

# CLIMATE CHANGE FOOD SECURITY



**Close up on local solutions**

Resilience to climate change  
is already taking root.  
By exploring grassroots practices,  
we can uncover the keys to navigating  
the most pressing challenge of our era.

# Feed

F I L E S

n.1 2025/1

This report has been published within the framework of FEED, part of the MEDIET project, funded by the Italian Ministry of Foreign Affairs and International Cooperation and realized by CIHEAM Bari.

**This report is available on the FEED website platform ([www.feedcommunity.net](http://www.feedcommunity.net)).**

**The selection of the good practices was based solely on the nature and effectiveness of the solutions implemented, without prioritizing any specific geographic area. This approach reflects a commitment to inclusivity and fairness, ensuring that all regions have the opportunity to contribute and benefit from the sharing of innovative solutions.**

#### Disclaimer

The opinion expressed in this publication are those of the authors.

They do not necessarily reflect the opinions or views of the CIHEAM Bari.

**The use of the logos of FEED, MEDIET, CIHEAM Bari and MAECI is not permitted.**

©CIHEAM Bari, Valenzano, 2025

ISBN: 978-2-85352-632-6

<https://doi.org/10.48259/bc1962h>

Not for sale edition

How to cite this publication: Mininni B., Bozzetto A., Lapedota E., Novielli A., Semeraro M. (eds) (2025). *Climate change and Food Security – Close up on local solutions*. Valenzano: CIHEAM Bari. FEED The Knowledge Community.

This publication is freely accessible and usable in compliance with the Creative Commons BY-NC-SA license. To view a copy of this license, visit <https://www.creativecommons.org/licenses/by-nc-nd/4.0/>

Creative and Editorial Services by



[www.wadjetfilm.com](http://www.wadjetfilm.com)

#### Editorial Management

Ernesto Pagano

#### Graphic Design

Gianluca Ferrentino

#### Copy Editing

Megan Kilbourn



# Feed

F I L E S

Climate Change and Food Security  
Close up on Local Solutions

#### SERIES EDITORS

**Mara Semeraro - Ernesto Pagano**

#### EDITORS

**Brigida Mininni**

**Andrea Bozzetto**

**Elvira Lapedota**

**Annetta Novielli**

**Mara Semeraro**

*We would like to express our deepest gratitude to Antonella Acquafredda, Donato Mondelli and Wanda Occhialini for their invaluable contributions to this report. Our acknowledgement also extends to Ahmed Levdhil Khalihena, Bouacida Saoussen, Mohamed Turki, Magdalena Lutz for uploading on FEED platform the good practices described in this report, and Asma Hamada Hamad and Divin Kouebatouka for the interviews kindly granted.*



## INTRODUCTION



Climate change poses a significant threat to global food security, with its impacts most acutely felt by vulnerable populations such as smallholder farmers, fishers, and rural communities. In 2023, an estimated 713 to 757 million people faced hunger worldwide, about one in 11 individuals globally and one in five in Africa (FAO *et al.*, 2024).

Rising CO<sub>2</sub> levels are reducing the nutrient content of staple crops, and by 2050, 600 million rice-dependent individuals could face micronutrient deficiencies, while 150 million may suffer from protein shortages. Rising temperatures, erratic weather patterns, and increasing frequency of extreme events—droughts, floods, and storms—severely disrupt agricultural systems. These changes threaten food availability, nutrition quality, and livelihoods, particularly in sub-Saharan Africa, where food insecurity is already prevalent.

The FAO emphasizes that building resilience in food systems requires sustainable, inclusive, and innovative agricultural practices. Local solutions, such as climate-smart agriculture, agroecological approaches, and improved water management, can help communities adapt

**Resilience in food systems requires sustainable, inclusive, and innovative practices**

and mitigate the adverse effects of climate change. Yet, these efforts must not just prioritize but champion equity and inclusion, ensuring that women, young people, indigenous peoples, and marginalized groups have the tools and resources to thrive in the face of climate-related stress. This is a call for fairness and justice in our response to climate change.

Addressing the intricate relationship between climate change and food security demands urgent global collaboration. This collaboration should focus on strengthening food systems through partnerships and investments in sustainable practices. Inclusive and community-driven solutions ensure no one is left behind, fostering climate resilience, food sovereignty, and livelihood security.

The FEED report, 'Climate Change and Food Security - Close up on Local Solutions,' is designed to engage actors interested in potential partnerships. The report highlights successful local experiences and amplifies the voices of those directly involved. It also provides a critical assessment of challenges to support new actions for replicating and scaling good practices.




## WHAT IS A Good Practice



A **good practice** is not only a practice that is good, but a practice that **has been proven to work well and produce good results**, and is therefore **recommended as a model**. It is a successful experience, which has been **tested** and **validated**, in the broad sense, which **has been repeated** and **deserves to be shared** so that a **greater number of**

**people can adopt it.** (FAO, 2016)  
FAO adopted several **criteria** to screen whether a practice is a genuine "good practice," such as **effectiveness**, **replicability**, and **sustainability**.

**FEED** collects information from the perspective of those **directly involved in implementing good practices** to offer a deeper understanding of their impact. Key aspects include **monitoring abrupt changes**, **assessing the sustainability of innovation**, and **understanding the broader impacts within the social, economic, and environmental context**.







**MAURITANIA**

## BEANS vs DROUGHT


Mauritanian Farmers transformed the increasing water scarcity into an opportunity for agricultural development with the Cowpea Bean cultivation.




**SYRIA**

## VETS ARE BACK

In northern Syria, disrupted agricultural and veterinary services were restored in 2023, benefiting 1,360 farmers. Crop protection, disease forecasting, and livestock care improved food security amid climate challenges.


**TUNISIA**

## ENDANGERED OASIS


Chenini, one of the last coastal oases, faced severe agricultural and biodiversity challenges from high salinity and irrigation problems. The local community action now serves as a model for other oasis communities.




**ZANZIBAR**




## REVIVING MANGROVES


The Ungujaukuu village community was suffering due to coastal erosion and marine habitat degradation, until a group of passionate volunteers started restoring the mangrove forest.




**TUNISIA**

## ORGANIC DATES

Nouiel Oasis farmers faced desertification, water scarcity, and fluctuating date prices. Farmers overcame these challenges by shifting to organic farming, forming groups, and securing certification, thereby assuring market stability.


**CONGO**

## COLD-CHAIN REVOLUTION

The "Greenbox" solar-powered cold storage unit is revolutionizing the way small farmers commercialize their products in a country where nearly 3 million farmers lack access to the power grid.

## LEARN MORE

This report features stories centered around the good practices collected on [www.feedcommunity.net](http://www.feedcommunity.net). Scan the QR code to explore hundreds of stories organized by topic.



## CHAPTER 1

# ENHANCING WATER MANAGEMENT

Water scarcity is an escalating global crisis with far-reaching economic, social, and environmental consequences. Climate change disrupts rainfall patterns, intensifies droughts, and exacerbates global water shortages. According to the United Nations, by 2025, two-thirds of the world population could face water stress (UNEP, 2024).

In the Sahel region, changing rainy seasons due to climate change contribute to desertification. Heavier rainfall is leading to increased runoff, eroding the nutrient-rich topsoil. Combined with unsustainable water management practices, this exacerbates the risk of conflicts and forced migration as water and food resources diminish while crop losses drive up prices. In areas like Sub-Saharan Africa and the Middle East, where agriculture is a pivotal economic driver, water scarcity has devastating impacts.

Groundwater depletion, soil salinization, and desertification threaten livelihoods by reducing crop yields and livestock productivity. Jordan, for instance, faces one of the most extreme cases of water scarcity, with an annual average of less than 100 cubic meters per person—far below the international water poverty threshold of 500 cubic meters (UN, 2022). The Balkans are also grappling with prolonged droughts, which are drying up rivers and lakes. Moreover, the fragmented distribution infrastructure hinders agricultural and household access to irrigation for farming and drinking water.

Local actions, therefore, can have significant global impacts by fostering sustainability and resilience. In water-scarce regions, farmers have adapted their agricultural practices by embracing sustainable diets, reducing water-intensive food production and waste, and improving overall water efficiency. These strategies address immediate water shortages and contribute to global efforts to combat climate change and preserve ecosystems.

This global perspective can help strengthening local resilience through innovations like rainwater harvesting and sustainable crops, offering scalable models for global water security and sustainable development.



COUNTRY: MAURITANIA



# HOW TO FIGHT DROUGHT WITH BEANS

Mauritanian Farmers transformed the increasing water scarcity into an opportunity for agricultural development with Cowpea Cultivation.

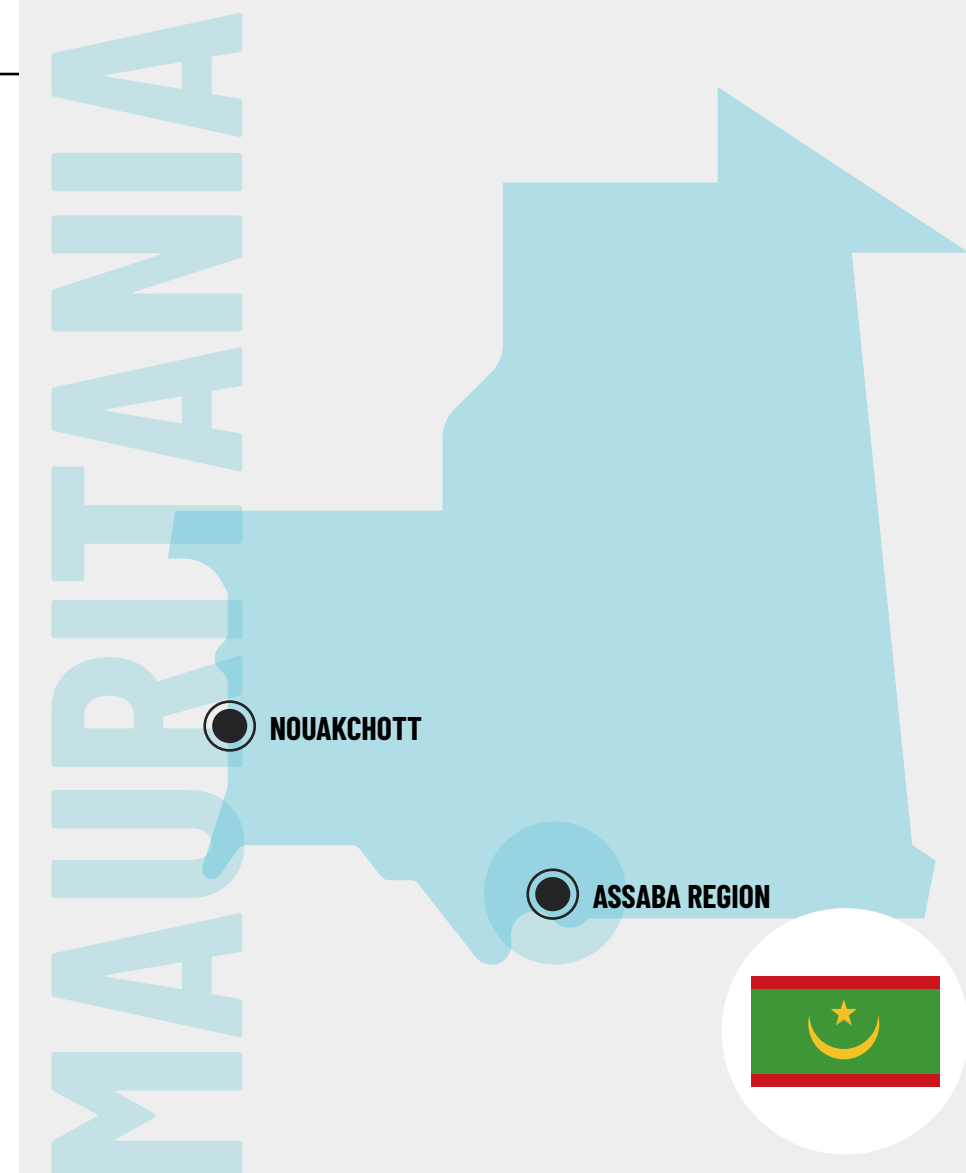


In the dry, arid regions of Mauritania, farmers face ongoing challenges as climate change increases the unpredictability of water availability. For decades, communities in Maghta Sfeirat, a village near the historic dam of the same name, have relied on crops like sorghum and maize. However, recurrent droughts, bird infestations, and pests have led to significant crop losses, weakening

local food security and putting the livelihoods of hundreds of families at risk.

Within this problematic context, local farmers, led by the Ould Sambeh brothers, developed an alternative solution to maize farming—cultivating cowpeas, a highly resilient crop requiring less water and offering higher nutritional value. Supported by the Rim-Rural development platform, this community-driven initiative marked a turning point for the region. By 2010, the farmers began shifting their focus to cowpea cultivation, transforming over 800 hectares of land into productive fields.

The transition came in response to severe climate hazards and the failure of traditional crops under changing environmental conditions. With their adaptability to dry climates and high protein content, cowpeas provided a solution to food insecurity and a pathway to economic stability. However, the path to change had its



Population

4,736,000



Average annual income

\$1,693



Working in agriculture

33.05%  
of the workforce

Agricultural workers by gender

M: 29.31 %

F: 29.31 %

of the workforce



Agricultural area

0.5%



challenges. At the outset, technical challenges such as bird attacks, grasshopper infestations, and issues with pest management needed to be addressed. The farmers, working in collaboration with the Ministry of Agriculture, introduced fenitrothion treatments to control locusts. They also secured the fields with fences, which helped protect the crops as they ripened slowly over a month and a half. These measures, coupled with traditional cooperative farming systems known as Twiza, ensured the long-term success of the cowpea fields.

The transformation brought by this initiative has been profound. Over the years, the community saw a marked improvement in food security. Cowpeas became a stable source of nutrition, especially for children, offering a richer and more diversified local diet. Economically, the farmers' incomes increased as they could market surplus crops to nearby regions, notably the regional capital of Kiffa. Women, too, played a central role in the project, processing cowpeas into various forms of food, including cakes, adding value to the crop.

This initiative enhanced local water management and fostered community resilience in the face of climate challenges by adapting new agricultural practices. By 2018, cowpea cultivation had spread beyond Maghta Sfeirat, benefiting more than 800 hectares of land and transforming agriculture across the region.

This project is a replicable model that demonstrates how communities can adapt to climate change by optimizing water management through crop selection. The success of cowpea cultivation in Maghta Sfeirat demonstrates how tailored agricultural solutions can address food security while enhancing community empowerment and economic stability.



“  
Over the years,  
the community saw  
a marked improvement  
in food security



# 1 Where are we?

The **Maghta Sfeirat Dam** village is in the **Assaba** region of **Mauritania**, which experiences periods of receding water.

# 2 What has been achieved?

Since **2010**, over **800** hectares have been transformed into productive cowpea fields.

# 3 When?

The project began in **2010**, with the first tests of cowpea cultivation. By **2012**, local farmers widely adopted this new crop.

# 4 Why?

Cowpeas require **less water** and are **resistant to pests**, offering a more reliable **alternative** to maize crops.

# 5 By whom?

**Maghta Sfeirat** farmers lead the project. The Rim-Rural development platform, along with the local delegation of the **Ministry of Agriculture**, has provided technical support.



# THE COWPEA

Cowpea is a widely adapted,  
**stress-tolerant**  
grain legume, vegetable,  
and fodder crop.

As a nitrogen-fixing legume, cowpea  
**improves soil  
fertility**

and serves as a biological tool  
for soil conservation  
through cover cropping.

Approximately  
**90%**  
of the world's cowpea is grown  
in sub-Saharan Africa, mostly  
in West Africa.

**It grows in  
sandy soils,**  
has excellent drought tolerance, and  
is best in hot areas because of its  
tendency to form a deep taproot.

Cowpea is a valuable,  
**cheap and nutritional**  
food in the human diet due to its  
**high protein and  
carbohydrate**

content with relatively low fat content.

Cowpea leaves also have

**significant economic  
and nutritional value,**

providing a consistent source of protein, vitamins, and  
numerous minerals.

Smallholders face  
**significant  
challenges**

in cowpea production, including  
severe pest and disease attacks, low  
soil fertility, drought, poor agronomic  
practices, and limited access to  
improved seed.





COUNTRY: TUNISIA



# CHENINI: A MODEL TO SAVE COASTAL OASES



The Chenini Oasis, located in Tunisia's Gabes region, is one of the last remaining coastal oases in the world. For centuries, local farmers have practiced traditional irrigation techniques, relying on carefully managed water distribution and drainage systems to sustain agriculture. These methods, handed down through generations, have allowed them to cultivate the land despite the challenges posed by a harsh environment. However, over time, the oasis has faced mounting environmental challenges. Increasing salinity in the soil

and water, combined with blocked drainage systems, began to severely threaten agricultural productivity and, with it, the livelihoods of the farmers who depend on the oasis.

The clogged drains, choked by reeds, debris, and waste, prevented excess water from flowing away. This caused water saturation and salt accumulation in the soil, ultimately killing crops and destroying the microbial life that is essential for plant growth. Without proper drainage, the land

became unsuitable for farming, and the sustainability of the oasis ecosystem was compromised. The farmers, who once relied on the oasis to feed their families and support their livelihoods, saw a sharp decline in productivity, with many being forced to abandon their farms. The oasis's decline was not only an economic crisis but also a threat to the region's biodiversity, as a once-thriving ecosystem deteriorated.

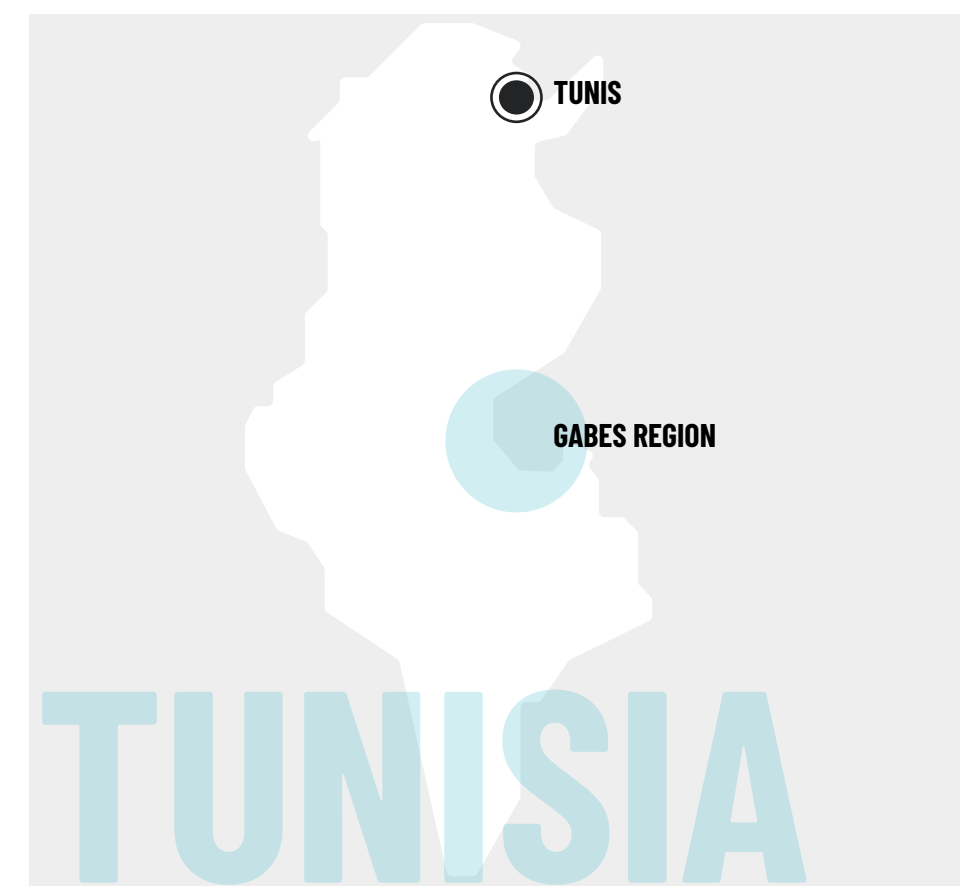
For generations, the community collectively maintained the drainage system in Chenini.

Organized within "Jamia Elma," the local water association, families and farmers worked together to ensure the system functioned properly. However, beginning in the 1960s, state interventions took over part of the responsibility for maintaining the drainage systems. Unfortunately, funding shortages and insufficient maintenance led to neglect. Over time, as the systems fell into disrepair, large areas of farmland were abandoned. Farmers could no longer cultivate their plots, and the oasis's degradation worsened, further endangering biodiversity and the livelihoods of the local community.

In response to this growing threat, the Association for the Safeguard of the Oasis of Chenini (ASOC) initiated a comprehensive rehabilitation project in 2017. Supported by the Environmental Governance Project (PGE-Gabes), ASOC set out to address the drainage issues by engaging local farmers and stakeholders in a collaborative effort to restore the oasis's agricultural landscape. The core idea behind the project was simple but transformative: rehabilitate the

clogged drains that had become unusable over the years and, in doing so, restore the land's productivity and safeguard the oasis's biodiversity. However, implementing this ambitious idea posed several challenges. The drainage system had been neglected for decades, and identifying the areas most in need of intervention required extensive mapping and diagnostic work. While local farmers were well aware of the problem, many had to be convinced to participate actively in the project. After years of neglect, they were uncertain about the feasibility of reviving their farms. Additionally, the clogged drains had accumulated significant plant growth and waste, further complicating the rehabilitation process. ASOC understood that to succeed, they needed to engage the farmers from the beginning of the project, ensuring they understood the long-term benefits of maintaining the drains and encouraging them to take an active role in the process. ASOC adopted a highly participatory approach. The organization conducted awareness campaigns and held numerous

Thanks to the  
local water  
association,  
families and  
farmers worked  
to restore the  
drainage and  
irrigation system  
of this oasis  
on the brink of  
extinction





meetings with farmers to discuss their challenges, gain their trust, and prioritize areas for intervention. This early involvement was crucial in building trust and ensuring the farmers felt a sense of ownership over the project. ASOC also used modern mapping techniques and diagnostic assessments to create a detailed understanding of the drainage network. This data was essential for planning the rehabilitation, as it allowed ASOC and the farmers to focus on the most critical sections of the drainage system, particularly those downstream, where agricultural production was most affected by waterlogging and salinity.

In two years, from 2017 to 2018, the project cleared 17 kilometers of drains that had been clogged for years. The rehabilitation process involved the removal of invasive shrubs, reeds, and accumulated household waste from the drainage channels. Once the blockages were cleared, the drains were reshaped to ensure proper water flow and the correct slope, which would help prevent future clogging. The results of the rehabilitation were immediate and transformative. Farmers who had previously abandoned their plots due to waterlogging and salinity issues began to return, resuming agricultural activities that had long been dormant.

The impact of the project extended far beyond just the physical rehabilitation of the drainage system. By restoring the functionality of the drains, the project significantly improved the health of the soil in the Chenini Oasis. With the excess water drained away and salt levels reduced, the soil became fertile again, supporting the growth of crops and the recovery of biodiversity. The return of native plants and wildlife signaled that the oasis ecosystem was beginning to heal. Farmers were once again able to cultivate their land, and the revived agricultural activity brought much-needed economic benefits to the local community. The success of the project demonstrated the



“  
**Restoring the drainage  
system renewed hope  
for Chenini’s farmers**

power of community-driven environmental action, highlighting how local knowledge and collaboration can be harnessed to tackle complex environmental challenges. By restoring the productivity of the land, the project also revived hope among the farmers and their families, who could once again rely on their land for income. This renewed productivity provided financial stability to families who had long struggled due to the degradation of the land.

Beyond clearing drains, the rehabilitation of the Chenini Oasis was about reviving an entire ecosystem. Restoring the drainage system helped prevent further soil degradation and desertification, both critical issues in the face of climate change. The project’s success also underscored the importance of proper water management in the oasis environment. In an area where water is a precious and limited resource, ensuring that it is used efficiently and that excess water is properly drained is essential for maintaining agricultural productivity and biodiversity.

In addition to improving the local environment, the project serves as a model for other communities facing similar challenges in arid and semi-arid regions. By combining traditional knowledge with modern techniques, the rehabilitation of the Chenini Oasis offers valuable lessons on how to address the impacts of environmental degradation and climate change. The project showed that by working together, communities can overcome significant obstacles and create sustainable solutions that benefit both people and nature.

As the Chenini Oasis continues to thrive, the local community remains committed to maintaining the drainage systems and ensuring the long-term health of the land. With ongoing support from ASOC and other stakeholders, the oasis stands as a testament to the resilience of both the environment and the people who depend on it. The success of the project has not only restored the productivity of the land but also renewed hope for the future of the Chenini Oasis and its surrounding communities.

## Where are we?

**Chenini Coastal Oasis**, Tunisia, faces challenges due to high salinity, water saturation, and clogged drainage systems, severely impacting agriculture.

## What has been achieved?

In over **two years**, **17 kilometers** of clogged drains were cleared, allowing farmers to **resume agricultural activities** and **increase productivity**.

## When?

The project began in **2017**, and by **2018**, the drains were **fully rehabilitated**, revitalizing agricultural land.

## Why?

Effective drainage is essential in the Chenini Oasis to **prevent salt accumulation and waterlogging**, ensuring **agriculture’s sustainability** and **biodiversity protection**.

## By whom?

The **Association for the Safeguard of the Oasis of Chenini (ASOC)** led the project in collaboration with local farmers and supported by the **Environmental Governance Project (PGE-Gabes)**.



CHAPTER 2

# PROTECTING BIODIVERSITY

“Biodiversity is the foundation of sustainable agricultural production and food security” (FAO, 2024). Crop and livestock production, fisheries, aquaculture, and forestry occupy and manage substantial portions of the world’s land, freshwater, and oceans. Climate change is increasingly causing the decline of biodiversity in the whole ecosystem.

In Africa, initiatives often aim to balance biodiversity conservation with the economic needs of local communities. While the continent is home to incredibly diverse marine and terrestrial ecosystems, it is experiencing rapid biodiversity loss. Projections indicate that by 2100, climate change alone could lead to the extinction of more than half of Africa’s bird and mammal species, as well as a decline in lake productivity and significant loss of plant species.

Land use changes in Sub-Saharan Africa, associated with intensive agriculture, have contributed to deforestation in some regions. The transformation of forested areas into agricultural landscapes affects habitats and alters ecosystem services such as carbon sequestration and water regulation. As biodiversity diminishes, it exacerbates climate change impacts and undermines the livelihoods of local communities that rely on forests for food, medicine, and income.

Similarly, the mountain regions of the Middle East, rich in biodiversity and home to many unique species, are threatened by environmental changes. These shifts, particularly affecting alpine species, put these ecosystems at risk. Therefore, the continued support for existing protected areas as well as the establishment of robust conservation systems that safeguard these unique habitats are essential.

The current state of biodiversity in the Balkans today is defined by a wide variety of ecosystems and many species that can only be found in this region. This region hosts approximately 40% of European vascular plants and a significant proportion of its fish, birds, and mammals. However, biodiversity faces serious threats, including habitat loss due to deforestation, pollution, and the impacts of climate change. Illegal and inadequate use of natural resources such as forests and fish exacerbates these challenges.

A stark example of climate change impacting biodiversity is the widespread bleaching of coral reefs. Coastal mangrove forests are essential for their survival but are, in turn, under threat due to humans intervention. The following chapter will explore how a community initiative has triggered a virtuous cycle that can serve as an example of resilience to climate change and an opposition to destructive human behaviors.



*The village of Ungujaukuu faced threats from coastal erosion and marine habitat degradation until the ZAVECO team, alongside local volunteers, began restoring the mangrove forest, planting more than 2 million seedlings.*

## BRINGING MANGROVES BACK TO LIFE

# FIELD TRIP ZANZIBAR

*These are the travel notes of Andrea Bozzetto, a cooperation expert at CIHEAM Bari, offering a personal glimpse into his experiences and insights gathered along the way.*



as we walked through the plantation. “They are life. They protect our coastlines, provide breeding grounds for our fish, and support our communities.”

The ZAVECO team, alongside nearly 100 volunteers from the village, had already planted over 2 million mangrove seedlings. Seeing the thriving young trees stretching along the coastline was inspiring. These volunteers, from elders to local youth, have been integral to the restoration process. As we walked further, I could sense the pride in their work, which was not just about planting trees but restoring balance to an ecosystem that had suffered years of degradation.

Rising sea temperatures, driven by climate change, have driven fish populations into deeper waters, while unchecked illegal logging has stripped the coastline of its natural defenses. The mangrove forests of Ungujaukuu had once stood as a barrier against coastal erosion and storm surges. Their destruction has left the village vulnerable to environmental and economic threats.

Ms. Hamad led me to a plantation section and invited me to plant a mangrove seedling. It was a humbling experience. I pressed the seedling into the mud, feeling its small roots grip the soil, and imagined the tree growing over the years to come, offering protection to the coast and life to the ecosystem. She added that some of the mangroves planted in this area bear the names of individuals who have supported the restoration, including the President of Tanzania, Samia Suluhu Hassan. It was a symbolic act, a small contribution to a much larger effort spanning time and space. Each tree planted here represents a step toward recovery, resilience, and sustainability.

ZAVECO's approach to restoration is holistic and community-driven. They understand that sustainable change requires more than just planting trees—it requires the active participation of the people who live in and

People from the ZAVECO team greeted me with a warm smile as they proudly led the way to the shores of the village of Ungujaukuu. Their mission is as ambitious as their will to accomplish it: restoring the mangrove ecosystems of Zanzibar.

My guide was Ms. Asma A. Hamad. She is the Vice-Chairman of ZAVECO, a strong visionary woman whose deep connection to the land and sea fuels her commitment to this cause. Her passion for restoring the mangroves is evident in every word she speaks, and she has become a key figure in uniting the community around this critical environmental effort.

After a brief discussion at the ZAVECO office, we set off to see the heart of the restoration work—the mangrove forests themselves.

The day was hot, with temperatures reaching 32°C. I was grateful for the plastic boots that ZAVECO had kindly provided. They were essential for navigating the thick, muddy soil of the mangrove plantation, where roots and shoots crisscrossed the earth in intricate patterns. Ms. Hamad told me that these haxhese boots were washed and reused by the community members, a simple yet effective practice highlighting the resourcefulness and sustainability embedded in ZAVECO's approach. “Mangroves are more than just trees,” Ms. Hamad said,

*continued* ►

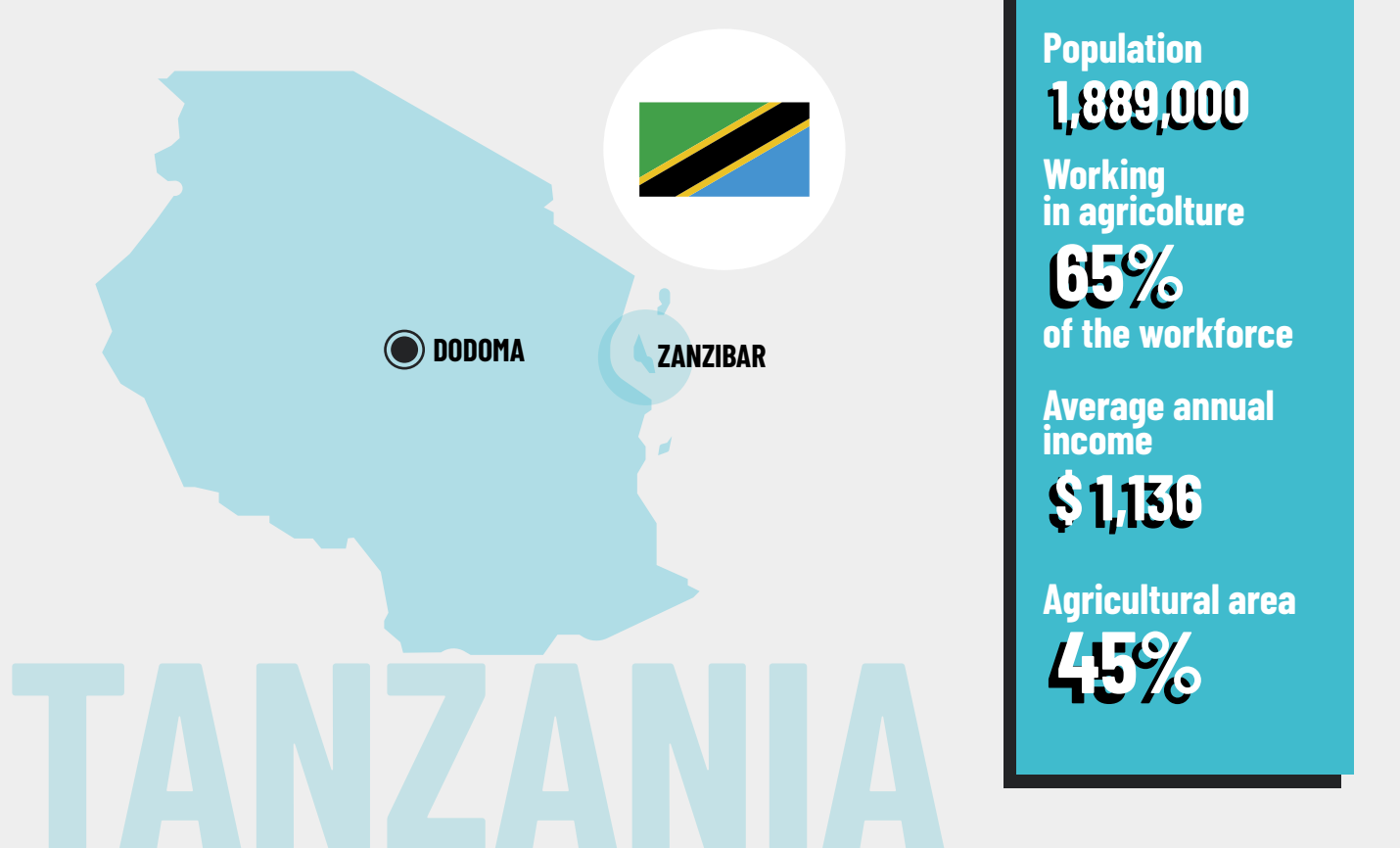




rely on these ecosystems. By involving the local community from the outset, ZAVECO has fostered a sense of ownership and responsibility among the villagers. It is this community involvement that has made the restoration effort so successful. Local fishers, whose livelihoods have been directly impacted by the decline in fish stocks, now see the restoration of mangroves as essential to their future. Mangroves serve as breeding grounds for fish, and the recovery of the forests is directly linked to the recovery of fish populations.

As we continued our walk through the mangrove plantation, Ms. Hamad pointed out areas where the trees had grown taller and thicker, providing habitat for crabs, fish, and birds. The ecosystem was returning to life, and the villagers' livelihoods improved.

*continued* ►





The community has also begun developing alternative income-generating activities, such as beekeeping, which provide economic support while reducing pressure on natural resources.

“Over the years, the community saw a marked improvement in food security

This diversification of livelihoods is key to ensuring the long-term sustainability of the mangrove restoration project.

Yet, challenges remain. The destruction of mangroves due to illegal logging continues to threaten the progress achieved, particularly in remote areas where monitoring is difficult. ZAVECO has

been advocating for greater enforcement measures and has partnered with local authorities to address the issue. They are also working to secure more funding and technical support to scale up their efforts, but the process is slow, and the threat to the mangroves is ever-present. Despite these challenges, the community's determination and the leadership of individuals like Ms. Hamad keep the project moving forward.

ZAVECO's work has become a model for other coastal communities in Tanzania and beyond. The restoration of mangroves in Ungujaukuu has demonstrated that community-driven conservation efforts can significantly impact the environment and local livelihoods. Mangrove ecosystems are crucial for protecting coastlines, supporting marine biodiversity, and providing economic benefits to coastal communities. By focusing on water management, biodiversity conservation, and community engagement, ZAVECO has shown that restoring ecosystems can be a powerful tool for building resilience in the face of



climate change. As I planted my seedling that day, I realized that this project is not just about saving trees but about safeguarding a way of life. The people of Ungujaukuu, led by Ms. Hamad's vision and the dedication of the ZAVECO team, are rebuilding their community from the ground up—one mangrove at a time.

Today, the restored mangroves stand as a testament to what can be achieved when communities come together with a shared purpose. The project continues to evolve, with ongoing efforts to monitor the forests, expand the restoration area, and educate the next generation about the importance of conservation. With continued support, this practice can potentially create lasting change, not just for the people of Ungujaukuu, but for coastal communities worldwide.



OUTLOOK  
1  
2  
3  
4  
5

Where we are?

The **Ungujaukuu** village in **Zanzibar, Tanzania**, faces coastal erosion and marine habitat degradation, exacerbated by climate change.

What has been achieved?

Over **2 million** mangrove seedlings have been planted, improving biodiversity and community engagement in restoration efforts.

When?

The project began in **2019** and remains ongoing.

Why?

Mangrove restoration **protects marine ecosystems, supports fisheries, and mitigates climate change impacts.**

By whom?

The **Zanzibar Volunteers for Environmental Conservation (ZAVECO)** led the initiative, with significant involvement from local community members.



FEED





Asma Hamada Hamad, Executive Secretary at Zanzibar Volunteer for Environmental Conservation, a non-profit organization established in 2017.

Q

HOW DID THE IDEA COME ABOUT?

The idea came when we saw a decline in fishing due to rising sea temperatures. Additionally, the degradation of mangrove forests has impacted these habitats, exacerbating the negative effects.

A

Q

WHO DID YOU INITIALLY WORK WITH TO DEVELOP IT?

At first, our efforts centered around engaging international volunteers in mangrove restoration. However, we quickly realized that lasting success could be achieved only by involving local communities, the “custodians” of these resources. This consideration led us to hold meetings to raise awareness about the crucial role of mangroves and collaborate on restoration efforts with the support of local elders.

A

Q

HAVE YOU RECEIVED ANY SUPPORT FOR DEVELOPING YOUR IDEA?

Support has come, though on a smaller scale. NGOs provided rain boots, and the Forest Department of our Government provided training in reforestation, leading to about 150 people now engaged in re-farming. We also received small grants, mainly for youth and women’s engagement in conservation.

A

Q

WHAT CHALLENGES ARE HINDERING YOUR EFFORTS TO PROTECT MANGROVES WHILE SUPPORTING LOCAL LIVELIHOODS?

One major challenge is the local economy, as many rely on mangroves for firewood or charcoal. Convincing them to stop without offering sustainable alternatives is difficult. While we have had between 100 and 300 people join our efforts, some local communities remain outside the group. Additionally, we lack equipment, such as kayaks, to patrol the mangrove forests, making it hard to prevent illegal deforestation.

A

Q

WHAT CONCRETE BENEFITS HAS THIS INITIATIVE BROUGHT?

We realized our efforts were making an impact when we saw increased involvement from youth and women in our conservation projects. Positive feedback and the success of our restoration and awareness programs confirmed that we were on the right path. We now have 23 young individuals involved, and our efforts include mangrove reforestation and tackling plastic waste.

A

Q

WHAT INITIATIVES DO YOU HAVE PLANNED TO LEVERAGE TECHNOLOGY FOR SCIENTIFIC RESEARCH IN THIS AREA?

While comprehensive scientific studies have yet to be conducted, we are seeking collaboration with students through internships to leverage remote sensing and GIS technology to analyze the impact and establish a baseline for future progress.

A

Q

WHAT SUPPORT IS NEEDED TO ENHANCE THE INITIATIVE AND EMPOWER LOCAL COMMUNITIES?

We require additional financial support and equipment, including kayaks, snorkels, and life jackets, to improve our eco-tourism initiatives. Collaborating with NGOs and academic institutions will enable us to expand our efforts and conduct thorough biodiversity assessments in restored areas. Empowering women and youth is also a critical priority, as it fosters awareness of sustainable livelihoods. For instance, introducing beekeeping as an alternative income source can significantly benefit these communities. Additionally, we are actively pursuing grants through project proposals.

A



COUNTRY: TUNISIA



# NOUIEL FARMERS GROWING ORGANIC



In Tunisia's Kebili region, the oasis of Nouiel has been a center for date production for generations. The cultivation of Deglet Nour dates forms the backbone of many livelihoods in this region. However, by the early 2000s, challenges began to threaten the sustainability of date farming.

Farmers faced water scarcity, desertification, fluctuating market prices, and the increasing cost of transitioning to organic farming. These issues were compounded by the individualistic approach

many farmers took, which limited their ability to negotiate better prices or adopt improved farming techniques. Desertification in the region made water resources increasingly scarce, making farming more difficult and expensive. Organic farming offered a pathway to higher-value products but was costly due to specialized inputs and certification expenses. For many small-scale farmers, these barriers led to low productivity and incomes. Additionally, fluctuating date prices, often controlled by monopolistic

exporters, left farmers vulnerable to market volatility. In response, a group of farmers, supported by the Ecole Supérieure des Industries Alimentaires de Tunis (ESIAT) and South Organic, took action. The goal was to unite the farmers, create organized groups, and adopt organic practices to improve the quality of dates and secure better market access. In 2001, the first group was established with 11 farmers in Klebya. By 2003, they obtained organic certification, which allowed them to enter new markets

and increase the value of their products. Transitioning to organic farming was challenging. Farmers had to overcome high costs for inputs like compost and mosquito nets to protect the dates from pests. Obtaining organic certification was a complex process, requiring adherence to strict standards and regular inspections. In 2007, differing views on biodynamic versus organic farming led to a split, resulting in the creation of the Nouiel group, which specialized in organic farming.

By 2011, the group grew to 16 farmers and secured organic certification independently, without relying on an exporter. This allowed them to diversify business partners and explore new opportunities. Their commitment to organic practices was solidified with HACCP and ISO 22000 certifications, further ensuring the safety and quality of their products. With these certifications, the farmers could sell their dates at higher prices, significantly improving their incomes and economic stability.

**By uniting under a common goal, local farmers adopted organic practices, improving date quality and gaining better market access**

The formation of the organized group was a turning point. By pooling resources, sharing knowledge, and negotiating better deals with buyers, the farmers improved their techniques, leading to higher yields and better quality dates. Regular training sessions provided by the CTAB (Technical Center for Organic Agriculture) were crucial in this transformation.

Today, the Nouiel group consists of 40 farmers covering an area of 40 hectares across multiple oases. They have diversified their markets, no longer depending on a single exporter. The group's ability to adhere to strict organic farming standards, monitored through regular checks by Ecocert, has improved both product quality and the environment. Farmers have embraced sustainable practices that promote biodiversity and reduce their farming footprint.

In addition to high-quality dates, the group has developed new products like date sugar, date flour, Robb (molasses), and date jam, all

*continued* ►







Organic farming increased farmers' income and promoted biodiversity in the oasis

derived from organic farming. These value-added products have opened up new revenue streams for the farmers and allowed them to enter new markets, particularly in Europe. Collaborations with companies like Zeinafood and Green Land, as well as those with researchers developing composting techniques, facilitated this diversification.

The Nouiel group's success has had a ripple effect throughout the region. Each year, they organize a national forum on organic farming and sustainable development, sharing their experiences and knowledge with other farmers and stakeholders. The forum has become a key event for promoting organic agriculture in Tunisia, highlighting the benefits of sustainable farming and fostering collaboration among farmers, researchers, and businesses. By embracing organic farming, the farmers have increased their incomes, protected the environment, and promoted biodiversity in the oasis. A strong sense of community has developed among the farmers, fostering knowledge-sharing and mutual support, ensuring the group can thrive in future challenges.

Looking ahead, the Nouiel group is exploring new opportunities for growth, including expanding its market reach and developing additional organic products. Their commitment to sustainable farming and ability to adapt to changing market conditions has positioned them as a model for other farming communities in Tunisia and beyond. As climate change and environmental degradation continue to threaten agricultural systems worldwide, the experience of the Nouiel farmers offers valuable lessons on building resilience through collaboration, innovation, and sustainability.

## Where are we?

In **Tunisia's Kebili** region. **Nouiel Oasis** is exposed to desertification, water scarcity, and fluctuating market prices for dates, a key agricultural products in the area.

## What has been achieved?

The farmers shifted toward **organic date production**. Through organized action, they increased the value and sustainability of their product.

## When?

The project began in **2001** with the formation of farmer groups. By **2011**, key certifications were secured, leading to increased market stability and production improvements.

## Why?

Organizing into groups allowed farmers to overcome the **limitations of individualism**, secure **better prices**, and **improve environmental sustainability** through organic farming.

## By whom?

The initiative was led by local farmers in collaboration with **ESIAT, South Organic**, and **Ecocert**, with support from researchers and the **CTAB (Technical Center for Organic Agriculture)**.



# SUSTAINING VALUE CHAIN

A food value chain encompasses all stakeholders involved in the coordinated production and value-adding activities necessary to bring food products to market. A sustainable food value chain ensures profitability at every stage, generates widespread benefits for society, and has a positive or neutral impact on the natural environment (FAO, 2024).

As the global population nears 8 billion, agricultural value chains face mounting pressure. Supporting food security through sustainable food production, distribution, and consumption becomes increasingly challenging. The food value chain is a significant driver of global greenhouse gas emissions, with agricultural production alone contributing about 11% of the total. Sustainable supply chain management has emerged as an effective strategy to lessen environmental impact, pollution, and waste. Pivotal practices include green logistics management, sustainable transportation choices, reduced transport times, refrigerated trucks with lower ecological footprints, reduced and recyclable packaging, and green purchasing. These actions collectively make the supply chain more sustainable, contributing to climate goals.

African agricultural value chains face hurdles in building green initiatives that reduce poverty and foster employment. Challenges include limited access to advanced farming resources and technologies, access to credit, poor infrastructure, and the far-reaching effects of climate change. Smallholder farmers often lack access to essential resources, which hampers productivity and limits income opportunities. Moreover, weak and unconnected transport systems, insufficient storage options, and limited market connectivity lead to considerable post-harvest losses and prevent farmers from accessing markets and securing fair prices for their goods.

In the Middle East, the agricultural industry faces unique challenges shaped by geopolitical dynamics and limited resources. The arid climates in Jordan, Lebanon, and Iraq exacerbate water shortages. Furthermore, prolonged conflicts in regions like Yemen and Syria have severely impacted agricultural output, leading to disruptions in supply chains.

In this complex scenario, it is important to highlight the efforts made at the community level to boost food security and enhance resilience among local populations.



COUNTRY: CONGO



# POWERING CONGO'S FARMING FUTURE

The GreenBox solar-powered cold storage unit is changing the way small farmers in Congo Brazzaville store and sell their produce, despite limited access to the power grid.



In rural Congo, smallholder farmers face challenges beyond crop cultivation. After harvest, perishable goods spoil quickly due to high temperatures and limited storage, leaving farmers with little to sell. In sub-Saharan Africa, up to 50% of harvested produce is lost due to post-harvest inefficiencies, and Congo is no exception. These losses affect food security, exacerbate poverty, and worsen malnutrition.

The UN estimates 1.3 billion tons of food are lost annually, much of it in regions lacking cold storage. In Congo Brazzaville, nearly 3 million farmers are not connected to the power grid. These inefficiencies deprive growers of income and expose them to food insecurity.

To address this critical issue, ETS MVUTU, a social enterprise in Congo, launched GreenBox, a mobile, solar-powered cold storage solution. GreenBox provides farmers and traders with affordable storage, extending the shelf life of goods from 2 to 21 days, reducing food losses. These units can store not only crops but also fish and vaccines.

GreenBox looks like the ideal solution for areas without electricity. Solar panels store energy in batteries, powering the refrigeration unit even at night. This ensures the cold rooms function off-grid, providing reliable storage in remote areas. A key feature is the Pay-As-You-Store model.

CONGO



Population  
**2,146,000**



Average annual  
Income  
**\$2,870**



Working in  
agriculture  
**70%**  
of the workforce



Agricultural  
workers by gender  
M: **48.35 %**  
F: **64.16 %**  
of the workforce



Agricultural  
area  
**31%**



Instead of farmers buying costly equipment, they rent space in the cold rooms. This helps even small farmers preserve more of their harvest and earn higher incomes. Some have seen earnings rise by 150% since adopting the system.

GreenBox faced challenges, including skepticism from farmers accustomed to spoilage. ETS MVUTU partnered with local women's groups and cooperatives to educate growers on the benefits of cold storage. Demonstrations built trust and encouraged its adoption. Transporting the cold rooms was another obstacle to overcome. GreenBox developed electric tricycles powered by solar-charged batteries to move th reducing between markets and farms, cutting logistics barriers and greenhouse gas emissions.

In just over a year, GreenBox cold storage units have served over 1,300 rural residents, including farmers and traders. Extending the shelf life of produce has improved food security, particularly for children who now have better access to fresh food. Beyond farmers and consumers, GreenBox has had broader economic and social impacts. More produce at market has boosted farmers' incomes, helping alleviate poverty. Hiring women to manage stations has empowered them with stable jobs and contributed to gender equality. Reducing food waste has also cut CO<sub>2</sub> emissions.

GreenBox's success stems from involving local stakeholders to ensure the storage units met farmers' needs. Farmers were involved at every stage, from design to training, making the cold rooms user-friendly for smallholder farmers. GreenBox now aims to expand its reach across sub-Saharan Africa. Early success in Congo shows the viability of mobile, solar-powered cold storage for reducing post-harvest losses.

The GreenBox initiative is more than just technology—it is transforming rural development. By providing a sustainable solution, GreenBox is helping create a future where food is preserved, livelihoods are protected, and communities thrive.



“  
GreenBox provides farmers and traders with affordable storage, extending the shelf life of goods from 2 to 21 days



Where are we?

In **Rural Congo** high temperatures and poor storage infrastructure lead to significant post-harvest losses for smallholder farmers, making **food preservation** a **critical challenge**.

What has been achieved?

GreenBox introduced mobile, solar-powered cold storage units, reducing post-harvest losses by **90%** and extending the shelf life of perishable goods from **2 to 21 days**, with flexible rental services.

When?

The project began in **2022** and is still ongoing through **2023**, significantly improving local agricultural productivity.

Why?

Efficient cold storage is vital to food security and economic stability. It **minimizes food waste** and **reduces environmental impact** in rural communities reliant on agriculture.

By whom?

GreenBox, a social enterprise **ETS MVUTU brand**, led the initiative, partnering with smallholder farmers and local traders to provide **accessible, off-grid storage solutions**.





*Divin Kouebatouka, Founder and CEO of GreenBox, is a social entrepreneur and a polytechnic engineer development manager with expertise in agro-industry start-ups, rural logistics, distribution, commercial strategy, contract negotiations, business processes, and team building.*

**Q** ◀ HOW DID THE IDEA COME ABOUT?

*My aunt inspired the concept behind GreenBox. She is a small-scale farmer who consistently loses around 50% of her fruit and vegetable production each season before reaching consumers due to the lack of electricity.*

▶ **A**

**Q** ◀ WHO DID YOU INITIALLY WORK WITH TO DEVELOP IT?

*I took my first steps with some colleagues at the Faculty of Engineering in Ghana, where I used to study. Today, I lead a team composed of engineers and business managers.*

▶ **A**

**Q** ◀ IN WHICH WAY DO YOU THINK GREENBOX IS INNOVATIVE?

*Thanks to the cold-storage solution, GreenBox helps small farmers avoid selling at low prices on harvest days and allows them to wait for higher demand and better prices. Moreover, the GreenBox tracking module monitors stored produce, providing alerts on quality changes, storage time, and energy usage, with a market analysis system for real-time price forecasts. The service is accessible via mobile phones, allowing farmers to easily manage their storage and market information.*

▶ **A**

**Q** ◀ WHAT CONCRETE BENEFITS HAS GREENBOX BROUGHT?

*Thanks to GreenBox, food waste has been significantly reduced, which also lowers carbon emissions, while addressing malnutrition as food spoilage has decreased, ensuring that more produce remains available for consumption. The rooms are installed in off-grid areas, improving sustainability and livelihoods. Farmers, through smartphones, can access digital solutions such as weather insurance, pest diagnostics, and agronomic advice, all aimed at reducing post-harvest losses and boosting agricultural productivity.*

▶ **A**

**Q** ◀ DO YOU HAVE ANY FIGURES FOR THESE BENEFITS?

*GreenBox is having a measurable social impact. We have empowered women with technical training in solar equipment maintenance to become managers of our storage units. Environmentally, we reduce food waste-related carbon emissions. I'm proud to share that our solar-powered cold storage unit helps cut up to 16.5 tonnes of CO<sub>2</sub> emissions per month.*

▶ **A**

**Q** ◀ HOW MUCH DO FARMERS PAY FOR THIS SERVICE?

*Farmers can rent one or more cases in the GreenBox for 0.5 dollars per week. They can pay directly from their phones with mobile money [Ed.: a widespread payment method in Subsaharan Africa].*

▶ **A**

**Q** ◀ HAVE YOU RECEIVED ANY SUPPORT FOR DEVELOPING YOUR IDEA?

*We have received support from local authorities and have established partnerships with universities and financial and technical partners (e.g., Agence Française de Développement and the Alliance for Rural Electrification). Today, five GreenBoxes are operational in the Congo, and a \$50,000 grant will support the construction of another next year.*

▶ **A**

**Q** ◀ WHAT CHALLENGES HAVE YOU FACED IN CONTINUING TO DEVELOP IT?

*One of the challenges is the high production cost, approximately \$20,000 per unit. Additionally, convincing small-scale farmers of the technology's benefits has been difficult. To address this, we have implemented training initiatives.*

▶ **A**

**Q** ◀ WHAT DO YOU NEED TO GO AHEAD WITH YOUR PROJECT?

*We need further funding to build more GreenBoxes to meet growing demand. Six million farmers in the Democratic Republic of the Congo could benefit from this innovation, which has significant potential for expansion across Central Africa.*

▶ **A**





COUNTRY: SYRIA



# RESTORING VET SERVICES IN POST-WAR SYRIA



In Northern Syria, where farming has long been vital, the disruption of agricultural and veterinary services due to conflict had devastating effects. Farmers and breeders struggled to maintain crop yields and livestock health. Without essential services, crop losses and animal disease spread, impacting food security. Extreme weather and unpredictable pests worsened the situation, endangering livelihoods. An assessment by CIHEAM Bari in 2023 showed communities urgently needed agricultural and veterinary services for

pest management, disease prevention, and livestock care. Farmers lacked inputs and technical support, leading to plant and animal diseases, resulting in economic losses. This required a multi-faceted approach to restore services and enhance the resilience of farming communities.

To address this, CIHEAM Bari launched a project, funded by the Italian Cooperation, to revitalize services. The project included crop protection through integrated pest management (IPM), veterinary care, and

using meteorological data to forecast plant diseases and prevent livestock losses. A participatory approach involved local farmers and technicians in the project's design in order to meet community needs.

Challenges included a lack of infrastructure and equipment for pest monitoring and veterinary care. The Syrian conflict left many technicians untrained. Providing accurate climate-related information was difficult. The project relied on remote mentoring from experts to build

local know-how. Despite these hurdles, the project reactivated agricultural extension services. A major success was introducing a meteorological control unit, allowing technicians to collect temperature and humidity data. This supported an Early Warning Disease System that gave timely alerts to prevent plant diseases and infestations. Predicting threats and taking preventive actions improved crop protection. Veterinary care saw improvement with the introduction of an ECHO machine for pregnancy testing in livestock, reducing birth mortality and helping breeders maintain healthy herds. Technical assistance also helped farmers reduce reliance on chemical inputs, promoting sustainable agriculture.

In one year, over 1,360 farmers and breeders benefited from the project, receiving support for crop management and livestock care. Training courses focused on pest monitoring, disease prevention, and sustainable farming techniques, ensuring long-term benefits. A key outcome was the Early Warning Disease System, a turning point in

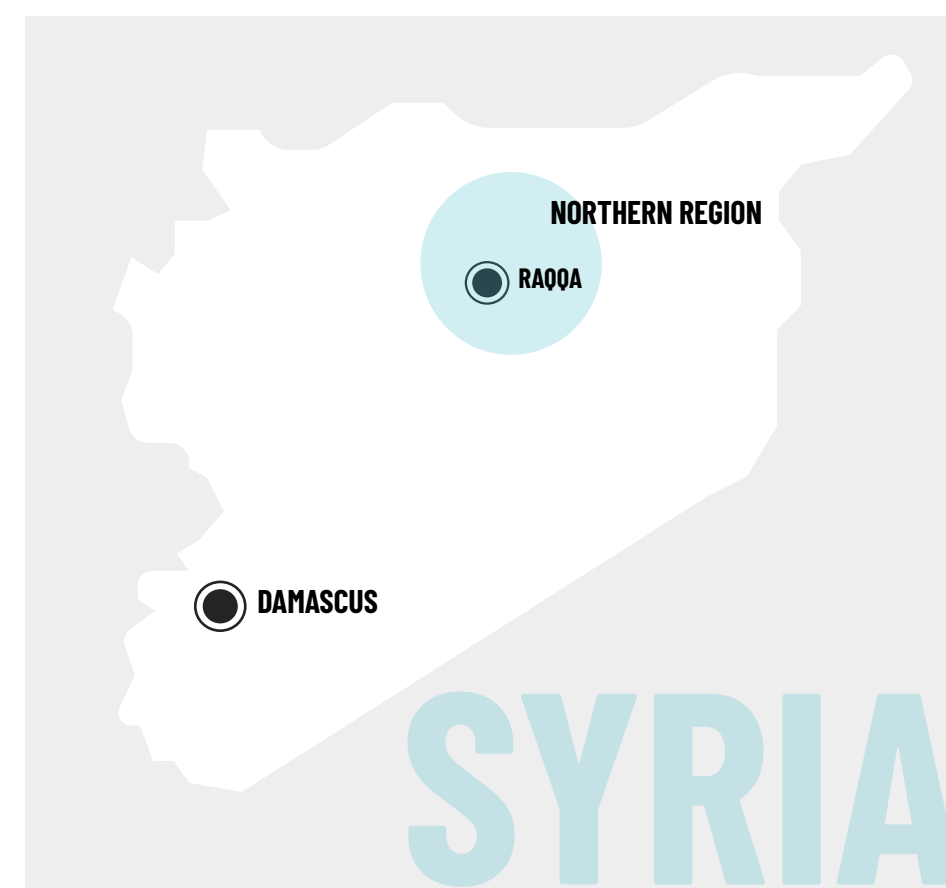
addressing climate challenges. Before the project, farmers had no access to climate data or disease forecasts. The system provided real-time data, enabling farmers to take proactive measures to protect crops. This improved food security and contributed to rural stability by helping farmers manage risks and avoid losses.

Veterinary extension services also boosted rural economies. By improving animal health and reducing mortality, the project helped breeders stabilize herds and increase productivity. Modern veterinary tools, such as the ECHO machine, allowed technicians to work more effectively, reducing livestock losses and boosting breeder incomes.

By the end of 2023, agricultural and veterinary services had brought significant change to Northern Syria. Farmers were better equipped to manage crops and livestock.

Meteorological data and disease forecasting tools helped them adopt sustainable farming practices, reducing chemical use and increasing productivity. The project also built local technician

**A project  
revitalized  
veterinary and  
agricultural  
services in Syria,  
improving food  
security and  
resilience for over  
1,360 farmers and  
breeders**



capacity to continue supporting communities.

The transformation of agricultural and veterinary services in Northern Syria serves as a model for other conflict-affected regions. Restoring services and integrating climate-smart practices improved food security and contributed to long-term rural stability. As the region recovers, the lessons from this project will be crucial for ensuring agricultural sustainability and stability.





Population

22,125,249



Average annual  
Income

\$2,083



Working in  
agriculture

15%  
of the workforce



Agricultural  
area

30%



Remote mentoring  
improved veterinary  
care, helping farmers  
stabilize herds



# Where are we?

In **Northern Syria** agricultural and veterinary extension services were disrupted during the **ISIS interlude**, leading to crop losses and livestock health issues in a challenging climatic environment.

# What has been achieved?

Agricultural and veterinary services were reactivated, with over **1,360 farmers** and breeders benefiting from crop protection, disease forecasting, and improved livestock care.

# When?

The project was implemented in **2023**, during which essential services, including pest management and livestock health services, were restored.

# Why?

Supporting **agricultural productivity** and **livestock health** is vital for food security in the region, where climate-related challenges exacerbate vulnerabilities in farming communities.

# By whom?

The project was led by **CIHEAM Bari** with technical assistance from international experts and local technicians, supporting the work of the **Raqqa Coordination Council (RCC)**.



# RECOMMENDATIONS THE WAY FORWARD

“Climate Change and Food Security – Close up on local solutions” underscores the power of a bottom-up approach rooted in local communities. While current data confirms that climate change threatens to reverse the progress achieved in the fight against hunger and malnutrition—intensifying risks to food security for the most vulnerable nations and populations—there have been encouraging advancements and innovations across many subregions of the world, grounded in a community-based understanding of local contexts. These locally-driven solutions enhance resilience and improve the availability, accessibility, and stability of food resources while remaining aligned with environmental sustainability and local needs.

Innovative agricultural practices, network programs, and investments can strengthen their impact on food security and resilience to climate change if they:

## 1. Empower local communities

by ensuring societal involvement and a sense of ownership, action, and responsibility through the active participation of local stakeholders in the decision-making, and leadership processes implementation, fostering long-term commitment.

## 2. Enhance gender-inclusive capacity-building initiatives

targeting women, youth, and marginalized groups, promoting technical and governance skills to foster awareness of sustainable livelihoods, create managerial opportunities, and empower youth to preserve and manage their family's traditional work.



## 3. Create public-private partnerships

by leveraging resources from governments, the private sector, and international organizations to unlock new funding opportunities through co-financing, grants, and other mechanisms. These collaborations lay the foundation for scaling sustainable solutions across diverse contexts through joint projects, knowledge-sharing platforms, and networks that address common challenges. These partnerships enable collective progress toward building resilience by sharing good practices and providing skills, expertise, and tools.

## 4. Collaborate with institutions

including national and local government bodies, to develop regulations and policies that take into account specific needs and contributions while raising awareness.



## 5. Support research

tailored to local environmental and socio-economic conditions, focusing on developing region-specific agricultural practices, eco-friendly pest control strategies, restoration techniques, and long-term scientific monitoring analyses to identify potential risks and provide feedback for improving interventions.

## 6. Integrate innovative technologies

to enhance the efficiency of climate adaptation strategies. The adoption of precision agriculture techniques enables the efficient and sustainable use of resources, including water, and allows for targeted and calibrated soil interventions. Real-time monitoring tools, such as moisture sensors, GIS mapping, and remote sensing technologies, improve resource management, support predictive models that inform decision-making, foster private sector growth, and encourage dialogue with public stakeholders.

## 7. Encourage market diversification

through resilient crops and sustainable farming, reducing dependency on single exporters and increasing income. Supporting value addition, mainly through women-led processing initiatives, can significantly enhance marketability. Promoting the production of nutrient-rich crops is another vital step toward improving overall nutrition. Investing in infrastructure is critical to expanding market access and reducing climate-related vulnerability. Facilitating the adoption of certifications and quality standards further increases the value of products, strengthens diverse forms of farmer collaboration, improves production techniques, enables better price negotiations, and ensures long-term economic stability and resilience.



REFERENCES

Aguiar F. (2023). *Food security challenges in the Middle East: insights from the UN's roadmap*. <https://www.bic-rhr.com/research/food-security-challenges-middle-east-insights-uns-roadmap>

Ahmadi M., Nawaz M.A., Asadi H., Hemami M.R., Naderi M., Shafapourtehrany M. and Shabani F. (2023). *Protecting alpine biodiversity in the Middle East from climate change: Implications for high-elevation birds. Diversity and Distributions*, 30 (5): 1. <https://doi.org/10.1111/ddi.13826>

AISCR (2024). *Enhancing agricultural productivity and resilience to ensure food security in Africa*. <https://aiscrglobal.org/agricultural-value-chain-food-security/>

FAO, IFAD, UNICEFM, WFP and WHO (2024). *The state of food security and nutrition in the world 2024 - Financing to end hunger, food insecurity and malnutrition in all its forms. Rome: FAO*. doi: <https://doi.org/10.4060/cd1254en>

FAO (2023). *Agrifood solutions to Climate Change – FAO's work to tackle the climate crisis*. <https://openknowledge.fao.org/server/api/core/bitstreams/d6b025b8-2ab7-47f2-b336-87a1de1e67e8/content/cc8055en.html>

FAO (2024). *Biodiversity*. <https://www.fao.org/biodiversity/en#:~:text=Biodiversity%20is%20the%20foundation%20of,the%20land%2C%20freshwater%20and%20oceans>

FAO (2024). *Sustainable Food Value Chains Knowledge Platform*. <https://www.fao.org/sustainable-food-value-chains/what-is-it/en/>

Gómez M.I., Meemken E. and Verteramo Chiu L.J. (2020). *Agricultural value chains and social and environmental impacts: Trends, challenges, and policy options – Background paper for The State of Agricultural Commodity Markets (SOCCO)*. Rome: FAO. <https://doi.org/10.4060/cb0715en>

Knez S., Štrbac S. and Podbregar I. (2022). *Climate change in the Western Balkans and EU Green Deal: status, mitigation and challenges. Energy, Sustainability and Society*, 12 (1): 8-12. <https://doi.org/10.1186/s13705-021-00328-y>

Konfo T.R.C., Chabi A.B.P., Amoussouga Gero A., Lagnika C., Avlessi F., Biaou G. and Sohounhloue C.K.D. (2024). *Recent climate-smart innovations in agrifood to enhance producer incomes through sustainable solutions. Journal of Agriculture and Foos Research*, 15: 1-2. doi: <https://doi.org/10.1016/j.jafr.2024.100985>

Mirzabaev A., Bezner Kerr R., Hasegawa T., Pradhan P., Wreford A., Tirado M.C. and Gurney-Smith H. (2023). *Severe climate change risks to food security and nutrition. Climate Risk Management*, 39: 5. doi: <https://doi.org/10.1016/j.crm.2022.100473>

UNEP (2024). *As shortages mount, countries hunt for novel sources of water*. <https://www.unep.org/news-and-stories/story/shortages-mount-countries-hunt-novel-sources-water#:~:text=By%202025%2C%201.8%20billion%20people,be%20grappling%20with%20water%20stress.&text=Historically%2C%20most%20fresh%20water%20for,has%20come%20from%20groundwater%20aquifers>

UNESCO and UN-Water (2020). *United Nations World Water Development Report 2020: Water and Climate Change*. Paris: UNESCO.

UN (2022). *Country programme document for the Hashemite Kingdom of Jordan (2023-2027)*. New York: UN. DP/DCP/JOR/4 [https://digitallibrary.un.org/record/3982776/files/DP\\_DCP\\_JOR\\_4-EN.pdf?ln=en](https://digitallibrary.un.org/record/3982776/files/DP_DCP_JOR_4-EN.pdf?ln=en)

WORLD BANK GROUP (2019). *This Is What It's All About: Protecting Biodiversity in Africa*. <https://www.worldbank.org/en/news/feature/2019/02/14/biodiversity#:~:text=It%20is%20estimated%20that%20by,significant%20loss%20of%20plant%20species>

PHOTO CREDITS

Cover:  
Zhuda - istockphoto.com

Introduction:  
EqualStock - unsplash.com | Andrea Bozzetto

Chapter 1:  
@jamoimages - unsplash.com

How to fight drought with beans:  
Jordan Opel - unsplash.com | Aref Barahuie - istockphoto.com | Gabriel Jimenes - unsplash.com

The Cowpea:  
Etienne Voss - istockphoto.com

Chinini: a model to save coastal oases:  
Attila Janosi - unsplash.com | Mohamed Fsili - unsplash.com

Chapter 2:  
Soliman Cifuentes - unsplash.com

Field Trip:  
Andrea Bozzetto

Interview 1:  
Andrea Bozzetto

Nouiel farmers growing organic:  
Rafai Ansari - unsplash.com | Mojammel Haque - istockphoto.com | Amy Vann - unsplash.com

Chapter 3:  
Tenzin Wangchuk - unsplash.com

Powering Congo's farming future:  
@kaysha - unsplash.com | Feed database

Interview 2:  
Feed database

Restoring vet services in post-war Syria :  
Ingeborg Korme -unsplash.com | Jotirmoy Gupta - unsplash.com | Mahmoud Sulaiman unsplash.com

Recommendations:  
Ruslichang - istockphoto.com | Gerasimov174 - istockphoto.com







