suddenly through an extreme weather event, these case studies demonstrate that the agricultural sectors can be better equipped to face these threats in the future by implementing a CSA approach. Showing successful results from projects on the ground is essential if farmers, national policy makers, international organizations and donors are to be persuaded to make CSA a priority. Coordination and integration across all agricultural sectors dealing with climate change, agricultural development and food security – at the national, regional and local levels – is a prerequisite for creating an enabling policy environment. Through the recently published (online) *Climate-Smart Agriculture Sourcebook* Second Edition 2017, at the 23rd Conference of the Parties to the United Nations Framework Convention on Climate Change (COP23), FAO continues to support the knowledge base of this concept.

1 The term "agricultural sectors" refers to crops, livestock, forestry, fisheries and aquaculture.

A regional overview of the CSA case studies





Sustainable forest management to mitigate climate change impacts in the Kyrgyzstan
Floating gardens: Climate-Smart Agriculture production system in Bangladesh
Climate-smart landscape-level planning in Burundi
Sloping Agricultural Land Technology (SALT) in coconut-farming communities in the Philippines affected by typhoon Haiyan

AFRICA

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>> Climate-smart landscape-level planning in BURUNDI

>> The "re-greening" of the Sahel for farmers in BURKINA FASO and NIGER

>> Assessing the role of livestock in building resilience to climate change in ZAMBIA

Climate-smart landscape-level planning in Burundi

Climate change impacts

According to climate model predictions, Burundi will become drier and hotter due to climate change. The country is predicted to have extended dry periods but with increased rainfall during the rainy season. The agriculture sector must adapt to this changing climate, producing food in higher temperatures where the groundwater is depleted and on land eroded by heavy rainfall.

The project

From 2010 to 2014, the **Kagera Transboundary Agro-Ecosystem Management Project** was implemented by FAO (and partners) and funded by the Global Environment Facility (GEF) in the Kagera river basin[2], which is shared by Burundi, Rwanda, Uganda and the United Republic of Tanzania. The project used the **LADA-WOCAT method** (Land Degradation Assessment in Drylands – World Overview of Conservation Approaches and Technologies) to carry out agro-environmental practices and tackle governance issues in the region.

Maps were developed by a multidisciplinary team and showed levels and types of degradation and successful intervention. Information was then gathered for an analysis of vegetation cover and biodiversity, and water quality. Their impacts were assessed in terms of livelihoods and key ecosystem services in the affected areas to support climate-smart production and Sustainable Land Management (SLM) on the project sites. The results of this analysis fed into an identification of key action areas for improved climate-smart production and SLM at each project site.

The key areas for action were identified as the following:

- **Development of the intervention toolset.** A broad range of stakeholders participated in the assessment and were informed about the project and its aims; the opportunities that existed to become involved through Farmer Field Schools (FFS); catchment planning and management; and the technical studies, support services, and legal or incentive measures in place.
- **Identification of micro-watersheds.** Awareness-raising and targeted selection sessions were organized for local communities, local governments and elected officials. Decentralized technical services were provided to ensure an appropriate, concerted site selection.
- **Biophysical characterization of the environment.** A detailed survey to characterize the selected micro-watershed conditions was conducted using the LADA method.
- **Development of a community action plan.** The formulation of a multisector, multi-annual community action plan was supported by the election of a watershed committee. It was backed up by training to guide the process, followed by monitoring and evaluation. The plan took account of climate change adaptation concerns and involved numerous climate-smart agriculture (CSA) interventions.
- **Implementation of the action plan.** An important part of the plan involved strengthening the capacities of FFS members to better adapt to climate change impacts through soil and water management on their farms.
- **Endogenous monitoring and evaluation.** The participatory evaluation of the activities focused on a number of agro-environmental measurements and a cost–benefit analysis of specific practices to better understand their opportunity costs and compare their benefits.

Project impacts

- In total, 50 project sites were managed by the local communities.
- The project trained over 1 200 FFS members – 60 percent of whom were women – on SLM practices, such as using biological pest control, promoting agro-biodiversity and harvesting water resources efficiently, as well as using improved seeds.

2 Under the TerrAfrica Strategic Investment Programme for Sustainable Land Management in sub-Saharan Africa, FAO supported the Kagera Transboundary Agro-ecosystem Management Project (Kagera TAMP).

- This resulted in the restoration of 4 600 hectares of previously degraded watersheds. The project also enabled local communities to improve management of the vegetation coverage and created a fundamental change in their outlook towards long-term development activities.

Replication around the world

To replicate the LADA-WOCAT method for climate-smart landscape-level integration, supportive local governments and elected officials are crucial for the participatory approach. Organizing decentralized services, such as committees and FFS, ensures inclusive processes through all stages of planning. For example, the LADA-WOCAT method has been replicated in South Africa[i], where a Land Use System mapping exercise was conducted to identify current land degradation in relation to the country's cropland, grassland, forest, wetlands, open water, bare areas and urban land. South Africa's most critical environmental issues are land degradation and desertification[ii], which are intimately linked to food security, poverty, urbanization and climate change. Land Use Systems and their attributes include many important parameters related directly to land degradation and soil and water conservation. Climate-smart landscape-level planning can be replicated in other regions or countries (with geographical proximity to a river basin) that are experiencing similar climate change impacts, such as heavy seasonal rainfall and soil erosion.

Pillar 1

To increase the agricultural productivity and boost the incomes of these farming households, the project installed storage facilities and connected farmers with local hotels to market and sell their surplus produce.

Pillar 2

To better adapt and build resilience to climate change, higher-quality seeds were introduced to help the communities manage their land. This increased and stabilized agricultural production, even in the face of climate change.

This case study was adapted from the Climate-smart agriculture Sourcebook Second Edition
Module A3 "Managing landscapes for Climate-Smart Agriculture Systems", Case Study A3-1:
www.fao.org/climate-smart-agriculture-sourcebook

The "re-greening" of the Sahel for farmers in Burkina Faso and Niger

Climate change impacts

In the 1970s and 1980s, the Sahel region experienced disastrous droughts that caused widespread famine. A major shift in temperature and precipitation patterns was observed, considered by experts to be an early impact of climate change in this region. Where two-thirds of the land cover consists of drylands and deserts, desertification affects millions of the most vulnerable people in Africa.

The Great Green Wall Initiative & the FAO programme

Established in 2007 and ledby the African Union, the *Great Green Wall Initiative for the Sahara and the Sahel*[iii] (GGW) has become Africa's flagship initiative to combat the effects of climate change and desertification and it is still ongoing[3]. This ambitious initiative sets out to plant a wall of 11 million trees spanning 11 countries from east to west (8 000 km long and 15 km wide) across the entire Sahara and Sahel region of Africa. Launched in 2014 as a contribution to the GGW, the **Action Against Desertification** programme is being implemented by FAO and partners with funding from the European Union (EU). The programme's activities focus on:

- **capacity development** of partner organizations and NGOs with a view to strengthening the **enabling environment** for sustainable land and forest management and restoration[iv];
- dissemination and use of **good practices** in Sustainable Land Management (SLM);
- **income-generation activities**, as well as the creation of employment opportunities in rural areas, especially for youth and women, based on the sustainable production, processing and marketing of agricultural products and forest goods and services; and
- Farmer Field Schools (FFS) and **knowledge exchange**, allowing farmers to learn about the causes of desertification and the best ways to combat and prevent it.

Of the 11 Sahelo-Saharan African countries in this initiative and programme[4], Burkina Faso and Niger have already seen positive results. In Burkina Faso and Niger, FAO supported large-scale land restoration by combining techniques such as enrichment planting, direct sowing and fencing to encourage natural regeneration; building capacity development; and promoting value chains of high potential non-timber forest products to tackle the diversification of economic activities. Policy changes regarding land tenure, and changes in opportunities for off-farm employment, also contributed to recent progress.

Programme impacts

As a result of the programme, an estimated 12 000 hectares of degraded land were planted between 2015 and 2017 to kick-start their restoration across the region.

Burkina Faso (Central Plateau)

- There have been **improvements in water availability and soil fertility**. Farmers have sown crops in planting pits and built stone contour bunds.
- **Land restoration[iv] has been implemented on more than 4 200 hectares of degraded land**, of which over 3 000 (prepared using the Delfino plough) have been planted to start their restoration.
- Activities have **benefited over 4 700 agropastoralist farmers**, half of them women.

3 Burkina Faso, Ethiopia, Gambia, Niger, Nigeria and Senegal have prepared their GGW national strategies and action plans, which are currently being implemented or are seeking financing. In Chad, Djibouti, Eritrea, Ethiopia and Mauritania, groups have also been mobilized and are involved in preparing action plans.

4 Burkina Faso, Chad, Djibouti, Eritrea, Ethiopia, Mali, Mauritania, Niger, Nigeria, Senegal and Sudan.

Niger (southern Niger)

- Farmers have **developed innovative ways of regenerating and multiplying valuable trees**. These lands now support increasing numbers of trees, crops and livestock, which have **enhanced the food security of about 3 million people**.
- In 2017, **1 050 hectares of degraded land were prepared for restoration** and almost 250 000 seedlings of well-adapted local trees, shrubs and grasses were planted[v].
- **Water levels in wells have increased significantly.** Some farmers maintain small vegetable gardens near the wells, so this increase adds to their incomes and improves nutrition.
- With **increased quantities of fodder and crop residues**, farmers keep livestock closer to their fields in **more intensive and profitable crop–livestock production systems**, which provide feed for animals and manure for fertilizer.

Replication around the world

The replication of activities to combat desertification can be applied in all countries facing land degradation and desert encroachment, and looking for re-greening. Under FAO's Action Against Desertification programme, the EU and partners[5] have committed to supporting Fiji[vi] in improving the condition and productivity of the agro-silvo-pastoral landscapes affected by land degradation, drought and desertification. In Fiji, land restoration has been implemented for smallscale farming on 2 000 hectares of communal lands in 64 local communities.

Pillar 1

The diversification of economic activities stimulates job opportunities and offers income-generating activities that promote value chains of high-potential non-timber forest products: for example, collecting and selling seed and fodder and the production and sale of nursery seedlings and honey.

Pillar 2

The replanting of trees not only protects genetic resources, but also combats land degradation and desertification by stabilizing soils, reducing water and wind erosion and maintaining nutrient cycling in soils. The leaves of the trees provide compost and the canopy creates shade: this increases the humidity and precipitation of the environment, requiring less watering of the land, and in turn, helps the landscape's resilience to drought.

Pillar 3

The landscape restoration of replanting trees increases carbon stocks.

This case study was adapted from the Climate-Smart Agriculture Sourcebook Second Edition 2017, Module A3 "Managing landscapes for Climate-Smart Agriculture Systems", Case Study A3-3: www.fao.org/climate-smart-agriculture-sourcebook

5 The African Union Commission, the Global Mechanism of the UNCCD, the Royal Botanic Gardens, Kew, and the Walloon region of Belgium.

Assessing the role of livestock in building resilience to climate change in Zambia

Climate change impacts

In Southern Africa, the demand for animal products is projected to double between 2006 and 2050. The combination of high food insecurity, relatively low yields, high deforestation and localized land degradation leaves Zambia particularly vulnerable to climate change. It is expected that the country will face rising temperatures, shortened growing seasons and increased frequency of severe climate events.

The model

FAO conducted a case study to better understand the role of livestock in building resilience in Zambia as there was a lack of large-scale, long-term assessments of livestock productivity under climate constraints. The Organization used a modelling framework that articulates data on:

- livestock generated by the **Global Livestock Environmental Assessment Model (GLEAM)**[vii];
- vegetation productivity generated under the DevCoCast project (dry matter productivity of natural vegetation); and
- agricultural yields through Global Agro-Ecological Zones (GAEZ).

GLEAM is a model that simulates the interaction of activities and processes involved in livestock production and the environment. It is designed to analyse multiple environmental dimensions, such as feed use, GHG emissions, land use and land degradation, nutrient and water use, and interaction with biodiversity. While many attempts have been made to quantify the mitigation potential of single technologies, few systematic studies exist for assessing "best-bet" options in different production systems and regions, and their impact on food security.

The modelling framework compared feed requirements of livestock with feed availability from agricultural and natural vegetation in order to estimate potential deficits. The modelling framework was applied under two timeframes, 1999–2011 and 2012–2030, and under two scenarios: a baseline scenario and a drought scenario. Within each year, the wet and dry seasons were modelled separately. These scenarios reflected the growth of the sector by estimating the number of animals. The baseline scenario had the same overall vegetation biomass productivity as in the 1999–2011 time series. The drought scenario included three years of severe drought and seven years of mild drought, calibrated using the 1999–2011 time series. A drought year was defined as a year with low vegetation productivity, assuming a direct link between climate and vegetation productivity.

Several improvement options targeted at the livestock sector were included in the modelling: for example, improved animal husbandry and health, as well as improved animal feed to increase productivity and mitigate GHG emissions. These options, together with modelling parameters and assumptions, were discussed with stakeholders in Zambia through a dedicated national workshop.

Project results

The results of this assessment study revealed the following benefits and trends in the livestock sector:

- The difference between the drought scenario and the baseline scenario in terms of productivity was limited, although it was found that the former led to lower production increases.
- Livestock can play an important role in **building resilience by buffering climate variability** and the corresponding variability in vegetation production. Livestock's buffering effect was most important in the drought scenario. In this scenario, the variability of vegetation production was highest and so was its difference in relation to the variability of livestock production.
- With improved practices, GHG emissions would increase by an additional 7 to 20 percent due to extra production gains and increases in animal numbers. However, by improving livestock productivity, improvement options would lead to a **strong decrease in emission intensity (emissions per unit of product), from 21 to 36 percent**.

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Replication around the world

This modelling framework could be used in any country looking to assess its livestock productivity under specific climate constraints in order to better understand how to build resilience to climate change. The GLEAM model, in particular, has been used in six practical case studies in selected regions and livestock production systems, namely:

- mixed dairy production in South Asia;
- commercial pig production in East and Southeast Asia;
- specialized beef production in South America;
- small ruminant production in West Africa;
- mixed dairy production in Organisation for Economic Co-operation and Development (OECD) countries; and
- mixed dairy production in East Africa.

Moving towards a more sustainable livestock sector requires a sound, evidence-based diagnostic of the undesired environmental side effects. Stakeholders can then identify and assess intervention areas and options. GLEAM is a key contributor to both processes.

Pillar 1

Production would increase by 30 percent in the baseline scenario without improvement options, while their adoption could roughly double the production gains.

Pillar 2

In both the past time series and the two scenarios, **the inter-annual variability of production was higher for vegetation biomass than for livestock products**. Therefore, results suggest that **livestock can enhance climate change adaptation by leading to a more stable production than by the use of vegetation biomass**.

Pillar 3

An option to offset the GHG emissions associated with the sector's growth would be the management of pastures for carbon sequestration. **This could offset emissions by 25 to 31 percent and decrease emissions intensity as well**, depending on the effect on productivity of improved carbon sequestration practices in grassland.

This case study was adapted from the Climate-Smart Agriculture Sourcebook Second Edition 2017,
Module B2 "Climate-Smart Livestock Production", Case Study B2-3:
www.fao.org/climate-smart-agriculture-sourcebook

ASIA & THE PACIFIC

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- >> Sloping Agricultural Land Technology in coconut-farming communities in the PHILIPPINES affected by Typhoon Haiyan
- >> Floating gardens: the Climate-Smart Agriculture production system in BANGLADESH

Sloping Agricultural Land Technology in coconut-farming communities in the Philippines affected by Typhoon Haiyan

Climate change impacts

In 2013 Typhoon Haiyan crossed the central regions of the Philippines, devastating 600 000 hectares of farmland and causing over USD 700 million worth of damage to the agriculture sector. An estimated 44 million trees were damaged or destroyed due to this extreme weather event that directly affected 1.7 million people working in coconut-farming-related activities.

The projecs

It was not sufficient *only* to replant the damaged coconut trees; rather, there was an urgent need for a massive and coordinated initiative to enable coconut-farming communities to build resilience for future disasters. In response, FAO integrated the Coconut-Based Farming Systems in its **Typhoon Haiyan Emergency, Recovery and Rehabilitation Programme.** After initial consultations with government partners and community-based organizations (CBOs), FAO determined the **Sloping Agricultural Land Technology (SALT)** as the most suitable climate-smart agricultural production system.

SALT is the planting of permanent shrubs such as coffee, cacao and citrus and other fruit trees in rows that are contoured throughout the farm plot. The SALT concept and layout provide a setting for planting short-term, medium-term and permanent crops, grown in alleys between contoured rows of nitrogen-fixing trees or shrubs. It also includes the planting of trees for timber and firewood on surrounding boundaries of the plot. This cyclical cropping method provides farmers with multiple harvests throughout the year.

SALT is a climate-smart solution for **smallholder farmers with few tools, little capital and limited farming grounds**. The implementation of the SALT concept and layout at scale involved some critical steps:

Farmer-cooperatives were trained on how to establish and maintain SALT sites, including an **on-site demonstration** at various SALT sites.

- A **planning session was conducted** with the different stakeholders to ensure that the planting was in line with the SALT layout.
- **Government partners were involved** and consulted at every level of the process.
- **Strong relationships with the government and beneficiaries**, and "ownership" of the SALT sites by both the coconut-based organizations and the local government units, were established.

Project impacts

FAO established **101 SALT sites** in Haiyan-affected regions through this project, providing the following outcomes:

- **2 265 households**, including **74 CBOs** that depend on Coconut-Based Farming Systems for their livelihoods, have benefited from this project.
- **Farmers are now able to earn from short-term crops every 3–4 months**; from medium-term crops every 5–12 months; and from perennial crops every fruiting season.
- Rotating and diversifying the crops has helped to **reduce the impacts of infestations from pests and diseases**.
- Agricultural technicians conducted a **climate-smart Farmer Field School (FFS) training**, for both government staff and local farmers, to promote the transfer of knowledge across the affected regions.
- A total of 209 agricultural technicians (117 of whom were women) completed the course.

Replication around the world

SALT could be implemented in areas characterized by natural slopes and ridges, and prone to landslides and slope instability due to intensive cultivation and cropping without any terraces or bunds. Hillside farm plots that experience erratic or increased rainfall patterns or severe soil erosion could benefit from this cost-effective system, not only to sustain but also to increase agricultural productivity for the farmer. For example, SALT could be implemented and adapted to local conditions by farmers in the hill regions of the north-eastern states of India, where traditional slash-and-burn methods are widely practised to cultivate hillside plots. These plots are particularly vulnerable to unseasonal rainfall, and yields are reduced over time due to the lack of soil fertility.

Pillar 1

The contoured layout of SALT enables farmers to plant vegetables and other cash crops to complement their main crops like coconut and corn. This provides farmers with a wider variety of food sources and incomes throughout the year.

Pillar 2

This farming system promotes the planting of drought-resistant trees for the hedgerows between contour lines in the plot: for example, the inexpensive leguminous tree *madre de cacao (Gliricidia sepium)* is easy to grow and requires less water. The SALT layout on natural slopes stabilizes the hillside land so that it is less prone to landslides.

Pillar 3

The soil and water conservation measures on a SALT plot include barriers of biomass, surface stones and the planting of nitrogen fixing plants for the hedgerows.

This case study was adapted from the Climate-Smart Agriculture Sourcebook Second Edition 2017,
Module B5 "Integrated production systems", Case Study B5-1:
www.fao.org/climate-smart-agriculture-sourcebook

Floating gardens: the Climate-Smart Agriculture production system in Bangladesh

Climate change impacts

Evidence of climate change in Bangladesh can be seen in an accumulation of heavy rains, frequent storms and rising sea levels that result in severe flooding. Due to continuous water-logged conditions, crops are often lost and land for agriculture has become scarce. The low-lying areas of the southern coastal – and south-central – districts of Bangladesh remain submerged for 6–8 month periods every year, especially during the monsoon season. As a result, crop cultivation is not possible on land. In these circumstances, location-specific adaptation and resilience measures to climate change have become a priority for improving the food security of the nation's vulnerable people.

The study

In 2015 FAO conducted a study[viii] on a successful climate-smart production system in the lowlands of Bangladesh that was based on the local knowledge of farmers. These farmers have converted the prolonged flooding season into an opportunity: "floating gardens". These are floating plots made from local organic material on which diversified vegetables are grown or seedlings are raised for marketing. The FAO study examined how these floating gardens production systems are constructed and how they contribute to resilience and livelihoods in these communities. The study was conducted at three floating vegetable cultivating districts: Pirojpur, Barisal and Gopalganj. The practitioners, local extension providers, input suppliers and local government officials were all consulted. There are only a handful of studies on the floating gardens production system.

Farmers prepare the rectangular-shaped beds during June and July and sow/transplant seeds eight to ten days after the last stacking to the garden bed. Around 30 species of vegetables, spices and other crops or seedlings are grown in this water-based production system. The major vegetable crops are okra, ribbed gourd, Indian spinach, brinjal, cucumber, red amaranth, stem amaranth, wax gourd and (in winter) turnip, papaya, cabbage, cauliflower, tomato and red amaranth. The spices turmeric and chili are also grown. Mixed intercropping is the most prevalent system.

The results

The results of the study demonstrate that floating gardens have several advantages:

- The fallow waterlogged area can be cultivated and the total cultivable area is increased.
- The area under floating cultivation is more fertile than land on the plains.
- No (or minimal) fertilizer and manure are required, unlike the conventional agricultural system.
- After cultivation, the biomass generated can be used as organic fertilizer in the field and it conserves natural resources.
- During floods, floating gardens can be used as shelters for poultry and cattle. Fishers can cultivate crops and fish at the same time, since the gardens are built on beds made of plant material and bamboo. This allows the plot to rise and fall with the river water levels, and it does not wash away no matter how long the floods last.

Floating gardens are environmentally friendly, while contributing to food security and nutrition. The organic production of vegetables is important for local, urban and export markets. There is scope for improving productivity, profitability and marketing, and also opportunities for value addition, through research and development programmes.

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Replication around the world

This floating gardens production system started and developed in the southern coastal and south-central districts of Bangladesh as an alternative form of livelihood. However, it is now being replicated in other regions of the country with similar ecosystems. The practice varies from place to place, and also differs in shape and size as well as production system.

Across the world, this unique system of floating gardens for vegetable and spice production (high-value crops) can flourish in areas with deeply flooded wetlands. For example[ix], in the southwestern valley of Mexico in the region of Xochimilco, floating gardens (known locally as chinampa[x]) were first introduced at the height of the Aztec Empire in the capital, Tenochtitlan, and other Aztec cities. The technique is still used to cultivate vegetables on freshwater lakes in Mexico.

Pillar 1

Considering all areas (districts) together as measuring 100 m^2, the FAO study found that farmers operating the floating gardens system receive an average gross return of USD 265 and a net return of USD 134 per season. In comparison, when cropping on plain land, farmers receive an average gross return of USD 31 and a net return of USD 10. The floating gardens production system clearly increases the farmers' incomes and is more profitable than vegetable cultivation on plain land.

Pillar 2

Initially developed out of necessity, the floating gardens approach uses local skills and knowledge for adaptation to the prolonged flooding season, and builds resilience to flooding.

Pillar 3

Recycling is an important component of this production system. Garden beds are made from local organic material (plants) that are almost free, recyclable and do not pollute. When the floodwater recedes, decomposed beds are used as compost on the ground to grow winter crops.

This case study was adapted from findings in Climate-Smart Agriculture: a call for action (FAO, 2015), Case 4 "Floating gardens: Spreading the tradition" (pp. 70–77): www.fao.org/3/a-i4904e.pdf

EUROPE & CENTRAL ASIA

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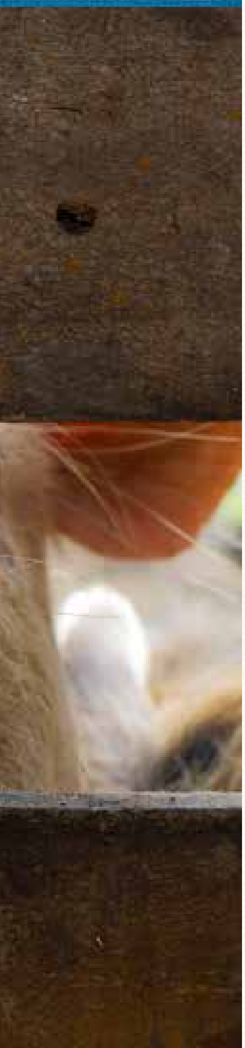
>> Indigenous pig breeds for climate-smart landscapes in the western BALKANS

>> Sustainable Forest Management to mitigate climate change impacts in KYRGYZSTAN

Indigenous pig breeds for climate-smart landscapes in the western Balkans



Climate change impacts

The western Balkans[6] are getting warmer and are projected to continue on this warming trajectory in the future. The region is receiving less precipitation, and this is projected to further decrease and vary according to terrain, elevation and proximity to the sea. In 2008 carbon dioxide (CO_2) emissions for the western Balkan countries ranged from slightly more than 1 tonne to just over 8 tonnes per capita; the region's contribution to global CO_2 emissions is much lower than in highly developed countries.

The project

Autochthonous (indigenous) pig production is attracting more consumer interest, as local pig breeds often require less intensive systems and offer higher-quality products. In Albania, Bosnia and Herzegovina, The former Yugoslav Republic of Macedonia and other western Balkan countries, pig production is important for livelihoods, diets and culture. However, local animal breeds, even though they continue to have a significant importance for local livelihoods and culture, are declining across Europe. Pig species native to this region are suitable for adaptation to local climatic conditions, but their numbers are falling due to so-called "improved breeds" that are seen as more suitable for export.

However, the native breeds can often be raised on agricultural lands that are unsuited to other production systems and can play a significant role in conservation activities that follow a climate-smart landscape approach. In the western Balkan countries, indigenous pig breeds are appreciated for their rooting activities[7]. Their grazing behaviour keeps the ground "open" and helps to conserve biodiversity. In shrubland, the grazing of pigs acts as a "living plough". The animals also produce fewer emissions due to a more sustainable value chain.

Project impacts

With the socio-cultural and agro-environmental benefits associated with local pig production (which are felt throughout the entire region), some local pig breeds have been officially protected as rare breeds.

- The project aims to halt the genetic erosion of this species by ensuring that its gene pool does not diminish. Animal numbers are being increased to help to protect these breeds from the risk of extinction.
- The pigs' rooting activities create open spaces that serve as semi-natural firebreaks and promote the germination and succession of annual plant species.
- The animals' free ranging creates a species-rich, highly biodiverse habitat mosaic, which in turn enhances the aesthetic value of the agricultural landscape.
- Traditional pig husbandry supports the preservation of the environment and the conservation of soil and biota regardless of climate variations.

Replication around the world

The herding of local animal breeds is beneficial for any region. Autochthonous pig breeding, more specifically, could be a suitable production system in regions experiencing a wide range of climates with mild, wet winters and hot, dry summers to temperate continental and alpine mountain climates. The animals can survive without much attention in regard to feeding and disease management due to their indigenous relationship with the landscape. For example, the Tenyi Vo pig breed in the extreme north-eastern corner of India is a native breed at risk because, like other local pigs, it is being crossbred or replaced by imported breeds. The Tenyi Vo is still the preferred breed due to its unique qualities and its importance in festivities among many tribes. Despite this, it is estimated that there are only between 900 and 1 000 purebred native Tenyi Vo pigs left in the area.

6 The western Balkan countries referred to in this case study include Albania, Bosnia and Herzegovina, Croatia, Montenegro, Serbia and The former Yugoslav Republic of Macedonia.

7 The western Balkan countries referred to in this case study include Albania, Bosnia and Herzegovina, Croatia, Montenegro, Serbia and The former Yugoslav Republic of Macedonia.

Pillar 1

This practice of allowing pigs to range freely improves land cover and production. Pig production in the western Balkans is crucial for sustainable livelihoods, diets and culture.

Pillar 2

Traditional pig husbandry has a low agro-environmental impact, is resilient to variations in climate, can contribute to the restoration of agricultural ecosystems and enhances biodiversity.

Pillar 3

The traditional practice of allowing pigs to range freely helps to create a species-rich habitat mosaic that enhances biodiversity. Although this activity increases soil carbon losses, the natural rooting of the pigs supports biomass growth above ground growth, which removes CO_2 from the atmosphere.

This case study was adapted from the Climate-Smart Agriculture Sourcebook Second Edition 2017, Module A3 "Managing landscapes for Climate-Smart Agriculture Systems", Case Study A3-2: www.fao.org/climate-smart-agriculture-sourcebook

Sustainable Forest Management to mitigate climate change impacts in Kyrgyzstan

Climate change impacts

Kyrgyzstan's mountainous landscape is rich in forests and natural resources. However, climate change can be felt through rising temperatures and decreasing precipitation, which has led to the decline of snow cover, melting glaciers and the flooding of lakes. The country's forests play a crucial role in regulating mountain run-off so that the rivers flow more evenly throughout the year – this is important not only for Kyrgyzstan but also for other Central Asian countries where farming relies heavily on surface irrigation. However, decades of intensive livestock grazing have taken a toll on the country's natural resources. Logging, as well as fires to clear land for farming or pasture, have damaged or destroyed forest cover.

The project

To mitigate climate change impacts through Sustainable Forest Management (SFM), the first and most important step was to help the Government of Kyrgyzstan to design and implement a comprehensive national forest inventory (NFI) of all forest types and land properties. In 2007 FAO initiated the Capacity Building for National Forest and Tree Resources Assessment and Monitoring project in Kyrgyzstan: an integrated landscape approach[8] was used to assess the country's forest and tree resources and strengthen the national monitoring capacity.

In December 2010 Kyrgyzstan completed its NFI – this was the first inventory of its kind to be carried out in the Central Asia region. Roughly 5.6 percent of Kyrgyzstan is made up of forests and the project surveyed 72 percent of the country's territory, over 14 434 000 hectares nationwide. A national forest vegetation and land-use classification system for remote-sensing surveys was developed. In addition, FAO and the Department of Forest, Hunting and Ground Inventory worked closely together to design a database to store and manage information from the forest and land assessments. The project brought together major stakeholders working on forest and tree resource management, civil society, NGOs, forest services, scientists, line ministries and international partners. The aim was to agree on a sector-integrated approach to assess the country's forestry resources and their multiple functions.

Project impacts

The project's results served as a baseline for a NFI, developed by the Government in consultation with local authorities and communities, NGOs and other stakeholders, and running until 2025.

- The inventory identified forests outside state-owned forest and protected areas not previously included in official statistics. As a result, national forest and shrubby vegetation coverage was updated from 4 to 5.6 percent.
- The Government officially adopted these new figures and has begun to review and amend existing national forest legislation and policies to cover and address these areas as well.
- The inventory has strengthened country-level capacity and created strong political ownership of its forests.
- The project generated up-to-date data from scientific, evidence-based assessments that can inform and shape national policies, legislation and programmes aimed at improving SFM and combating climate change.

8 An "integrated landscape approach" refers to a set of concepts, tools, methods and approaches used in landscapes in a bid to achieve multiple economic, social and environmental objectives (multifunctionality). This is done through processes that recognize, reconcile and synergize the interests, attitudes and actions of multiple actors.

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Replication around the world

Implementing a comprehensive NFI can be replicated in any country. Inventory methods have evolved and new tools are currently available, such as the FAO-Google Collect Earth tool[9] (www.openforis.org/tools/collect-earth.html). Selecting one method or technology over another will depend greatly on the strengths and capacities of the country concerned. In Brazil, FAO initiated a project entitled Establishing Methodological Basis and Building Partnerships for Brazil's National Forest Resources Inventory. The aim was to provide technical assistance to the Brazilian Forest Service in the methodological development and testing of the NFI methodology for field sampling and landscape mapping. As a result of the NFI preparatory process, methodological refinements and testing were carried out in all Brazilian biomes. The information collected was beneficial for a country with a strong forestry vocation, one that is dependent on forests for employment, ecotourism, wildlife and natural resources.

9 Collect Earth is a tool that enables data collection through Google Earth. In conjunction with Google Earth, Bing Maps and Google Earth Engine, users can analyse high and very high resolution satellite imagery for a wide variety of purposes, including multi-phase NFIs.

Pillar 1

The inventory was the first step in fostering SFM in order to combat climate change. It eventually led to more than 1 million beneficiaries of this project who live in or near forests and rely heavily on wood for heating, construction, food and incomes (walnuts, pistachios, and fruit such as apples, pears and plums). The project has raised awareness among local communities of the importance of saving the biological and landscape diversity, as well as the environmental functions and the aesthetic and recreational values of existing forests.

Pillar 2

The inventory has built greater resilience. It has also encouraged a greater understanding of how the country's forests play a crucial role in preventing soil erosion, mudflows, landslides and avalanches, as well as regulating mountain run-off so that rivers flow more evenly throughout the year.

Pillar 3

Before the NFI, logging and burning trees to clear land for farming or pastures was a common practice: in addition to degrading the soil, these activities released CO_2 and greenhouse gases into the atmosphere. The inventory was an essential step in order to begin monitoring these gases. Through the establishment of SFM, these activities (logging and burning trees) are no longer common practice.

This case study was adapted from the FAO Forestry monitoring and assessment Country Projects, Sustainable forest management in the Kyrgyz Republic [www.fao.org/forestry/fma/73410/en/kgz] and the Project's Final Report of FAO TCP/KYR/3102 (D) Capacity Building for National Forest and Tree Resource Assessment and Monitoring Project and contains statistical data on the analysis and evaluation of the forest and tree resources of Kyrgyzstan.

LATIN AMERICA & THE CARIBBEAN

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>> Climate-smart agroforestry systems for the Dry Corridor of CENTRAL AMERICA

>> Climate-smart mussel farming in CHILE: a food system with minimal greenhouse gas emissions

Climate-smart agroforestry systems for the Dry Corridor of Central America

Climate change impacts

The Dry Corridor is located in Central America's ecoregion of dry tropical forests that cover the lowlands of the Pacific coastal areas of El Salvador, Guatemala, Honduras and Nicaragua. The Dry Corridor has a distinct and prolonged dry season, but at the same time the region experiences excessive rainfall and severe flooding. These impacts are accentuated by climate change every year and have a significant impact on agricultural production and land degradation, especially on hillside plots[xi].

The project

In the Dry Corridor, local producers used the slash-and-burn method to clear their plots of land. In 2005 FAO[xii] supported a participatory process with grain producers (staple grains, mainly corn, bean and sorghum) to transition from this traditional slash-and-burn methods to an **integrated climate-smart production system**. In collaboration with the International Center for Tropical Agriculture (CIAT), this four-year project managed trials on 15 plots.

The project process led to spotlighting a traditional-knowledge farming system, the **Slash-and-Mulch Agroforestry System**, known as *Quesungual* farming system in Honduras and *Kuxur rum* in Guatemala[10]. This relies on conservation agriculture principles to grow grains interspersed with native multipurpose nitrogen-fixing trees that are planted along the contour lines of the plots. Strategically planting grains and trees together provides better soil erosion control on drought-prone hillsides impacted by land degradation.

Trees from this integrated climate-smart production system provide key services:

- **shading**, which reduces evapotranspiration;
- **soil retention through the root systems**, thus reducing erosion and landslides;
- **fertilization through leaves releasing to the soil**, especially if nitrogen-fixing species are used;
- **diversification of households' production** (wood, fruits, leaves, etc.); and
- **protection of crops and soil from rain and wind**.

This agroforestry system was promoted and validated in eastern Guatemala and in the Lempira region of Honduras. It has proved to be "climate-smart" through improved soil and water conservation, increasing productivity and resilience to agro-climatic risks, and reducing GHG emissions.

Project impacts

The *Quesungual/Kuxur rum* farming systems had the following outcomes:

- The yields of maize, beans, sorghum and coffee increased (e.g. in Guatemala, maize yields rose by 11–25 percent in soils enriched with the pruning of medium-size leguminous trees (*Gliricidia sepium*).
- The time required to prepare the land and control weeds was reduced – an important consideration in an area where labour scarcity is a major constraint for farm productivity.

By measuring methane, nitrous oxide emissions and carbon stocks sequestered in the soil and trees, CIAT found that the global warming potential of the *Quesungual* Slash-and-Mulch Agroforestry System is only a quarter that of traditional slash-and-burn agriculture methods.

10 Quesungual is the name of the Honduran village where the ancestral agroforestry practice was discovered while "Kuxur rum" means "my humid land" in Ch'orti', the local language of the Guatemalan region where the practice was developed.

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Replication around the world

According to the FAO publication, **Save and Grow in practice**[xiii], the Slash-and-Mulch Agroforestry System is seen as an alternative to slash-and-burn agriculture for **sub-humid hillside areas of the tropics**. It is estimated that in **18 other countries** of Africa, Asia and Latin America there is a 50 percent probability of finding similar conditions to *Quesungual* test sites, with the largest areas located in Brazil, the Democratic Republic of the Congo and El Salvador.

Pillar 1

The project found that *Quesungual* and *Kuxur* rum farming systems increased agricultural productivity, because less labour is required to establish and maintain the plots, especially after the third year of implementation. This system provided additional benefits and incomes to the grain producer households, in the form of extra wood for construction and fuel for cooking, as well as fruits and organic fertilizer.

Pillar 2

This farming system is more resilient to extreme climate events than traditional cropping systems: it enhances the moisture retention in the soil; enables crops to better resist periodic droughts; and reduces the risk of erosion and landslides.

Pillar 3

This agroforestry system mitigates GHG emissions by accumulating more biomass and carbon stocks and reduces the burning of organic matter.

This case study was adapted from the Climate-Smart Agriculture Sourcebook Second Edition 2017,
Module B5 "Integrated production systems", Case Study B5-2:
www.fao.org/climate-smart-agriculture-sourcebook

Climate-smart mussel farming in Chile: a food system with minimal greenhouse gas emissions

Climate change impacts

In Chile, climate change and climate variability are impacting mussel production in three ways: more frequent red tides, ocean acidification and a lack of available wild seeds. El Niño[11] and the 2010 earthquake disrupted normal water levels and currents at some mussel farms, damaging stocks in the water and affecting mussel growth. Mussel farming tends to be carried out in more protected coves and bays, where it is generally less exposed to extreme weather events than other aquaculture systems. Ocean acidification can be a major threat for all bivalve[12] farms, as lower levels of pH in the water can interfere with the formation of the calcium-rich valves. The lack of available wild seeds used in mussel farming due to coastal oceanographic conditions is also a result of climate change.

The initiative

In Chile, the most common farmed species is *Mytilus chilensis*. Farms can be of different sizes and operate at different scales of production. The farming is done using long lines: the "mother line", which is usually about 100 metres long, is tied to the bottom of floats. The mother line can support the hanging of many other vertical lines. The majority of mussel farming is carried out in floating or underwater holding systems that encourage the mussels' permanent filtration of phytoplankton from the water[xiv]. These systems use two techniques: (a) suspended lines from a floating tray or individual long lines tied to a weight on the bottom; and (b) a floating system on the surface, which helps the mussel seeds to attach themselves to these lines and individuals to grow by feeding on the available phytoplankton. This initiative further aligns with the country's new National Action Plan for Climate Change 2017–2022, which commits to a reduction in the intensity of its CO_2 emissions by at least 30 percent by 2030.

System impacts

This climate-smart system directly contributes to adaptation, resilience and mitigation.

- The adaptation activities that **reduce the exposure to red tides in mussel farming** are achieved through selecting resistant strains of mussel and increasing hatchery-produced larvae under more controlled conditions.
- Most bivalve farming can be **carbon-friendly** and is **comparatively energy efficient**. Cultured filter feeders (e.g. bivalves, such as mussels and oysters, and some echinoderms, such as sea cucumbers) and algae do not need external feeds, because **they can live on carbon and other nutrients in the environment**.

The implementation of permanent food safety monitoring programmes in Chile has lowered health risks and improved preparedness in this sector.

Replication around the world

This mussel farming system has been replicated in countries with vast coastal exposure to similar climate impacts, such as warming coastal waters or rising sea levels due to El Niño. For example, New Zealand has now joined Chile as one of the world's top five mussel producers and has a coastline that is also threatened by climate change[xv]. Mussel farming in New Zealand is also carried out using a long line system. Its mussel farming is restricted to areas that are suitable with respect to its biology (high subtidal) and its sea conditions (sheltered inshore areas). For countries such as Chile and New Zealand, where the mussel production industry is extremely valuable to the incomes and livelihoods of mussel farmers, this system provides adaptation and resilience to El Niño, red tides and other climatic variables. It is also a food system that countries can implement with minimal GHG emissions.

11 Cyclical El Niño events are associated with physical and biological changes in the ocean that affect fish distribution, species composition and abundance, resulting in a commercial loss for important capture fish species.
12 A bivalve is an aquatic invertebrate whose shell consists of two hinged valves: for example, clams, oysters, scallops and mussels.

Pillar 1

Chile is one of the world's largest producers and exporters of mussels. The two types of mussel farming techniques protect bivalve farming from climate impacts, thus enhancing the livelihoods and incomes of local Chilean communities.

Pillar 2

The best approach for reducing mussel farm exposure to red tides is to implement permanent food safety monitoring programmes. Producing larvae in hatcheries and having adequate management of the brood stock are also essential adaptation measures.

Pillar 3

Mussel farming can be done with no or minimal GHG emissions and environmental impacts. This climate-smart system supports the country's new National Action Plan for Climate Change 2017–2022.

This case study was adapted from the Climate-Smart Agriculture Sourcebook Second Edition 2017, Module B4 "Climate-smart fisheries and aquaculture", Case Study B4-3: www.fao.org/climate-smart-agriculture-sourcebook

NEAR EAST & NORTH AFRICA

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>> A Water Scarcity Initiative in the NENA region

A Water Scarcity Initiative in the NENA region

Climate change impacts

The Near East and North Africa (NENA) region is naturally exposed to severe shortages of water: 90 percent of the region consists of arid, semi-arid and dry sub-humid areas, and 45 percent of the total agricultural area is exposed to salinity, soil nutrient depletion and wind–water erosion. The over-exploitation of groundwater has been alarming. The per capita fresh water availability has decreased by 23 percent over the last 40 years and is projected to decrease by another 50 percent by 2050. The considerable degradation of water quality is accelerating, while competition for water among all agricultural sectors is rising. Climate change has caused higher temperatures, droughts, floods and soil degradation and will pose a further threat to the region's water resources and food security in the future.

The initiative

To address these challenges, in 2013 FAO launched the Regional Initiative on Water Scarcity in the Near East and North Africa Region[xvi], providing, as a first output, a Regional Collaborative Strategy on Sustainable Agricultural Water Management. This strategy represents a framework to assist countries in identifying and streamlining policies, governance reforms, economic, institutional and technical options and innovative implementation modalities that can sustainably improve agricultural productivity and food security in the region.

In the context of the ever-increasing scarcity of water resources, the Regional Collaborative Strategy seeks to:

- establish a process for addressing the water–agriculture related issues in the region, by using an evidence-based approach to bring together institutions and programmes at all levels, harbour effective partnerships and use farmer-to-farmer knowledge sharing, such as Farmer Field Schools (FFS), to exchange solutions among practitioners;
- identify the information gaps and challenges to be overcome in water for agriculture;
- highlight the need to strengthen knowledge, cooperation and coordination among stakeholders at all levels; and
- document options for filling the information and knowledge gaps and for addressing the key problems.

Initiative impacts

Between 2013 and 2015, countries in the region developed a higher proportion of their available water resources and constructed more water storage per capita than any other region in the world. There were several ways in which regional collaboration helped NENA countries to act on the supply-side drivers of scarcity:

- The economic use of treated waste water, and other non-conventional water resources such as brackish water, was maximized.
- A region-wide exchange of experience helped to establish best practices and guidelines; and regional or bilateral cooperation programmes helped with benchmarking, capacity building, and applying standards and regulatory frameworks.
- Optimizing benefits from transboundary resources at the basin scale was a priority topic for the region.
- Establishing a governance framework for groundwater benefited from region-wide sharing of data, information and knowledge, as well as from a review of experience across the region and in other regions.

Replication around the world

At COP22, FAO launched a scaled-up version of this regional initiative, the Global Framework on Water Scarcity in Agriculture (WASAG)[xvii], which is a global replication of the Water Scarcity Initiative for the NENA Region. WASAG is an example of how the Water Scarcity Initiative can be scaled up to suit not only national or regional needs but also global conditions. This initiative supports any region with projected population growth and facing the negative impacts of climate change, such as drought, the degradation of water quality and the over-exploitation of natural water resources. Investing in a Water Scarcity Initiative will contribute to evidence-based water policies, improved planning and better governance of water resources. The initiative has helped to strengthen collaboration among countries and with international partners for a common approach to the challenges posed by water scarcity in the region.

Pillar 1

Regional collaboration to **improve water use efficiency and crop water productivity in the region** was achieved through agricultural water management, applied research, farming systems development and the transfer of technology. As a result, the **economic crop water productivity across all irrigation systems in the NENA region was found to average five times that on schemes in other regions**, with an average value of USD 0.47/m^3, compared to USD 0.087/m^3 for other schemes. At USD 0.85/m^3, pressurized systems in the NENA region achieved almost twice the global average of economic crop water productivity for pressurized systems.

Pillar 2

The NENA region **prioritized modelling and monitoring for adaptation strategies, which required the use of new technologies**, particularly remote sensing, mapping and monitoring a wide range of natural resource parameters. Satellite data combined with geographic information system (GIS) are now able to measure changes in land cover; forecast crop yields; monitor crop stress and quantify production and yields; measure stream flows, soil moisture and water storage; and follow pollution plumes in water or in the soil.

Pillar 3

The adoption of slow release nitrogen fertilizers **reduced production costs, increased output and incomes, lowered the costs of GHG production** and **reduced the mobilization of nitrous oxide** (a GHG).

This case study was adapted from the FAO Near East and North Africa's Water Scarcity Initiative Main Report, Towards a Regional Collaborative Strategy on Sustainable Agricultural Water Management and Food Security in the Near East and North Africa Region (2nd edn, 2015):
www.fao.org/fileadmin/user_upload/rne/docs/LWD-Main-Report-2nd-Edition.pdf

Climate-smart action

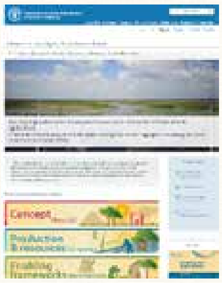
The outcome of these projects and initiatives has created a better understanding of the potential accelerators and barriers for the adoption of climate-smart agriculture (CSA). These insights are essential in preparing the groundwork for the further expansion of CSA at all levels. FAO believes that successful CSA experiences need to be made available in a timely and accessible manner to support ongoing efforts to promote it. To address the specific challenges posed by climate change to sustainable food and agriculture, FAO promotes CSA as an approach that can transform and reorient agricultural systems to effectively support development and ensure food security in a changing climate.

In 2015 the international community adopted the 2030 Agenda for Sustainable Development, which provides an unprecedented international framework for increasing the effectiveness of national actions and collective international efforts to achieve sustainable development. The transformative nature of CSA practices, and the scalability and replicability of the approaches, systems and initiatives highlighted in this publication, show how CSA can help to achieve the Paris Agreement, adopted at the 2016 UNFCCC Conference of the Parties (COP21), and, ultimately, the Sustainable Development Goals. Through replicating CSA around the globe, we can feed the world and protect our planet.

Climate change has no borders or boundaries. It affects all agricultural sectors: from mussel production along Chile's coastline to floating gardens in the southern coastal and south-central regions of Bangladesh. There are many agricultural practices that can achieve the three objectives of CSA, ranging from climate-smart agroforestry systems implemented in the Dry Corridor of Central America to the Sloping Agricultural Land Technology (SALT) in coconut-farming communities in the Philippines. Whether climate change is experienced slowly over the course of many years, on a seasonal basis or as an extreme weather event like a typhoon, communities need to take climate-smart action to help their sectors to adapt to these climate change impacts and promote resilience in the future.

These successful projects and initiatives enable communities *to be better prepared* to safeguard their livelihoods and incomes, and implement adaptation and mitigation synergies against the impacts of a changing climate. These stories show that the efforts needed to implement such projects and initiatives require enhanced financial options, support from enabling policy frameworks, strong national and local institutions, and the implementation of practices at field level. CSA must be related to local farmers' knowledge, requirements and priorities, and it must benefit the farmer both in the short and the long term.

Additional resources

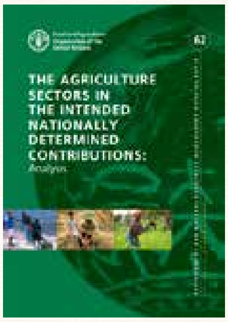


Some of these case studies have been adapted from the ***Climate-Smart Agriculture Sourcebook*** Second Edition 2017. For additional information and more case studies, visit the website launched at COP23 in 2017, which includes 23 modules on CSA and over 30 case studies.

www.fao.org/climate-smart-agriculture-sourcebook

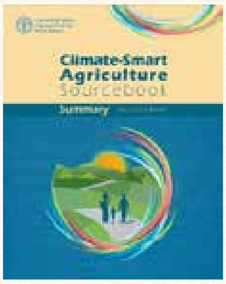
FAO and its partners continue to support CSA work and ongoing projects in the regions. The latest updates and news related to ***FAO's work on CSA*** are also available on the ***CSA sourcebook*** website:

www.fao.org/climate-smart-agriculture



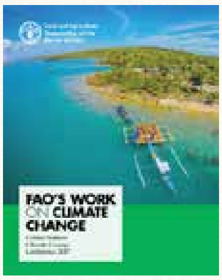
Many countries have embraced the CSA concept. This was evidenced in a study issued by FAO in 2016, showing that 32 of the 189 countries that had submitted Intended Nationally Determined Contributions (INDCs) for the Paris Agreement specifically referenced CSA. For more information on the FAO-produced ***INDC global analysis***, visit the website:

www.fao.org/3/a-i5687e.pdf



FAO has recently produced two additional communication products on CSA. For the contents of the 23 modules of the ***CSA Sourcebook*** Second Edition 2017, a ***Summary booklet*** is available online in five languages: www.fao.org/3/a-i7994e.pdf. For the basic concept and definition of CSA, an introductory ***CSA infographic*** is available online in three languages:

www.fao.org/3/a-i7926e.pdf



FAO also released a booklet on ***FAO's work on climate change*** at the United Nations Climate Change Conference in 2017. This facts-and-figures-packed publication includes key messages, data, methods and tools, FAO action areas, and information on financing agriculture's potential. For a more in-depth look at FAO's work on climate change, visit the website:

www.fao.org/3/a-i8037e.pd

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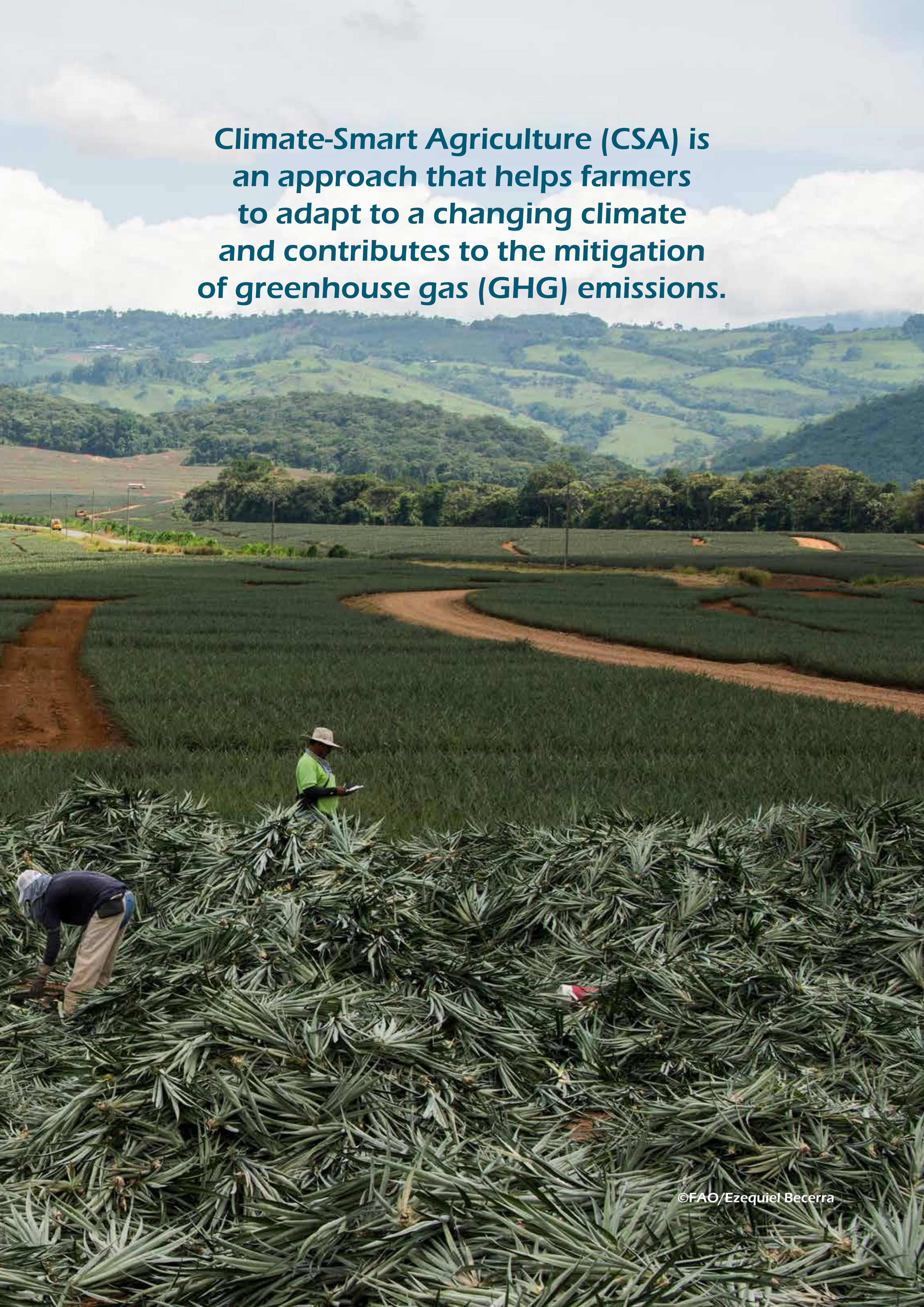

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This publication is a compilation of the success stories covering different regions' landscapes where on-the-ground climate-smart agriculture (CSA) work has been implemented in recent years. Climate change affects all agricultural sectors, from mussel production along Chile's coastline to floating gardens in Bangladesh. There are many agricultural practices that can achieve the three objectives of CSA, ranging from climate-smart agroforestry systems implemented in the Dry Corridor of Central America to Sloping Agricultural Land Technology (SALT) in coconut-farming communities in the Philippines. Whether climate change is experienced slowly over the course of many years, on a seasonal basis or as an extreme weather event such as a typhoon, communities need to take climate-smart action to help adapt their sectors to these climate change impacts and promote resilience for their future. These successful projects and initiatives enable communities to be better prepared to safeguard their livelihoods and boost household incomes, and identify synergies between adaptation and mitigation.

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