



CONFRONTING THE CLIMATE CRISIS WITH FOOD SYSTEMS TRANSFORMATION

Stories of action from 14 countries



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PREFACE

Integrating food systems transformation into the Nationally Determined Contributions (NDCs) – the national climate actions at the heart of the Paris Agreement, is critical to delivering on interconnected ecological, biodiversity, health, economic, social, and cultural goals. Taking a food systems approach builds climate resilience and results in a diversity of context-specific solutions for food production, distribution, consumption, and waste. Yet, food systems are rarely prioritized in climate policy.

This catalogue of global Case Studies complements a suite of publications that are designed to centre food systems transformation in future climate debate and policy:

- 1. Untapped Opportunities for Climate Action: An Assessment of Food Systems in Nationally Determined Contributions:** A summary report providing a synthesis of the 14 country assessments with recommendations and priority actions for policymakers and climate policy advisors
- 2. A Practical Guide to Assessing Food Systems in Nationally Determined Contributions (NDCs):** A guide with a framework designed to enable users to take a food systems approach to developing future NDCs and implementing climate policies.
- 3. A set of 14 country assessments** examining the latest NDCs of 14 countries from around the world, outlining areas of improvement and opportunity.

Users are also encouraged to read **Confronting the Climate Crisis with Food Systems Transformation: Stories of Action from 14 Countries**, which provides a catalogue of global case studies that complement the suite of materials for policymakers, advisors, and advocates of climate action.

INTRODUCTION

There is a magic number with which the global community is increasingly well-acquainted: 1.5°C (2.7°F).

Set out by the Paris Agreement in 2015, this is the increase in global average temperature above pre-Industrial levels that our planet must not surpass if we are to avert catastrophic global warming and prevent a cascade of other ecological, economic, and human health crises.

Unfortunately, the majority of countries do not have sufficient climate measures in place to meet this goal. Current domestic climate action plans — Nationally Determined Contributions (NDCs)¹ — offer a collective pledge that is estimated to limit warming to 2.4°C (4.3°F), still well above the Paris Agreement target. As policymakers worldwide prepare to enhance their NDCs in 2025,² one significant source of emissions must not be overlooked.

WHY FOOD SYSTEMS? WHY NOW?

The role that food systems play in climate change still goes unacknowledged. One reason is because the emissions produced by food systems cannot be encapsulated in a single sector (that is, energy, transport, manufacturing). This means its true contribution isn't necessarily obvious when looking at data that categorizes greenhouse gas (GHG) emissions in such a way.³

In reality, global food systems account for 21 to 37% of all anthropogenic GHG emissions and are one of the greatest drivers of environmental degradation, biodiversity loss, water shortages, and pollution.

This encompasses emissions from production, processing, packaging, transport, storage, consumption, and the disposal of food. Left unchecked, business-as-usual emissions from food systems alone would push past the 1.5°C (2.7°F) emissions budget as early as 2051.

At an individual level, food and the need for nourishment is a necessity that transcends borders, political affiliation, creed, and economic status. At a systems level, recognizing the climate impacts of food systems has never been more important to addressing the climate emergency and contributing a range of other co-benefits:

- Enhance and restore natural ecosystems while ensuring our growing population has enough nutritious food;
- Promote healthier diets, which will benefit human health and well-being; and
- Increase community and ecological resilience against external shocks, including changing weather patterns, more frequent and intense climatic events, and the ramifications of COVID-19 and potential future pandemics.

Fortunately, practical solutions at the crossroads of food systems transformation and climate action are possible and, as we highlight in this report, already underway.

In the pages that follow you will find 14 Case Studies from 14 countries worldwide that bring to the fore the positive impacts being created by Indigenous Peoples, farmers, citizens, civil society groups, businesses, and

governments. We hope these stories offer insight into crucial lessons for designing food systems initiatives that tackle the climate emergency.

These Case Studies were selected based on a [rigorous criteria](#) and are part of a broader initiative to encourage policymakers and decision makers to include food systems interventions within their next NDC enhancement — ideally as soon as 2022.

KEY CROSS-CUTTING INSIGHTS

These Case Studies highlight the myriad of policies, practices, and opportunities for climate action. Further, they demonstrate the diversity of actors leading change at local, regional, and national scales.

The stories present a healthy serving of hope and show what is possible when we take a food systems approach to climate mitigation and adaptation. What's achieved goes well beyond the realms of food and climate action, and can contribute to building more equitable, inclusive societies and a healthy planet.

Based on our analysis, here are five primary cross-cutting insights and opportunities to accelerate food systems transformation for climate action.

1) An inclusive, rights-based, participatory approach is central to the most successful and impactful projects.

In all Case Studies, intended beneficiaries were actively engaged from the outset in the design of policies and practices. Ensuring the participation of Indigenous Peoples, women, smallholder farmers and fishers, youth, and other marginalized groups is particularly vital. An inclusive approach supports the sustainability of initiatives from design through to implementation and monitoring and evaluation.

From an inclusive governance perspective, cross-sectoral coordination and collaboration was a critical ingredient to success. For national or municipal initiatives, this includes the need for cooperation across and between government ministries/departments to ensure a coherent and consistent regulatory approach.



In Colombia, participatory governance processes have been designed to overcome structural inequities and potential power imbalances. These processes were used to develop territorial roadmaps for a new food and land-use economy.



In Kenya, marketing and retail training for farmers, especially women, helps them sell produce directly to customers, cutting out middlemen and generating more take-home income as a result. Peer-to-peer learning and on-farm training have also been essential in exchanging knowledge, sharing solutions, and challenging dominant agricultural narratives.



In Spain, the City of Barcelona has established transparent, coherent, and participative governance mechanisms that allow for the co-design of public policies on climate, food justice, nutrition security, and nature.

2) Mindset and narrative shifts are necessary to unlock the co-benefits of agroecological and regenerative forms of food production.

A number of Case Studies demonstrate how agroecological and regenerative practices can support climate mitigation and adaptation strategies while achieving a range of other co-benefits. Policy and decision makers must move past outdated, predominant narratives to focus on holistic systems built around regenerative practices; culturally appropriate, healthy, and sustainable diets; and a reduction in food waste and loss.



In Bangladesh, water-retention technologies combined with agroecological practices in rice–fish production have increased access to indigenous fish and reduced methane emissions from paddy fields.



In Egypt, arid desert landscapes are being transformed into oases using biodynamic and organic agricultural methods. Among other activities, the initiative produces medicinal herbs and food, and achieves sustainable development outcomes through the reduction of pesticides and chemical fertilizers, tree planting, and a focus on soil fertility.



In South Africa, the initiative highlighted provides training and supports disadvantaged communities to grow perennial food forests. These community spaces have become a fantastic source of sustainable, nutrient-rich food and provide shade in urban environments.

3) Equitable access to nutritious, sustainable, and culturally appropriate diets are critical for reducing food-based GHG emissions. Food environments that value waste-reduction strategies are equally important.

Food consumption patterns — from what we eat to what goes to waste — can have a significant impact in reducing anthropogenic GHG emissions from food systems. Several Case Studies emphasized the importance of promoting positive food environments underpinned by diversified food production tailored to local growing conditions and sociocultural preferences.

A shift to more plant-based foods, especially in the Global North, was also commonly emphasized as a solution to mitigating the climate impacts of diets. Finally, certain Case Studies demonstrate how reducing and repurposing food loss and waste are central to mitigating climate change and slashing GHG emissions.



In China, an initiative reduces dietary GHG emissions by providing chefs with the tools to encourage people to increase their consumption of high-quality, diverse, plant-based diets.



In the United Kingdom, a campaign is addressing the socio-economic determinants of child food poverty and is committed to improve access to nutritious and affordable fresh fruit and vegetables.



In the United States, food waste is being reduced from retail through to consumption in a data-driven collaboration with a range of food businesses and civil society organizations.

4. Collaborating with stakeholders at the intersection of food and health is a win-win for ecological and human health and well-being.

Food systems policy and practice have the opportunity to benefit the health and well-being of both people⁴ and the planet. Case Studies identified the need for increased collaboration across public health, nutrition, and climate communities.



In Canada, health professionals are being brought together to lead projects that see the food served in health-care facilities as a vehicle to tackle climate change — while also delivering culturally appropriate patient care and community well-being.



In Germany, one city stipulates that the meals served in public canteens — including schools, municipal kitchens, and public hospitals — meet minimum levels of organic and regional foods and ingredients. Partnerships across the food systems help make this public procurement goal a reality.



In Egypt, a medical centre has been established in conjunction with a biodynamic agriculture organization, recognizing the interconnectedness between nutritious food, human health, and sustainable community development.

5. Innovative investment and finance models are vital to supporting community actions that achieve climate mitigation and adaptation impacts.

The Case Studies demonstrate there are significant opportunities to ensure finance is redirected to support community-based climate actions and a “Just Transition” movement.⁵ This includes mobilizing funding from governments, philanthropic organizations, companies, ethical banks, multilateral donor agencies, and others. Further, the creation of cooperative groups, microfinance initiatives, and other innovative financial models are necessary to reduce the financial risks and liabilities of already marginalized or disenfranchised groups.



In France, a food coupon scheme is being trialled in one city to ensure all citizens have equal access to nutritious food. The coupons offer disadvantaged families the opportunity to buy their preferred fruits and vegetables in partnership with community grocery stores and local food banks.



In Senegal, a dedicated credit guarantee facility was established to incentivize local banks to extend credit to household biogas enterprises. Biogas production contributes to ending deforestation and producing energy from human and animal waste.



In Vanuatu, the government committed initial resources in support of its National Adaptation Programme of Action, which subsequently unlocked over 200 million USD from intergovernmental organizations, other national governments, and the private sector. This is one example of how public finance can be used to tap into private and blended models of finance.

These 14 Case Studies present clear and compelling evidence for how food systems can contribute creative solutions to climate change. Just as importantly, they provide hope and inspiration for an alternative path forward. These stories demonstrate all that can be achieved when the public, private, and philanthropic sectors work with actors across the food system to advance actions that transform the status quo, reduce emissions, and adapt to and mitigate the effects of climate change — while creating positive change in a multitude of ways.

CASE STUDIES



CASE STUDY

BANGLADESH

Bangladesh's floodplains take centre stage in food security, equity, and climate change mitigation efforts

PROJECT SUMMARY

This project takes a community-based approach to managing rice–fish production systems in Bangladesh's floodplains. This has contributed to improved food security, increased livelihood opportunities, and the implementation of measures that mitigate climate change. The initiative is led by [WorldFish](#), a non-profit organization that focuses on reducing hunger, malnutrition, and poverty across Africa, Asia, and the Pacific.

THE FOOD-CLIMATE CONNECTION

Bangladesh's floodplains are home to critically important rice–fish production systems. Climate change and other anthropogenic factors have been a stressor for these valuable environments.

Improved floodplain management techniques mitigate the effects of climate change in two crucial ways: by reducing the use of artificial fertilizers (since fish droppings serve as natural fertilizer) and by ensuring parts of the floodplain remain wet to prevent organic matter from decomposing and releasing methane and carbon dioxide.

CLIMATE FACTS

- **Food production and emissions.** Agriculture accounted for 39% of Bangladesh's total GHG emissions in 2012, more than any other sector.
- **Bangladesh's NDC.** The NDC sets an unconditional emissions-reduction target of 6.73% when compared to 2012 levels. This may be increased to a 15.12% reduction target if the government receives international support.⁶
- **Domestic climate approach.** The Government of Bangladesh prioritizes adaptation over mitigation as a means to become climate resilient.

FOOD SYSTEMS FACTS

- **Economic contribution.** Agriculture, forestry, and fisheries comprise 12% of Bangladesh's GDP.
- **Employment.** An estimated 84% of rural Bangladeshis depend on agriculture for their livelihoods, either directly or indirectly.
- **Food security.** One in 10 people face severe food insecurity, despite significant economic progress and poverty-reduction measures in recent years.

LESSONS FOR CLIMATE ACTION PLANS

The WorldFish community-based fisheries aquaculture (CBFA) program offers several lessons for NDCs:

- **NDC development process:** Participatory engagement and consultation processes should involve a variety of stakeholders, including fishers, farmers, landless groups, women, and NGOs.
- **Content of the NDC:** Wild-caught and farmed aquatic foods play a vital role in providing healthy and nutritious food, particularly in low- and middle-income countries. At the same time, closed-loop aquaculture and fisheries systems are central to climate mitigation. Low-impact water-retention technologies in rice–fish production systems can increase access to a diversity of indigenous fish and reduce methane emissions from paddy fields.
- **Implementation of the NDC:** The involvement of farmers and fishers in participatory appraisals and project monitoring and evaluation is crucial to build trust and project success.

KEY INSIGHTS

There is a well-known proverb in Bangladesh: *Mache bhate Bengali*, which translates to “A Bengali is made of fish and rice.” These staple foods form the foundation of the country's diet, and both are deeply embedded in the food cultures and traditions of the Bangladeshi people. This is especially true in rural communities.

Rural environments are also where you'll find the country's floodplains. Up to 80% of Bangladesh's total land mass is located in these lowland areas, with about a quarter of the country remaining underwater for 4 to 6 months of the monsoon season.

Branching off major river systems and in areas regularly inundated by rainfall, the floodplains are central to the production of rice and fish. They offer a range of livelihood and ecosystem services for the millions of farmers and fishers who rely on them for nutritional food and income.

Rice–fish production systems are a dominant economic activity on the floodplains, and depend on seasonal weather cycles. In these rotational systems, rice is cultivated during the dry season for personal consumption and sale in local markets. The harvesting of wild or cultured fish happens simultaneously, and fish thrive in dense rice plants where they are concealed from predation. Wild and introduced fish populations alike hinge on the 4-to 5-month monsoon season, when the floodplains are submerged and become extensive inland fisheries.

For centuries, this seasonal cycle proceeded like clockwork. However, these rice–fish systems now face increased stress due to climatic and anthropogenic factors. This includes rapid infrastructure development, pollution, and increased fishing pressure — combined with inconsistent patterns of rainfall that have caused flooding, droughts, and a disruption to the life cycles of fish and other aquatic species.

These pressures and the disturbance of formerly predictable seasonal cycles have resulted in drastic reductions in the harvesting of fish and the production of rice. They have also contributed to a rise in myopic behaviours,

“CBFA presents a clear example of how taking an ecosystem-based approach can provide a win-win for communities, commercial production, and the environment.”

— DR. BENOY BARMAN, SENIOR SCIENTIST, WORLDFISH

such as the use of artificial fertilizers and pesticides that boost rice production in the short-term but affect survival rates of fish and other wetland species.

IMPROVING FLOODPLAIN MANAGEMENT FOR PEOPLE AND THE PLANET

Recent years have brought efforts to reimagine how to better manage Bangladesh’s floodplains to build more equitable communities, improve food security, and promote resilient, biodiverse ecosystems.

One such approach is being led by WorldFish, an international non-profit aquaculture and fisheries research and innovation organization. WorldFish oversees several community-based fisheries aquaculture (CBFA) projects that have introduced a new method of aquaculture to people living near these lowland rice fields. In it, fish such as carp are stocked in the rice fields so people can harvest these alongside naturally occurring wild fish.

“CBFA presents a clear example of how taking an ecosystem-based approach can provide a win-win for communities, commercial production, and the environment,” explains Dr. Benoy Barman, a senior scientist with WorldFish.

Bangladesh’s floodplains are a focal point when it comes to the country’s climate change mitigation efforts. According to Barman, a perennial challenge is how to retain surface water in the floodplains during the monsoon. Rainfall in fields quickly runs off into nearby canals, impacting the viability of aquaculture. These drained wetlands also [contribute to emissions](#), releasing carbon dioxide and methane when the once-water-logged organic matter dries and decomposes.

To maintain the moisture content of CBFA-managed floodplains, community members trained by WorldFish construct simple water-retaining structures. These dam-like barriers maintain consistent surface water that helps to build soil organic matter, moisture content, and improve the diversity of native fish species.⁷ Research is a foundational pillar of WorldFish, and the organization is still gathering quantitative analysis of the emissions reductions that have been achieved through its CBFA production system. [Research from elsewhere in Asia](#) shows that similar “alternate wetting and drying” techniques have curbed GHG emissions, particularly methane, from rice production by 30 to 70% without impacting yield. It also lessens the amount of water needed for production.

Other measures contribute further to climate change mitigation. Another CBFA innovation is the construction of porous enclosure fences that allow small indigenous fish to move freely in and out of the floodplain while keeping larger fingerlings of stocked carp contained. Ensuring that juvenile fish remain in the paddy field reduces the need for chemical fertilizers to grow rice since fish droppings serve as a natural fertilizer. Through WorldFish, around 500 square kilometres (193 square miles) of floodplains have adopted this CBFA management system, benefiting more than 100,000 households. This social impact is another tremendously important element of the WorldFish approach.

FOOD SYSTEMS GOVERNANCE GROUNDED IN COMMUNITY ENGAGEMENT

The WorldFish CBFA projects would be nothing without community — it's in the name, after all. Active engagement with local residents is a central tenet of the projects.

One means of engagement has been the creation of several cooperatives to oversee the management of floodplain rice–fish production systems. Also known as community-based organizations (CBO), these cooperatives involve a diverse group of actors, from fishers to farmers, landless peoples to civil society groups. Also included are NGOs and institutions ranging from local to national governments.

This plurality of voices is engaged in different ways. For example, people who buy into cooperative membership receive training and have autonomy to develop their own locally relevant governance approach for the floodplain area. This participatory governance process includes the establishment of rules and regulations that ensure the project benefits the community.

For community members who lack access to land, the cooperative grants permission to harvest small fish in the floodplain using traditional gear. This builds relations and maintains harmony between the cooperatives and the local community — and provides a subsistent food source for poor households.

Further, WorldFish oversees several nutrition education programs. These programs focus on strengthening the role of women in decision-making within the CBO and their contribution to improving the nutritional outcomes of their family. Reducing the health costs associated with malnutrition is implicit in the WorldFish projects, and affirming a culture of eating nutrient-rich, indigenous fish species is a way to achieve that. At a policy-making level, WorldFish works closely with local and regional governments. It has presented strong evidence in favour of revised policies that encourage public investment in improved floodplain management and has advocated for the agency of local communities to manage this resource.

WHAT'S NEXT?

Though WorldFish's CBFA projects have improved fish–rice production and established new local alliances, challenges remain. For one, a portion of Bangladesh's floodplains are private property, with land leased by CBO members so they can fish and farm. Under the current system, the majority of leases are for between 3 and 5 years — an insufficient period of time for a cooperative to invest in its operations given that the lease could be revoked at the end of the term.

Without the possibility of obtaining a longer-term lease, the positive changes achieved by CBFA projects could be lost. WorldFish, alongside its CBOs, is advocating for longer-term lease agreements (30+ years) to ensure greater security and access to land — and the continued environmental benefit of these rice–fish management systems.

Further quantitative research is also needed on various scientific and social topics, such as how to improve the quality of stocked fish, how to engage an even greater number of community members, and the impact of climate change on floodplain systems.

Meanwhile, WorldFish's CBFA practices demonstrate it's possible to support biodiversity, mitigate the effects of climate change, and transform food systems to be more inclusive, nutrition-sensitive, and ecologically sound. As trialled through WorldFish's efforts and the dedication of CBO members, Barman sees an opportunity for a similar approach to be scaled across Bangladesh where there is demand for increased community participation and improved floodplain management.

Said Barman: "We hope that in the future, due to the community-based organizations having a lot of innovations, that the ecosystem health will be improved and will bring a more sustainable future for the floodplains."

SUMMARY OF IMPACTS ACHIEVED

- **A model to scale.** Other Bangladeshi communities have noticed the positive outcomes of CBFA activities and are adopting the model in their areas. Interest has also been expressed by the national government's Department of Fisheries.
- **Increased income.** WorldFish found that CBFA generates 3.74 times more fishing income for households in project sites when compared to control sites.
- **Greater productivity and profit.** In some sites, the CBFA approach resulted in a 10% lower cost of rice production. These benefits were gained with no reduction in wild fish catch, which refutes the belief that industrial systems are the most cost efficient. The project also increased fish production significantly, which increased the profit per hectare of floodplain areas by 20 to 85% over previous profitability levels.
- **Focus on equity.** CBFA reduces the vulnerability of marginalized community members, particularly women, landless individuals, and low-income fishers. It engages them in training and decision-making, and creates additional subsistence fishing opportunities for up to 6 months of the year. These linkages have levelled the playing field of power, led to more participatory governance, and increased the confidence and agency of community members.



CASE STUDY

CANADA

The Canadian organization using food in health care to heal patients and the planet

PROJECT SUMMARY

Nourish Leadership works at the intersection of food and health care. The Canadian organization brings together health leaders, organizations, Indigenous Peoples, and other actors to design food-centred, locally grounded solutions that bring bold leadership to climate action, health equity, and community well-being.

THE FOOD-CLIMATE CONNECTION

Canada's healthcare sector generates 5.2% of the country's greenhouse gas (GHG) emissions. Food is a significant part of this footprint — generally due to food waste and unsustainably sourced ingredients. Climate change also has a disproportionate impact on the physical and mental well-being of Indigenous Peoples. It can exacerbate food insecurity — rates of which are already higher in Indigenous communities — by limiting access to traditional foods and gathering practices. It can also contribute to ecological grief, as people witness their ancestral land changing or disappearing.

CLIMATE FACTS

- **Food production and emissions.** Canada's food systems contribute 30 to 40% of the country's total GHG emissions. Most of these emissions are from land-use change, energy consumption, and food waste. The Canadian healthcare sector generates 5.2% of the national carbon footprint.
- **A global concern.** According to Health Care Without Harm, if the healthcare sector were a country, it would be the planet's fifth-largest GHG emitter.
- **Canada's NDC.** Canada's updated NDC sets an emissions-reduction target of 40 to 45% in 2030 compared to 2005 levels. It includes a commitment to reach net zero emissions by 2050.⁸

FOOD SYSTEMS FACTS

- **Hospital food waste.** One study found that 40% of hospital food is thrown out, leading to unsatisfied patients and perpetuating the climate crisis.
- **Healthcare food budgets.** Globally, an estimated 4 billion CAD (3.12 USD) is spent on healthcare food services each year. This budget rarely goes toward local, sustainable, and culturally appropriate food.
- **Food security.** In 2017–18, 12.7% of Canadian households experienced a form of food insecurity. Rates of food insecurity are twice as high among Indigenous populations.

LESSONS FOR CLIMATE ACTION PLANS

Nourish Leadership's approach offers several lessons for NDCs:

- **NDC development process:** Nourish takes a systems-wide approach and has an inclusive program of stakeholder engagement, with strong representation from Indigenous Peoples and the health community. Together, these groups identified a program of work that highlights climate mitigation and health co-benefits. Partnership and collaboration with diverse actors are the foundation of Nourish, and guide its objectives of narrative-shifting and movement-building in the health and food systems.
- **Content of the NDC:** Nourish urges actions that bring co-benefits for patients and the planet, including a reduction in food waste and shifting toward more plant-based diets. It views these actions as essential strategies for reducing carbon emissions. There is explicit recognition and support for the role of Indigenous Peoples in climate policy and a strong focus on honouring the relationship communities have with land and place.
- **Implementation of the NDC:** Nourish believes in building a leadership community of practice. This community includes diverse actors who are committed to working together to change systems and build evidence for other adopters to follow. Nourish supports healthcare institutions to work alongside their communities to invest in the social and ecological determinants of improving nutrition, food environments, and access to fresh, healthy, culturally relevant, and sustainable foods.

KEY INSIGHTS

The food served in healthcare facilities can be a powerful tool to heal both patients and the planet. This is the premise behind Nourish Leadership, a Canadian charitable organization that empowers healthcare leadership in climate action, health equity, and community well-being.

Nourish grew out of efforts to encourage public hospitals and healthcare facilities to purchase and serve more local, culturally appropriate food. Today, the organization describes itself as “a growing national community of practice that works across community, institutional, and policy scales to steward innovation to transition to a more preventive, equitable, and sustainable health system and future.”

To achieve this vision, Nourish brings together healthcare leaders, community organizations, and Indigenous Peoples. It celebrates Indigenous foodways as a path toward sustainable food systems and culturally appropriate care, while also acknowledging that these customs and ways of knowing have been systematically neglected in Canada. This has had detrimental effects on the health of Indigenous Peoples in the country and on the planet, as food systems have spiralled away from values of place, reciprocity, and taking only what one needs.

LEADING SYSTEMS AND PLACE-BASED CHANGE

Healthcare institutions have significant purchasing power and influence. With an estimated 5.07 CAD (4 billion USD) spent on healthcare food services globally each year, Nourish sees food as a fundamental social determinant of health and a powerful intervention point in the fight against climate change.

The organization supports healthcare institutions to take leadership in three impact areas:

1. **Climate:** Canada’s healthcare sector generates 5.2% of the country’s national carbon footprint, and food is a significant part of this. Nourish focuses on reducing food waste and nudging the healthcare sector toward more plant-based, climate-friendly menus and procurement. The organization also looks to Indigenous foodways as a source of wisdom to navigate out of the climate crisis.
2. **Equity:** Indigenous Peoples in Canada are disproportionately food insecure, experience higher rates of diet-related diseases, and are more vulnerable to the mental and emotional repercussions of climate change. Widening disparities in income and wealth, exacerbated by the climate crisis and social isolation, put pressure on healthcare systems. Nourish works with healthcare institutions to address the root causes of inequity. It compels hospitals to recognize the value of Indigenous healing practices, including the provision of culturally appropriate food.
3. **Community well-being:** Interrelated issues of diet, affordability, and accessibility to healthy food should be dealt with through preventive measures. Nourish supports healthcare leaders and institutions to work alongside their communities and invest in preventive actions that improve nutrition, food environments, healthcare menus, and access to fresh, healthy, cultural, and sustainable food.

Nourish has a variety of projects and programs, all of which are framed in its six “Nourish Food for Health Levers”:



Nourish Leadership’s Food for Health Levers are a resource that frames the powerful ways we can impact climate, equity, and community well-being through food in healthcare. (Source: [Nourish Leadership](#).)

Each lever represents a food-related action that can be taken by healthcare institutions and providers to impact climate, equity, and community well-being. Nourish's website explores each intervention point [in greater detail](#) and outlines specific actions that healthcare leaders can take.

SPACES TO EXPLORE THE FUTURE OF FOOD AND HEALTH CARE

Though the nature of its projects varies, Nourish has always been about bringing together diverse actors working across the health and food systems.

This started in 2016 with the creation of the Nourish Innovator Cohort. The 2-year program brought together 26 innovators from across Canada — individuals who were responsible for some element of food in health care and who also had a vision to elevate its role in patient care and community well-being.

Innovators from the first cohort introduced traditional and cultural food programs, pioneered values-based food procurement, and undertook a range of climate and sustainability efforts, including reducing meat and packaging, planting hospital gardens, and constructing beehives.

[One innovator](#), Josée Lavoie, led the food services team at a pediatric hospital in Montreal. After the cohort, Lavoie and her team implemented a new room service model to deliver on-demand meals to patients. As a result, the kitchen went from throwing out 45% of food to just 5% — making it an impactful solution to mitigate climate change. The new model also dramatically increased patient satisfaction regarding the hospital's food offerings.

[Another innovator](#), Dan Munshaw from the City of Thunder Bay, achieved several successes related to [values-based food procurement](#) for the city's long-term care facilities and hospitals. Munshaw created new policies to enable procurement from local farmers and Indigenous hunters and gatherers. He also pioneered "forward buying" agreements with local producers wherein the city committed to purchase a certain amount of food for an agreed-upon price. This stimulated the demand for locally grown food. Overall, Munshaw's efforts resulted in local food procurement as a percentage of total food procurement increasing from 15% in 2012 to 34% in 2018.

The latest iteration of Nourish's convening work is the creation of its Anchor Cohort program.⁹ The Anchor Cohort brings together healthcare and community partnerships called Anchor Collaboratives. Together, the collaboratives address interconnected challenges such as health inequity, food insecurity, diet-related chronic disease, and the impacts of climate change.

Seven Anchor Collaboratives — made up of 90+ participants — are taking part in the 2021–2023 cohort. One collaborative is based in Northern Ontario, where "a lack of Indigenous food sovereignty and access to traditional foods is compounded by food insecurity, leading to negative health outcomes."

The Northern Ontario collaborative is a partnership between the Northern Ontario School of Medicine (NOSM) and the Northern Ontario Indigenous Food Sovereignty Collaborative. Generally, medical school courses include little discussion of the intersection between nutrition, climate, and the social determinants of

health. NOSM champions a more holistic approach: Students are trained to see their studies through a food systems lens and are working with partners across the region to procure local, traditional foods. Offered at local healthcare facilities, these foods are more culturally appropriate and reduce GHG emissions associated with the production and transport of conventionally served meals.

WHAT'S NEXT?

A culmination of many years of work — and building on the wisdom of Indigenous Peoples from time immemorial — Nourish launched its [“Food is Our Medicine”](#) campaign in May 2021. Food is Our Medicine is both the program name and the narrative Nourish is promoting.

The campaign includes an online Learning Journey course for healthcare professionals who are interested in learning about the relationships between Indigenous foodways, healing, the land, and health care. It shares why it's important to have traditional food in health settings and how healthcare leaders can integrate Indigenous foodways in a respectful and meaningful manner. The self-paced course is complemented by an Indigenous Foodways Digital Bundle that incorporates readings, reflection questions, and other resources.

Food is Our Medicine grew out of the organization's Traditional & Cultural Food project, led by the Nourish Indigenous & Allies Advisory. This council is made up of Indigenous and non-Indigenous health leaders, including individuals from the original Innovators Cohort. Nourish aspires to have 400 learners complete the Learning Journey by National Indigenous Peoples Day in June 2022.

Later in 2022, Nourish will be launching its latest campaign to promote climate-friendly menus in healthcare settings across Canada. The planetary menu is based on the [EAT-Lancet planetary health diet](#), which emphasizes a transition to plant-based diets and a reduction in food waste. The goal of the campaign is to have at least 100 Canadian health institutions adopt climate-friendly menus in the next 4 years.

Meanwhile, through its Anchor programs, Nourish hopes to accelerate a local and global movement where healthcare institutions work with community actors and governments to shift policy and practice to preventive health care that benefits patients and the planet. Food is both the lens through which to see this work and the means to achieve it.

SUMMARY OF IMPACTS ACHIEVED

Food is Our Medicine impact. As of early 2022, over 600 health professionals have signed up for Nourish's “Food is Our Medicine” Learning Journey.

Public outreach. Nourish has hosted numerous well-attended webinars around the topics of reconnecting food and health, traditional food programs, values-based procurement, anchor institutions, and its other collaborative projects.

The lasting impact of Innovator Cohorts. Twenty-six healthcare innovators participated in the first Innovator Cohort (2016–2019) and have introduced traditional and cultural food programs within their organizations. Continuing to work together, innovators have also developed a range of [collaborative national](#)

[projects](#) and have accomplished long-lasting systems change that may not have been possible if people were tackling challenges alone.

Decolonize food in health care. Indigenous foods are rarely incorporated into hospital meals, yet they are so important for culturally appropriate care and embracing Indigenous foodways. In listening to and learning from Elders, knowledge-keepers, and Indigenous Peoples from across Canada, Nourish uses food in health care to advance the connected goals of reconciliation and climate action.



CASE STUDY

CHINA

Meet the national organization promoting plant-based alternatives in China

PROJECT SUMMARY

The [Good Food Fund](#) is the leading voice for plant-based diets and food systems transformation in China. It is the driving force behind an unprecedented effort to revolutionize the social discourse around plant-based diets through innovative initiatives that unite producers, consumers, and chefs of all ages.

THE FOOD-CLIMATE CONNECTION

China consumes more than a quarter of the global supply of meat, a demand that will continue to rise as the country gets wealthier. This is to the detriment of the environment, as biodiverse landscapes are cleared for resource-intensive livestock rearing and feed. A [2021 study](#) found that animal-based foods produced twice as much emissions as plant-based alternatives.

The Good Food Fund is spearheading a shift toward plant-based diets as a way to reduce China's food-based greenhouse gas (GHG) emissions and normalize healthy, sustainable, and diverse plant-based foods. It's an example of the importance of demand-side measures to achieve climate goals.

CLIMATE FACTS

- **Food production and emissions.** In 2018, China's food system emitted 1.09 billion tons of CO₂e (carbon dioxide equivalent), nearly 10% of the country's national GHG emissions and 2% of total global emissions.¹⁰
- **China's NDC.** The NDC commits the country to becoming carbon neutral before 2060 and to reduce carbon dioxide emissions by 65% compared to 2005 levels by 2030.¹¹
- **Local consumption, global impact.** China's large imports of soybean for animal feed have been associated with overseas deforestation, especially in Latin America.

FOOD SYSTEMS FACTS

- **Economic contribution.** Agriculture contributes to 7.2% of China's GDP. Agricultural imports total 872.7 billion Chinese yuan (CNY) (137 billion USD) and exports approximately 872.7 billion Chinese yuan (CNY) (137 billion USD).
- **Meat consumption.** China consumes 28% of the global supply of meat, including half the world's consumption of pork. This is increasing as people become wealthier.
- **Food security.** Undernutrition rates in China have dropped significantly in the last three decades; at the same time, overweight and obesity rates are climbing as a result of an excessive intake of fat, calories, sugar, and physical inactivity. The prevalence of diet-related diseases such as adult diabetes is also on the rise.

LESSONS FOR CLIMATE ACTION PLANS

The Good Food Fund offers several lessons for NDCs:

- **NDC development process:** The Good Food Fund developed its vision in partnership with various actors, including chefs, parents of young children, college students, designers, senior citizens, and small family farmers. Leadership has been fostered across these many groups.
- **Content of the NDC:** The Good Food Fund advocates for policies where governments halt subsidies for animal agriculture and instead ramp up investments in incentives for plant-based dietary transitions, reducing food waste and improving unsustainable farming practices. They aspire to reduce per capita meat consumption by 30% or more by 2030.
- **Implementation of the NDC:** The Good Food Fund aims to establish food policy councils across China, with the goal of encouraging the government to engage various stakeholders, design food policies centred around health and sustainability, and implement policies with efforts coming from different government departments.

KEY INSIGHTS

When it comes to making people and policymakers recognize the connection between food systems and climate change, few in China are doing more than Jian Yi and his organization the Good Food Fund.

Founded in 2017 by Yi, an award-winning Chinese filmmaker and activist, the Good Food Fund has a vision to promote good food to improve human health, animal health, and planetary health. It operates under the [China Biodiversity Conservation and Green Development Foundation \(CBCGDF\)](#), one of the country's most active and established environmental organizations.

The Good Food Fund supports investigative research, communications efforts, policy advocacy, public education, and entrepreneurship efforts to create healthier and more sustainable food systems. It does this by focusing on five priorities:

1. Promoting plant-based diets;
2. Stopping the abuse of farmed animals and promoting animal welfare;
3. Promoting access to healthy and nutritious foods;
4. Supporting smallholder farmers and regenerative farming; and
5. Improving food literacy.

When it comes to promoting plant-based diets, the Good Food Fund hosts a series of events to advance the uptake of these products among chefs, institutional food services, and the public alike. This movement toward plant-based eating is happening at a critical time — both for the health of Chinese citizens and for the country's climate change commitments.

Yi describes this moment as a turning point. [As he told the *Financial Times*](#) in 2020 about China's understanding of food systems: "We are currently trying to connect the dots for people to convey that this is a global problem that requires a solution in China."

CHANGE IN INCOME, CHANGE IN DIET

First, some context to frame the current context in China: Life is changing rapidly for people across the country, and with it comes a shift in diet.

Just four decades ago, beef was known as “millionaire’s meat” because it was so expensive and inaccessible to the average Chinese household. As average household incomes rise across China, it is understandable why a greater number of consumers are opting for the status and taste of animal-based protein, particularly beef and pork.

The typical Chinese family now eats quadruple the amount of meat they did 30 years ago, and the country’s meat consumption is set to increase by 50% by 2030 if it stays on its current trajectory.¹² This mirrors global trends where demand for meat has tripled in the last half century — meat production in Asia has increased a staggering 15-fold in this same period.

This increase in meat consumption worldwide has negative implications for climate change targets. Meat production has a huge environmental footprint and impacts GHG emissions, land, and water use.

Beef production is especially resource intensive and polluting. It requires significant land be converted for cattle rearing and feedstock, and produces more GHG emissions than any other food product. China is the largest importer of beef worldwide, followed in second by the United States. It’s a multi-billion-dollar demand that’s fuelling deforestation around the world.

This increase in meat consumption is also adversely impacting peoples’ health. Heart disease, diabetes, cancer, and obesity are the cause of 85% of deaths in China, and many of these conditions are aggravated by an overconsumption of meat.

While meat has become more affordable in China, the taste for animal-based protein is a recent development, and one Jian Yi believes can be reversed in favour of plant-based alternatives.

Evidence shows that people are receptive to such alternatives — be it plant-based meat substitutes, soy, tofu, or more whole foods like legumes, fruits, and vegetables. One survey from across Asia-Pacific found that 62% of consumers in the region are open to buying more plant-based protein alternatives.

Says Yi on this opportunity: “People in China have long accepted the centrality of plants in their diet; we just need to give them the tools to act upon that belief.”

PUTTING GREENER DIETS ON THE MENU

For Yi and the Good Food Fund, those tools take many forms and formats.

One is the Good Food Festival, a popular event that aims to increase the consumption of plant-based, nutritionally diverse diets by 30% by 2030 to replace the existing 30% in animal-based protein. The festival focuses on empowering chefs to be role models in healthy eating, promoting plant-based alternatives, and elevating the importance of animal welfare.

It instills in chefs the mindset that they can shape the behaviours of their diners, the food service industry, and producers. Good Food Fund chefs have also been connected with chefs from North America through a Food Forward Forum that highlighted the diversity of Chinese ingredients and created an outlet for knowledge exchange.

Another of the Good Food Fund's initiatives is Mama's Kitchen, [a project that won a Rockefeller Foundation 2050 Food System Vision Prize](#). Based on the eight Good Food Pledge principles outlined by the organization, Mama's Kitchen works with farmers, scientists, and chefs to develop plant-based recipes and ingredients. The goal is to increase the diversity of food produced and consumed while also strengthening links between producers and consumers.



The eight Good Food Pledge principles for individuals, families, communities, and institutions in China and around the world. (Source: Good Food Fund.)

Mama's Kitchen is envisioned as a community "Good Food Hub" where chefs of all ages can gather to learn about food systems and gain hands-on cooking skills. It encourages every person to learn more about food systems and to shape their own definition of "good food." By emphasizing creative cooking with a variety of plant-based foods, citizens are urged toward a more plant-based diet while also celebrating local ingredients, recipes, ecosystems, and cultures.

A prototype of the Good Food Hub has been built in Yunnan province, and the Good Food Fund ultimately envisions them as spaces where urban dwellers can go to restore their connection with how food is grown and with the natural world. "That's one reason why we've been eating so much [meat], because we lost our connection with land, with our food," [explained Yi on a 2021 podcast](#).

Finally, the Good Food Fund is actively working to rewrite the social discourse around plant-based diets and vegetarianism — controversial terms that can bear strong religious or historical burdens. To do this, the organization hosted a national contest to reinvent the Chinese characters for “plant-based food” and introduced concepts like “Plant Forward” into the Chinese language as a way to prompt a deep cultural shift. Innovative and dynamic, each of these projects aims to popularize plant-based foods and generate demand. They are also creating a wider audience of people who can champion plant-based alternatives, from children to chefs to producers.

Explains Jian Yi of the Good Food Fund’s many projects: “Our generation will set the new default in our kitchen so that our children grow up eating healthy and sustainable food. It is time that China — which is now the world’s second-largest economy and the largest consumer and producer of food — thinks about what example we can make for other parts of the world by eating well.”

WHAT’S NEXT?

While promoting nutritious plant-based diets and food literacy have been the Good Food Fund’s focus to date, Yi and the team recognize the need for a flexible approach so they can mobilize around different opportunities.

For example, in 2020 the Chinese government announced targets to significantly reduce food waste in the country. With it, the Good Food Fund added a new arm to its work to tackle this other major contributor to GHG emissions.

The Good Food Fund benefits from the extensive connections it has built in Beijing and across China with a range of stakeholder groups, including the Chinese culinary society, the food service industry, chefs, universities, non-profit organizations, and communities.

“I think the most important thing any individual can do, if they want to bring change in any space, is to form connections,” said Yi. “Connect with policymakers, connect with people who produce meat, connect with people who want to take time with you.” Through its many initiatives, the Good Food Fund is doing just that.

SUMMARY OF IMPACTS ACHIEVED

Change the narrative. The Good Food Fund has helped mainstream conversations around sustainable food consumption issues in China. They have done this in many creative, engaging ways: by hosting annual food summits, adding plant-based recipes to China’s most popular cooking app, and by creating new Chinese characters to describe plant-based food and vegetarianism.

Connect the right people. The good food summit is the first and only annual national conference to bring together food systems actors working across China’s food system, including policymakers, civil society, academia, and business.

A global voice. The Good Food Fund, particularly the work of its founder Jian Yi, has brought China’s food systems transformation efforts to the world stage and has given China more credibility at global debates and the 2021 U.N. Food Systems Summit.



CASE STUDY

COLOMBIA

A shared vision that puts food and land at the heart of Colombia's climate action

PROJECT SUMMARY

In Colombia, nation-wide and regional roadmaps are shaping the country's food and land-use economy. The roadmaps promote regenerative approaches to increase productivity, improve local incomes, preserve and restore ecosystems, and mitigate and adapt to the effects of climate change. The project is led by the [Colombia Food and Land Use Coalition](#).

THE FOOD-CLIMATE CONNECTION

Colombia is one of the world's most biodiverse countries, but its ecosystems are at risk from encroaching agricultural and cattle ranch expansion. The country also has one of the highest rates of agrochemical use in Latin America, though this has not increased agricultural production.

Long-term planning involving a variety of actors and at varying scales is important to achieving sustainable development goals that reduce greenhouse gas (GHG) emissions and preserve valuable environments for generations to come.

CLIMATE FACTS

- **Food production and emissions.**

Deforestation accounts for roughly one-third of Colombia's total GHG emissions. This is driven largely by land grabs for cattle ranch expansion and illicit crop production. Livestock farming is associated with a further 9% of total emissions.

- **Colombia's NDC.** Colombia commits to an unconditional reduction in GHG emissions of 51% by 2030.¹³

- **Regional emissions.** Antioquia, the setting for this Case Study, is the highest emitting region in Colombia. This is due to significant environmental challenges, some of which include the encroachment of the agricultural frontier, high soil degradation, and land-use change.

FOOD SYSTEMS FACTS

- **Economic contribution.** Agriculture accounted for 6.3% of Colombia's GDP in 2018, 16.4% of employment nationally (and 60% in rural areas), and 19% of exports.

- **Food security.** More than half of Colombian households do not have enough food to lead a healthy and active life. At the same time, one in three people are overweight and one in five are obese.

- **A regional paradox.** Antioquia is one of the main food growing regions in Colombia but faces high rates of food insecurity. The region also loses or wastes one-third of the food it produces due to a lack of storage infrastructure and/or failure to get foods to market before they spoil.

LESSONS FOR CLIMATE ACTION PLANS

The Colombia and Antioquia Food and Land Use (FOLU) roadmaps offer several lessons for NDCs:

- **NDC development process:** A transparent and democratic stakeholder engagement process should take place during the early planning and formulation of policies. Involving a variety of actors, this participatory process will enable people to think in an integral, systemic manner. This phase should be designed in such a way as to overcome structural inequities and power imbalances — for example by including peasants and Indigenous groups from the outset. This stakeholder engagement is as important as the policy outcome itself.
- **Content of the NDC:** The Antioquia FOLU coalition places a strong emphasis on regenerative agriculture, in alignment with the country's NDC, which promotes agroecological and regenerative approaches to farming and fishing. Smallholder farmers and communities should be engaged to ensure ownership of actions that move regenerative agriculture from theory to practice.
- **Implementation of the NDC:** Coordination across government is important in both design and implementation of regional road maps. Changing the mindsets of regional policymakers and decision makers across ministries was central to the success of this platform.

KEY INSIGHTS

When aspiring to transform food and land-use systems, it's helpful to have a roadmap to get you there. Such is the case in Colombia, where the [Food and Land Use Coalition](#) (FOLU) platform has brought together hundreds of stakeholders and participants from peasant and Indigenous communities, the public and private sectors, civil society, trade organizations, academics, and the donor community to create a shared vision for the future.

The outcome of this collaboration was the development of the “Colombia Roadmap for a New Food and Land Use Economy” in 2018. It set out strategies and actions to transform the country's food and land-use economy in such a way as to boost income generation, employment, and business opportunities.

The food and land-use economy balances the generation of new economic value with the need to protect and regenerate the planet's ecosystems. It's a powerful approach that contributes to the U.N. Sustainable Development Goals, Paris climate commitments, and international biodiversity targets. National coalitions such as the one in Colombia are supported by the [Food and Land Use Coalition](#), an international community of organizations and individuals.

Though the development of the FOLU Colombia roadmap in 2018 was promising, the coalition's recommendations were overlooked by a new national government. The change in leadership shifted government priority, with greater emphasis placed on productivity and how food and agriculture could contribute to the economy. Food systems sustainability was not high on the agenda.

As a result, FOLU Colombia decided to apply the lessons it had learned through developing a national roadmap and apply them at a territorial level. Working with regional government and corporate leaders, the intended outcome was the participatory creation and tangible implementation of a series of territorial roadmaps.

“Participatory governance processes need to be designed in such a way that they overcome structural inequities and any potential power imbalances. This builds trust, ensures resources are committed, and empowers local decision makers to ensure plans are turned into concrete actions.”

— LAUDIA MARTÍNEZ ZULETA, COUNTRY DIRECTOR, FOLU COLOMBIA

DESIGNING A REGIONAL ROADMAP

One group that took up the mantle of the regional roadmaps was the Antioquia Coalition for a New Economy for FOLU. Antioquia is in Colombia’s northwest, and is home to vastly different cultures and ecosystems, ranging from the Andes Mountains down to the Caribbean coast.

Despite being one of the main agricultural regions in Colombia, Antioquia faces significant food insecurity challenges. Seven in 10 people are food insecure — higher than the Colombian average — while at the same time childhood obesity rates are rising.

Land-use challenges run parallel. According to the Antioquia Governor’s Office, the region faces significant environmental pressures, including the encroachment of the agricultural frontier, high deforestation rates, soil degradation, water shortages in some areas, and land-use change. Each contributes to Colombia’s GHG emissions, and Antioquia is the highest emitting region in the country.

These realities were top-of-mind for the coalition of regional actors who came together to create the Antioquia FOLU roadmap. As with the creation of the national roadmap, the development process — a so-called “diagnostic phase” — was crucial to engage diverse actors and participants.

“Participatory governance processes need to be designed in such a way that they overcome structural inequities and any potential power imbalances,” explains Claudia Martínez Zuleta, the country director of FOLU Colombia. “This builds trust, ensures resources are committed, and empowers local decision makers to ensure plans are turned into concrete actions.”

This initial diagnostic phase scrutinized the state of the region’s ecosystems, biodiversity, climate impacts, agricultural productivity, food markets, health and nutrition, and food loss and waste to get a big picture snapshot of the challenges and opportunities for food and land-use transformation.

Importantly, several ministries were involved in the process, including the ministries of health, environment, and agriculture. This is a testament to the cross-sectoral nature of food and land use. To raise public awareness and acceptance the Antioquia roadmap is championed by eight well-respected and recognizable ambassadors from a variety of backgrounds. This has helped connect the project to new audiences, including high-level policy and decision makers.

“What is inspiring about the FOLU roadmapping process is that we have been able to connect actors working on similar projects or issues together, who would continue to work in isolation otherwise,” expands Martínez Zuleta.

The resulting Antioquia FOLU roadmap is guiding the region over the next decade. It highlights four strategic priorities and four critical levers of change that must be addressed if food and land-use transformation are to be achieved:



The Antioquia FOLU roadmap's four strategic priorities and four critical levels of change. (Source: FOLU Colombia.)

ACTIONS TO MITIGATE AND ADAPT TO CLIMATE CHANGE

The Colombia-wide roadmap developed in 2018 led to a variety of actions and programs linked to climate change mitigation and adaptation, including:

Climate Finance Accelerator (CFA). The CFA promotes the design of blended finance projects in alignment with Colombia's climate agenda and its Paris Agreement commitments. Funded by the U.K. Department of Business Energy and Industrial Strategy, the CFA takes a bottom-up approach to support middle-income countries like Colombia meet their NDC.¹⁴ It does this by helping to identify blockages that hinder finance from flowing at the amount and speed required to meaningfully impact climate ambitions. As a result of several workshops and webinars with a range of participants, 60 Colombia-based proposals were submitted for blended financing — including several from across the agriculture, food, forestry, and land-use nexus. As of the end of 2021, 10 have been selected for funding.

Mainstreaming Sustainable Cattle Ranching. This nation-wide program integrates cattle raising and regenerative agroforestry systems across 4,000 farms. Funded by the U.K. government and the Global Environment Facility, the program has restored 280 square kilometres (108 square miles) of degraded land by providing technical assistance for farmers.

Similarly, the Antioquia FOLU roadmap lists over 100 climate actions that address the coalition's strategic priorities and levers of change. This includes a significant focus on regenerative and agroecological production through the implementation of POTA,¹⁵ an agricultural land-use plan for Antioquia.

It's estimated that regenerative agriculture in the region could reduce water use by 60%, raw materials by 40%, and increase productivity by up to 20%. This would capture between 36 to 45 tons of carbon per hectare.

“We are in the process of developing a group of actors working on regenerative agricultural projects so they can share knowledge, scale their models, and inspire others in regenerative practices,” explains Martínez Zuleta, the country director with FOLU Colombia.

Roadmap partners have also implemented farming schools that are an outlet for peer-to-peer learning and mentorship. Ultimately, the FOLU platform has highlighted the importance of mainstreaming the concept of “regeneration” in all policies, not only those pertaining to agriculture.

WHAT'S NEXT?

Tangible policy change and action stemming from the roadmaps is happening, though it takes time. The Colombia FOLU roadmap, for instance, influenced the Colombia Food Loss and Waste laws and policies. At a regional level, the current Antioquia Development Plan for 2020–2023 highlights specific actions from the territorial roadmap, including reducing barriers to public and private digital innovation, strengthening human capital, and ensuring access to healthy and nutritious foods.

In the future, the Antioquia FOLU coalition plans to develop an internal carbon market that makes funding climate change initiatives in the region more viable. It's also exploring ways to establish payment schemes for environmental services in subregions, which would create a channel for the private sector to fund local conservation efforts.

With an emphasis on strategic collaboration, participatory engagement, and a holistic approach to food systems, the Colombian national and regional roadmaps offer inspiration and guidance for climate action and sustainable development at large.

SUMMARY OF IMPACTS ACHIEVED

New strategic alliances. The roadmap development and implementation process forged new partnerships with hundreds of actors across sectors, scales, and socio-economic divides. For example, government ministries within Antioquia (health, environment, agriculture) are collaborating together through the action-planning process; other bodies, such as the Bank of Colombia, have been brought in through the financing of specific initiatives.

Redirected financial flows. The coalition involved academic partners and international donors, which has ensured more financial and human resources be allocated to food systems transformation projects.

Initiated coalitions for action. FOLU Colombia has initiated sub-groups focused on “the sustainable use of pesticides and fertilizers, the promotion of jurisdictional approaches to better food and land use in two regions (Quindío and Urabá), the measurement of food loss and waste, and supporting healthy school diets and action on the ocean.”

Mainstreamed the mindset of regeneration. The roadmaps in Colombia and Antioquia highlight the concept of “regeneration” in terms of food, agriculture, and land-use systems, and outline how a regenerative approach can be adopted across different government ministries.



CASE STUDY

EGYPT

Building sustainable communities and climate -positive agriculture in the Egyptian desert

PROJECT SUMMARY

SEKEM is a sustainable development initiative operating in the Egyptian desert. Since 1977, the initiative has grown to include a group of companies, NGOs, and educational institutions. Overall, SEKEM takes a holistic approach that integrates ecology and economy, society and culture. Utilizing biodynamic farming methods on land it has reclaimed from the desert, SEKEM demonstrates that sustainable agriculture and communities are possible even in arid environments.

THE FOOD-CLIMATE CONNECTION

SEKEM's operations are carbon positive, meaning the organization sequesters more carbon dioxide than it emits. This is due to a number of ecological practices, including tree planting, organic agriculture, and soil management. Spotlighting such practices is of crucial importance as Egypt grapples with adapting to and mitigating the effects of climate change.

CLIMATE FACTS

- **Food production and emissions.** Agriculture constitutes 10% of Egypt's total GHG emissions. As a whole, the country contributes less than 0.7% of global carbon dioxide emissions.
- **Egypt's NDC.** Egypt last submitted its NDC in 2017, which does not provide quantified targets or specific plans for emissions reductions. Future emissions-reduction measures are also conditional on international funding.
- **Climate change.** Egypt is one of the countries most vulnerable to climate change. This is due to its dependence on the Nile River, which services needs for drinking water, agriculture, industry, fish farming, power generation, inland navigation, and more.

FOOD SYSTEMS FACTS

- **Contribution to GDP.** The agricultural sector is Egypt's biggest employer, engaging 31% of the total population. It contributed 11.7% to national GDP in 2015.
- **Nature of farms.** Egypt's agriculture sector is dominated by small farms managed using traditional practices.
- **Food security.** According to World Food Programme data, malnutrition is a growing public health concern in Egypt, with a 21.4% stunting rate, 16% overweight and obesity rate, and 5.5% underweight rate of children under 5.

LESSONS FOR CLIMATE ACTION PLANS

SEKEM's activities and approach offer several lessons for NDCs:

- **NDC development process:** SEKEM is guided by principles of respect and dignity for all — be it employees, community members, or beneficiaries. The initiative advocates for a human rights-based approach within its activities. SEKEM also proactively engages and empowers women and other disadvantaged groups. It seeks community participation in both the design and implementation of its projects.
- **Content of the NDC:** Biodynamic and organic farming are at the heart of SEKEM's work. This includes reducing reliance on pesticides and fertilizers through approaches such as the use of nitrogen-fixing leguminous crops, composting, integrated pest management, and companion planting. Combined with tree planting and soil management, SEKEM's operations are carbon positive. The initiative aims to support food sovereignty and community self-sufficiency through the growth of healthy and nutritious foods and the offering of various health and nutrition training programs.
- **Implementation of the NDC:** SEKEM places strong emphasis on social and community development. Approximately 10% of its businesses' net profits are allocated to community development projects, including schools and a medical centre.

KEY INSIGHTS

All at once, SEKEM is a community, a social enterprise, and a promising solution for the future of food. The initiative started in 1977 when the late Dr. Ibrahim Abouleish and his wife Gudrun transformed a plot of land in the Egyptian desert into a successful farm. Using biodynamic¹⁶ and organic agricultural methods, the desert was reclaimed, and a vibrant and profitable agricultural business emerged from the arid landscape.

In line with his vision of sustainable community development, Abouleish founded SEKEM with the intention to build healthy communities by supporting organic agriculture alongside the development of social and cultural initiatives and infrastructure.

Today, SEKEM has several arms:

- **SEKEM Agriculture:** The initiative directly cultivates nearly 3 square kilometres (1.2 square miles) of farmland using organic and biodynamic methods. It purchases from 265 farmers (who manage over 13 square kilometres/5 square miles of land) through the Egyptian Biodynamic Association (EBDA), a SEKEM-created NGO. Through EBDA, SEKEM has helped over 700 farmers in Egypt shift from conventional to organic agriculture.
- **SEKEM Holding:** As a social enterprise, SEKEM has a number of specialized companies that produce and market its products. These companies include: ISIS Organic, which produces organically grown food and drink products; SEKEM Health, which markets natural healthcare products; and NatureTex, an organically certified textile company. SEKEM's many products are sold in Egypt, Europe, and North America.
- **SEKEM Development Foundation:** SDF is the social and cultural branch of the initiative. It has supported the establishment of many community projects, including educational facilities and a local medical centre. SDF is financed partly by a 10% profit share from SEKEM companies as well as a variety of public and private donations.

- **Heliopolis University for Sustainable Development (HU).** In 2012, SEKEM inaugurated HU, the first non-profit university in Egypt and the Middle East. It trains students in organic agriculture, business and economics, pharmacy, engineering, and physical therapy. It also undertakes important research related to the benefits of organic farming and its effects on people's health. Additionally, HU's Carbon Footprint Centre monitors the carbon impacts of SEKEM's activities and offers certified carbon credits.

Through its many interventions, SEKEM shows that it's possible to have an economically viable business ([its net revenue for 2020](#) equated to 35.6 million USD) that also supports community building, social equity, education, and a healthy environment.

AN ANSWER TO EGYPT'S CLIMATE CHANGE WOES

The SEKEM model provides a case study for what climate-resilient agriculture (and communities) could look like in Egypt and around the world.

Nowhere is this more important than in Egypt, consistently ranked as one of the countries most vulnerable to climate change due to water supply and scarcity. Most of Egypt's farmland depends on the country's most famous water body — the Nile River. But the flow of the Nile [has been threatened](#) in recent years, due to pollution, climate change, and population pressures. Now, [a massive hydroelectric dam](#) constructed upriver in Ethiopia is constricting the Nile further still.

[Egypt's first NDC submission](#) sets the scene for climate challenges already present and those to come. Based on data from FAO, it expects the productivity of wheat and maize — two major agricultural crops — [to fall by 15% and 19%](#) respectively by 2050. Further, the NDC details that 12 to 15% of Egypt's most arable land will be negatively affected by sea level rise and saltwater intrusion. Other impacts, such as a decline in livestock productivity due to rising temperatures and diseases, are also forecast.

Combined, it paints a dire picture for Egypt's agricultural future. SEKEM's envisioning of a new paradigm may be exactly what is needed.

SCALING SUSTAINABLE COMMUNITIES

As a business, SEKEM is proudly carbon positive, meaning its tree planting and biodynamic agriculture operations sequester more carbon dioxide than they emit. Over the years, SEKEM has planted 600,000 trees across its sites, [which have sequestered](#) 500 megatons of carbon dioxide — about double Egypt's annual CO₂ emissions.

Now, the initiative is scaling its sustainable community approach to other desert areas in Egypt. This includes [SEKEM Wahat Greening the Desert](#), a pilot project wherein over 10 square kilometres (3.9 square miles) of desert is being transformed into fertile farmland — just as SEKEM founder Abouleish did at the mother site in 1977. *Wahat* means "oasis" in Arabic.

With 96% of Egypt being desert, the Wahat pilot project aims to demonstrate that desert land reclamation is a solution to the country's agricultural land shortage. Biodiversity monitoring is currently underway on the desert site to develop a strategy for future farms on arid land.

SEKEM's vision is for Wahat to become a self-sufficient, sustainable community based around the principles of biodynamic agriculture. With a focus on the conservation of water, soil, and energy, the project is using solar-powered pivot irrigation¹⁷ and compost to turn desert sand into healthy living soils that can grow food and capture carbon at a rate of 975 tons per year.

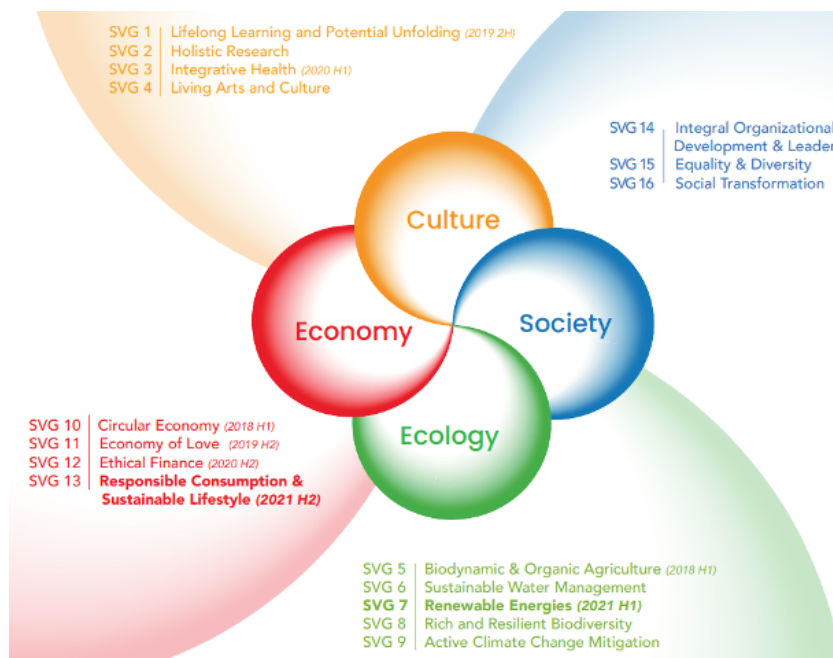
A SEKEM publication describes the initiative's vision for sustainable communities like Wahat: "In the shadow of trees, animals will be fed, who contribute with their manure to the very important compost production, which will vitalize the soil. The organic produce will be further processed by businesses who are attracted to build up their factories surrounding the community and providing additional jobs. The value creation from economic life will be used to finance education, arts, research, and many other activities for enriching community life and unlocking human potential. This will assure a continuous impulse of renewal, where humanity and nature can further evolve."

In addition to its ecological practices, Wahat will be equipped with housing and other facilities that will provide education and care for SEKEM's employees and surrounding communities.

Says Thomas Abouleish, Chief Relations Officer: "We want to showcase and build sustainable communities and this needs to be more than just sustainable agriculture. ... It's about providing people meaningful jobs and giving them access to decent housing, educational, and health facilities."

WHAT'S NEXT?

SEKEM has been operating under a holistic approach to ecology, economy, and community for more than four decades, and it doesn't plan to stop anytime soon. In recognition of its 40th anniversary in 2017 — and in line with its forward-looking spirit — SEKEM released its vision and mission for the next 40 years. This graphic outlines the SEKEM Vision Goals for Egypt 2057 (SVG):



SEKEM's Vision Goals for Egypt 2057 (SVG), which includes a transition to 100% organic agricultural production. (Source: sekum.com.)

By 2057, the company envisions having developed the agricultural model of the future. This includes goals of developing new climate change–resilient seeds, a sustainable waste and water recycling system, a sustainable energy-management system, and concepts to preserve and enhance biodiversity — all experiments being trialled at its Wahat site. SEKEM also aims to continue inspiring development organizations in Egypt and around the world.

Further, it sets specific targets for the next 4 decades to plant 2.4 million trees, which would sequester an estimated 2 megatons of carbon dioxide. Through this and other actions it expects to create 8,000 jobs and approximately 178 million Egyptian pounds (EGP) (11.3 million USD) of net present value from direct job creation.

While some may say it's not possible to plan a business so far into the future, SEKEM can point to its impressive ecological, economic, cultural, and social track record — solutions and successes that were nothing more than the well-intentioned vision of Dr. Ibrahim Abouleish some 40 years ago.

SUMMARY OF IMPACTS ACHIEVED

Improved food access. An estimated 22,778 people are supplied with food from a SEKEM farm.

Tree planting. SEKEM has planted over 600,000 trees that have sequestered an estimated 500 megatons of carbon dioxide. The accumulated net value from carbon sequestration is estimated at 89 million EGP (5.7 million USD).

Desert land reclamation. As of 2019, SEKEM had reclaimed nearly 7 square kilometres (2.7 square miles) of desert land. All of it is cultivated using biodynamic agricultural methods.

Reduction in artificial fertilizer and pesticide use. Following advocacy from SEKEM, in 1994 the Egyptian government banned the spraying of chemical pesticides on cotton. This resulted in a 90% reduction in the use of synthetic pesticides for Egyptian cotton farming.



CASE STUDY

FRANCE

The French city that's inviting citizens to play an active role in food systems transformation

PROJECT SUMMARY

The Dijon Metropolis is transforming its local food systems to support agroecological forms of farming and improve access to healthy, sustainable, and nutritious food for all citizens. The city's sustainable food plan places a strong focus on local innovation and impact by leveraging cross-departmental collaboration and actions at a city level. It demonstrates that local food systems transformations are not only possible but can also achieve a range of positive environmental, economic, and social impacts.

THE FOOD-CLIMATE CONNECTION

Through its projects, [Dijon's Sustainable Food 2030 plan](#) will reduce the carbon footprint of the territory's food systems, including from agricultural production, processing, distribution, and consumption. It is shortening food supply chains, reconnecting consumers and producers, and encouraging agroecology approaches — each of which contribute to building a local food system that is more resilient to climate change.

CLIMATE FACTS

- **Food production and emissions.** In 2016, France's agricultural sector was responsible for 17% of the country's total greenhouse gas (GHG) emissions.
- **The E.U.'s NDC and national commitments.** The E.U. puts forward an economy-wide emissions-reduction target of 55% by 2030. France's national energy and climate plan commits to a reduction in GHG emissions of 40% by 2030 compared with 1990 levels and aims to reach carbon neutrality by 2050.¹⁸
- **A local leader.** Dijon has been recognized as a European Green Capital. The metropolis is characterized by its proximity to nature and has put a plan in place to conserve and enhance its local biodiversity in order to mitigate the impacts of climate change.

FOOD SYSTEMS FACTS

- **Contribution to GDP.** In 2018, agriculture accounted for 1.7% of France's GDP and 2.5% of employment. Burgundy-Franche-Comté, where Dijon is located, is the third-largest farming region in France.
- **A country-wide shift.** The national "Agroecological Project for France" supports education, research, and incentives for farmers to move forward with agroecology. The aim is for 200,000 French farms to have adopted these practices by 2025.
- **National food policy.** EGalim, the food and agricultural law adopted by the French parliament in 2018, stipulates that half of food served in school canteens from 2022 onward must come from sustainable agriculture and that 20% should be organic.

LESSONS FOR CLIMATE ACTION PLANS

Dijon's Sustainable Food 2030 initiative offers several lessons for NDCs:

- **NDC development process:** Citizen panels and assemblies are important to the success of a project. The City of Dijon is using these and other stakeholder engagement tools to ensure disadvantaged groups are actively involved in the visioning, decision-making, and implementation process of its food systems changes. Cross-departmental collaboration at a city level, particularly with the social services department, has been important when engaging these under-represented or marginalized groups.
- **Content of the NDC:** Promoting agroecological practices and stimulating demand for locally produced agroecological foods is at the heart of Dijon's approach. Sustainable Food 2030 accounts for externalities across the supply chain and identifies several priority actions that should be taken.
- **Implementation of the NDC:** Transparent and democratic stakeholder engagement processes were important throughout the project. In Dijon, these processes involved a variety of actors, including the private sector, incubators, food technology start-ups, academic partners, associations, civil society, impact investors, governments, and NGOs.

KEY INSIGHTS

Dijon and French gastronomy are often referenced hand-in-hand. The capital of France's Burgundy region is a food and cultural hub, and is widely recognized for its wines, crème de cassis, and the mustard that bears its name.

What may be less known about the Dijon Metropolis¹⁹ is its reputation as a leader in food systems transformation. The vehicle for change is Dijon's flagship sustainability initiative, "Sustainable Food 2030,"²⁰ an ambitious and innovative multi-year plan to achieve healthy and sustainable food systems by the end of the decade.

As one report says, the plan puts the city's sustainable food supply strategy at "the heart of its ecological transition" concerning the reduction of greenhouse gas (GHG) emissions, protection of biodiversity, and the conservation of water, energy, soil, and other natural resources. Recognizing the connection between gastronomy and ecological thinking, the European Green Capital awards describes Dijon as "strengthening the links between biodiversity and local economic development."²¹

From a social standpoint, Sustainable Food 2030 aspires to reflect the needs and nature of Dijon's food producers and residents. With the open invitation for public input from all citizens, Dijon is leading a paradigm shift where people see themselves not as passive buyers and consumers of food, but as active participants who can suggest solutions and shape its food systems for the better. This concept of food citizenship is an exciting, emerging movement.

Over 50 private and public organizations were brought together to select the 24 projects that make up the Sustainable Food 2030 plan. These groups will continue to be engaged in the coming years to implement the initiative's ideas and accomplish its objectives.

The 24 projects fall under the following [strategic objectives](#):

1. **Promote agroecological production, with the goal of reconnecting Dijon citizens with food producers.** This includes providing citizens with details of how and where food is grown, its nutritional quality, health impacts, and processing and distribution information.
2. **Increase the proportion of agroecological foods grown and consumed locally.** Including through the development of innovative new products and raw ingredients.
3. **Ensure Dijon citizens have access to healthy and nutritious foods and diets.** These foods should be priced affordably, and citizens should see themselves as active participants within the food systems. The goal is also to renew trust between Dijon citizens and food producers.
4. **Establish new research and innovation facilities.** One will be a Living Food Lab where people can test innovative food production and consumption solutions and validate new business models.
5. **Work with start-ups to develop apps that increase access to information.** Design digital and in-person platforms where Dijon residents and other stakeholders can learn more about local food systems.

The Sustainable Food 2030 plan is operating with a budget of 46 million EUR (52.3 USD). For other French communities and cities worldwide, the plan aims to demonstrate that it's possible to transform local food systems to yield a range of positive environmental, economic, and social outcomes.

SCALING UP AGROECOLOGY

The Dijon Metropolis is home to 260,000 residents and is located 310 kilometres (192.6 miles) southeast of Paris. Characterized by its proximity to nature, [45% of land](#) in the metropolis is dedicated to food farming, and the food and agriculture sector employs 9,000 people. Alongside healthcare and digital technologies, agri-food is considered a leading sector and the metropolis [markets itself](#) as a “testing ground for agricultural and ecological studies.”

Promoting agroecological practices and stimulating demand for locally produced foods are central pillars of the Sustainable Food 2030 plan. To do this, the metropolis is training farmers to transition from conventional to agroecological means of production, protecting the environment as a result.

To provide a market for this produce, Dijon has created a vegetable-processing facility for its local public kitchens. Currently, 35% of produce at the city's central kitchen is organic, more than is required by the French government's agriculture and food law. The processing facility also aims to convert foods grown using agroecological approaches into novel and innovative ingredients that could be enjoyed locally.

Continuing down the value chain, Dijon is creating a new “Dijon Agroécologie” food certification that will be awarded to local products that meet certain health, nutritional, and environmental standards. The intent is that the label will carry a certain cachet, which could help market and increase the value of agroecological goods from the region.

The label scheme will also encourage people to purchase food from local farmers — shortening supply chains and reconnecting producers directly with consumers. Through its actions, Sustainable Food 2030

expects to increase the quantity of local agricultural produce consumed by Dijon citizens by 10 to 12% by decade's end.

REMOVING THE BARRIERS THAT LIMIT HEALTHY DIETS

Another primary aim of the Sustainable Food 2030 initiative is to improve access to healthy, nutritious foods for vulnerable, racialized, and disadvantaged groups — an estimated 15% of Dijon's population.

In hosting citizen panels and consulting with social and poverty-alleviation groups, Dijon's social services department noticed that consumption of fruit and vegetables was low among this population. This was particularly true for children.

Listening to citizens helped the social services department to understand the multiple reasons why people were not eating healthy diets — a combination of affordability, lack of access, and sociocultural factors. With an understanding of such nuances, the Sustainable Food 2030 initiative has designed interventions that combine education initiatives with economic levers to address issues of budget constraints and the availability of certain foods.

For example, a food coupon distribution scheme is planned for launch in 2023, giving single-parent families and other vulnerable groups access to subsidized fruits and vegetables at community grocery stores.

People receiving the food coupons will be able to choose the produce they prefer when shopping. Radically different from a system where people are seen as passive recipients of food aid and must take what they are given, such an approach provides people the agency to choose the fruits and vegetables they like best — regardless of household income or purchasing power.

From an environmental perspective, a lasting change in eating habits in favour of locally grown fruits and vegetables would shorten supply chains and substitute unhealthy, less sustainable processed foods and meat products with plant-based proteins.

Once launched, the food coupon experiment will last for 6 months. Lessons learned will be used to inform the wider rollout of the initiative in other parts of the Dijon metropolis.

WHAT'S NEXT?

Research and innovation are also priorities of Sustainable Food 2030. Dijon is home to a number of agri-food research centres, higher education and training institutions, and other organizations that are pooling their knowledge to create a new Living Food Lab.

Over the coming years, the lab will test new production and consumption models for the region and research foods that have proven to be beneficial to human health and environmental sustainability — leguminous crops like peas, field beans, and lentils, for example.

Proudly showcasing its agri-food system to the world, in April 2022 Dijon will open its International Food and Wine City, a site that will host exhibition spaces, restaurants, and culinary-training facilities. The new location is expected to draw more than a million visitors to celebrate the wealth and diversity of Dijon and French gastronomy.

With its 24 projects either underway or slated to soon start, Dijon is a national and international leader in sustainable food systems. As an information overview about the Sustainable Food 2030 plan [stated](#), “Dijon métropole is inventing a new model of producing and consuming within its territory, for the benefit of people, the environment, and the economy.”

SUMMARY OF IMPACTS ACHIEVED

Digital platforms for citizens. As part of its 24 projects, online and digital tools have been created to help people navigate the complexity of food choices that impact health and sustainability, fight food waste, and improve the nutrition of pregnant women and young children.

School and social feeding programs. The City of Dijon provides over 8,000 meals a day (more than 1.2 million a year) to children and vulnerable families via school and social feeding programs. As of 2021, 36% of the food is organic and more than half is sourced locally. At least one meal a week is vegetarian.

National recognition. The Dijon Metropolis received the French government’s “Territories of Innovation” award in 2019 in recognition of its role in transitioning toward a sustainable food system.



CASE STUDY

GERMANY

Championing organic food systems in the German city of Nuremberg

PROJECT SUMMARY

Nuremberg is a leader in Germany and the European Union when it comes to promoting organic food and farming. Since 2003, the [Organic Metropolis Nuremberg](#) initiative has implemented dozens of projects in partnership with various food systems stakeholders. Nuremberg is also part of a wider network of organic cities in Germany, a group that is influencing national policy and sharing learnings from one city to the next.

THE FOOD-CLIMATE CONNECTION

Among its many benefits, organic farming protects and restores soils, reduces pollution in waterways, promotes biodiversity, and mitigates climate change. Organic Metropolis Nuremberg also focuses on shortening food supply chains, transitioning public canteens to plant-based menus, and stimulating local demand for organic products — measures that will reduce greenhouse gas (GHG) emissions and contribute to more sustainable food systems.

CLIMATE FACTS

- **Food production and emissions.** Germany's agricultural sector accounts for 7% of the country's total GHG emissions. This has declined by 18% since 1990, mainly due to a decrease in livestock rearing.
- **The E.U.'s NDC and national commitments.** The E.U. puts forward an economy-wide emissions-reduction target of 55% by 2030. Germany adopted new climate legislation in 2021 that sets an emissions-reduction target of at least 65% by 2030 and at least 88% by 2040, with the goal of achieving net GHG neutrality by 2045.²²
- **Agri-food and energy.** Germany's National Energy and Climate Plan proposes adopting organic and other sustainable agricultural methods. It also seeks to reduce GHG emissions from livestock farming and improve animal welfare by limiting the number of livestock per hectare.

FOOD SYSTEMS FACTS

- **Contribution to GDP.** The food system accounts for 6.5% of Germany's GDP and 12% of professional employment.
- **Organic agriculture.** More than 10% of German farmland is dedicated to organic production, with the new coalition government from 2021 targeting to increase this share to 30% by 2030. The organic food market in Germany has nearly tripled in value in the last decade.
- **Balancing supply and demand.** Germany's agricultural sector meets only one-third of local demand for vegetables and only one-fifth of demand for fruit. At the same time, the country exports about one-third of its agricultural products.

LESSONS FOR CLIMATE ACTION PLANS

The Organic Metropolis Nuremberg initiative offers several lessons for NDCs:

- **NDC development process:** Participatory stakeholder engagement is important, and the City of Nuremberg brought together a broad group of stakeholders involved in the organic food movement. This created trust and understanding between actors and ensured solutions were locally relevant.
- **Content of the NDC:** With a strong emphasis on organic agriculture, Organic Metropolis Nuremberg highlights the importance of shorter food value chains in building resiliency, economy, and green employment opportunities. It also focuses on the provision of healthy and sustainable foods to reduce GHG emissions. Municipal government officials and departments can play a vital leadership role in sharing practical lessons that inform national policies. Initiatives should include both supply and demand-side measures and feature ambitious, clearly articulated targets.
- **Implementation of the NDC:** Adequate funding is required for implementation. In Nuremberg, public–private partnerships helped unlock funding for specific initiatives. Project partners recognized the importance of national and E.U.-level advocacy to redirect fiscal incentives away from harmful subsidy programs and toward more organic farming practices.

KEY INSIGHTS

Two decades ago, organic food and farming seemed exotic and unattainable in the German city of Nuremberg. “Back in 2003, organic initiatives were a fringe topic — but today we’re seeing plenty of support for our work,” said [Dr. Werner Ebert](#).

Ebert is the head of Organic Metropolis Nuremberg, an initiative established in 2003 and overseen by the city’s Department for Environment and Health, in close collaboration with other municipal departments. Today, the Bavarian city is seen as one of the foremost municipalities championing the organic food and farming movement within Germany and across Europe.

Nuremberg is also one of the founding cities of [Biostädte](#), a network of 20 organic cities across Germany — in fact, Ebert is the group’s coordinator. Established in 2010, Biostädte works with city authorities, municipalities, and districts across Germany to promote organic farming and organic food. Together, member cities advocate for policies that support regenerative, agroecological food and farming. City members focus on exchanging knowledge, operating joint projects, securing funding for organic farming, and advocating for policies and publicity in support of organic initiatives.

Germany is one of Europe’s largest producers and suppliers of organic foods, with 10% of farmland under organic production. A growing awareness of the dual crisis of climate change and biodiversity loss and the increased desire for nutritious food has seen demand for organic foods rise in the country.

Favourable national and E.U. strategies have created a policy environment in which the organic sector can grow. Germany’s [National Energy and Climate Plan](#), for example, commits to organic and other sustainable

methods of agriculture, while the 2021 coalition government intends to increase organically farmed land in Germany to [30% by 2030](#).

Similarly, the E.U.'s [Farm to Fork strategy](#) targets having at least 25% of European agricultural land under organic farming by the decade's end. The strategy aims to accelerate Europe's transition to a sustainable food system in order to mitigate climate change and adapt to its impacts, protect biodiversity, and ensure food security and public health for all.

Organic Metropolis Nuremberg recognizes the role that cities can play in achieving these bigger-picture targets. To reduce its climate emissions and scale up organic production, the city set [a number of goals for 2026](#), including:

- At least 90% of foods served within local daycares must be organic.
- At least 75% of foods served within school canteens must be organic, with an interim target of 50% by 2022.
- At least half of food served within municipal facilities and at municipal events must be organic.
- At least 25% of food grown in the city is produced using organic production techniques.
- The city will promote regional, seasonal, and Fairtrade foods using organic quality standards. This will create additional economic value and employment opportunities.

SUPPLY: SUPPORTING LOCAL ORGANIC GROWTH

To achieve its 2026 goals, Organic Metropolis Nuremberg includes several supply and demand-focused interventions. This ensures that organic foods are not only being produced, but that the market for and value of those products is increasing alongside.

From a supply side, the city is working to convert conventional farms to organic production. In 2018, it also established the ["ReProLa"](#) project, which focuses on securing land that can be used to produce regional products. Along with helping organic producers access land, the project investigates how organic products contribute to sustainable land use and protect cultural heritage.

As an important agricultural region, Bavaria was historically home to a number of indigenous, nutrient-rich crops. A focus of Organic Metropolis Nuremberg is to research and revive the production of these traditional foods. For instance, the city is financially supporting a traditional apple orchard project in the nearby Hersbruck Mountains wherein indigenous tree varieties are being mapped and replanted. The apples are then being processed into organic apple juice and sold in regional markets, generating economic returns and creating local employment.

In a similar project, the city is collaborating with national and local organizations to promote heritage cereal grains based on old wheat varieties. The project supports the regional economy and contributes to the preservation of biodiversity.

Linking both supply and demand, particularly in the peri-urban fringe, the city has established a community-based agriculture model called [Stadt, Land, Beides](#) (translation: "Both City and Country") with the German

[Solidarity Agriculture \(Solawi\)](#) network. As the name suggests, the model connects urban consumers (called “harvest dividers”) with local farmers and producers. Urban consumers pay a set amount for organic food upfront, offering farmers the financial stability to plan their harvest in advance. Harvest dividers can then collect their products at one of the local depots in and around Nuremberg.

DEMAND: PUBLIC PROCUREMENT AND CITY-LED MARKETING

From a demand side, Organic Metropolis Nuremberg [uses public procurement](#) in schools and municipal kitchens as a powerful lever to drive organic production.²³

Though school canteens are privately managed, Organic Metropolis Nuremberg indirectly influences the type of food served by stipulating the minimum levels of organic and regional food that must be included in school meals. With organic food required to constitute 90% of daycare foods and 75% of school canteen foods by 2026, the initiative has created a guaranteed demand for organic ingredients and products.

“The proportion of organic ingredients has continuously increased — and usually without an increase in price,” said Werner Ebert, head of Organic Metropolis Nuremberg in [a 2018 interview](#). Public canteens are encouraged to prepare meals from scratch, purchase seasonal produce, and reduce the amount of meat served, a trio of measures that keeps costs low while ensuring better-quality food is served.

Other public institutions, such as the Nuremberg hospital, municipal staff restaurants, and municipal catering services have also increased the amount of regional and organic food served. From public procurement to marketing to consumers, Organic Metropolis Nuremberg serves as a de facto promotion agency for the city’s organic products. Each year, the city organizes dozens of events to promote organic foods and stimulate the creation of new products by private companies.

The largest-scale example is BioFach, an annual event hosted in Nuremberg. BioFach is the world’s largest trade fair for organic products, and it promotes the environmental, health, and economic benefits of organic agriculture to local and international audiences. The event is the cornerstone of Nuremberg’s strategy to work with the private sector, and the fair attracts and connects organic producers and consumers from around the world.

Finally, to ensure demand for organic food continues into the future, Organic Metropolis Nuremberg runs several [food literacy programs](#) for residents young and old. One program targeted at school children, Climate Protection on a Plate, trains educators to talk to their students about the impact of meat consumption on climate change and the importance of eating plant-based foods.

For older students, the initiative has established post-secondary and vocational courses dedicated to organic production. That includes [a local university degree program](#) on “management in organic and sustainability business” that focuses on the importance of organic farming and its links to nutrition, food safety, and sustainability. The goal is to equip students with the multidisciplinary, systems-thinking mindset needed to lead food systems transformation.

WHAT'S NEXT?

The City of Nuremberg has become one of Germany's leading regions in organic agriculture. Its municipal leaders have become advocates for organic food and farming nationally and within the European Union, championing regulatory and policy change in support of Germany's organic agriculture strategy and climate mitigation targets.

With a philosophy and vision predicated on increasing the proportion of organic foods grown in and around the city, Organic Metropolis Nuremberg is improving local ecosystems, providing its residents with a nutritious and sustainable food supply, and reducing GHG emissions to the benefit of the city and the planet.

Finally, Nuremberg's leadership and engagement in the Biostädte network demonstrates that it's possible to focus on local projects and innovations while also supporting a nation-wide, municipal-level movement of cities championing food systems change.

SUMMARY OF IMPACTS ACHIEVED

Engage in national networks. As a leading member of Biostädte, a network of German cities committed to an organic food movement, Nuremberg shows it's possible to foster local innovation while also being part of a national dialogue.

Public procurement of organic food. Nuremberg's main hospital sources 30% of its food from local organic farms. Further, the number of schools serving organic foods has increased by about 65% over the last 5 years.

Global reach. The annual BioFach trade fair attracts more than 40,000 visitors from 130 countries, making Nuremberg an international hub for the organic food and agriculture community.

Educational programs. The Climate Protection on a Plate program has reached over 5,000 children and more than 200 teachers and educators.

Fairtrade city. Nuremberg has been a Fairtrade City since 2010, with over 100 shops and 79 restaurants offering Fairtrade products.



CASE STUDY

KENYA

Achieving Kenya's "climate-smart" agriculture goals through agroecology and organic farming

PROJECT SUMMARY

Sylvia's Basket aspires to revolutionize the consumption of organic produce in Africa. The Kenyan business is promoting the spread of more agroecological farming practices, ensuring organic foods are affordable and accessible to the majority, not only the middle class.

THE FOOD-CLIMATE CONNECTION

Organic farming and the agroecological principles that underpin it are beneficial for the natural environment. It applies techniques that can reduce greenhouse gas (GHG) emissions and sequester carbon, minimize the use of chemical fertilizers and pesticides, and enhance local biodiversity and soil health.

CLIMATE FACTS

- **Food production and emissions.** Land-use change, forestry, and agriculture contribute to three-quarters of Kenya's GHG emissions.
- **Kenya's NDC.** Kenya's NDC was submitted in 2020 and targets a GHG emissions reduction of 32%. Kenya seeks to be a low-emissions society by 2050, an objective it hopes to achieve using mitigation measures such as increasing forest cover and stimulating climate-smart agriculture.
- **Climate vulnerability.** Ninety-eight percent of Kenya's agricultural activities are rain-fed and highly susceptible to climate change and weather variability.

FOOD SYSTEMS FACTS

- **Contribution to GDP.** Agriculture is the backbone of the Kenyan economy. It accounts for one-third of the country's estimated 9,319 billion Kenyan shilling (KES) (82 billion USD) GDP.
- **Employment.** Agricultural livelihoods correspond to over 50% of total employment in Kenya. Notably, only 10% of Kenyan youth are employed in the sector, highlighting a trend of the younger demographic moving away from agrarian lifestyles.
- **Organic food consumption and production.** Less than 1% of Kenya's total agricultural area is cultivated using organic practices, despite the growing demand for chemical-free food. Kenyan organic farmers produce at least 5 million tons of organic food annually for export and for domestic markets.

LESSONS FOR CLIMATE ACTION PLANS

Sylvia's Basket offers several lessons for NDCs:

- **NDC development process:** Sylvia's Basket places strong emphasis on collaboration with women and young people. For example, it supports them with training and capacity-building through the establishment of kitchen gardens. Experiential and peer-to-peer learning have been important to build knowledge, share solutions, and challenge existing narratives about Kenya's agricultural sector.
- **Content of the NDC:** Organic farming and agroecological techniques can build soil health, sequester carbon, and improve the water-retention capacity of soils. This improves farm resilience to the impacts of climate change. When combined, these holistic measures benefit local environments and farmer incomes.
- **Implementation of the NDC:** Sylvia's Basket shows how entrepreneurs can operate a profitable business model that also contributes to achieving NDC goals. This case also demonstrates how change is needed to realign investment, research, innovation, and government policies to support agroecological principles that will achieve climate-smart agriculture ambitions. In the absence, it is difficult to mainstream organic and regenerative farming practices. Implementation strategies should also involve marginalized groups — alongside a cross-ministerial approach from the government.

KEY INSIGHTS

Sylvia Kuria, a smallholder farmer and food systems entrepreneur, is driven by a mission to make organic food accessible to as many people as possible in her home country of Kenya.

As a child growing up in Kenya's capital, Nairobi, Kuria spent holidays at her grandparents' farm and dreamt of becoming a farmer. Around 2010, with her young family in tow, Kuria moved from Nairobi to Limuru, a town in the Kenyan countryside. Soon, she had established a small kitchen garden where she began growing vegetables for her family.

It didn't take long for the pests and diseases to hamper her plans. "I went to my local agro-vet shop and asked for something to deal with them. When I saw what they gave me I wasn't very comfortable with it," recalled Kuria [in a video](#). "The chemicals were too strong, and I wasn't comfortable feeding my children that food."

The encounter motivated Kuria to research alternatives. She learned about organic and agroecological farming practices such as mulching, composting, crop rotation, companion planting, and other techniques that she still uses on her farm today.

Buoyed by her success, Kuria established Sylvia's Basket in 2016. The business trains smallholder farmers in organic and agroecological farming practices, strengthens local food sovereignty, and ensures organic food is within everyone's reach. It stems from Kuria's belief that organic agriculture and the agroecological principles that underpin it are crucial to addressing food insecurity and the climate crisis, both of which already affect agricultural production and the well-being of people across Kenya.

Explains Kuria of her business vision: “Healthy, safe, and nutritious food is a fundamental human right, and we want to supply as much organic produce to as many Kenyans as possible.”

AGROECOLOGICAL PRINCIPLES TO MITIGATE CLIMATE CHANGE

Despite increasing demand for organic produce in Kenya, it’s estimated that less than 1% of the country’s total agricultural area is cultivated using organic practices.

“African agriculture is premised on the production of monoculture crops for export, such as maize,” explains Kuria. “These farming systems use large quantities of artificial fertilizers and pesticides that are damaging soil health, contributing to climate change, and harming the health of many Kenyans.”

Kuria’s pair of organic farms in Limuru and Mai Mahiu town look dramatically different from monocrop-dominated fields. She grows more than 30 types of indigenous crops, including cassava, sweet potatoes, beans, cowpeas, pigeon peas, and pumpkins. These mixed organic farms are structured around agroecological principles that serve as valuable climate change mitigation measures.

Rotational cropping systems help build soil health and reduce pests and disease, especially when combined with a mix of plants such as neem, pepper, and ginger, which contain natural pest-deterring properties.

Mulching, composting, and cover cropping are other agroecological techniques utilized on the farm. These enhance soil organic matter, support water retention, and increase soil fertility. “Farming systems that use artificial fertilizers often create a hard pan on the soil surface, which means the rain runs off quickly rather than soaking into the soil,” Kuria observes.

The introduction of agroforestry has also contributed to the success of Kuria’s farms. When she first started on her land, the soil was arid and cracked. Planting over 2,000 indigenous leguminous trees made a radical difference: “Trees produce shade, which reduces soil moisture loss and the stress on plants. This, in turn, makes them more resistant to pests and disease,” says Kuria.

[Research from western Kenya](#) has shown that agroforestry can simultaneously improve the livelihoods of smallholder farmers and mitigate climate change. It does this by reducing the need for pesticides and fertilizers (through nitrogen-fixing trees), sequestering carbon, and reducing GHG emissions. Alongside organic production, agroforestry could be a powerful tool for any country to meet its NDC commitments.

Within Kenya, the activities of Sylvia’s Basket align with the [Kenya Climate Smart Agriculture Strategy](#), the objectives of which are to adapt to climate change, build resilience of agricultural systems for enhanced food and nutritional security while minimizing emissions, and improve livelihoods.

Sylvia’s Basket is also a member of a national multistakeholder platform that works toward climate-smart agriculture practices in Kenya. Together, the network is dedicated to addressing the impacts of climate change and meeting Kenya’s obligations to the Paris Agreement, as stipulated in the country’s NDC. Through her business operations, Kuria demonstrates how the private sector and entrepreneurs can operate in such a way that is profitable and in support of a country’s climate goals.

SUPPORTING FARMERS TO MEET MARKET DEMAND

Fruits and vegetables harvested from Kuria's organic farms go toward providing over 100 households with food baskets that incorporate a "rainbow of colours" and showcase nutrient-dense, local, traditional crops. Since 2019, these baskets have been sold at an organic shop in Nairobi.

"I've got so many reports where [customers] say 'your kale, your spinach, your carrots are so sweet!' says Kuria. "I tell them it's because they are grown in the natural way [...] and that is why they are that tasty."

Kuria's produce is supplemented by fruits and vegetables grown by other smallholder organic farmers in Limuru. Such a business model supports these farmers to access a reliable alternative market for their produce and avoids price gouging from middlemen sellers — a challenge Kuria initially faced.

As a result, the incomes of farmers who supply Sylvia's Basket are, on average, twice that received by farmers from middlemen. Kuria sees it as a reward for farmers who are producing foods with lower health and environmental impacts. With a commitment to provide fresh organic vegetables to customers within 24 hours of harvest, Sylvia's Basket produce is less likely to perish and contribute to lost farmer income and methane emissions from food loss and waste.

Despite purchasing from 15 to 20 farmers, Sylvia's Basket is still unable to satisfy demand for the businesses' organic food baskets. An interviewee notes that interest has risen steadily over the past several years — particularly since the COVID-19 pandemic prompted Kenyan consumers to look for healthy foods that could boost their immunity.

To ensure a greater supply of organic produce, Sylvia's Basket focuses on building the capacity and knowledge of Kenyan farmers through visits to Kuria's farms, interactive workshops, and peer-to-peer learning. Other Kenyan citizens, particularly women and young people living in Nairobi, are encouraged to establish organic kitchen gardens as a way to feed themselves and improve access to nutritious indigenous foods — increasing food sovereignty as a result.

Kuria is also an ambassador with Organics International (IFOAM) and has helped run workshops across Africa where she teaches women and smallholder farmers about organic farming.

WHAT'S NEXT?

In the coming years, Kuria aspires to continue increasing the availability of organic produce so she can scale her food basket business from 100 to 500 households. Public or private funds could be useful in achieving this, and both remain a significant barrier to replicating or scaling the Sylvia's Basket business model.

Additionally, Kuria recognizes the need to dedicate herself to policies that will support the creation of enabling environments and incentives for organic farmers. For example, alongside a local county official and other stakeholders, Kuria and her business are lobbying for the creation of an agroecological policy framework for her region. Such policies could levy support from local and national governments to roll out extension services that bolster organic farming activities, such as the distribution of organic manure over artificial fertilizers.

“We have an imbalance whereby these farmers who are growing safe produce do not have access to markets that recognize their organic produce. If we don't support retailers, wholesalers, the middlemen who are in the organic value chain, then we compromise organic produce being available to more people on the African continent.” — SYLVIA KURIA, A SMALLHOLDER FARMER AND FOOD SYSTEMS ENTREPRENEUR

Outside of policy-making, Kuria also acknowledges the importance of extending awareness of organic practices beyond smallholder farmers and consumers. For local NGOs, she says there is an urgent need to focus not only on agricultural production but on training actors across the value chain to increase the market for organic products.

“We have an imbalance whereby these farmers who are growing safe produce do not have access to markets that recognize their organic produce,” said Kuria in a [2021 video](#) for IFOAM. “If we don't support retailers, wholesalers, the middlemen who are in the organic value chain, then we compromise organic produce being available to more people on the African continent.”

SUMMARY OF IMPACTS ACHIEVED

Increased local incomes. Sylvia's Basket creates the conditions for smallholder farmers to succeed and scale. This includes serving as the direct-to-consumer link between farmers and the market — farmers who supply Sylvia's Basket have, on average, doubled their incomes when compared to selling through middlemen. The company currently purchases from 15 to 20 farmers.

Organic farm training. Sylvia's Basket has trained over 1,000 smallholder farmers across central Kenya. The business ensures there is a market for this organic produce through its food baskets.

Enhanced soil health. On-farm soil testing by the University of Nairobi demonstrates marked improvements in soil health since the organic farms were established.

Greater access to organic produce. The Sylvia's Basket shop in Nairobi receives upward of 500 kilograms (1,102 pounds) of produce weekly from farmers across Kenya. As a result, the shop supplies over 100 households with produce baskets filled with indigenous fresh fruits and vegetables.



CASE STUDY

SENEGAL

Senegal's national biogas program engineers an alternative cooking fuel and organic fertilizer

PROJECT SUMMARY

The Senegal National Domestic Biogas Program (PNB-SN)²⁴ is leading the transition to a cleaner fuel source (biogas) that can be used for household cooking and lighting. A by-product of biogas production is the creation of organic fertilizer that can be used for agriculture or sold by farmers as a secondary income stream.

Overall, the program is improving the quality of rural living conditions, reducing greenhouse gas (GHG) emissions, curbing deforestation, and improving food security. The latest phase of the program is led by two Senegalese ministries and sponsored by the Swiss government.

THE FOOD-CLIMATE CONNECTION

Biogas is an alternative energy source with a number of food-climate benefits. Produced in a biodigester tank, organic material is broken down using a process called “anaerobic digestion.” The result is a green energy source that can be used as a cooking fuel and for lighting. This circular system of energy production reduces the need to burn wood or charcoal as cooking fuel, thereby mitigating the release of carbon dioxide and safeguarding forests.

The biodigestion process produces a mineral-rich fertilizer that can be used to grow fresh, organic produce. This reduces the reliance on environmentally harmful chemical fertilizers and improves local food security.

CLIMATE FACTS

- **National emissions.** The average person in Senegal produces less than a ton of CO₂ each year — significantly less than the global average of over 6 tons per annum. Despite contributing very little to global emissions, Senegal is one of the countries most vulnerable to the effects of climate change.
- **Senegal's NDC.** Senegal has both an unconditional and conditional target, depending on international aid. It is based on a business-as-usual scenario that uses 2010 as a base year. In the unconditional scenario,

FOOD SYSTEMS FACTS

- **Contribution to GDP.** Senegal's agricultural industry employs approximately 70% of the country's working population and contributes to 15% of the national GDP.
- **Energy access for cooking fuel.** Rural Senegal communities predominantly cook on stoves fuelled by wood and charcoal. Only two-thirds of the country has access to electricity, the price of which can also be out-of-reach for some households. There is the demand for an alternative source of clean cooking fuel.

CLIMATE FACTS

Senegal proposes GHG emission reductions of 5% by 2025 and 7% by 2030. In the conditional scenario, the goal is a 23.78% reduction in emissions by 2025 and a 25.53% reduction by 2030.²⁵

- **Transition to renewable energy.** Senegal looks to the electricity and power sector to meet its emissions-reduction targets. Its strategy includes a shift to renewable energy and less-intensive fuel sources, including biogas.

FOOD SYSTEMS FACTS

- **Food security.** Food insecurity rates are on the rise, exacerbated by the droughts and weather variability caused by climate change.

LESSONS FOR CLIMATE ACTION PLANS

The Senegal National Domestic Biogas Program offers several lessons for NDCs:

- **NDC development process:** The Senegalese government placed strong emphasis on the importance of participatory engagement with actors from the government, civil society, the private sector, and consumer organizations. The second phase of PNB-SN has also focused on the strengthening of empowerment programs in order to improve the living conditions of women.
- **Content of the NDC** The use of biodigester technology reduces GHG emissions and improves human health by curbing the burning of biomass that generates harmful particulate matter. A novel financing scheme lets households access loans to purchase a biodigester at no upfront cost. Fertilizers produced as a by-product of the biodigestion process can be used for agriculture and as an additional income-generating stream. The implementation of domestic biogas digesters is explicitly referenced in Senegal's NDC.
- **Implementation of the NDC:** There is a lot to learn through trial, error, and iteration. Early phases of PNB-SN witnessed less interest than anticipated in the biodigesters. A project review and stakeholder engagement determined that a new financial mechanism was required to incentivize biogas production and scale up the program.

KEY INSIGHTS

No two meals in no two places are the same. Also different are the methods in which people around the world prepare their food. According to the World Health Organization, 2.6 billion people — most of whom live in low- and middle-income countries — rely on open fire or simple cookstoves to meet their cooking needs. These fires and cookstoves are stoked in various ways, including coal, kerosene, and biomass such as dried animal dung, firewood, and charcoal. While households are often limited in the cooking fuel they can access or afford — and may prefer the taste of food cooked over a flame — the burning of these fuel sources can cause non-communicable disease, drive deforestation, and increase CO₂ emissions.

In Senegal, the National Biogas Program (PNB-SN) is providing people with a sustainable, clean alternative. Biogas and the biodigester technology that produces it are central in the West African nation's strategy to meet its NDC targets.

The Senegalese government first launched PNB-SN in 2009. Created to oversee the expansion of biogas technology across Senegal, the program helps smallholder farmers and rural and peri-urban households to access finance in order to install biodigesters and adopt other income-generating activities. In Phase 1 of the program (2009–2015), PNB-SN supported the transition to clean energy for over 2,300 households and more than 23,000 people.

The program entered Phase 2 in 2020 with sponsorship from the Swiss government. By 2030, it plans to build 60,000 biodigesters that will produce biogas from human and animal waste. The price tag for implementing this second phase of the program is estimated at 46 billion CFA (79 billion USD) over the 10-year period.

WHAT IS BIOGAS AND WHAT ARE ITS BENEFITS?

Biogas offers a promising solution to mitigate climate change, improve food security, and protect human health. It's produced when a process called "anaerobic digestion" breaks down organic materials such as food scraps, agricultural waste, and manure in an oxygen-devoid setting (usually a large tank). Biogas can be used as an alternative cooking fuel and to generate electricity.

Replacing traditional cooking fuel sources with biogas has wide-ranging impacts,²⁶ including in Senegal:

- **GHG emissions:** The Intergovernmental Panel on Climate Change estimates that replacing traditional open fires with improved cookstoves (including those powered by biogas) has significant global CO₂ mitigation potential. PNB-SN in Senegal is expected to reduce approximately 550,000 tons of CO₂eq between 2021 and 2030.
- **Deforestation:** According to the Senegalese Ministry of Energy, firewood and charcoal are used as cooking fuel by 86% of households. This subsistence activity is depleting forests. An alternative energy source could slow unsustainable deforestation rates in Senegal and worldwide.
- **Food security:** A by-product of biogas production is a mineral-rich residue that can be used as a safe organic fertilizer. This bio-fertilizer can improve soil quality and be used to grow indigenous fresh fruits, legumes, and cereals for personal consumption. Increased crop productivity through the use of bio-fertilizer is an expected outcome of PNB-SN.
- **Human health:** Open fires and cookstoves are not always well ventilated and can suspend smoke and particulate matter in the air. These harmful pollutants are then inhaled and contribute to various health issues, particularly for women and children. In Senegal, 6,300 people are estimated to die prematurely each year because of indoor air pollution. Biogas does not generate the same indoor air pollutants.
- **Income generation and rural livelihoods:** Biogas can reduce household energy costs and the fertilizer produced (or the produce it is used to grow) can be sold within local markets. An objective of PNB-SN is to reduce poverty and improve the living conditions of people in rural and peri-urban areas of Senegal. Phase 2 of the program plans to create labour opportunities for local communities, targeting the development of 50 small-scale biogas enterprises and over 500 skilled jobs.

Biodigester machines can be big or small, high-tech or constructed using materials purchased at a local market. The typical Senegalese biodigester is an underground tank built of brick or concrete, roughly the size of a small garbage dumpster.

The PNB-SN program trains people to feed their biodigester with cow manure and water. The gases released during the anaerobic digestion process are captured in barrels, connected by tubes to cookstove burners.

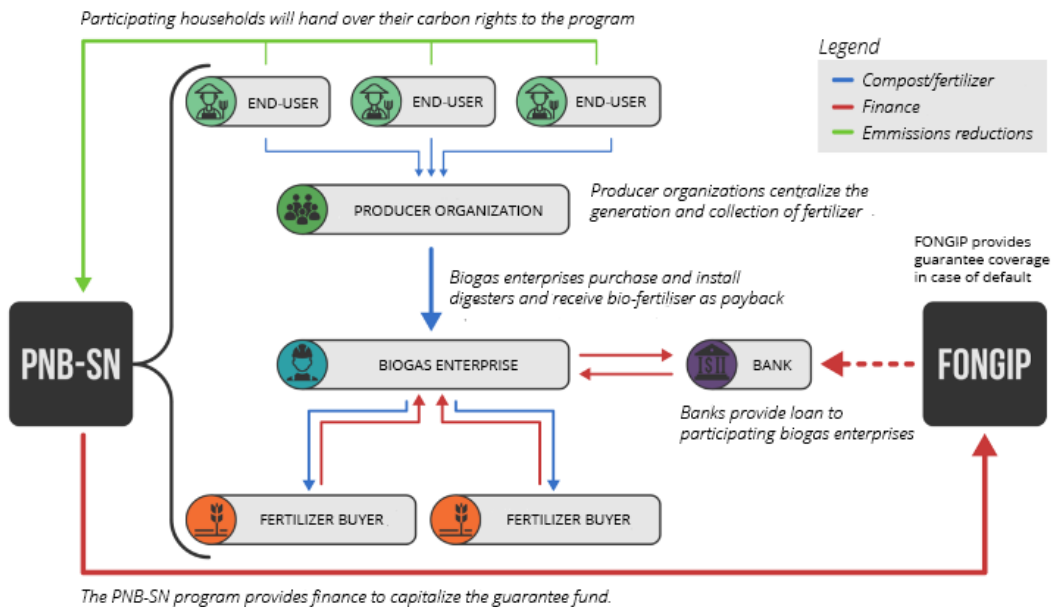
Two sacks of manure can be loaded into the biodigester daily to produce sufficient fuel for 5 to 6 hours of cooking and some lighting. An additional benefit of PNB-SN is the improvement of agricultural waste management in Senegal. Livestock feces pollute groundwater, a hazard that's reduced when the manure is gathered and used to produce biogas.

AN INNOVATIVE, ITERATIVE FUNDING SCHEME

A shortcoming of the first phase of PNB-SN was that the upfront investment needed to purchase a biodigester was unaffordable to many. As a result, installation numbers were lower than anticipated.

Informed by stakeholder feedback, Phase 2 of the program leveraged private sector finance to create a system that reduces risk and increases the viability of the biodigesters for every stakeholder. This involved reallocating part of its capital to establish the "Senegalese Priority Investment Guarantee Fund," which incentivizes local commercial banks to provide loans to qualified biogas enterprises. These enterprises, in turn, provide and install biodigesters to households at no upfront cost. Households repay the loan value monthly by donating all (or a share of) the bio-fertilizer generated.

This updated system has permitted a greater number of individual households to install biodigesters, generate clean cooking fuel, and produce bio-fertilizer for personal use, sale at market, or debt repayment.



The PNB-SN stakeholders and their roles. (Source: October 2020 presentation about the PNB-SN project.)

Phase 2 of PNB-SN has also focused on maturing the commercial market for organic fertilizer in order to increase the value of and demand for bio-fertilizer.

The Senegal government has supported clean cooking and sustainable fuels for households through a range of other national policies, including an Energy Sector Development Policy Letter (2019–2023) and its Plan for an Emerging Senegal (a reference framework for economic and social policy in the mid and long term).

WHAT'S NEXT?

As part of ongoing research efforts, PNB-SN regularly monitors, reports, and verifies the emissions reductions from installed biodigesters. The program is also working with regional academic and research organizations to lower the cost and improve the efficiency of existing biodigester technologies.

While the program has already leveraged private-sector finance to create the credit guarantee fund, it will need to unlock additional financing to reach its full scale and extend until 2030. Complementing this financing will be the in-kind contributions of NGO implementing partners whose missions are geared toward empowering rural communities and safeguarding the environment.

Finally, providing training to local service providers and biogas enterprises ensures the long-term viability and success of this second phase. This will enable the ongoing maintenance and repair of biodigesters.

[According to reports](#), Senegal aspires to become the West African leader in green energies, with a 30% share of renewable sources in its energy mix by 2030 — with the scale up of biodigesters, the country is well on its way to getting there.

SUMMARY OF IMPACTS ACHIEVED

Impressive Phase 1 results. The replacement of biomass as a cooking fuel source has resulted in annual savings of 11,400 tons of wood and 6,800 tons of charcoal use. Biogas production has been estimated to be, at minimum, 2.2 million cubic metres of biogas per year. This has resulted in the sequestration of more than 20,000 tons of CO₂eq.

Improved household incomes. The sale of organic bio-fertilizers by biodigester-owning households generates an additional 30,000 to 150,000 CFA (50 to 260 USD) per month, per household.

Soil quality and crop yields. The use of organic bio-fertilizer has substantially improved soil quality and yields of winter and vegetable crops, contributing to improved food security for 822 households.

Innovative new financial mechanisms. After an underwhelming uptake in the first phase of the program, Phase 2 capitalized an innovative “guarantee fund” scheme that mitigates the financial risks faced by commercial banks. This enabled small-scale biogas enterprises to access attractively priced loans from financial institutions, which in turn let the enterprises install more biodigesters.



CASE STUDY

SOUTH AFRICA

In South African cities, food forests and trees are crucial to combat climate change

PROJECT SUMMARY

Food & Trees for Africa (FTFA) is one of South Africa's leading environmental and food security non-profits. The organization runs a portfolio of programs that focus on the environmental, social, and economic benefits of urban greening through tree planting and food gardens. Its programs work in under-resourced and marginalized communities, ensuring the benefits of fresh, nutritious food and greenspace are more equally distributed to all.

THE FOOD-CLIMATE CONNECTION

Tree planting is one of the best, most cost-effective strategies for climate change mitigation and adaptation. Among their many benefits, trees absorb and store carbon, house biodiversity, and reduce the risk of landslides, floods, and drought. In cities, trees also provide invaluable shade and cooling, essential as global temperatures rise. By training beneficiaries in agroecological and permaculture practices through its garden programs, Food & Trees for Africa is also nurturing local food systems that are more resilient to the effects of climate change.

CLIMATE FACTS

- **Food production and emissions.** Food systems account for 15 to 20% of greenhouse gas (GHG) emissions in South Africa. Most of these emissions come from agriculture, energy consumption, and food waste.
- **South Africa's NDC.** South Africa's NDC was updated in September 2021. It limits the country's annual GHG emissions to 398 to 440 million tons of CO₂eq by 2030.²⁷
- **Severe droughts.** As a region, Southern Africa is at high risk of droughts. The most recent drought lasted from 2018 until early 2021, and was declared a national emergency in South Africa and neighbouring Namibia. The prolonged dry period and disrupted rains led to delayed sowing periods for farmers and contributed to overall food insecurity.

FOOD SYSTEMS FACTS

- **Contribution to GDP.** The agricultural sector contributes approximately 134.8 South African rand (ZAR) (9 billion USD) to South Africa's GDP. Smallholder crop farming is witnessing a significant decline. This is due to several interrelated causes, including environmental change, declining soil fertility, and water scarcity.
- **Food security.** Despite the right to food and adequate nutrition being enshrined in the South African constitution, hunger is rife. Almost 20% of households faced inadequate or severely inadequate access to food in 2017, and 27% of children are undernourished.

LESSONS FOR CLIMATE ACTION PLANS

Food & Trees for Africa (FTFA) offers several lessons for NDCs:

- **NDC development process:** FTFA aims to positively impact the lives of all South Africans, particularly marginalized and under-resourced groups. Its vision is based on principles of transparency and inclusive participation from all relevant food systems stakeholders. That includes health and nutrition experts, academia, women, local communities, smallholder farmers, the urban poor, and young people.
- **Content of the NDC:** FTFA focuses on “biointensive agriculture,” which includes agroecology, permaculture, conservation and rehabilitation agriculture, and natural farming. While taking a scientific approach, they also consider the needs and experiences of the communities where they work to ensure solutions are relevant to the local context.
- **Implementation of the NDC:** The organization supports and builds the capacity of local communities through the establishment of community cooperatives. The cooperative model helps farmers benefit from economies of scale, improves the economic sustainability of their initiatives, reduces risks, and offers a better chance to access small amounts of government funding and land tenure.

KEY INSIGHTS

There are any number of ways to take action against climate change. For Food & Trees for Africa (FTFA), tree planting has been the method of choice for the past three decades.

Since 1990, the South African non-profit organization has planted over 4.8 million trees alongside 17,500 schools and communities. [FTFA's vision](#) is “one where everyone has access to good, clean, naturally grown food that promotes health and happiness.”

In addition to tree planting, FTFA establishes food gardens, offers hands-on permaculture workshops, and oversees advocacy and skills training. The organization operates as a social enterprise and works predominantly with vulnerable, under-resourced groups, including women and residents in South Africa’s low-income townships.

With 99% of FTFA’s funding coming from private-sector sponsorship and donations, the organization is mindful to put decision-making power in the hands of community members.

Using an approach called “Asset Based Community Development,” FTFA works with its beneficiaries to shape projects that satisfy local needs — not only donor priorities. By supporting community members to identify and mobilize existing, often unrecognized assets, the organization has empowered thousands and boosted the long-term sustainability and community ownership of its projects.

The outcome is an extensive portfolio of programs that focus on the intersection of food security, environmental sustainability, and urban greening — while also building more equitable communities for all South Africans.

TREE PLANTING FOR PEOPLE AND THE PLANET

[Trees are one of our most powerful allies](#) in fighting climate change. They absorb and store carbon dioxide

and purify the air. From canopy to roots, trees regulate the water cycle, reduce soil erosion, and provide food, shelter, and medicine to humans and animals alike.

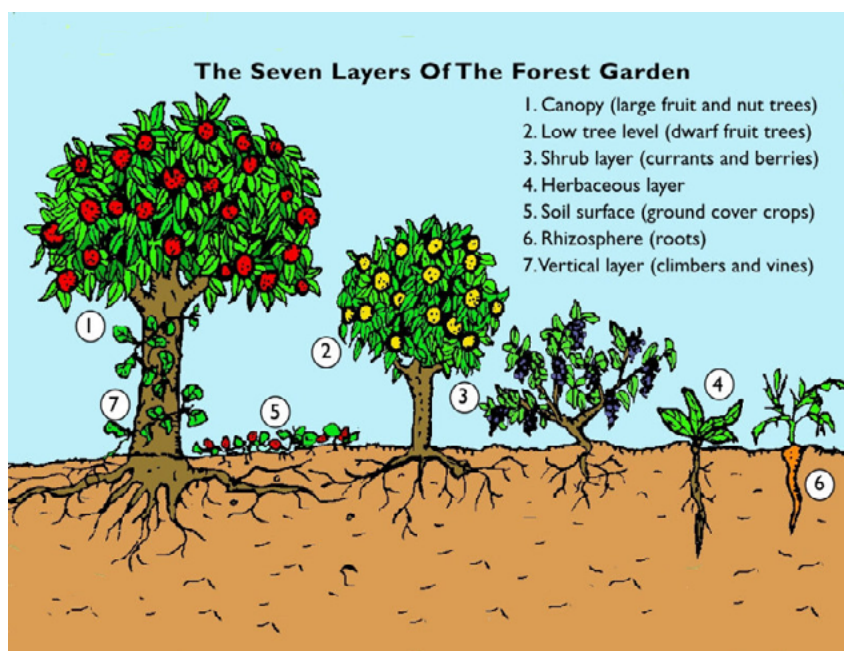
Getting more trees in the ground is at the heart of FTFA's work. The organization has two flagship community tree-planting programs, Trees for All and Trees for Homes, both of which bring urban greening to shared public spaces and private homes.

Urban trees come with a range of benefits. While many South African cities are hubs of economic opportunity, they are also becoming increasingly uncomfortable places to live as global temperatures rise. Concrete buildings and roads absorb and trap heat, a phenomenon known as the urban heat island effect. Strategically planted mature trees can lower temperatures by as much as 25°C (77°F) when compared to unshaded areas.

Unfortunately, these benefits are not equitably distributed. A 2020 study from South Africa found that green-spaces and urban trees are concentrated in wealthy neighbourhoods — a reality mirrored in cities worldwide. By directing its urban greening efforts in townships and less wealthy areas, FTFA ensures a greater number of people can access the multitude of benefits provided by trees and greenspace.

For example, Trees for Homes is leading greenbelt initiatives in a number of South African townships, transforming communities into “rich urban food forests, teeming with life and biodiversity.” The program is registered with the Verified Carbon Standard, which means companies and other groups can support the program as a way to offset their carbon emissions.

Another popular FTFA project, Food Forests Initiative, creates perennial forest gardens in schools and communities. Mimicking the natural systems so carefully created by Mother Nature, the FTFA team constructs its forest gardens in seven layers.



(Source: Food & Trees for Africa website.)

Similar to FTFA's community tree-planting programs, the Food Forests Initiative plants a 50:05 mix of indigenous shade trees and local food trees, though the exact tree species vary by local conditions and community need.

Once forests begin to flourish, communities can harvest nutrient-dense, delicious food on an ongoing basis. These nutritious fruits and nuts may otherwise have been unaffordable to households and communities.

From a climate perspective, perennial food forests take longer to establish, locking more carbon into the soil and trees as a result. FTFA generally works on a site for a minimum of 3 years, training and supporting community members to monitor and care for the forests.

Fostering a new generation of community foresters creates local environmental champions and the opportunity for temporary or longer-term employment — plus it improves tree survival rates. The outcome is a thriving carbon-capturing forest, sustainable economic development, and enhanced livelihoods for people living everywhere a FTFA tree has been planted.

GARDEN-BASED COMMUNITY DEVELOPMENT

Just as FTFA's tree-planting programs reduce climate emissions and increase food security, so too do its school and market gardening programs.

One example is EduPlant, an environmental education initiative that supports schools in under-resourced areas to develop or improve their food garden. Since 1994, the initiative has run workshops where students, teachers, and community members get their hands dirty to learn about permaculture principles.

Endorsed by the South African Department of Education and the National School Nutrition Programme, EduPlant's impact on local food security is tangible: FTFA has noticed less stunting in schools that have food gardens because canteen meals have been supplemented with fresh fruits and vegetables.

Beyond schools, EduPlant gardens are food security and education hubs for the entire community. External monitoring and evaluation found that over 60% of people involved in the workshops replicate the activities learned in their home kitchens and gardens.

Proximity to an EduPlant garden can also cultivate a sense of pride, belonging, and environmental stewardship. "The key with EduPlant is ensuring children understand that they are an active part of the web of life," explains Robyn Hills, FTFA's Head of Programmes. "That type of empowerment is particularly challenging in South Africa because children don't always have parents or food."

The community-wide social and economic dimensions of EduPlant are also worth noting. Says Hills: "There's so many systemic inequalities in under-resourced communities that the gardens become a safe space for women, older people, and vulnerable children."

Through EduPlant and its other food garden programs, FTFA supports what it calls "biointensive agriculture," incorporating the science and practice of agroecology, permaculture, conservation and rehabilitation agriculture,

and natural farming. By training farmers in climate-resilient farming techniques, FTFA aims to improve the viability of smallholder farming at a time when [1 in 5 crop-farming households have been lost](#).

In line with that mission, FTFA also builds the capacity of smallholder farmers through the establishment of community cooperatives. The cooperative model helps farmers benefit from economies of scale, improves the economic sustainability of their businesses, reduces risks, and offers an increased likelihood of accessing small pots of government funding and land.

WHAT'S NEXT?

Though much of its work is grounded within local communities, FTFA is also engaged in bigger-picture efforts to combat climate change.

The organization hosts the [African Climate Reality Project \(ACRP\)](#), an initiative that has trained hundreds of African “Climate Reality Leaders” from 30 countries across the continent. Joining with governments, NGOs, and scientists, Climate Reality Leaders mobilize to find solutions to climate change and call on world leaders for more ambitious action. For example, ACRP’s “Sink Our CO₂” campaign is creating awareness and training around the role that forest management, restoration, and protection can play in carbon sequestration.

In the future, FTFA also plans to further develop its carbon projects, enabling more companies and individuals to support its programs as a way to offset their GHG emissions.

The organization’s decades-long commitment to the food–climate nexus demonstrates the strength of a holistic approach that ensures people of all ages understand the links between the environment, their health, and their own prosperity.

SUMMARY OF IMPACTS ACHIEVED

Urban tree planting. FTFA plants 23,000 trees every year in urban or urban fringe areas. The organization has planted more than 4.8 million trees in its 30-year existence, with a survival rate of 86% after 3 years.

School and market garden programs. FTFA manages the largest school and market garden programs in South Africa. The total area of FTFA-planted vegetable gardens and orchards country-wide is nearly 10 square kilometres (3.8 square miles).

EduPlant workshops. Since 1994, over 770 permaculture food garden workshops have been held. Through these workshops, the program has trained over 18,000 schools and more than 51,000 educators.

Policy advocacy. FTFA has influenced several South African policies. These include the National Schools Nutrition Programme, a government program that provides one nutritious meal per day to all learners in lower-income primary and secondary schools, and Johannesburg’s Urban Forestry Policy.

Direct donor funds to community-identified needs. Nearly all of FTFA’s operating budget comes from corporate sponsorship of tree-planting projects and individual donations. Rather than prescribing solutions, FTFA has asked communities to identify their risks, opportunities, and needs, and adapts its programs and plantings to fit.



CASE STUDY

SPAIN

The “Barcelona Challenge” prompts city leaders in Spain and globally to act across the food–climate nexus

PROJECT SUMMARY

The [Barcelona Challenge for Good Food and Climate](#) is a call to action for cities around the world. It impels municipal leaders to put food and agriculture at the heart of their community’s response to the climate emergency. The Challenge has created a set of core metrics that cities can use to measure the positive impact of their food–climate commitments. In this Case Study, we look to the leadership of Barcelona in making progress toward these goals.

THE FOOD–CLIMATE CONNECTION

Over half of the global population now lives in an urban area, and it’s in cities that over 70% of the world’s food is consumed. As a result, cities are essential places to advance food systems and consumer behaviour change.

With a direct connection to residents and fewer bureaucratic hurdles than larger jurisdictions, cities are the ideal size and scale in which to champion sustainable food systems to tackle the climate emergency.

CLIMATE FACTS

- **Food production and emissions.** Spain has expressed the ambition to decrease emissions from the agricultural sector by 18% by 2030 as compared to 2005 levels. As of 2019, a 4.6% decrease had been achieved. The country’s agricultural sector alone accounts for 12% of total greenhouse gas (GHG) emissions.
- **The E.U.’s NDC.** The E.U.-wide NDC outlines an economy-wide emissions-reduction target of 55% by 2030 when compared to 1990 levels.²⁸
- **Spain’s climate targets.** According to its National Energy and Climate Plans 2021–2030, Spain aims for a 23% reduction in GHG emissions when compared to 1990 levels.

FOOD SYSTEMS FACTS

- **Contribution to GDP.** Spain’s agri-food sector accounted for 13.8% of national employment and 8.9% of GDP in 2018. The agricultural production value in Spain exceeds 50 billion euros (EUR) (56.8 billion USD), with flagship products including wine and olive oil.
- **Organic agriculture production.** Spain has the largest total area devoted to organic agriculture in the European Union, and ranks third in the world.
- **Dietary trends.** Figures from 2019 show that only half of adult Spaniards eat a healthy diet; 1 in 5 adults are considered obese; and 41% of Spanish children aged 6 to 9 fall under the category of obese or overweight, the second-highest percentage in the European Union.

LESSONS FOR CLIMATE ACTION PLANS

The Barcelona Challenge for Good Food and Climate offers several lessons for NDCs:

- **NDC development process:** Improving city governance is a priority. Additionally, there is the need to establish transparent, coherent, and participative governance mechanisms that unlock the co-design of public policies on climate, food justice, nutrition security, and nature. Emphasis is placed on partnership and collaboration between local administrations and civil society, citizens, community organizations, the business sector, and other stakeholders committed to securing every person's right to food through sustainable food policies.
- **Content of the NDC:** The Barcelona Challenge promotes a shift in consumer behaviours toward healthy and sustainable diets based on local, plant-based foods and away from the consumption of meat, dairy, and ultra-processed foods that are high in fat, sugar, and salt.
- **Implementation of the NDC:** Through a Cities Toolkit, monitoring and reporting mechanisms have been established to gauge the continued effectiveness of The Barcelona Challenge initiative.

KEY INSIGHTS

Cities have long been recognized as a primary point of intervention to achieve both food justice and climate action.

The COVID-19 pandemic exposed this realization, and the role of cities in sustainable food systems was discussed in 2021 at the United Nations Food Systems Summit and as part of the [Glasgow Food and Climate Declaration](#) presented at COP26.

In ongoing acknowledgement of the need for city leaders around the world to act across the food–climate nexus, Barcelona's city council launched [The Barcelona Challenge for Good Food and Climate](#). Fittingly, Barcelona itself has been an exemplary leader in this space, having established participative governance mechanisms that enable the co-design of public policies related to climate, food justice, nutrition security, and nature.

The Barcelona Challenge was introduced during the 7th Global Forum of the Milan Urban Food Policy Pact (MUFPP), which was hosted by the Catalan city in October 2021. As a policy tool, The Barcelona Challenge is promoted by a number of city networks worldwide and is primarily funded by the City of Barcelona and the Daniel and Nina Carasso Foundation.

"We want to put the political energy of cities into pushing forward this situation [of climate change]," explained Álvaro Porro, Commissioner of Food Policy with Barcelona's City Council, [at the 2021 MUFPP convening](#). "Cities occupy 2% of the Earth's surface but use 80% of the world's energy. Seventy percent of the food globally produced is consumed in cities. Food and cities have to be part of the equation."

The Barcelona Challenge is a call to action for cities and their residents to engage in a series of commitments that transform food systems and tackle the climate emergency at a global scale.

The Challenge takes aim at two issues: the mitigation of and adaptation to climate change over the 2021–2030 period. By modifying how food is produced, distributed, and recycled locally, cities are challenged to reduce their GHG emissions and build their adaptive capacity so food systems are more resilient to extreme climatic events. Overcoming this pair of challenges will, in turn, help ensure access to sufficient, sustainable, healthy, and nutritious diets for all.

As of the 2021 launch, nine cities across three continents have signed onto The Barcelona Challenge, including Belo Horizonte, Brazil; Antananarivo, Madagascar; and several European cities including Marseille, Valencia and, of course, Barcelona.

NEXT STEP ALONG THE SUSTAINABLE FOOD SYSTEMS ROADMAP

Though named after one city, The Barcelona Challenge is all about continuing global action. It draws on the [C40 Good Food Declaration](#) (2019) and expands the urban food policy commitments previously made through the [Milan Urban Food Policy Pact \(MUFPP\)](#).

Launched in 2015 during a World Expo event in the Italian city, MUFPP was the world's first international agreement on sustainable urban food systems. The pact has been signed by more than 210 mayors and municipal leaders who continue to meet annually at such global forums as the one hosted in Barcelona in 2021.

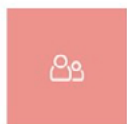
The MUFPP inspires city-led change through 37 voluntary actions clustered in 6 categories. The Barcelona Challenge is structured on this MUFPP Framework for Action and covers the same six action categories — with the important addition of a climate lens.



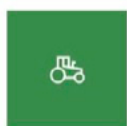
1. Ensuring an enabling environment for effective action (governance): The main focus for The Barcelona Challenge in this category is to establish coherent and participative governance mechanisms that allow for the co-production of public policies on climate, food justice, nutrition security, and nature in order to strengthen food system resilience in the face of extreme climate events and include food in local Climate Action Plans.



2. Sustainable diets and nutrition: The main focus is to ensure the transition to sufficient, sustainable, nutritious, and culturally appropriate diets for the entire population, in line with the Planetary Health Diet guidelines, by increasing overall healthy, plant-based food consumption, and fully aligning public food procurement with the Planetary Health Diet by 2030.



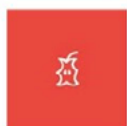
3. Social and economic equity: The main focus is to embed the Planetary Health Diet and sustainable (agroecological) food supply approaches within services and programmes, addressing food vulnerability and poverty with special consideration given to children's and other vulnerable groups' diets.



4. Food production: The main focus is to promote sustainable, socially fair, and equitable forms of production and processing of local, healthy food by ensuring the territorial planning and management of local resources.



5. Food supply and distribution: The main focus is to re-territorialize and restructure socially and economically viable food distribution and logistics networks (via wholesale, municipal or farmers markets, local food networks, small food retailers, and public food procurement services) to adapt them to extreme events and to reduce impact on nature and communities.



6. Food waste: The main focus is to reduce food loss and waste by 50% by 2030 (from a 2015 baseline) and reuse and recycle food waste and other food-related waste.

The six action categories of The Barcelona Challenge align with (and build on) the priorities outlined in the Milan Urban Food Policy Pact. (Source: The Barcelona Challenge website.)

“The idea behind The Barcelona Challenge was not to launch another declaration, but to focus on commitments linked to practical action and targets that can deliver concrete results,” explains Maria Carrascosa, Project Coordinator with The Barcelona Challenge.

In Barcelona, for example, the Challenge led to the creation of a cross-departmental working group that is responsible for coordinating sustainable and healthy food policies across municipal departments. The working group engages in partnerships and cooperation with civil society, citizens, community organizations, businesses, and other stakeholders to gather their input on such policies.

One of the activities coordinated by the working group is a campaign to raise awareness about the [planetary health diet](#).²⁹ The diet — designed to balance the health of people and planet — centres on locally produced plant-based foods such as fruits, vegetables, cereals, legumes, and nuts. It also encourages a reduction in the consumption of meat, dairy, and ultra-processed foods high in fat, sugar, and salt.

At an institutional level, the Barcelona working group prioritizes improving public food procurement policies to spur the purchase of local, nutritious, and organic food in line with the planetary health diet.

Cities committed to The Barcelona Challenge also streamline the process of including more organic produce in services available to vulnerable communities (such as food banks and community kitchens) and lobby for the banning or limitation of ads promoting unhealthy foods.

A TOOLKIT FOR ACTION

Where The Barcelona Challenge builds on the Milan Urban Food Policy Pact (MUFPP) is in the creation of a [toolkit](#) for global action. The tool makes it easier for municipal leaders and local authorities to visualize the positive impact their food systems commitments could have on the city, their citizens, and the climate.

The toolkit can also estimate the projected GHG emissions reductions associated with a municipality's urban food policies. These reductions are calculated based on the latest findings from international scientific research and are meant to further quantify the benefits that come with committing to healthy and sustainable diets for all.³⁰

The toolkit also measures the more tangible social, ecological, and economic effects of food policies. These impacts are made visible on each of the signatory cities' reporting dashboard.

Barcelona's food policy actions, for example, [are projected](#) to reduce the city's annual GHG emissions by 119,800 tons of CO₂e³¹ and conserve 180,000 cubic metres of water (about 72 Olympic-size swimming pools). The city's actions are also anticipated to save over 92.4 million EUR (105 million USD) in public expenditures because of reduced health and environmental costs arising from the increased production and consumption of organic, nutritious food. This should, in turn, prevent [212](#) early deaths.

Beyond Barcelona, some cities that signed onto The Barcelona Challenge have produced maps and online directories of local agroecological food supply chain actors. This has increased market viability of these approaches and helped connect producers, processors, and distributors.

Others promote the creation of multifunctional peri-urban agricultural parks that incorporate land banks, farm business incubators, and community seed banks. Each promotes sustainable agri-food production and boosts local food supply.

While no two Barcelona Challenge cities are identical in their context and local policies, all are contributing to the common goal of using food systems change to take climate action.

WHAT'S NEXT?

The Barcelona Challenge emphasizes the need to move beyond virtue signalling declarations to tangible actions. The development of the Challenge's toolkit urges city governments to articulate specific actions that will facilitate the transformation of food systems while also delivering on climate mitigation or adaptation commitments.

Engagement from across Barcelona's administration has demonstrated how city-level officials can champion actions that make a difference locally, nationally, and internationally. Involvement of city leaders, including the Mayor of Barcelona, have shown other municipal leaders what is possible and has influenced other cities and policymakers in Catalonia and Spain to follow suit.

Municipalities around the world are invited to join The Barcelona Challenge before March 2022. In reviewing the Challenge's toolkit, interested municipalities are required to develop at least one action under three of the six categories — tailoring the framework to meet their local contexts.

Cities that sign up for The Barcelona Challenge commit to reporting progress annually, with the first report to be presented at the next MUFPP Global Forum in 2022. A cities learning exchange has also been established so municipal staff and elected officials can share their experience addressing climate change through sustainable food policies.

While still in its infancy, The Barcelona Challenge presents an exciting and inspiring opportunity for cities around the world to mobilize, collaborate, and lead.

SUMMARY OF IMPACTS ACHIEVED

Establishment of local governance structures. The Barcelona Challenge has further prompted cities worldwide to create local food policy councils, panels, and other governance structures to link policymakers to citizens and ensure all food systems actors have the opportunity to be heard.

A global alliance of cities. Nine locales signed on as “core cities” as part of The Barcelona Challenge, meaning they're committed to taking at least one action in all six of the Challenge's action categories.

Carrying forth the momentum of international dialogues. The Barcelona Challenge represents the next step on a roadmap of political action, starting with the Milan Urban Food Policy Pact (2015), the C40 Good Food Cities Declaration (2019), and the Glasgow Food and Climate Declaration (2021).



CASE STUDY

UNITED KINGDOM

Addressing the links between childhood food security, dietary inequality, and climate action in the United Kingdom

PROJECT SUMMARY

The Children's #Right2Food and #EndChildFoodPoverty campaigns are ensuring all children in the United Kingdom have access to healthy, affordable food. The campaigns are led by [The Food Foundation](#), alongside well-known footballer Marcus Rashford and young food ambassadors. Advocacy efforts linked to these campaigns have resulted in a government funding package to help alleviate child food insecurity.

THE FOOD-CLIMATE CONNECTION

A dietary transition away from animal-based protein toward more nutritious fresh fruits and vegetables is widely recognized as a primary strategy to combat climate change. If everyone living in the United Kingdom switched to the country's nationally recommended diet, the country could cut food emissions by 17%.

However, in the United Kingdom and around the world, a climate-friendly, nutritious diet may not be affordable, accessible, or appealing. This is especially true for lower-income households, who would need to spend 40% of their disposable income to meet the U.K.'s national dietary guidelines. Tackling food inequality within society is an environmental and moral imperative.

CLIMATE FACTS

- **Food production and emissions.** Food production accounts for nearly 20% of the U.K.'s greenhouse gas (GHG) emissions.
- **The United Kingdom's NDC.** The economy-wide headline target of the NDC is to reduce GHG emissions by 68% by 2030 compared to reference levels.³²
- **Dietary guidelines and climate change.** Research from 37 middle- and high-income nations suggests nationally recommended diets could be an important policy tool for decreasing the environmental impacts caused by people's eating patterns.

FOOD SYSTEMS FACTS

- **Healthy eating.** A third of adults and only 12% of 11- to 18-year-olds in the United Kingdom eat the recommended five daily portions of fruits and vegetables. Inequities are rife: The poorest 20% eat, on average, one portion of vegetables less a day than the richest 20%.
- **Childhood obesity.** One in five children in the United Kingdom are either overweight or obese by the time they start school. The Food Foundation found that half of children born in the United Kingdom in 2020 will experience obesity by the age of 65.

FOOD SYSTEMS FACTS

- **Food security among children.** An estimated 2.5 million children in the United Kingdom experienced food insecurity between February and July 2021. Nearly half of food-insecure families with children do not qualify for the Free School Meals scheme because the income threshold is set too low.³³

LESSONS FOR CLIMATE ACTION PLANS

The Food Foundation's campaigns offer several lessons for NDCs:

- **NDC development process:** It's powerful to engage actors with lived experiences — those who are most impacted by a project, initiative, or policy. For the development of the Children's #Right2Food Charter, young ambassadors, disadvantaged groups, and children experiencing food insecurity worked alongside parliamentarians and other experts.
- **Content of the NDC:** Tackling dietary inequalities, the root causes of food insecurity, and other social justice issues are fundamental to meeting climate targets. A dietary transformation that focuses on access and affordability of healthy and nutritious foods such as fresh fruits and vegetables should also be considered.
- **Implementation of the NDC:** Ongoing project monitoring is a powerful contributor to the success of this project. The Food Foundation's campaign established clear targets and milestones that are continuously monitored through its data dashboard.

KEY INSIGHTS

The Food Foundation is a charitable organization on a mission to change food policy and business practice to ensure everyone across the United Kingdom can afford and access a healthy and sustainable diet. It elevates citizen's voices, including those who do not traditionally hold power or have a say in policy, namely children and disadvantaged groups.

Since its founding in 2014, The Food Foundation's initiatives have earned wide recognition by policymakers, health professionals, and leading decision makers across the United Kingdom. Two of its campaigns, Children's #Right2Food and the #EndChildFoodPoverty, have been particularly impactful at driving policy and raising public awareness.

When it comes to the link between food inequality and climate change, the organization's [2021 annual report](#) referenced that "eating less meat and more veg can help to lower greenhouse gas emissions as well as having

health benefits in high-income countries.” It acknowledged that addressing the barriers to increased vegetable consumption is vital to overcome interlinked climate and health challenges.

THE ENVIRONMENTAL IMPACTS OF FOOD INEQUALITY

Food security and climate change are inextricably bound. To feed the world’s growing population in a way that is sustainable and healthy for people and the planet, the [EAT-Lancet Commission on Food, Planet, Health](#) calls for “a more than doubling in the consumption of healthy foods such as fruits, vegetables, legumes and nuts, and a greater than 50% reduction in global consumption of less healthy foods such as added sugars and red meat.”

More specific to the United Kingdom, the [2021 National Food Strategy](#) states that favouring protein-rich raw ingredients such as lentils, tofu, chickpeas, and whole grains could lead to a 68 to 94% decrease in GHG emissions.³⁴ Opting for meat-mimicking alternatives would have an equal effect. The U.K.’s [Eatwell Guide](#) recommends eating at least five portions of fruit and vegetables each day. It also encourages people to eat plant-based proteins such as beans, peas, and lentils as an alternative to meat.

But recommended diet guidelines are not always feasible for families. This is due to many factors, including affordability, access, convenience, and appeal. In fact, [only 18% of children](#) in the United Kingdom eat the recommended five portions of fruit and vegetables each day.

[Several findings](#) from The Food Foundation explore this alarming reality: It found that calorie for calorie, healthy foods are nearly three times as expensive as less healthy foods. The foundation also noted that the poorest fifth of U.K. households would need to spend 40% of their disposable income on food to meet the Eatwell Guide recommended diet. Furthermore, traditional U.K. dishes are typically rich in meat and dairy, skewing taste preferences away from foods that would be healthier for people and the planet.

As a result of these realities, lower-income households are more likely to depend on processed, unhealthy foods that provide less nutritional value and have a larger environmental footprint.

Diet-related health concerns are also higher among lower-income households — and this has risen with the COVID-19 pandemic. [Food Foundation data](#) from 2020–21 found that children aged 10 to 11 in low-income households are more than twice as likely to be overweight or obese than those in high-income homes. This increases the risk of a number of health conditions later in life.

With implications for public health, social justice, and climate change, ensuring children have enough healthy and nutritious food to eat is both a moral and an environmental imperative.

TAKING ACTION FOR THE RIGHT TO FOOD

In 2018, The Food Foundation released a landmark report, [The Children’s Future Food Inquiry](#). Initiated by a bi-partisan parliamentary committee and led by 15 young food ambassadors, the report was a nation-wide look at children’s food access across four U.K. nations.

The inquiry's findings depended on quantitative data from policymakers, academics, and childcare workers, as well as qualitative research in the form of interviews and workshops with nearly 400 children from across the United Kingdom. All voices were considered with equal weight, acknowledging that expertise comes in many shapes and forms.

The inquiry's findings shaped the creation of The Food Foundation's [Children's #Right2Food Charter](#). Released in 2019, the Charter is an evidence-based roadmap to tackle children's food insecurity and obesity, while protecting every child's right to food. The Food Foundation has since released a COVID-19 update to reflect the challenges exacerbated by the pandemic.

The Charter campaigns for a number of new or updated government policies and programs that would better support children to eat well. This includes expanding the U.K. government's School Fruit and Vegetable Scheme (SFVS) to the benefit of all children in primary and secondary school. The current SFVS is limited to children aged 4 to 7 who are in a fully state-funded school in England. It entitles eligible children to a piece of fruit or vegetable each school day.

Though climate change is not explicitly mentioned in the Charter, its effects would be mitigated by the actions suggested within it. For example, the Charter recognizes the importance of increasing the amount of fruit and vegetables eaten by children as part of a healthy, balanced diet. If achieved, this would have a positive impact on food-related GHG emissions.

To track real-time policy progress toward delivering the Charter's recommendations, The Food Foundation created an [interactive dashboard](#). The visual tool presents U.K.-based data about children's food policy in a single place for policymakers and other decision makers.

A HIGH-PROFILE PARTNERSHIP

In 2020, The Food Foundation partnered with Manchester United footballer Marcus Rashford to lead his award-winning #EndChildFoodPoverty campaign. Similar to the Children's #Right2Food Charter, the campaign calls to improve access to food for low-income children.

The campaign formed a task force of 20 charities and food businesses calling on the U.K. government to support the following three recommendations in the National Food Strategy:

1. **Free school meals:** Extend the offer of free school meals to more children in need. Current income-eligibility thresholds are too high for many households to qualify.
2. **Holiday provisions:** Permanently expand holiday provision funding so that all children who receive free school meals continue to get them when schools are closed. This would impact an additional 1.1 million children.
3. **Healthy Start vouchers:** Increase the value of vouchers to 4.25 British pounds (GBP) (5.79 USD) a week (from 3.10 GBP/4.22 USD). This scheme is meant to provide a nutritional safety net to pregnant women and children under 4 in low-income families. Among other public health priorities, Healthy Start vouchers support the enjoyment of a healthy diet, including the purchase of fresh fruits and vegetables.

As of 2020, the campaign successfully expanded the free school meals program and holiday provision funding, as well as increased the value of Healthy Start vouchers. These policy changes represent up to a 400 million GBP (545 million USD) commitment to children's food and will improve the lives of 1.7 million children. While the #EndChildFoodPoverty campaign again does not explicitly reference climate change, ensuring access to healthy and nutritious food for all children would bring a range of environmental benefits.

WHAT'S NEXT?

The Food Foundation will continue to monitor progress toward its Children's #Right2Food and #EndChildFoodPoverty campaigns in the years to come. It also leads other advocacy and information sharing around food security issues.

For example, the organization tracks food price inflation, with a monthly update published on its website. In the United Kingdom and around the world, inflation rates are driving up food costs at an alarming pace. This issue particularly affects lower-income families who already face difficulties putting food on the table.

The Food Foundation also hosted a number of side events at COP26 in Glasgow. Since then, the organization has published blog posts aimed at [explaining](#) the new Glasgow Food and Climate Declaration and [opportunities](#) for the United Kingdom to show leadership at the food-climate nexus.

With its team of young food ambassadors leading the way, The Food Foundation is [increasingly speaking up](#) about food systems transformation as a solution to the climate crisis and the push to include food policy measures in updated NDCs. Next on the agenda: COP27 in Egypt.

SUMMARY OF IMPACTS ACHIEVED

Reach of #EndChildFoodPoverty campaign. The task force associated with the campaign and Marcus Rashford [launched a Parliamentary Petition](#) that gained more than 1.1 million signatures in 6 months.

Permanent policy change. In November 2020, The Food Foundation's campaigning successfully secured an extension of the Holiday Activity and Food Programme provisions and increased the value of Healthy Start vouchers to 4.25 GBP (5.79 USD) a week.

Significant new relationships. The Food Foundation team has developed strong relationships with government departments and the organization's young food ambassadors meet regularly with officials and Ministers to discuss progress toward the Children's #Right2Food Charter.



CASE STUDY

UNITED STATES

Data-driven solutions to end food loss and waste across U.S. food systems

PROJECT SUMMARY

ReFED is taking a systems-wide approach to curb food loss and waste across the United States. Through a pair of roadmap reports and an accompanying online portal, the American non-profit organization is ensuring all food systems stakeholders have the data, knowledge, and resources to initiate their own projects and policies to halve food waste by 2030.

THE FOOD-CLIMATE CONNECTION

Reducing food loss and waste is one of the top solutions to combat climate change. Globally, 24% of the greenhouse gas (GHG) emissions generated by food and agriculture come from food that is lost in supply chains or wasted by consumers — and yet few countries have created dedicated measures or policies to address the issue.

CLIMATE FACTS

- **Food waste and emissions.** Food loss and waste in the United States have a GHG footprint equivalent to 4% of the country's total emissions. Worldwide, an estimated 6 to 10% of GHG emissions are associated with food loss and waste.
- **The U.S.'s NDC.** In its NDC, the United States sets an economy-wide target to reduce its net GHG emissions by 50 to 52% below 2005 levels by 2030.³⁵
- **A major pollutant.** Food left to decompose in landfill creates methane, a climate-warming gas 25 times more potent than carbon dioxide.

FOOD SYSTEMS FACTS

- **Food waste in the United States.** According to ReFED, 35% of all food in the United States went unsold or uneaten in 2019. That equates to 408 billion USD worth of food and roughly 2% of the American GDP.
- **Food security.** While food waste is rife, 1 in 10 American households are food insecure. As a result of the COVID-19 pandemic, 42 million Americans now struggle with food insecurity.
- **A global concern.** Worldwide, approximately one-third of all food produced for human consumption is lost or wasted.

LESSONS FOR CLIMATE ACTION PLANS

ReFED's work offers a number of lessons for NDCs:

- **NDC development process:** ReFED's work on food waste demonstrates the importance of undertaking a holistic assessment of the food systems and potential measures to address systemic opportunities and barriers. Data and evidence can help policymakers and stakeholders to move beyond target and goal setting by focusing the main pathways for action.
- **Content of the NDC:** NDCs should include targets and measures to reduce food loss and waste. If fulfilled, these could contribute significantly to GHG emissions reductions. There is the opportunity for governments to invest in infrastructure and incentives that divert food waste from landfill. Countries could also support consumer awareness and educational campaigns, and assert leadership at a global and domestic level.
- **Implementation of the NDC:** Working with a range of stakeholders offers a unique opportunity to identify challenges, compromises, and opportunities for collaboration. Appropriately designed policies and measures can unlock private, public, philanthropic, and multilateral financing that promote food systems transformation (generally) and food waste prevention strategies specifically.

KEY INSIGHTS

As the climate emergency escalates, curbing food loss and waste is increasingly being put forward as a way to reduce GHG emissions.

That includes in the United States, where over one-third of all food went unsold or uneaten in 2019. Most ended up in a landfill, where it contributed to 4% of the country's total annual emissions. A dire environmental concern, the issue of food waste is even more heinous when seen through a food and social justice lens: food is rotting while so many American households are unable to access nutritious, healthy meals.

This is the crux of the problem that American non-profit organization, ReFED, is working alongside stakeholders to solve. ReFED is dedicated to ending food loss and waste across U.S. food systems through the advancement of data-driven solutions.

The organization was formed in 2015 to create the first-ever national economic study and action plan committed to tackling food waste at scale — a landmark report that was released the following year.³⁶

Building on this 2016 roadmap, ReFED published its "Roadmap to 2030" in early 2021. Created in collaboration with experts and practitioners from the food industry, professional trades, academia, and beyond, the report is an action plan to reduce food loss and waste in the United States by 50% by 2030.

Both the 2016 and 2021 roadmaps align with Sustainable Development Goal 12.3, which targets halving global food waste at the retail and consumer level, and reducing food losses along production and supply chains by 2030. "Our goal is to give companies, policymakers, and others the information that will enable them to act," says Dana Gunders, ReFED's Executive Director, of the roadmaps.

ReFED believes that food waste is a systemic problem and that solving it requires a systems-wide response. Its “Roadmap to 2030” looks at the entire value chain and points to seven action areas where food systems actors should focus their efforts:



The systems-wide interventions identified by ReFED, with a focus on prevention measures. (Source: ReFED website.)

According to Gunders, the five prevention measures identified above are often more complex and difficult to tackle, but offer the greatest return on investment, both financially and environmentally.

SHARING DATA-DRIVEN SOLUTIONS

Recent years have seen an increasing need for robust data to fill knowledge gaps and arm decision makers with the information they need to take meaningful, prioritized action against food loss and waste.

“Roadmap to 2030” is one platform to do that; another is the accompanying [ReFED Insights Engine](#). The Engine is an open-source online portal designed to serve as the next generation of data and guidance on the U.S. food waste challenge. Built using more than 50 data sets, the interactive platform lets users explore the financial and GHG reduction benefits associated with 42 food waste solutions that fall under the roadmap’s 7 action areas.

Importantly, the solutions highlighted by the ReFED Insights Engine identify actions that can be implemented today by players across the food value chain. Restaurants can reconsider their portion sizes, retailers can develop consumer education campaigns, and farmers can consider partnering with alternative sales channels to sell their imperfect or surplus produce.

The Insights Engine also includes a granular analysis of food waste across the United States by state, sector, cause, and impact — further fodder that policymakers and food systems actors can use in their advocacy. For those driven to act, the ReFED Insights Engine also features a vetted directory of “solutions providers” who can offer products and services to help them reduce their food waste footprint.

UNLOCKING PUBLIC, PRIVATE, AND PHILANTHROPIC CAPITAL

ReFED estimates that an annual investment of 14 billion USD over the next 10 years could cut food waste in half. This [would result in a 5:1 return](#) — an estimated 73 billion USD in annual net financial benefit. Over the course of the decade, these measures would create 51,000 jobs, reduce GHG emissions, and save water.

Catalyzing this 14 billion USD investment of public, private, and philanthropic capital is another significant focus of ReFED's work.

Leveraging its domain expertise, the ReFED team educates and advises funders on emerging investment opportunities, consults with food businesses to select effective food waste solutions, and connects them with people who can make those solutions a reality. To further support this work, in 2021 ReFED partnered with the Upcycled Food Association [to launch](#) the first-ever Food Waste Funder Circle. The Circle is a network of private, public, and philanthropic funders interested in directing their capital to food waste solutions.

ReFED also coordinates connections between donors and smaller organizations. At the start of the pandemic, the organization launched its "ReFED COVID-19 Food Waste Solutions Fund." The fund raised 3.5 million USD in just 2 months, vital financial support that was directed to 37 mid-sized organizations working on food waste reduction and hunger relief efforts in vulnerable communities across the country.

Over the years, ReFED has also recognized the need to nudge capital and resources toward experimentation and innovation in the food waste space.

[In a recent partnership](#), ReFED teamed up with The Wonderful Company, makers of a popular pomegranate juice, to advise the company's Wonderful Innovation Challenge. The Challenge offered up to 1 million USD to innovators who could pitch pilot-ready solutions to transform the company's 50,000 tons of pomegranate husks into a value-added resource. This is but one example of how ReFED collaborates with players across the value chain to pioneer creative and impactful food waste solutions.

WHAT'S NEXT?

Since its establishment, ReFED has played a leading role in shaping the United States' food waste narrative and policy. Alongside other organizations, ReFED is advocating for the passage of [two new food waste bills](#) that were introduced in Congress in July 2021: the Zero Food Waste Act and the Cultivating Organic Matter through the Promotion of Sustainable Techniques (COMPOST) Act.

The Zero Waste Food Act would create a new grant program within the U.S. Environmental Protection Agency where state, local, tribal, and territorial governments — as well as non-profits — could access funding to support projects focused on achieving food waste-reduction goals.

Outside of these two promising policies, ReFED plans to continue serving as the "Big Tent" for those operating in the food loss and waste space. Flexing its national reach, ReFED launched its Food Waste Action Network in late 2021. The platform plans programming, networking opportunities, and roundtable discussions on the topic of food waste.

The first topic of discussion was the possibility of creating a nationally coordinated consumer education campaign. That discussion will be carried on in 2022 with the goal of having players from across the country and across sectors launch a campaign using their united voice and collective influence.

Says Gunders on the role of ReFED in these diverse engagements: “Across and around the food system there are so many people who cross over this issue [of food waste]. Arming those people with information, giving them ways to connect, and using our power to take on thorny difficult topics are all important parts of our role.”

SUMMARY OF IMPACTS ACHIEVED

Standardized date labelling for food packaging. A top food waste solution identified in ReFED’s 2016 roadmap was to standardize date labelling on food packaging. The organization worked with industry, legal, and food safety experts to create a framework for determining which products should receive labels indicating food quality and which should be labelled with discard dates. This guidance led to the adoption of voluntary standardized date labelling by the Food Marketing Institute, the Grocery Manufacturers Association, and the Consumer Goods Forum, whose membership includes over 400 companies from 70 countries. As a result of ReFED and its partners’ efforts, to date there has been 35% compliance with these voluntary guidelines.

Tools for global change. ReFED’s frameworks and methodologies have been adopted or used by over 20 organizations, including the Organization for Economic Cooperation and Development, Asia-Pacific Economic Cooperative, Walmart, Deloitte, and John Hopkins University. Several countries, including the United Kingdom, Australia, Guatemala, Turkey, and the Philippines have approached ReFED to explore the possibility of replicating the ReFED Insights Engine in their own countries.

Government cooperation and collaboration. ReFED has built relationships and trust with several U.S. government departments, including the Environmental Protection Agency, Food and Drug Administration, and Department of Agriculture.

Insights to inform the private sector. Major retailers such as Amazon, Kroger, and Aldi are using ReFED’s data and insights to explore solutions to improve their bottom line and save food from being wasted. Food brands Campbell’s and Unilever have also used the ReFED Insights Engine to change their supply chain and consumer messaging.



CASE STUDY

VANUATU

In Vanuatu, improving the adaptive capacity of coastal Pacific Island communities to climate change

PROJECT SUMMARY

The [Vanuatu Coastal Adaptation Project \(VCAP\)](#) is a United Nations Development Programme-supported initiative to improve the resilience of coastal communities to climate change. Under the auspices of the country's national sustainable development plan and in collaboration with local Indigenous communities, VCAP has implemented several village-level activities that build climate resilience, safeguard food security and livelihoods, and preserve local biodiversity.

THE FOOD-CLIMATE CONNECTION

As a small island developing state, Vanuatu is ranked as the country most vulnerable to climate change. Climate risks include intensified cyclones, storm surges, landslides due to intense rainfall, and sea level rise. Vanuatu's economic and food systems are dependent on agriculture and fisheries, two sectors that have already been disrupted by such climate risks.

CLIMATE FACTS

- **Food production and emissions.** Agriculture, forestry, and other land use generate as much as 73% of Vanuatu's total greenhouse gas (GHG) emissions. However, the country's contributions to climate change are negligible, with absolute emissions contributing approximately 0.0016% to global emissions.
- **Vanuatu's NDC.** The country's NDC includes a goal to ensure that by 2030, the country's agricultural sector is still able to support household income and food security. Vanuatu also commits to have 100% of its electricity generated by renewable and sustainable sources by decade's end.
- **Sea level rise.** Satellite data indicates that the sea around Vanuatu has risen by about 6 millimetres (0.24 inches) per year since 1993.

FOOD SYSTEMS FACTS

- **Contribution to GDP.** Vanuatu's economy is primarily based on small-scale agriculture, which provides a livelihood for two-thirds of the population. Agriculture accounts for 20% of national GDP.
- **Food and culture.** Many ni-Vanuatu (the country's Indigenous Peoples) grow their own food on customary land, meaning they are mostly self-sufficient when it comes to food production. Food, land, and culture are deeply intertwined.
- **Fish as food.** As a coastal country, the fisheries sector is important for income generation and food production. Many of Vanuatu's poorer households rely on coastal fisheries as a subsistence food source.

LESSONS FOR CLIMATE ACTION PLANS

The Vanuatu Coastal Adaptation Project offers several lessons for NDCs:

- **NDC development process:** VCAP sought representation and involvement from national government, communities, and other stakeholders. The project was designed to build on community strengths and capabilities.
- **Content of the NDC:** VCAP demonstrates the need for “soft” climate adaptation measures (ecosystem-based solutions) to complement “hard” measures (infrastructure improvements, etc.). When coupled, these solutions promote food and water security and foster community economic development. Climate adaptation finance is vital to support those countries most impacted by climate change, including many Pacific Island nations.
- **Implementation of the NDC:** An overarching policy framework — in this case Vanuatu 2030 — unlocked philanthropic and multilateral investment that focused on capacity-building, disaster risk management, and climate adaptation measures. Achieving climate change resilience demands that governments take a holistic, comprehensive, and integrated approach.

Engagement with customary leadership (village chiefs) was crucial throughout all phases of VCAP, from project design to implementation.

KEY INSIGHTS

At the COP26 climate conference in November 2021, several Pacific Island countries came forward with a collective call for urgent climate action and adaptation financing. That included Vanuatu, an archipelago of 83 islands in the South Pacific Ocean.

“Every year and every degree brings the Pacific islands new levels of climate extremes and climate suffering,” said [Sumbue Antas](#), Permanent Representative to the United Nations Office in Geneva, in his address. The climate crisis, Antas explained, is “taking with it our livelihoods, our natural resources, our territorial integrity, our cultural identities, our human rights, and even our lives.”

Vanuatu has been identified as the country most vulnerable to climate change, and the crisis affects food and nutrition security in direct and indirect ways. In recognition of these threats and the deep connection ni-Vanuatu people have to their land, the environment is one of the pillars of [Vanuatu 2030](#), the country’s national sustainable development plan.

In recent years, adaptation measures have become an unfortunate necessity to ensure Vanuatu and its islands are prepared to face rising sea levels, natural disasters, and other climate risks. To that end, the Vanuatu Coastal Adaptation Project (VCAP) is focused on building climate resilience through improvements to long-term food security, sustained livelihoods, environmental resource protection, and infrastructure improvements.

The project was first launched in 2015 and is now [in its second phase](#). VCAP 2, as it’s called, will run between 2021–2026. It builds on the successes of Phase 1 and works on ecosystem conservation through

the establishment of terrestrial and marine protected areas (a “ridge to reef” approach) and implementing resource management plans in villages. Activities to prevent land degradation will also be supported by VCAP 2.

Both phases of VCAP have been supported by the United Nations Development Programme (UNDP) with international funding from the Global Environment Facility (GEF) and the Least Developed Country Fund (LDCF).

Vanuatu’s Ministry of Climate Change oversees the project at a national level and its activities are consistent with Vanuatu 2030 and the [Vanuatu Climate Change and Disaster Risk Reduction Policy](#).

COMMUNITY RESILIENCE THROUGH ADAPTATION

Climate change adaptation measures are vital to Vanuatu’s continued sustainable development and food security.

“The very diverse environment that once sustained our forefathers with great abundance and continues to play a central role in the livelihood of ni-Vanuatu has begun to change,” noted the late Edward Nipake Natapei, then Vanuatu’s Deputy Prime Minister, in the Preface of [Vanuatu’s National Adaptation Programme for Action](#) (NAPA, released in 2007). “Crops in subsistence gardens are showing signs of stress, prolonged and enhanced drought conditions are resulting in water shortages, rising sea levels are slowly eating away our shores.”

These challenges are coupled with the consumption demands of a growing population, the transition to a cash-based economy, and changing attitudes toward the environment.

In line with existing policies, VCAP’s interventions focus on 8 of the 19 adaptation strategies highlighted in NAPA, including:

1. **Agriculture and food security:** VCAP works to improve the preservation, processing, and marketing of foods, and to ensure fresh produce reaches the market quickly (reducing food loss). The project focuses on creating added-value products that bring greater economic value to producers. It also aims to improve agricultural practices using a blend of contemporary and traditional techniques.
2. **Resilient crop species, including traditional varieties:** VCAP promotes the planting of indigenous, nutrient-rich food crops that are more adapted to extreme climatic conditions. These activities are run in collaboration with the Department of Agriculture and Rural Development and the Department of Forestry, both housed in the national Ministry of Agriculture.
3. **Land-use planning and management:** Support for communities to develop more integrated land-use planning and the development of early warning systems for pests, diseases, and natural disasters.
4. **Water management policies and programs:** Community training and development programs centre on preserving soil organic matter and supporting rainwater harvesting.
5. **Community-based marine resource management programs:** Work with fishers and communities to protect sensitive coastal ecosystems (such as mangroves, reefs) through the use of contemporary and traditional fishing and aquaculture practices. Territorial ecosystems around watersheds are also protected.
6. **Mainstream climate change into human and ecosystem infrastructure design and planning:** Ensure transport, health, and other community infrastructure is climate-proof and resilient to the impacts of future climatic events.

7. **Sustainable livestock farming and management:** Training programs focus on animal husbandry, reducing animal disease, and mitigating the environmental impacts that can come from the mishandling of animal feces. In certain cases, community members are given improved livestock breeds that may fare better in a changing climate.
8. **Developing Integrated Coastal Zone Management programs:** Including the development of sustainable mangroves and coastal flora management plans in collaboration with local communities and leadership.

While all VCAP activities fall under these categories, inclusive community engagement is essential to the project's success. Traditional chiefs preside over the majority of areas where VCAP operates, and these communities are home to primarily Indigenous ni-Vanuatu Peoples. Village chiefs, leaders who continue to play an active role in ni-Vanuatu society, are the focal point for consultation, and community members are also engaged in groups large and small to identify local priorities and existing strengths.

The project also considers customary land and water management practices, such as the periodical closure of marine areas to enhance fish catch.³⁷ In learning from this Indigenous knowledge, VCAP aims to further enhance conservation value by introducing complementary means of planning, training, enforcement, and monitoring and evaluation.

For example, in Imale village on Vanuatu's Aniwa island, VCAP advanced income and food security by encouraging sustainable inshore fisheries practices and the conservation of marine resources. [Described](#) one community member, Challe Waiwai: "Our marine protected area has helped us to protect our reef and increase the quantity of fish and shellfish. Our marine resources are more plentiful now and the coral reef seems healthier."

VCAP also trains community members to oversee climate change adaptation activities, including those that enhance food and nutrition security. This includes planting climate-resilient crops and trees, monitoring fisheries, livestock rearing, and the supervision of community greenhouses for native fruit tree growth. To ensure lessons learned can be applied by other communities, all best practices from the project are documented and shared with local and national stakeholders in English, Bislama, and French, Vanuatu's official languages.

WHAT'S NEXT?

The second phase of VCAP has recently begun, and its impact has yet to be measured. However, with the successes of Phase 1, the next several years have a strong foundation to build on.

Regionally, the Government of Vanuatu plans to continue working alongside other Pacific islands to exchange knowledge and experiences related to sustainable development and climate change. One such engagement is with the Alliance of Small Island States, a climate change negotiations group made up of 51 islands that are particularly vulnerable to climate risk. Groups like AOSIS are a critical vehicle for island countries and states around the globe to speak up with a strong, unified voice.

Finally, though VCAP is already working at the intersection of climate change and food security, a [2020 study](#) deemed that more could be done to find innovative ways to increase the resilience and adaptive capacity of communities in such a way that also improves nutrition and health outcomes.

The example set by VCAP demonstrates how a national government-led initiative can effectively engage with its citizens to create locally relevant adaptation measures that tackle linked climate and food-security challenges.

SUMMARY OF IMPACTS ACHIEVED

New protected areas. Phase 1 of VCAP established at least eight coastal protected areas (mangroves, coral reefs) and two upland protected areas.

Early warning systems. All communities involved in VCAP are now receiving timely and accurate early warnings of coastal hazards, including floods, cyclones, and other natural disasters. This notification enables communities to prepare in advance for such emergencies.

Added infrastructure. VCAP Phase 1 included several infrastructure-related upgrades for communities, such as the installation of rainwater catchment and gravity-feed water systems. According to verbal reports from community members, the new footpaths and road improvements implemented by VCAP enabled people to better access essential services, including transporting food to market.

Monitoring local fisheries. Nine fisheries associations now have the knowledge and tools to monitor and evaluate their coastal fishery and other linked ecosystems. This data could be used to inform future interventions.

APPENDIX: METHODOLOGY

The Case Studies in this report were selected based on the following criteria:

1. **Geography:** The Case Studies represent the 14 countries examined in the Country Assessments, reflecting differing cultural perspectives and food pathways from 6 continents.
2. **Connection to existing frameworks:** Including the Global Alliance for the [Future of Food's Seven Calls to Action](#),³⁸ the Global Alliance's [Seven Principles](#) to shape our holistic vision of the food system, and Beacons of Hope: Accelerating Transformations to Sustainable Food Systems.
3. **Contribution to national climate targets:** Demonstrating how food systems can contribute to a country's climate mitigation or adaptation targets, as well as elements identified in the [NDC Assessment Framework](#).
4. **Scale:** Initiatives that operate at community, local, regional (city), national, and international levels.
5. **Impact measurement:** Priority was given to initiatives that measure their impact using quantitative data, qualitative data, lived experiences, or a combination of the three.

Each Case Study was written based on desk research and, in some cases, an interview with the key individual(s) involved in the implementation of the initiatives.

ENDNOTES

- 1 Also known as Intended Nationally Determined Contributions (INDC), NDCs are non-binding national plans that highlight domestic climate actions toward 2030. This includes climate-related targets for GHG emissions reductions, government policies and measures, and how a country intends to contribute to achieving the global targets outlined in the Paris Agreement.
- 2 “Enhanced” is often the term used to suggest that the next NDC revision should be more ambitious than the previous. Following COP26 in Glasgow, countries are encouraged to submit enhanced NDCs annually, starting in 2022.
- 3 A visualization from Our World in Data does an effective job at explaining this shortcoming and outlines the GHG emissions that result from food and agriculture: <https://ourworldindata.org/food-ghg-emissions>.
- 4 The World Health Organization identified five food–health impact pathways in its July 2021 report “Food Systems Delivering Better Health,” which can be read [here](#).
- 5 A Just Transition seeks to ensure the benefits that come from a food systems transformation are shared widely, while also supporting those who stand to lose economically — be them countries, regions, industries, communities, workers, or other community members.
- 6 For analysis of how effectively Bangladesh has integrated food systems in its NDC climate action plan, see the Global Alliance’s Country Assessment: https://futureoffood.org/case_studies/bangladesh/.
- 7 The growth of aquaculture in Bangladesh has led to a decline in fish diversity, with little consideration for the nutritional quality of fish. See <https://thefishsite.com/articles/aquaculture-to-combat-undernutrition-in-bangladesh>.
- 8 For analysis of how effectively Canada has integrated food systems in its NDC climate action plan, see the Global Alliance’s Country Assessment: https://futureoffood.org/case_studies/canada/.
- 9 The name refers to the responsibility healthcare institutions have to anchor well-being in their communities.
- 10 See <http://agfep.cau.edu.cn/module/download/downloadfile.jsp?classid=0&filename=2105141928327359.pdf>.
- 11 For analysis of how effectively China has integrated food systems in its NDC climate action plan, see the Global Alliance’s Country Assessment: https://futureoffood.org/case_studies/china.
- 12 Per capita consumption of meat in China is still lower than in many countries, including the United States, Australia, and Argentina. These countries have the highest average total meat supply per person, per annum. The average Chinese consumes 60.69 kilograms (133 pounds) of meat each year, while the average American consumes more than double that — 124.1 kilograms (273.6 pounds) in the same 12-month period.
- 13 For analysis of how effectively Colombia has integrated food systems in its NDC climate action plan, see the Global Alliance’s Country Assessment: https://futureoffood.org/case_studies/colombia/.
- 14 More information can be found on the U.K. Government website: <https://www.gov.uk/government/publications/climate-finance-accelerator/climate-finance-accelerator>.
- 15 POTA is the acronym for “*Plan de ordenamiento Territorial Agropecuario de Antioquia*.”
- 16 Biodynamic agriculture is similar to organic agriculture in that it is “a holistic, ecological, and ethical approach to farming, gardening, food, and nutrition.” To this, biodynamic agriculture adds spiritual and astrological perspectives. A principle of biodynamic agriculture is to acknowledge the symbiosis between all living things. It also utilizes “biodynamic preparations” (a combination of natural medicinal herbs and other organic materials) to enhance soil health. The Biodynamic Association website is a helpful resource for those looking to learn more: <https://www.biodynamics.com/biodynamic-principles-and-practices>.
- 17 Pivot irrigation is a method of crop irrigation where water sprinklers rotate around a centre pivot-point.
- 18 For analysis of how effectively France has integrated food systems in its National Energy and Climate Plan, see the Global Alliance’s Country Assessment: https://futureoffood.org/case_studies/france/.
- 19 In France, a metropolis is an administrative entity made up of several towns. The Dijon metropolis is centred around the city of Dijon.
- 20 The initiative is called “*Alimentation Durable 2030*” in French.
- 21 Dijon was shortlisted as one of four finalists for the 2022 European Green Capital Awards.
- 22 For analysis of how effectively Germany has integrated food systems in its National Energy and Climate Plan, see the Global Alliance’s Country Assessment: https://futureoffood.org/case_studies/germany/.
- 23 Nuremberg’s public procurement practice focus is inspired by the Copenhagen House of Food initiative. In 2007, the Danish capital committed to stocking its public kitchens with 90% organic products by 2015. As an outcome, the project directed public spending toward developing the

country's organic food sector and improved the healthiness of meals served in public kitchens. An upcoming Global Alliance for the Future of Food [Beacons of Hope](#) story focuses on the inspiring example set by the Danish city.

- 24 *Programme National de Biogaz domestique du Sénégal* in French.
- 25 For analysis of how effectively Senegal has integrated food systems in its NDC climate action plan, see the Global Alliance's Country Assessment: https://futureoffood.org/case_studies/senegal.
- 26 Read more about the expected outcomes from Phase 2 of PNB-SN [here](#).
- 27 For analysis of how effectively South Africa has integrated food systems in its NDC climate action plan, see the Global Alliance's Country Assessment: https://futureoffood.org/case_studies/south-africa.
- 28 For analysis of how effectively Spain has integrated food systems in its National Integrated Energy and Climate Plans, see the Global Alliance's Country Assessment: https://futureoffood.org/case_studies/spain.
- 29 The planetary health diet is a global reference diet based on the findings from the EAT-*Lancet* Commission on Healthy Diets from Sustainable Food Systems. It was released in 2019 and is a central component of the C40 Good Food Cities declaration.
- 30 For further information, see [The Barcelona Challenge's methodology](#).
- 31 According to city data, food and drink consumption in Barcelona generated 2.5 million tons of CO₂e in 2021. See: https://www.barcelona.cat/infobarcelona/en/food-consumption-in-the-city-generates-2-5-million-tonnes-of-co2-a-year_1117827.html.
- 32 For analysis of how effectively the United Kingdom has integrated food systems in its NDC climate action plan, see the Global Alliance's Country Assessment: https://futureoffood.org/case_studies/united-kingdom/.
- 33 These are meals provided by the government for children and families who meet a certain eligibility criteria: <https://www.gov.uk/apply-free-school-meals>.
- 34 Interestingly, the National Food Strategy also outlines the “hidden cost of carbon” for a number of commonly purchased foods, reflecting a [True Cost Accounting](#) approach to its analysis.
- 35 For analysis of how effectively the U.S. has integrated food systems in its NDC climate action plan, see the Global Alliance's Country Assessment: https://futureoffood.org/case_studies/united-states/.
- 36 The 2016 “Roadmap to Reduce U.S. Food Waste by 20 Percent” can be found here: https://refed.org/downloads/Foundation_Action_Paper_Web.pdf.
- 37 These temporarily closed areas are called *tabu* by ni-Vanuatu communities.
- 38 Released in 2021, the “7 Calls to Action” touch on all priority aspects of food systems transformation. These interconnected statements were shaped by the Global Alliance's research, various convenings and international dialogues, and perspectives shared by members and partners since 2012.

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ABOUT THE GLOBAL ALLIANCE FOR THE FUTURE OF FOOD



The Global Alliance is a strategic alliance of philanthropic foundations working together and with others to transform global food systems now and for future generations. We believe in the urgency of transforming global food systems and in the power of partnership to effect positive change. Food systems transformation requires new and better solutions at all scales through a systems-level approach and deep collaboration among philanthropy, researchers, grassroots movements, the private sector, farmers and food systems workers, Indigenous Peoples, government, and policymakers.

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