Compendium of Country Case Studies: Accelerating Transition to Sustainable Agriculture

Just Rural Transition

UN CLIMATE CHANGE CONFERENCE UK 2021
IN PARTNERSHIP WITH ITALY

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Foreword

Agriculture is essential for so many reasons – for food, for livelihoods, for our economies. But it is also the second main driver of climate change after energy, and by far the biggest driver of biodiversity loss and environmental degradation. Although we have delivered miraculous increases in food productivity over the past few decades, we have done so at the expense of future generations, and without very serious change we risk undermining our ability to sustain ourselves.

We therefore urgently need to deliver an ambitious global transition to sustainable, climate resilient agriculture that protects the natural ecosystems we all depend on, and which in turn allows agriculture to thrive to produce nutritious food and livelihoods for our children, their children and the generations to come.

The challenge is complex and many different actions will be needed, but government policies and support are one of the most powerful levers we have.

Globally, countries spend over $700bn a year of public funds in support of agriculture. Only 6% is explicitly used to address the challenges of climate change or biodiversity loss, with a further 6% going on public goods such as research and innovation. This means there is enormous potential to rethink and redirect public policies and support to move away from harmful practices towards creating incentives for sustainable agriculture and food systems.

As Nature lead for the UK's COP Presidency, I have been greatly heartened to see Ministers coming forward to engage in an open and collaborative spirit on how we can all best address this challenge in the COP26 Policy Dialogue to Accelerate Transition to Sustainable Agriculture.

I also greatly appreciate the efforts made by several countries to share their experiences by authoring their own case studies in this Compendium.

The studies are organised in chapters aligned to specific themes of the dialogue, whilst research, development and innovation is a cross-cutting issue throughout the Compendium.

- The Building Resilience chapter brings experience from some of the most vulnerable countries to climate change, on redirecting policies and support to help farmers adapt, and to increase food security.
- The Farmers as Stewards of Nature case studies illustrate policies that enable and reward farmers to protect and restore natural resources.
- The Ambition to Action chapter highlights policy reforms to reduce emissions and improve environmental outcomes, at the same time as increasing productivity and food security and supporting healthy diets.

The Compendium highlights a rich diversity of pathways to accelerating the shift to sustainable agriculture.

It illustrates the need for state-led action, farmer-led innovation and international collaboration to ensure change is achieved at the pace and scale needed.

Many thanks to all countries who have contributed to this valuable resource.

Rt Hon Lord Goldsmith, Minister of State for Foreign, Commonwealth & Development Office (FCDO) and the Department for Environment, Food and Rural Affairs (Defra)

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PREFACE | CHAIR'S SUMMARY

Initial country case studies for this Compendium were contributed through the COP26 Policy Dialogue on Accelerating Transition to Sustainable Agriculture. Please find the Chairs' Summary below.

COP26 Policy Dialogue on Accelerating Transition to Sustainable Agriculture through Redirecting Public Policies and Support and Scaling Innovation

The Policy Dialogue on Accelerating Transition to Sustainable Agriculture was co-convened by the UK as incoming COP Presidency and by the World Bank. Its intent was to catalyse efforts to deliver the global transformation in agriculture and land use so urgently needed to tackle climate change, to produce nutritious food, to support jobs and economic growth, and to protect our planet.

Launched in April 2021, 34 countries participated in the period up to COP26 either at Ministerial and, or senior technical levels, mainly through Ministries of Agriculture. Participating countries and representative institutions include: African Union, Angola, Brazil, Colombia, Costa Rica, European Commission, Ethiopia, Germany, Ghana, India, Indonesia, Italy, Japan, Jordan, Madagascar, Malawi, Morocco, Mozambique, Netherlands, New Zealand, Nigeria, Philippines, Sierra Leone, South Africa, Spain, Switzerland, UEA, Uganda, UK, USA, Uzbekistan, Vietnam, Zambia and Zimbabwe.

In joining this Policy Dialogue, participants recognised the importance of agriculture in producing food and providing livelihoods for billions of people across the world, as well as a major economic sector. At the same time, agriculture is the second main driver of greenhouse gas emissions after energy and the major cause of biodiversity loss, which in turn undermines food systems, and poses risks for farmers, communities and economies.

Participants agreed that there is an urgent need and potential for transformation in agriculture and food systems.

Globally, countries provide over USD 700 billion per year in support to their agriculture sectors whether through subsidies, market price supports or other mechanisms.

Through the Policy Dialogue, participants shared evidence and experiences on designing and implementing public policies and support to re-shape agricultural practices and investments. This included both the challenges and the opportunities of redirecting public finance, and also the trade-offs involved in changing policy to incentivise and support farmers and businesses to invest in sustainable, resilient agriculture.

There was discussion of new approaches to research, development and innovation to help catalyse the needed transition to sustainable food systems.

Participants also highlighted the importance of partnerships for action; between governments and other national stakeholders and through government-to-government collaboration.

Experiences shared through the Policy Dialogue suggest that action is needed at multiple levels: on policy design and implementation; exchange of knowledge, information and tools; coordinated research to identify and develop effective approaches and technologies; support for farmers to develop, adopt and take effective practices to scale; and to develop a shared understanding of 'sustainable agriculture', how to assess this and how to integrate it into markets.

The Dialogues covered a range of topics, summarised below:

Farmers as stewards of nature: Government policies can create incentives and support to help farmers invest in sustainable land use. With this aim, some countries have introduced payment for ecosystems services and others are redirecting policies and support towards schemes that reward farmers for protecting or restoring the environment, reducing emissions and increasing carbon sequestration.

Some countries are adopting an integrated landscape approach, including recognition of tenure rights, to improve the sustainability of agricultural practices. It was noted that international markets play a significant role, where consumer demand for sustainable products and a fair price to farmers can enable sustainable production of food crops and agricultural commodities such as soya and palm oil.

Research and innovation: Increasing productivity whilst limiting land use (preventing deforestation or agriculture expansion onto other fragile ecosystems), reversing harm to the environment and increasing carbon sequestration will all be needed to deliver sustainable food systems.

Investment will be needed in new technologies or practices, according to local context. For instance, this could be to scale up agro-ecological approaches or to reduce emissions from livestock.

Government support may be needed to promote and scale farmer-led innovations appropriate to local context and needs.

Collaboration and partnerships including public-private partnerships are key to increase investment in innovation at scale; to catalyse private investment; to ensure farmers are heard and help to shape innovation; to build consensus and to identify effective approaches to scale up what works.

Ambition to Action: Building a shared understanding of why we need sustainable agriculture and opportunities to get there is critical for the transition. This includes engaging with farmers, businesses and other stakeholders.

Stakeholder consultations including with farmers and other key players are helping governments to formulate and secure buy-in to new policies, for instance to decarbonise agriculture and adapt to climate change, whilst ensuring productivity for food and economic benefits. Cross-government approaches, building consensus with farmers and setting ambitious targets can help to accelerate change.

Consumer choices are instrumental in deciding what gets produced and need to be considered in policy reforms.

Measuring and monitoring progress, for instance on emissions reduction, are needed to keep actions on track.

Forward Look

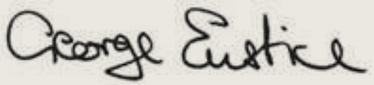
Rich experiences shared through the Policy Dialogue are reflected in a growing **Compendium of Country Case Studies.** Interested lead countries have each contributed a policy briefing note that reflects on policy actions taken to advance the transition to sustainable agriculture. This online Compendium will be launched at COP26 and provides a living platform for further sharing. To date, contributing countries include: Brazil, Colombia, Costa Rica, Ghana, Germany, India, Italy, Japan, Jordan, Malawi, Morocco, Netherlands, New Zealand, Sierra Leone, Switzerland, UK, US and Vietnam.

Experience shared through the Policy Dialogue has led to the development of a **Policy Action Agenda (PAA)**. This is a non-prescriptive framework for action, to guide governments and other stakeholders in finding pathways to sustainable agriculture. It provides a working definition of sustainable agriculture and, drawing on contributions to the Policy Dialogue, it illustrates the type of actions that governments and others can take.

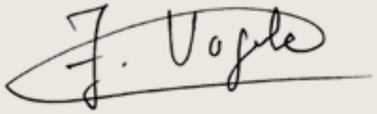
In endorsing the PAA, stakeholders commit to progress a just transition to sustainable agriculture, through appropriate policies, investments and support according to their context and mandate.

The PAA is further supported by a Global Action Agenda on **Transforming Agricultural Innovation** which provides a joint vision, objectives and a set of joint research priorities.

The Policy Dialogue – both as an independent channel and through other, existing fora – will continue to provide a platform beyond COP26 to share knowledge and experience, to build partnerships and to collaborate as we jointly seek to resolve policy and practice related issues as well as other barriers to sustainable agriculture.



Rt Hon George Eustice, Secretary of State for Environment Food and Rural Affairs, United Kingdom



Dr. Juergen Voegele, Vice President, Sustainable Development Practice Group, World Bank

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Ambition to Action

Repurposing direct payments to transform Switzerland's agricultural sector

A SUMMARY OF PROGRESS SINCE 1992

Swiss Federal Office for Agriculture (FOAG)

Background information

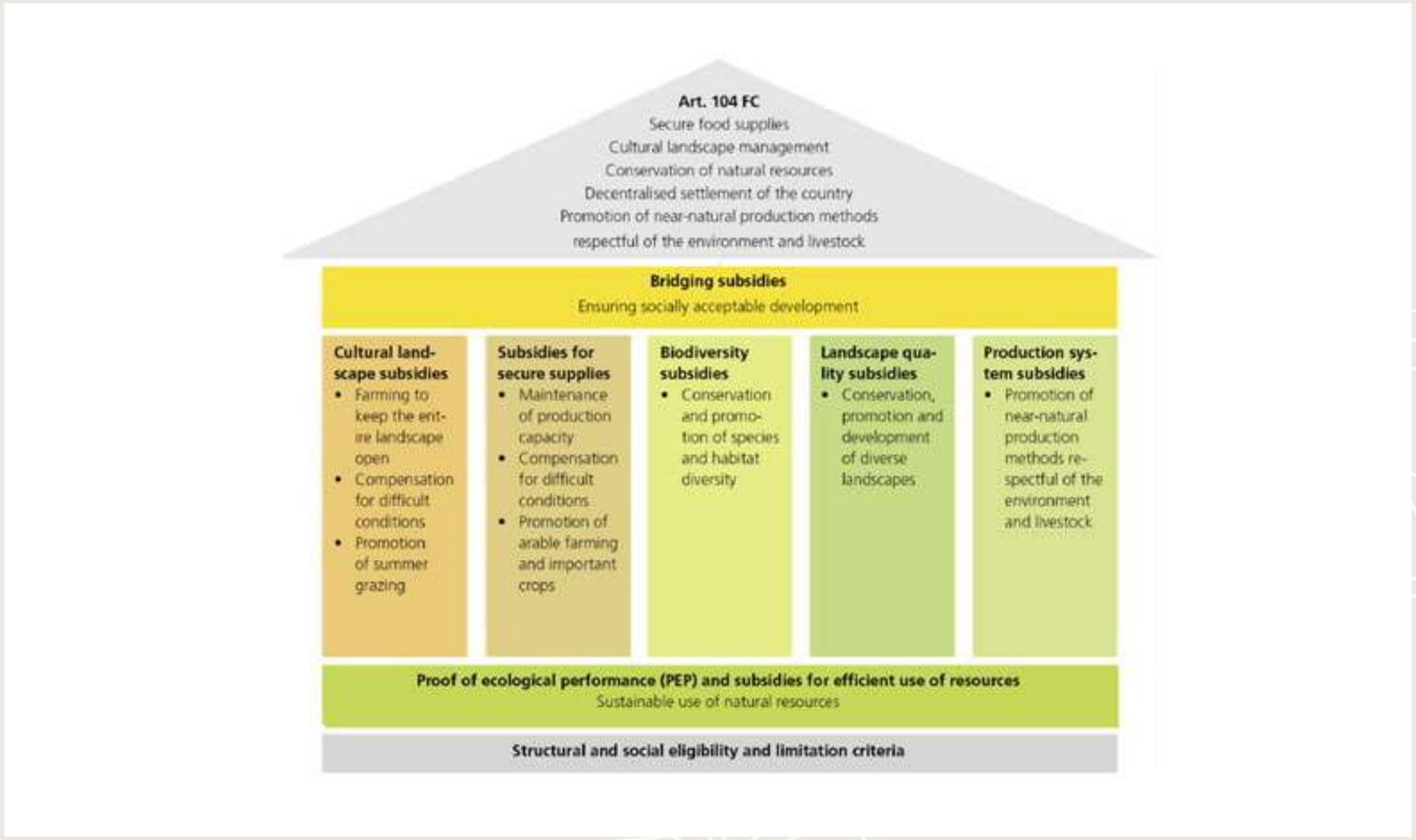
In the Swiss Constitution, Article 104 on Agriculture asks the Confederation to ensure that the agricultural sector not only makes an essential contribution towards the reliable provision of food for the population, but also contributes to a number of cross-cutting outcomes, such as the conservation of natural resources, the maintenance of Switzerland's cultural landscape, and support for rural communities. These public services and public goods are achieved through the use of repurposed direct payments.

Farmers are required to meet a number of requirements **(Art. 70a AgricA)** in order to receive these direct payments, including proof of ecological performance (PEP). PEP comprises: criteria on fertiliser usage, land for biodiversity quotas, appropriate livestock conditions, crop rotation, soil protection, and restrictions on plant protection products.

> **" Switzerland has been taking gradual steps to repurpose traditional support to farmers, for better environmental outcomes. "**

A Step by Step reform process since 1992

Switzerland has undertaken a step-wise reform process since 1992, making gradual changes to repurpose traditional agricultural support. Environmental cross-compliance requirements were introduced in 1999 as part of the Agricultural Policy (AP) reform programme that ran from 1999-2003. Since then, a significant proportion of agricultural support has been subject to environmental requirements.



Swiss Federal Office for Agriculture (FOAG)

Year	Main Amendments[1]
1992	• Introduction of direct payments: decoupling price from income policy
1996	• New constitutional basis **(Art.104 Cst)**
1999	**AP 2002:** • Removal of state price and purchase guarantees • Introduction of proof of ecological performance as direct payment condition
2004	**AP 2007:** • Gradual abolition of the milk quota system (until 2009) • Introduction of auctioning for the distribution of meat tariff quotas
2007	**AP 2011:** • Abolition of export subsidies for primary agricultural products • Shift from market support funding to direct payments • Reduction of border levies for bread grain and animal feed
2014	**AP 2014-17, extended to 2021** • Greater focus of direct payment on Art.104 Cst • Strengthening the instruments for implementing the quality strategy • 2019: elimination of export subsidies on processed agricultural products
2017	• New article on food security in the Swiss Constitution **(Art.104a Cst)**

In particular, four steps have proved especially successful in Switzerland: (i) proof of ecological performance (PEP); (ii) instruments to reduce biodiversity loss and its maintenance and promotion **(Art. 73 AgricA)**; (iii) landscape management and conservation policies **(Art. 74 AgricA)**; and (iv) efforts to promote environmentally friendly types of production systems and animal welfare **(Art.75 AgricA)**.

Switzerland requires inclusive and consultative policymaking processes when making any amendments to laws and regulations. As such, in designing these policy reforms to agriculture, Switzerland adopted a multi-stakeholder approach as early as possible in the drafting stage.

Recent challenges for future developments of the Agricultural Policy

While Switzerland made significant progress during 1992-2003, progress since 2014 has been modest. Reforming the current system to make additional progress has been challenging. On 12 February 2020, the Federal Council proposed a revision to the current agriculture law (AP 22+). The proposed amendment would have enabled Swiss agriculture to be more sustainable, increase its added value on the market, improve the efficiency of operations, and ensure that the environmental impact and consumption of non-renewable resources were further reduced within the sector.

However, a significant counterargument purported that it would decrease Switzerland's self-sufficiency and create additional administrative burden, and ultimately the reform process in Parliament was blocked. In parallel to this process, progressive and predominantly urban voices in the country started a number of popular initiatives demanding change in the sector. They include, for example, "For clean drinking water" (January 2018), "For a Switzerland free of synthetic pesticides" (May 2018) and "No Intensive Farming in Switzerland" (2019, against large-scale livestock production). The gap between Parliament and civil society increased and created additional challenges to find widely accepted solutions.

The first two initiatives, on water and synthetic pesticides, were rejected by the Swiss population in a referendum in June 2021. Nevertheless, the Parliament did modify legislation in order to reduce the risks linked to the use of pesticides (by 50% by 2027), and to reduce nitrogen and phosphorus losses in agriculture (by at least 20% by 2030 compared to the average value for the years 2014 to 2016).

Looking toward the future of Switzerland's agricultural policy, the Federal Council is now required by both chambers of Parliament to submit a **report on the future direction of agricultural policy** to Parliament by the end of 2022.

1. For a more detailed overview of the agricultural policy trends in Switzerland, see Table 25.2 - OECD (2021), "Switzerland", in Agricultural Policy Monitoring and Evaluation 2021: Addressing the Challenges Facing Food Systems, OECD Publishing, Paris, https://doi.org/10.1787/747b1303-en.

Taking lessons from previously-faced challenges, Switzerland can stipulate that it is crucial that agricultural policy is an iterative reform process based on consensus and a widely accepted, long-term strategy. Indeed, a number of years without reform will only increase the gap between progressive and conservative camps that could lead to further blocks to development.

Switzerland's recent experience in aligning government policies

In June 2021, the Federal Council adopted **the 2030 Sustainable Development Strategy** (2030 SDS) and an Action Plan for the period 2021–2023. The 2030 SDS defines three priority issues: i) sustainable consumption and production; ii) climate, energy and biodiversity; and iii) equal opportunities and social cohesion.

This initiative to break down silos and promote further coherence between sectoral policies is a first step towards a more systemic approach. The 2030 SDS sets out how Switzerland intends to implement the 2030 Agenda for Sustainable Development over the next nine years.

The strategy highlights the need for a whole food systems transformation, targeting action on sustainable consumption and production through the following objectives:

- On the basis of environmental accounting, the carbon footprint from final per capita food demand declines by one quarter compared to 2020.
- The proportion of the population consuming a healthy, balanced and sustainable diet in line with the recommendations of the food pyramid will increase by one third.
- Avoidable food loss and waste per capita (all along the value chain up to and including the consumption stage) will be reduced by 50% per capita.
- The proportion of farms whose production methods demonstrably exceed the ecological services requirements will increase by a third compared to 2020

The 2021-2023 Action Plan complements existing federal strategies and instruments with targeted measures in areas where gaps or the need for further cross-sectoral collaboration have been identified. It is comprised of 22 measures, including stakeholder dialogues for sustainable food systems, the reduction of food loss and waste, and an update on the Climate Strategy for Agriculture. Details can be found here.

" Taking a system-wide approach, the 2030 Sustainable Development Strategy will reduce emissions from food by 25% and cut food waste by 50%. "

Long-Term Climate Strategy

On 27 January 2021, the Federal Council adopted the Long-Term Climate Strategy for Switzerland, which sets out climate policy guidelines up to 2050 in order to achieve the country's net zero target. Similar to the development of the 2030 Sustainable Development Strategy, Switzerland is developing a sectoral climate strategy that considers the climate impact of agriculture in the context of the entire food system and contains similar elements to the SDS 2030 but with a longer time horizon, namely 2050.

Swiss Federal Office for Agriculture (FOAG)

Making the transition to sustainable, resilient and low carbon agriculture in Brazil

THE ABC+ PLAN

Brazil Ministry of Agriculture, Livestock and Supply (MAPA)

Brazil Ministry of Agriculture, Livestock and Supply (MAPA)

Context for ABC+ and Brazil's agricultural policy

In 2009 Brazil made a voluntary commitment to combat climate change through reforms to agriculture and cattle rearing. In this context, in 2010 the ABC Plan was created, led by the Ministry of Agriculture, Livestock and Supply (MAPA), with a focus on consolidating low-carbon agriculture.

The sector committed to promoting the scale up, over 10 years, of 6 decarbonising technologies (direct planting systems, biological nitrogen fixation, planted forest, recovery of degraded pastures, integration of crop-livestock-forest in their different combinations, and treatment of animal waste), which have brought greater income, productivity and resilience to the sustainable technologies and production systems in an extension of 35 million hectares. The initial mitigation estimate was 132 to 162 million tonnes of CO2 equivalent.

From 2010 to 2020, Brazilian producers implemented the above technologies on 52 million hectares, which is equivalent to more than twice the area of the United Kingdom, surpassing the target by 46.5%. In addition, 170 million tons of CO2 equivalent were mitigated, overcoming the original target.

In 2021 MAPA made public its strategy for ABC+, a new phase of the ABC Plan to 2030. One of its main innovations is the integrated landscape approach (ILA), consolidating a gradual transition over the last decade that makes it possible to combine both conservation and production.

ABC+ also brings a continuous introduction flow of new sustainable technologies and production systems, stimulating the incorporation of technological innovation.

Challenges for ABC+ in the decade ahead

- Applying ABC+ throughout the national territory, in the 6 biomes, and in all 27 Federative Units, taking into account the particularities of each reality.
- Fostering technology transfer with the training of technicians and extensionists as well as technical assistance to support rural producers in the adoption and maintenance of the sustainable technologies and production systems.
- Supporting research, development and innovation with a focus on continuous improvement of ABC+ Sustainable Technologies and Production Systems, based on the best available science.
- Strengthening the governance, monitoring and evaluation of ABC+, as well as promoting the valuation and recognition of producers who adopt sustainable technologies and production systems.

Expected benefits from ABC+

- With a strong technical-scientific basis, in addition to mitigation, ABC+ will promote more resilient, more productive and more competitive food systems.
- The new target, in area expansion, will be 72 million hectares, an increase of 103% compared to the first phase.
- In addition to a strong look at contributions in terms of adaptation, ABC+ will also bring individual mitigation potential to the fostered sustainable technologies and production systems.
- The integrated landscape approach, in addition to encouraging environmental regulation and compliance with the Forest Code, will promote territorial ordering and encourage the preservation of biodiversity on the property, in the region and in the hydrographic basins.

“ From 2010 to 2020, Brazilian producers implemented decarbonising technologies across 52 million hectares of land, equivalent to more than twice the area of the United Kingdom. This led to mitigation of 170 million tons of CO_2 equivalent, surpassing the original target. ”

The costs of inaction

- Tropical agriculture will be greatly impacted by global warming, with a high risk to food production and food insecurity.
- Producers will be more vulnerable to changes in climate and extreme events, which are likely to intensify, with social and economic consequences.
- Degraded pastures emit greenhouse gases and have low production capacity.

How can ABC+ help producers?

- ABC+ will foster the appreciation and recognition of products and producers that use ABC+ technologies, with opportunities for new markets and products.
- ILA encourages environmental and land tenure regularisation.
- ABC+ promotes diversification in the territory and the property.
- The ABC Programme 2020-21, the Public Policy financial arm, offered BRL 10 billion (USD 1.8 billion) in credit for producers to implement ABC+ on their property, with differentiated interest and grace periods.

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Brazil Ministry of Agriculture, Livestock and Supply (MAPA)

Reducing nitrogen emissions in the Netherlands

THE CONVERTING TO SUSTAINABLE AGRICULTURE PROGRAMME

The Netherlands Ministry of Agriculture, Nature and Food Quality

As part of measures to reduce nitrogen emissions, the Ministry of Agriculture, Nature and Food Quality has allocated EUR 175 million for the Converting to Sustainable Agriculture Programme. Finance is often a problem for farmers and growers who want to convert to a form of agriculture that is more sustainable and extensive and uses fewer nitrogen inputs. By supporting farmers to get access to finance, the programme will encourage and support farmers and growers to accelerate the transition to more sustainable or extensive agriculture. The programme comprises an Investment Fund, a grant scheme to support the drafting of a conversion plan, a grant scheme for starting a demonstration farm, and a loan guarantee scheme for working capital. The Investment Fund was launched in July 2021 and the two grant schemes will be launched in November 2021. The loan guarantee scheme will come into effect later this year.

Converting to sustainable production methods is not easy and often requires investment upfront – in operational processes and in the development of new products and product concepts – before there can be any expectation of a return. Getting finance for all this is often a struggle, as conventional financiers are generally hesitant to finance the conversion to more sustainable production methods.

They consider that there is insufficient evidence for the profitability of investments in more sustainable operations, processes, production methods and new products or product concepts. As a result, they tend to attribute a higher risk profile – arguably too high – to these activities. Another difficulty is that new systems require a lead time before achieving optimum performance, while the costs of conversion are not immediately offset by higher returns on sustainably produced products. For instance, farmers who convert to organic agriculture may not market their products as organic until several years have passed. A producer in the process of conversion must also take account of unexpected financial setbacks, which could result in acute liquidity or continuity problems for the business.

"The EUR 75 million Converting to Sustainable Agriculture Programme will improve access to finance for farmers to support the transition to sustainable practices through an Investment Fund, grants schemes for initial start-up activities, and a loan guarantee scheme for working capital."

In order to do justice to the diversity within agricultural sectors and regions, and to give scope to the enterprising spirit of individual producers, the Converting to Sustainable Agriculture programme is designed around objectives, rather than measures. In their conversion plans, producers applying for financial support must specify how exactly the conversion will contribute to these objectives, which relate to, for instance, nitrogen emissions, climate action, biodiversity and animal welfare. The programme thus delivers a comprehensive contribution both to solving the problem of excess nitrogen deposition and to the other transitions that need to be made in the agricultural and horticultural sectors. The excess nitrogen issue is closely connected with these other transitions, so the solution to this problem must be part of a comprehensive approach that also addresses greenhouse gas emissions, for instance.

The Investment Fund is designed so that banks also cover a share (60%) of the required investment. In other words, private parties also commit to the producer's conversion plan. The Investment Fund is a revolving fund, providing producers with subordinated loans. As they are repaid over time, that money can be used in turn to help other businesses.

The difficulty with this instrument, however, is the complexity of monitoring the ultimate gains in sustainability produced by the conversion at farm level. Good indicators to measure the progress with and effects of conversion are lacking for some sustainability goals. In other words, a producer's conversion plan is assessed beforehand, but establishing the results post-conversion is complex.

In the case of the Investment Fund, an expert committee assesses whether the plans submitted make a sufficiently large, comprehensive contribution to the achievement of the fund's various goals. This assessment is based on science as well as knowledge of farming practice.

The committee has already approved a number of plans submitted to the Investment Fund, and financing for these first applications will be issued shortly. By using public funding to attract much more private finance, the Fund enables the implementation of sustainability plans.

Climate solutions for American producers, landowners, and communities

LEVERAGING CONSERVATION AND INNOVATION TO ADVANCE CLIMATE-SMART AGRICULTURE AND FORESTRY

US Department of Agriculture (USDA)

Climate change poses a significant risk to US agricultural production, forest resources, and rural economies. The US Department of Agriculture (USDA) is responsible for federal efforts to support private farm and forest landowners and resource managers as they implement climate solutions. USDA is developing a comprehensive strategy centered on voluntary incentives that is inclusive of all agricultural producers, landowners, and communities. This strategy is supported by two reports which were released earlier this year: the **90-Day Progress Report on Climate-Smart Agriculture and Forestry** was published in May 2021 and **USDA's Action Plan for Climate Adaptation and Resilience** was published on 7 October 2021.

USDA offers an array of tools, programmes, and resources for producers that support sustainable productivity growth while providing climate mitigation opportunities and building resilience to the impacts of climate change. This case study provides examples of how USDA is leveraging conservation and innovation to advance climate-smart agriculture and forestry.

Climate-smart agriculture and forestry partnership initiative

On 29 September 2021, USDA announced a new initiative to finance the deployment of climate-smart farming and forestry practices to aid in the marketing of climate-smart agricultural commodities. Guided by science, USDA will support a set of pilot projects that provide incentives to implement climate-smart conservation practices on working lands and to quantify and monitor the carbon and greenhouse gas benefits associated with those practices through the supply chain. The Department published a **Request for Information** seeking public comment and input on design of this new initiative, which is slated for implementation later this year.

Delivering climate solutions through USDA conservation programmes

Within USDA's current suite of conservation and working lands programmes there are multiple opportunities to target climate outcomes by leveraging voluntary incentives. USDA's strategy is to strengthen the ability of these programmes to deliver climate benefits alongside other environmental and economic benefits. Since January 2021, USDA has made a number of updates to these programmes, including:

Environmental Quality Incentives Programme (EQIP): In 2021, USDA is providing USD 10 million in a pilot programme to support climate-smart agriculture and forestry through voluntary conservation practices in 10 targeted states. This new assistance, available through the Natural Resources Conservation Service (NRCS), will help agricultural producers plan and implement voluntary conservation practices that sequester carbon, reduce greenhouse gas emissions, and build

resilience to the impacts of climate change on working lands. This pilot will be expanded through a comprehensive effort across all states and programmes to support farmers, ranchers, and forest landowners in fiscal year 2022.

Conservation Reserve Programme (CRP): USDA's Farm Service Agency (FSA) has deployed several updates to CRP which bolster programme effectiveness and target climate outcomes. CRP is one of the world's largest voluntary land conservation programmes with a long track record of preserving topsoil, sequestering carbon, and reducing nitrogen runoff, as well providing healthy habitats for wildlife. In exchange for a yearly rental payment, farmers enrolled in the programme agree to remove environmentally sensitive land from agricultural production for 10 to 15 years and instead plant species that will improve environmental health and quality. Updates to CRP in 2021 include higher payment rates, new incentives, a targeted focus on greenhouse gas emissions reductions and carbon sequestration, and a new initiative aimed at better quantifying CRP's climate benefits.

Pandemic Cover Crop Programme: To help farmers maintain their cover crop systems despite financial challenges posed by the pandemic, USDA's Risk Management Agency issued a USD 5 per acre premium support for producers who planted a qualifying cover crop. This benefit was available for most producers across the US who had existing crop insurance coverage. The programme successfully enrolled 14 million acres of cover crops, resulting in USD 58 million in premium reductions for producers to date.

Regional Conservation Partnership Programme (RCPP): Through the RCPP, NRCS is investing USD 330 million in 85 locally driven, public-private partnerships to address climate change, improve the nation's water quality, combat drought, enhance soil health, support wildlife habitat, and protect agricultural viability. An additional USD 75 million has been invested in RCPP Alternative Funding Arrangements focused on climate-smart agriculture and forestry and conservation priorities, and improving access for historically underserved producers.

Conservation Innovation Grants (CIG) Programme: NRCS has invested USD 15 million to support the development of new tools, approaches, practices, and technologies to further natural resource conservation with a focus on climate-smart strategies, and USD 25 million for On-Farm Conservation Innovation Trials.

Harnessing the nation's forest resources

USDA's US Forest Service (USFS) aims to increase the carbon sequestration potential of forests on public and private land across the United States, while maintaining other valuable ecosystem services, adopting climate-adaptive management practices, and reducing the risk of severe wildfire. Since January 2021, USFS has invested:

- USD 285 million in improving national forest and grassland infrastructure through the National Parks and Public Land Legacy Restoration Fund
- USD 218 million to fund Great American Outdoors Act projects that conserve critical forest and wetland habitat, support rural economic recovery, and increase public access to national forests and grasslands
- USD 15 million in grants to develop and expand the use of wood products, strengthen emerging wood energy markets and protect community forests

USDA's Forest Service will continue to implement a climate-smart strategy that increases the rate of fuels reduction to decrease the risk of severe wildfire, increases the rate of reforestation, expands the use of agroforestry, promotes the use of sustainable forest products, and supports applied forest research to inform climate-smart management.

> **"NRCS is investing USD 330 million in 85 public-private partnerships to address climate change, improve water quality, combat drought, enhance soil health, support wildlife habitats, and protect agricultural viability. An additional USD 75 million has gone towards climate-smart agriculture, forestry and conservation priorities, and improving access for historically underserved producers."**

USDA's Climate Hubs

The **USDA Climate Hubs** deliver science-based, region-specific information and technologies in partnership with USDA agencies and partners to enable climate-informed decision making, reduce agricultural risk, and build resilience to climate change. The Climate Hubs translate climate science to action to ensure producers and land managers have useful and actionable information about climate change and its impacts to support adaptation, mitigation and resilience efforts. The Climate Hubs provide (1) tools, technologies, and resources, (2) regional assessments of risk and vulnerability, and (3) outreach, education, engagement, and technical support for farmers, ranchers, foresters, extension, and public on science-based risk management and innovative ways to lower barriers to adaptation, mitigation, and resilience-building. The Climate Hubs Strategic Plan (2020-2025) and national fact sheet are available here.

Innovation for climate-smart agriculture and forestry

Addressing the parallel challenges of sustainably increasing agricultural production for a growing population while mitigating and adapting to climate change will require innovative and transdisciplinary research and development. USDA will target its climate research to better understand the full range of potential climate impacts, accelerate the development of science-based solutions, inform the deployment of adaptation strategies, and use new surveys and analyses to pinpoint barriers to access. Importantly, USDA must leverage its research agencies to identify innovative technologies and systems to mitigate climate change, including new tools for quantification, monitoring and verification of carbon reductions and sequestration. It will be important as ever that USDA research and programme agencies partner to ensure that these innovations work for producers and land managers.

Ongoing and recent efforts to advance innovation in climate-smart agriculture and forestry include:

- USD 10 million invested through USDA's National Institute of Food and Agriculture in a new programme area priority called 'Extension, Education, and USDA Climate Hub Partnerships'. These funds will support training for the next generation of agriculturalists and foresters to incorporate climate change research into their management practices.
- The planned launch of the Agriculture Innovation Mission (AIM) for Climate at COP26, which aims to increase and accelerate global investment in climate-smart agriculture and food systems innovation from 2021-2025. This joint US-United Arab Emirates initiative already has the support of over 30 countries and the Food and Agriculture Organisation (FAO).
- USDA's Agricultural Research Service will establish a Comprehensive Climate Change 'Center of Excellence' that will ensure that innovations are positioned to be adopted and build a platform to enable climate change decision making. The Center will foster climate-smart technologies, cooperate with the private sector to assess the performance and efficacy of new technologies and conservation, and partner with USDA programme agencies to integrate promising technologies into USDA conservation programmes.

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Development of the Measures for achievement of Decarbonisation and Resilience with Innovation (MeaDRI)

A SYSTEMS APPROACH TO SUSTAINABLE AGRICULTURE IN JAPAN

Japan Ministry of Agriculture, Forestry and Fisheries (MAFF)

In order to establish production, distribution and processing in harmonisation with environment and sustainable, quality and healthy diet in a holistic manner in response to mounting awareness of global environmental issues, a systems approach is required addressing measures relating to inputs, processing, distribution and consumption, in addition to those relating to production. In Japan, as a result of an intensive consideration since October last year, the "**Measures for achievement of Decarbonisation and Resilience with Innovation (MeaDRI)**" was formulated in May this year as a new strategy aiming to achieve both enhancing production potentials of agriculture, forestry and fisheries and sustainability through innovation. MeaDRI aims to promote development and deployment of new technologies through innovation at each level of supply chain from inputs to production, processing/distribution and consumption.

MeaDRI sets out goals to be achieved by 2050, including zero emission from agriculture, forestry and fisheries sectors, 30% reduction in chemical fertiliser use, 50% reduction in risk-weighted use of chemical pesticide, and scaling up organic farming. In order to achieve these goals, existing technologies will be disseminated by 2030, and in parallel, development of innovative technologies will be promoted by 2040, including those relating to electric and hydrogen agricultural machineries, which will be deployed by 2050, so as to achieve the vision for 2050.

MeaDRI also provides for policy directions for each of the four policy areas:

1. Inputs
2. Production
3. Processing/distribution
4. Consumption (Figure 1)

Those include: decarbonisation and reduction of environmental burdens in materials and energy sourcing for 1) inputs; establishing sustainable production systems through innovation for 2) production; developing waste-free processing and distribution systems for 3) processing/distribution; and promoting sustainable consumption and food education for 4) consumption, for each of which more specific directions and concrete actions are provided. MeaDRI is intended to generate a cyclic flow of the four policy areas and to encourage participation of multiple stakeholders, not only producers, in the process.

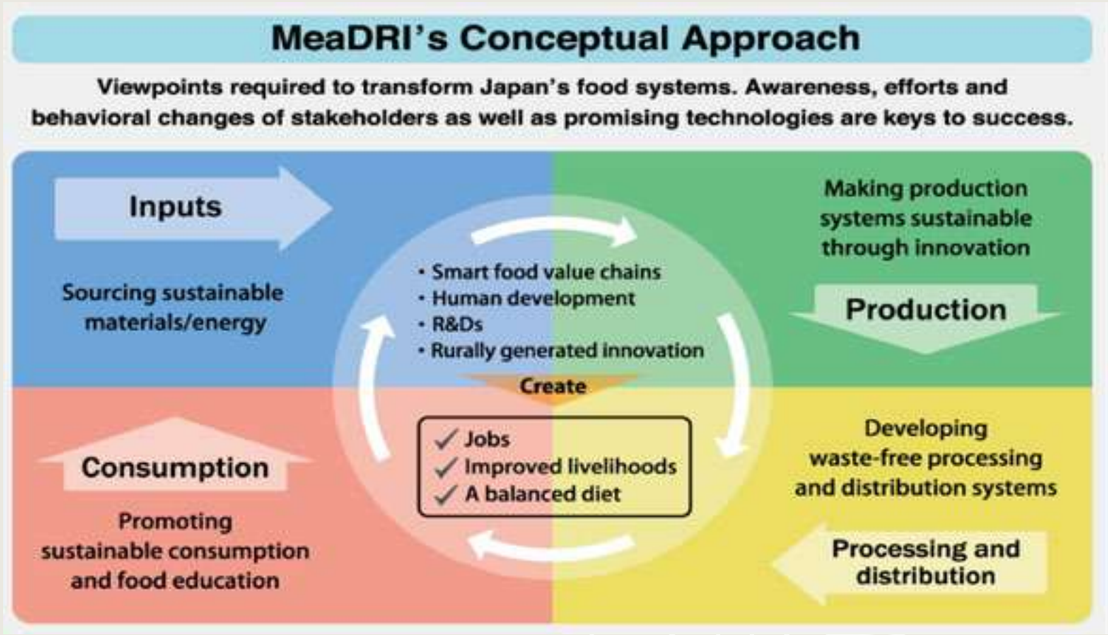

Figure 1: MeaDRI's Conceptual Approach

Japan Ministry of Agriculture, Forestry and Fisheries (MAFF)

In addition, MeaDRI also addresses greening of MAFF's policy tools.

Asia-Monsoon climate is recognised for its high temperature and humidity, where pests and diseases occurrence is likely to be high. In addition, countries in the region have common farming characteristics: their food production is based mainly on rice and many of their farms are small operations. MeaDRI could be a leading model for new food systems in areas under Asia-Monsoon climate where climatic conditions and infrastructure for food production differ from those in Europe and Americas. Indeed, technological advancement is promoted in Japan to boost productivity of its limited area of arable lands while reducing greenhouse gas emissions from rice paddies and analyzing soils with artificial intelligence. Organic farming with automated weed control could also be a groundbreaking innovation.

> **"By 2050, Japan's new MeaDRI policy sets out to achieve zero emission from agriculture, forestry and fisheries sectors, 30% reduction in chemical fertiliser use, 50% reduction in risk-weighted use of chemical pesticide, and scaling up organic farming."**

Based on the experience of developing MeaDRI, the following could be highlighted as important points for government action to promote repurposing of public policies and support, to deliver a transition to sustainable agriculture and scaling up of innovation:

1. Even if the goals are common across countries, since climatic conditions and circumstances surrounding production, distribution and consumption differ greatly across countries and products, each country should choose appropriate policies with due considerations of its national circumstances. In case of MeaDRI, in order to provide clear visions for innovation towards its ambitious goals for 2050, roadmaps for each of the areas of technological development as well as a roadmap for dissemination of technologies in the next 5 years were developed. Dissemination of technologies and research and development of innovative technologies/production systems will be advanced along those roadmaps.

2. It is important to carefully listen to a wide range of opinions from stakeholders and to ensure a transparent process in setting new policy directions. In the development process of MeaDRI, the Minister and Vice-Ministers have had a number of dialogues with producers and food manufacturers, etc.

MeaDRI was developed after a total of 22 active engagements since January this year with a wide range of stakeholders and intensive discussions within the ministry.

MAFF will promote measures to achieve the visions of MeaDRI.

Japan Ministry of Agriculture, Forestry and Fisheries (MAFF)

Transforming New Zealand's agricultural sector

FARMING WITHOUT SUBSIDIES AND HE WAKA EKE NOA

New Zealand's Unique Circumstances

New Zealand has a natural advantage in agricultural production and the primary industries play a significant role in our economy. Whilst not a large producer in global terms, New Zealand exports 85% of total food produced and agriculture makes up around 10% of GDP and 75% of merchandise exports. New Zealand's agricultural sector is one of the least subsidised in the OECD. Between 1984 and 1990, all direct farmer support was eliminated. This came with significant challenges, but as a result New Zealand's agricultural sector became more focused on production, its customers, and their needs. Removing subsidies allowed producers to be agile and respond to market signals, creating a more innovative, efficient, and sustainable agricultural sector.

This case study showcases New Zealand's history of agricultural reforms. In particular, the benefits gained from eliminating subsidies, what that process has taught us, and how we are incorporating these lessons into today's reforms.

Agricultural Reform: Farming without subsidies (1984 – 1990s)

An economic crisis in the mid-1980s sparked a period of radical economic reform in New Zealand, including the abolition of farm subsidies. Like most developed countries, New Zealand had pursued agricultural protection, and the two decades to 1984 saw an acceleration in production grants and subsidies to the agricultural sector, with producer support peaking at 34% in 1983. Subsidies obscured market signals to farmers (including demand for products) and resources were used inefficiently. For example, in 1983, 11 million lambs were produced with effectively no market to sell to and had to be rendered down for use as fertiliser products.

In 1984, the Government announced the rapid phase-out of producer support to agriculture as part of a package of reforms to transition towards a market-driven, competitive economy for all sectors. This included the abolition of minimum price schemes for wool, beef, sheep meat and dairy products, withdrawal of tax and interest rate concessions, removal of input subsidies and the phase-out of land development loans. Some support was available for farmers who had to leave their land because it was no longer profitable.

Today, New Zealand's level of producer support is estimated to be 0.4%. Most import tariffs are set at zero and no quotas are applied.

Government support is mainly restricted to investment in research and innovation, sanitary and phytosanitary measures, pest and disease control, and marketing and promotional services. Direct support is mainly for medium- to large-scale emergencies, climatic events, and erosion control. The government's core role is to establish a regulatory framework and neutral business environment, noting the importance of education, innovation, technology, and competition to a successful agricultural sector.

Lessons/Outcomes

The 1980s agricultural reforms set the scene for farming in New Zealand being an industry adaptive to market signals. New Zealand found that with the right policy and business approach, farming can prosper without trade and production-distorting support and that this has direct positive benefits for the economy, productivity and for greenhouse gas emissions intensity.

The reforms led to fewer sales opportunities for farmers, which had previously been artificially inflated by subsidies, thereby increasing competition and the need to adapt, innovate and search for new export markets. The agricultural sector diversified away from sheep, expanding into dairy, deer, horticulture and forestry. As a result, primary export revenue doubled in the ten years following the reforms, and further increased by over 60% in the next ten years.

Agriculture's share of GDP has continued to grow, and productivity has quadrupled, while emissions per unit of product have continued to decline (see Figure 2). This has been achieved despite our key exports generally facing high tariff barriers and heavily subsidised competition.

Eliminating subsidies also had some positive environmental impacts caused by significant productivity gains, the uptake of better farm management practices, and reductions in environmentally harmful inputs. By contrast, subsidies coupled to production decisions can have negative environmental impacts by incentivising production intensity and land use conversions. For example, in New Zealand, sheep numbers fell from 70 million in 1983 to 40 million in 2005, while production levels remained the same and revenues increased. Emissions intensity has continued to fall since the reforms. The removal of incentives to develop land into pasture also reduced conversions of indigenous forest and other marginal land. Pasture area declined from 14.1 million hectares in 1983 to 12.1 million in 2004 and planted forest increased from 1 million hectares to over 1.8 million over the same period, despite the removal of forestry establishment grants in 1984. A significant amount of land has also been put under permanent protection. We see the global elimination of trade- and production-distorting subsidies as a pivotal step in transitioning to a more sustainable agricultural sector globally. Such subsidies often have negative environmental impacts (through encouraging over-production or inefficient use of resources), as well as on rural livelihoods. The elimination of such subsidies would create wins across the board for environmental sustainability, economic prosperity, and global food security by preventing trade restrictions and distortions in world agricultural markets.

" Emissions intensity has continued to fall since New Zealand introduced reforms. The removal of incentives to develop land into pasture also reduced conversions of Indigenous forest and other marginal land. "

New Zealand has reaped the benefits from eliminating agricultural subsidies, including increased efficiency and innovation and some better environmental outcomes. We are confident that this reform has achieved positive outcomes for the agricultural sector. However, the economic crisis necessitated reform at pace, which made for a difficult transition period for farmers.

Rural communities saw farm incomes, profitability and land values fall, whilst farm input costs and debts increased.

Unemployment temporarily rose as some farmers had to leave farming and rural businesses stopped operating. Government assistance in the form of debt restructuring, credit mediation and transition funding helped mitigate the impact, however the speed of transition increased pressure on farmers and rural communities.

New Zealand Ministry for Primary Industries, Manatu Ahu

Whilst the sector ultimately benefited from reform and the effects were less damaging than expected (only 1.6% of farmers left the land compared to an anticipated 16%), current agricultural policy is more focused on engagement, collaboration and the provision of research and extension services to farmers, to better facilitate similar difficult adjustment periods.

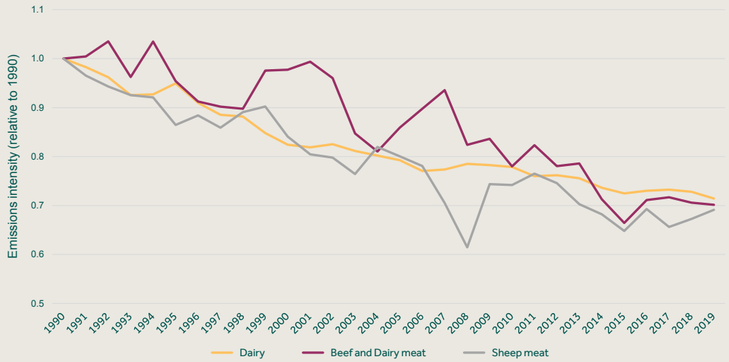

Figure 2: Emissions intensity has decreased across the dairy, sheep and beef sectors since 1990

> **"By 2025, agricultural greenhouse gas emissions will have mandatory pricing under He Waka Eke Noa – The Primary Sector Climate Action Partnership."**

Agricultural reform: He Waka Eke Noa (2019-2025)

Despite the efficiency gains and resultant benefits of the reforms, the challenge of managing agriculture's environmental impacts is ongoing, and increased intensification in following decades has seen the degradation of waterways and other environmental harms. We are continuing to address these, and a new shift in New Zealand's agricultural policy is currently underway – the development of a pricing and reporting system for agricultural greenhouse gas emissions. By 2025, agricultural greenhouse gas emissions (biogenic methane and nitrous oxide) will be priced in New Zealand. Fuel and energy used on farm and in processing is already priced through New Zealand's Emissions Trading Scheme. No other country is currently considering mandatory emissions pricing for these agricultural greenhouse gases. In contrast, many countries continue to subsidise agriculture in ways that keep emissions higher than they would be without such subsidies.

We recognise that this transition will be difficult. We are including farmers in the policy design and development process to signal change early and will provide extension services to enable a smooth transition.

An emissions pricing system to measure, manage and reduce agricultural greenhouse gas emissions is being designed by a partnership between Government, industry and Māori, entitled He Waka Eke Noa – The Primary Sector Climate Action Partnership.

Key milestones have been signalled early and staged so that farmers will have time to adapt and prepare. We are also partnering with industry and Māori to support their transition and provide them with the necessary tools to meet the legislated milestones by 2025. For example, farm planning guidance, which includes good management practices and emissions calculation tools, has been released early to help farmers meet the milestone of having a written farm plan in place to measure and manage their greenhouse gas emissions by 2025.

We are explicitly focused on bringing farmers along and growing extension services to provide greater support in meeting these milestones. The Government is establishing a new extension service programme to assist farmers to adjust to new environmental regulations.

We believe that the best way to support producers is to empower positive change at the farm and catchment level, incentivising innovation that benefits sustainability without compromising economic efficiency, and taking an outcomes-based approach that allows farmers to achieve goals in ways that are best suited to their circumstances.

Farmers as Stewards of Nature

The UK's Agricultural Transition Plan

TRANSFORMING THE WAY FARMING AND THE COUNTRYSIDE ARE SUPPORTED AND REGULATED

UK Department for Environment, Food and Rural Affairs (Defra)

National Context

In line with the Net Zero Strategy (October 2021) the Agricultural Transition Plan aims to move the UK agricultural sector to a system where farmers and land managers are rewarded for carrying out more environmentally sustainable practices. Net zero will be a key priority across the delivery of a suite of environmental land management schemes.

Since leaving the European Union in January 2021, and therefore the European Union's Common Agricultural Policy, the UK is transforming the way farming and the countryside are supported and regulated, bringing the biggest changes to the sector in more than 40 years.

Agriculture in the UK is devolved. The UK Agriculture Act 2020 gives powers to England, Wales and Northern Ireland to amend EU retained legislation and introduce new legislative powers. This means that each administration has the chance to develop its own policies to best suit its farmers and unique landscape. This case study will focus on the reform in England, but more details on other devolved powers in Scotland, Wales and Northern Ireland can be found in Annex 1.

Between 2021 and 2028, England will gradually reduce and then stop untargeted direct payments. Money that is freed up will be repurposed to support farmers to improve the environment, improve animal health and welfare, and reduce carbon emissions.

By 2024 we will have fully introduced our three new environmental land management schemes and they will be open for applications: the Sustainable Farming Incentive, Local Nature Recovery and Landscape Recovery. These schemes are intended to provide a powerful vehicle for achieving the goals of the 25 Year Environment Plan and the UK's commitment to net zero emissions by 2050, with the ambition to enrol 75% of farmers in England in low carbon practices by 2030, and 85% by 2035[1].

> **"The Agricultural Transition Plan aims to enrol 75% of farmers in England in low carbon practices by 2030, and 85% by 2035."**

Sustainable Farming Incentive

The vision for sustainable farming is for a thriving agricultural sector where the majority of farms are profitable, productive and economically sustainable without subsidy through basic payments, and are all making a significant and widespread contribution to environmental, biodiversity, and climate change goals.

The Sustainable Farming Incentive will pay farmers for actions they take (going beyond regulatory requirements) to manage their land in an environmentally sustainable way. Actions will be grouped into simple packages set out as standards, to make it as easy as possible for farmers to identify those actions that are best suited to their land and their business. The aim is to make it attractive and straightforward for everyone to take part, including the many farmers who are not currently in an agri-environment scheme.

We are working with a range of stakeholders from farming and environmental backgrounds to design and develop the Sustainable Farming Incentive, and over 2,000 farmers were invited to take part, with the first agreements starting in October 2021.

1. Emissions mitigation in agriculture is complex and diverse, with no silver bullets. It is difficult to establish a single metric to track progress, but the government monitors engagement with low carbon farming practices through our Farm Practice Survey. We will continue to improve this metric in future years to address what we consider to be key limitations in the current approach.

UK Department for Environment, Food and Rural Affairs (Defra)

The core elements of the Sustainable Farming Incentive that will be available in 2022 are:

- Arable and horticultural soils standard
- Improved grassland soils standard
- Moorland and rough grazing standard
- Annual Health and Welfare Review

By making core elements of the Sustainable Farming Incentive available from 2022, alongside existing schemes, we are aiming to:

- Provide more ways for farmers to be rewarded for producing public goods on their land that are not already rewarded through other schemes, as early as possible in the transition period
- Bring more land into environmental management – our aim is for at least 70% of farms to participate in agri-environment schemes by 2028 (compared with around 32% now)
- Start to deliver crucial emission reductions from the sector. Initial projections are that the Sustainable Farming Incentive scheme soil standards (arable and horticultural soils and improved grassland soils) could deliver average potential carbon savings of up to 60,000 tonnes of CO2 equivalent in England annually over the fourth carbon budget period under the Climate Change Act, from 2023 to 2027. These average potential carbon savings could reach up to 800,000 tonnes of CO2 equivalent in England annually from 2033 to 2037. These savings are roughly equivalent to a total of up to 400,000 cars off the road per year over the CB6 period. These soil standards include important potential mechanisms to sequester more carbon, but we know that we must do more to deliver our net zero ambitions
- Maintain and enhance habitat condition through soil standards, as well as increase the area of and the connectivity of priority and other semi-natural habitats
- Establish a baseline for animal health and welfare on farm and at a national level to facilitate targeted improvements over the lifetime of the transition period
- Roll out the scheme in an incremental way, expanding and improving it as we go, including feeding in the learning from piloting

UK Department for Environment, Food and Rural Affairs (Defra)

Beyond 2022, a wider set of standards are under active consideration and could include:

- Agroforestry standard
- Hedgerows standard
- Arable and horticulture land standard
- Waterbody buffering standard
- Improved grassland standard
- Low and no input grassland standard
- Farm woodland standard
- Dry stone walls standard
- Heritage standard
- Farmyard infrastructure standard
- Orchards and permanent crops standard
- Peat soils standard

The role for Research and Development

The Farming Investment Fund (Farming Innovation Programme) launched in October 2021. The fund is worth GBP 17.5 million and is open to applications for agreed items and larger scale projects which support improvements in productivity. The kinds of things grants might be awarded for could include:

- On-farm water storage infrastructure, including reservoirs
- Precision agriculture equipment
- Robotic or automated technology
- Equipment and technology for storing, sorting, or processing products.

Under the 2013 Agri-Tech Strategy (Innovation Centres and Agri-tech Catalyst Fund) the GBP 90 million Industrial Strategy Challenge Fund 'Transforming Food Production' is supporting groundbreaking research and development so farmers will be able to harness the latest technology to produce high-quality food, increase their productivity and move towards net zero emission productive farming systems by 2040. This public investment aims to support the development and use of precision agricultural technologies that boost the efficiency and productivity of UK agricultural systems.

Working with farmers

Since 2018, the UK government has been undertaking a number of tests and trials to help understand how the new environmental land management schemes could work in a real-life environment. Using test and trial activity as a vehicle to engage with a wide range of farmers, land managers and stakeholders, it has allowed policy makers to harness their ideas and contribute to the design of the future schemes. Almost 3,000 farmers and land managers are engaged in tests and trials, covering a range of different sectors, geographies and land types.

> **"The Farming Investment Fund is providing GBP 17.5million to support the development and use of precision agricultural technologies that boost the efficiency and productivity of UK agricultural systems."**

UK Department for Environment, Food and Rural Affairs (Defra)

A holistic approach to sustainable agriculture in India

THE USE OF INTEGRATED ORGANIC FARMING SYSTEM (IOFS) MODELS

India Ministry of Agriculture and Farmers' Welfare

Sustainable agriculture entails taking a holistic approach to increasing agricultural productivity and resource management in order to address all three critical components of sustainability: they economy, the environment, and society. Major challenges in sustainable agriculture in India include increased climate variability, declining soil health, groundwater use, loss of biodiversity (including agro-biodiversity), and environmental pollution. To address these issues, the Government of India has implemented several programs and schemes over the years. The Indian Council of Agricultural Research (through the All India Network Programme on Organic Farming (AINP-OF) under ICAR-Indian Institute of Farming Systems Research, Modipuram) has been conducting multi-location long-term research on organic farming from 2004. This work has led to the development of several Integrated Organic Farming System (IOFS) models suitable for the agro-ecological conditions across India. IOFS models involve cropping systems (including high-value crops such as spices), livestock components, agroforestry, fodder production, and holistic societal development.

IOFS is a holistic and multidisciplinary approach that integrates several components on a single farm, thereby minimising the risk of farming communities.

It is essential for the efficient management of available resources at the farm level to: reduce environmental degradation, generate adequate income; enhance resource-use efficiency and recycling of farm by-products; provide balanced and nutritious food which is economically viable, socially acceptable, and environmentally sound; and create employment and improve farmers' livelihoods in a sustainable manner.

The Mission Organic Value Chain Development for North Eastern Region (MOVCDNER) is among the schemes to encourage the adoption of organic farming. It was introduced in 2016 in the Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, and Tripura states. The project aims to mobilise commodity clusters and facilitate the training of farmers, on-farm infrastructure development, organic certification services to farmers, and the creation of market linkages. In addition, lead agencies were established at the central and state levels to partner with value-chain-supporting agencies, service providers, and business development consultancies in order to provide access to information and finance to create an enabling environment for the sector's growth.

Over the six years of the MOVCDNER scheme, 170 Farmer Producer Organisations (FPOs) have formed, covering 83,000 farmers, and 79,000 hectares of land has been certified as organic farmland. In addition, 141 postharvest and processing facilities and an end-to-end value chain have been developed for ginger, turmeric, chilies, large cardamom, pineapple, and speciality rice.

The scheme is now being scaled up, with a target to transform another 100,000 hectares of land and invlolve 100,000 farmers. The aim is to improve the sustainability of agricultural land in the northeast regions of India by promoting organic farming, limiting the use of chemical agents, generating sustainable livelihoods and promoting inclusive development, and encouraging sustainable and healthy diets.

" Over 6 years, 79,000 hectares of land has been certified as organic farmland, with 83,000 farmers taking part. This is being scaled up in the North East to transform another 100,000 hectares of land and involve 100,000 farmers. "

India Ministry of Agriculture and Farmers' Welfare

Examples of successful IOFS models

A holistic approach for doubling farmers' income in terraced land of Sikkim (Himalayas)[1]

In the eastern district of Sikkim, an IOFS model, designed by ICAR-Sikkim Centre, provided various inputs/interventions to reorient their traditional farming into IOFS to increase the farms' income. Major technologies were introduced in the village, including: a low-cost micro water storage structure, Jalkund, using silpaulin (250 GSM); low-cost plastic tunnels (transparent UV stabilised sheet of 45 GSM) for sequential vegetable cultivation; and zero-till vegetable pea, mustard, cole crops, buckwheat. Efforts also included strengthening backyard poultry production with Vanaraja, livestock production, and Napier cultivation as fodder grass on terrace risers.

Capacity-building through institutional intervention helped change farmer attitudes and motivated the farming community to adopt improved technological options, leading to higher yields and incomes in the village. For example, agricultural productivity of the Kharif and Rabi vegetable crops increased using the improved production technology. New practices to cultivate buckwheat also resulted in an increase of net income for farmers in the region.

Additionally, 10 low-cost micro water harvesting structures (Jalkund) demonstrated in the village encouraged the farmers to optimise diversification by cultivating cole crops, potato, vegetable pea, fenugreek, coriander, etc., during the Rabi season. The overall performance of crops' production under recommended technologies through the IOFS was superior to conventional methods, with an average net income increase of INR 45,829 and a 41% yield increase, resulting in a benefit-to-cost ratio of 2.14.

In addition, increased green fodder was made available during the lean period in the village with the cultivation of hybrid Napier and oat on the terrace risers and stony terraces. Piggery also improved by introducing high-yielding crossbreds and a low-cost shed with better management. These interventions also led to an increase in incomes and agricultural productivity, including dairy milk production, for livestock farming. The average performance of livestock under the recommended technology was superior over the farmers' practice, which produced an average net income of INR 2,77,287, with a 70.4% yield increase and a benefit-to-cost ratio of 2.55.

1. **Ravikant Avasthe*, Raghavendra Singh*, Boniface Lepcha**, Prasanta Pathak**, Amit Kumar*, J. K. Singh**, Subhash Babu* and Pallabi Phuka**n**, *ICAR Research Complex for NEH Region, Sikkim Centre, Tadong, Sikkim-737102 and **ICAR-Krishi Vigyan Kendra, East Sikkim, Ranipool, East Sikkim, Sikkim, India.

Nalla BhakshanaPrasthanam (The Safe Food Project), Kerala[2]

In Kerala, a collective of young farmers – Nalla BhakshanaPrasthanam – aims to provide nutritious food to the community. The collective started in 2009 with less than 20 farmers interested in protecting nature and natural resources in the Edappal panchayath. The major activities include:

(i) Production of crops including rice, vegetables (ash gourd, bitter gourd, snake gourd, pumpkin, ridge gourd, bottle gourd, ivy gourd, vegetable cowpea, cucumber, etc.), fruit crops (banana, mango, jackfruit, etc.), plantation crops (coconut, areca nut, etc.) and tuber crops (cassava, elephant foot yam, yams, and taro).

(ii) The sale of organic products through the selling outlet at Ponnani, Malappuram.

(iii) Conducting training programmes on organic practices for farmers.

(iii) Conducting training programmes on organic practices for farmers.

The collective promotes IOFS and recycling natural resources produced on the farm. One cluster member said that by adopting an integrated farming system, he could reduce the production cost by almost 50% by using farm animals as the source for manure. It could also reduce the purchase of organic manures like farmyard manure, poultry manure, etc., which are much more costly and contaminated with chemicals from animal feed. Azolla cultivation is also practiced by farmers and used as feed for farm animals and biofertiliser for crops such as rice.

Members of the cluster were aware of the health benefits of organic farming and the consumption of poison-free organic products. Farmers used organic manures such as cowdung, biogas slurry, poultry ads goat manure, vermicompost, neem cake, groundnut cake, etc., for cultivation, as well as jeevamritham, panchagavya, vermiwash, etc. Ghana jeevamritham is a product prepared by a cluster member using cow dung enriched with beneficial microorganisms.

Effective soil fertility management is being done using farmyard manure, poultry and goat manure, vermin compost, biogas slurry, neem cake, groundnut cake, and biofertilisers.

Green manuring, residue mulching, and in situ incorporation of weeds also increases soil fertility. Pest and disease management is being done with neem oil, cow urine, mathi-sharkara, garlic spray, chili spray, Beauveria, Trichoderma, Pseudomonas, and indigenous practices. According to the farmers, pest and disease attacks were reduced in Modipuram under organic management practices. Multiple cropping, intercropping, sequential cropping, relay cropping, and crop rotation practices were followed to maintain soil fertility. Farmers are aware of the role of legumes in the cropping system to improve the soil status.

2. **Suja, G.,Harishma, S.J and Shyam Sasi,**All India Network Programme on Organic Farming, ICAR-Central Tuber Crops Research Institute, Thiruvananthapuram, Kerala, India

Carbon farming in Germany

REPURPOSING PUBLIC SUPPORT TO DELIVER A TRANSITION TO SUSTAINABLE AGRICULTURE

Germany Federal Ministry of Food and Agriculture (BMEL)

Sustainable agriculture is the basis for achieving economic, social and environmental benefits from food systems for the current and future generations. In Germany, public policies, funding and support have facilitated measures to mitigate greenhouse gas emissions, support adaptation to climate change and to protect biodiversity and natural ecosystems. They foster and support sustainable management of natural resources such as water, air and soils in order to ensure their long-term availability and quality. At the same time, efforts have been made to ensure food security, fair incomes and decent livelihoods for farmers and the rural population.

Current context

Germany has successfully adapted direct payment schemes under the EU Common Agricultural Policy, shifting these to support agro-environmental schemes and rural economies. These funds facilitate investment at the farm level to reduce greenhouse gas emissions from agriculture, support organic farming, or enable extensively managed high-nature-value grasslands.

The German government has set up several funds to reduce greenhouse gas emissions from agriculture.

The Energy and Climate Fund supports a range of activities including enhancing energy efficiency in agriculture, use of biogas, protection of organic soils, reduction of peat use, and sustainable management of soil organic matter to mitigate greenhouse gas emissions.

> **"The new National Climate Law includes specific targets to achieve net-zero in land use, land use change and forestry."**

As part of the new National Climate Law, Germany has committed to reduce its greenhouse gas emissions by at least 65% by 2030 compared to 1990 levels. The long-term goal is to achieve net zero by 2045. For the first time, the new law also includes specific targets to achieve net-zero in land use, land use change and forestry (LULUCF). To reach these targets, accelerated action is essential to expand the natural carbon sink capacity of land, with a particular focus on peat.

In Germany, soils used for agricultural purposes currently store around 2.5 billion tons of organic carbon at a depth of up to 1 meter. This natural property of soils contains high potential for climate protection and this can be enhanced by building up the humus content in the soil. Using cultivation and land management practices that increase humus, soil stocks of organic carbon can be increased whilst also increasing soil fertility, biodiversity and other natural soil functions. This in turn helps adapt agriculture to improving the effects of climate change.

Examples of carbon farming practices being implemented in Germany include:

- Year-round greening with catch and cover crops (planted between main crops to prevent soil erosion and provide green manure)
- Perennial field forage cultivation with deep-rooting crops
- Crop rotations that increase humus
- Establishment of sustainable agroforestry and hedges
- Expansion of organic farming
- Organic fertilisation in compliance with applicable fertiliser regulations
- Leaving crop residues on the arable land
- Reduced tillage
- Avoidance and prevention of grassland conversion

Germany Federal Ministry of Food and Agriculture (BMEL)

Challenges

The potential of arable soils for carbon sequestration is largely dependent on local agro-ecological characteristics and management practices. In addition, there are limits to how much carbon can be captured. For example, humus build-up is easier in a humus-degraded-soil and the sequestration potential is much higher than for soils already rich in humus. Germany is exploring action-based funding that supports carbon farming measures on land with the highest potential to deliver on positive climate outcomes while trying to ensure all farmers have equal opportunity to engage in support schemes.

Natural carbon sinks are subject to climate influence and natural variability. Furthermore, increase in humus content is only possible over a significant period of time and, even then, the increase is difficult to measure. This could lead to inaccuracy in performance assessment. Regular, valid monitoring is time-consuming and expensive. Research and policies that help to address these challenges will be needed, to accelerate the transformation process.

Farmers and landowners are key to achieving sustainable agriculture. It is they who plan and invest in sustainable practices in the long-run. Bearing this in mind, decisions to redirect public policies and support must be taken responsibly and with a certain degree of consistency over time. Enabling such long-term public support is a challenge that requires ongoing effort.

To help ensure farmer buy-in for transition to more climate and environment-friendly practices, the German government is providing approximately EU95 million for pilot projects and individual farm interventions, as well as funding for agricultural research and development until 2023. This investment will develop a simple and robust monitoring system. It will also explore the establishment of a viable reward system for sustainable and long-term carbon farming.

In a pilot initiative with some 100 pilot farms across Germany, experience and evi-dence will be gathered to inform policy interventions and future scale up of effective projects. The initial pilots aim to provide insights for improving programme design, with a focus on establishing a business model for carbon capture and storage, while identifying the best ways to expand stakeholders' awareness and understanding of the benefits. The findings will serve as guidance to help private actors and public authorities accelerate the roll out of carbon farming initiatives.

> **"The German government is providing approximately EU95 million for pilot projects and individual farm interventions, as well as funding for agricultural research and development until 2023."**

Germany Federal Ministry of Food and Agriculture (BMEL)

Just Rural Transition

UN CLIMATE CHANGE CONFERENCE UK 2021
IN PARTNERSHIP WITH ITALY

WORLD BANK GROUP

Reshaping the narrative of low-carbon cattle ranching in Costa Rica

DECARBONISING CATTLE RANCHING THROUGH AN INTEGRATED APPROACH

Costa Rica Ministry of Agriculture and Livestock (MAG)

Introduction and Context

Costa Rica has prioritised innovative sustainable environmental policies for many years. Agriculture became a focus sector with the introduction of climate change actions in the 2010-2021 National Policy for agriculture, food security and rural development. The policy kickstarted a process to integrate environment, agriculture and market competitiveness in international trade. This vision was consolidated in 2018 with the launch of the National Decarbonisation Plan for 2018-2050. The plan has ten pillars of action, three addressing agriculture, and one for low-carbon cattle ranching.

Historically, and similar to other Latin American countries, cattle ranching is based on extensive land use conversion with low added-value chains. However, beginning at the end of the 1980s the area under pastures in Costa Rica began to shrink, herd intensity and added-value of production increased, while simultaneously the country forest cover began to increase. A combination of domestic policy reform and wider factors instigated this change, from the elimination of previous land grants, a collapse in international meat prices, and the rise of environmental ambition domestically and internationally.

While this is an important trend, cattle ranching still accounts for 20.3% of Costa Rica's total GHG emissions. About 30% of the national cattle herd is also highly vulnerable to the effects of climate change: in 2015 alone the country spent US$40m dealing with El Niño Climate Oscillation (ENSO) effects. Cumulative losses through recurrent events continue to directly affect the sector's competitiveness.

Costa Rica's ambition to decarbonise cattle ranching requires an integrated approach that goes beyond GHG mitigation and builds in resilience by addressing soils, biodiversity and water, ensuring food security and productivity, and revitalising a culturally important economic sector.

NAMA and the decoupling of production and environmental impact

Costa Rica introduced its ambition for low-carbon ranching through a national Decree in 2015, aligned with the "Nationally-Appropriate Mitigation Measures" (NAMA) . It was followed by a strategy to enable the policy, technological and investment conditions to encourage win-win outcomes. Central to this there are two types of decoupling: 1) the assumption that more value needs to come through more inputs or resource use, and 2) the assumption that the creation of economic value needs to happen at the expense of environment degradation (see Figure 1).

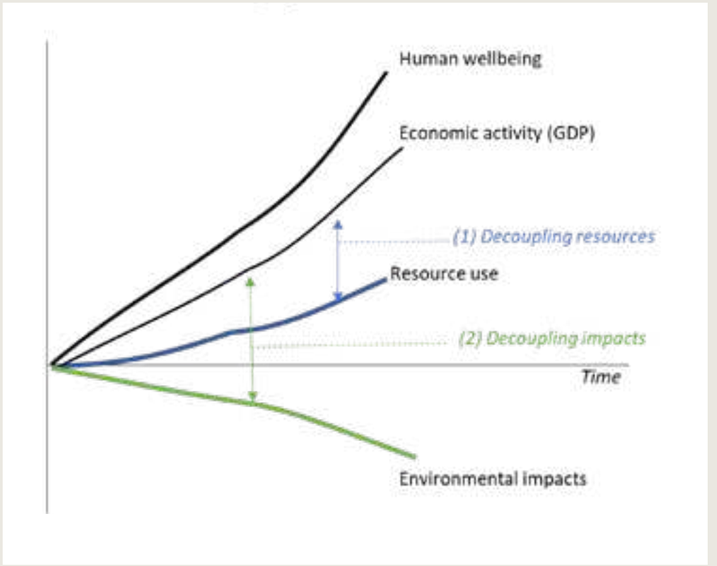

Figure 1. Two elements of 'Decoupling'

Baseline studies have helped determine current status of the sector as a critical step in designing appropriate policies.

The majority of the national herd is reared in medium-to-large holdings (about 65% of cattle in 20-500 hectares farms). About 40% of the farms use improved pasture systems, but this percentage decreases with total farm size.

About 20% of the total area under pasture is on land classified as suitable for forest use (e.g. steep slopes).

With support from the World Bank, detailed analysis of GHG emissions was undertaken – using a methodology that includes herd structure and diet to estimate the methane (CH_4) contributions by ruminants – to assess the impact over time of farm level actions for improved pasture management.

The findings show that between 1990 and 2014 Costa Rica experienced:

1. **A reduction of 45% of total pasture;**
2. **A reduction of 40% in herd size;**
3. **A 72% increase in milk production;**

Evidence from the studies further shows that improvements in animal productivity are the result of more comfortable surroundings, where trees provide shade, fodder, wind protection and support water regulation.

Challenges to low-carbon cattle ranching

Despite these successes, Costa Rica faced numerous challenges promoting low-carbon cattle ranching, for example:

1. Traditionalist attitude, risk aversion and mistrust of innovation, especially for lower-income producers, for example where ranching has a cultural rather than economic motivation
2. Limited knowledge of business opportunities and technological innovations, where information is not always provided on time, is not relevant, or where producers do not make the effort to learn and digest this new information
3. Low desire to invest in the farm, with high transaction and legal costs to access the banking system, which in turn is not flexible to incorporate different repayment terms and risk exposure (for example to El Niño)
4. Generational challenges where younger people are not attracted to what is perceived as a stagnant, uneconomical sector
5. Perception that imported inputs are better than national, which discourages demand of more sustainable, locally generated inputs like organic fodder and fertilisers
6. Unions and other supporting organisations have low capacity to increase the services they offer, and have low membership and low ability to access resources, with often confusing governance systems
7. Perception of high levels of bureaucracy and excessive regulation, and low-quality support from public sector.

Costa Rica Ministry of Agriculture and Livestock (MAG)

Policy approach to scale up low-carbon cattle ranching

Having strong evidence of the co-benefits and clear pathways to achieve them, design based on contextual evidence was the first step towards change. Following this, the Ministry engaged in a series of dialogues with public and private bodies, enterprises and unions, to understand stakeholder interests, needs and plans as means to create a participatory and empowering strategy. This led to the creation of various co-dependent mechanisms beyond the ranching sector needed to incentivise action. Key factors to success include clear governance; access to technical support, monitoring and verification; and financial resources. This for example includes support with measuring and certifying carbon emissions reduction for compensation, and access to payments for ecosystem services for activities linked to forest conservation, reforestation or restoration.

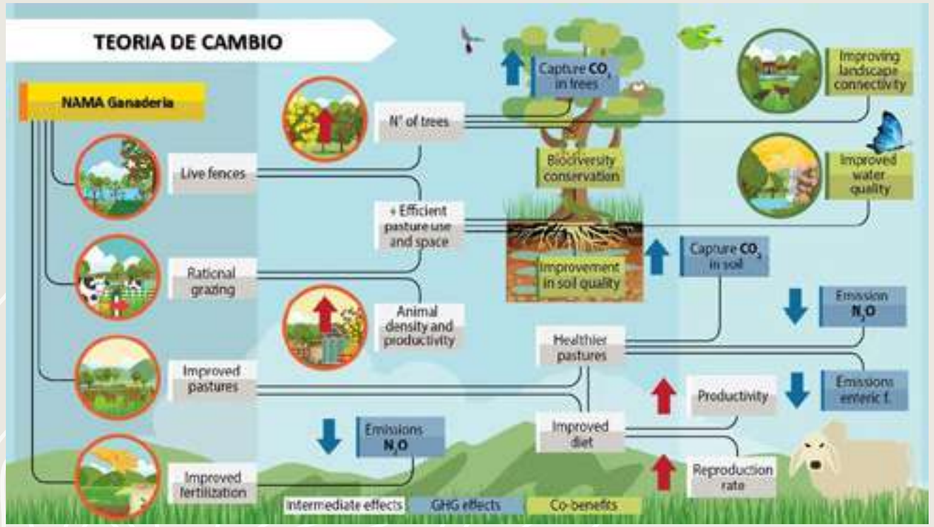

Figure 2. Theory of Change

There are ongoing proposals for a business incubator platform, which is exploring potential instruments such as co-funding for the adoption of specific technologies for lower-income producers, access to preferential interest rates, and/or credit guarantees for producers with low access to mainstream finance.

The experience so far demonstrates that, by taking a holistic approach to improved farm management, it is possible to turn the tide on cattle ranching being a contributor to the country's GHG emissions, while generating financial returns and ensuring the sector's competitiveness.

Looking forward, Costa Rica's ambitions for the sector are:

1. By 2025: an integrated, circular economy model for cattle ranching
2. By 2030: 70% of the total herd and 60% of the total cattle ranching area under low-carbon technologies (e.g. using live fences, rotational grazing, improved pastures and improved fertilisers)
3. By 2050: 100% of the sector using the most advanced technologies according to sustainability, competitiveness, low emission and resilience standards

Source: Chacón Navarro, Mauricio. 2020. Costa Rica en ruta hacia la descarbonización 2013-2018. Coordinador de Acciones Climáticas y Descarbonización del Sector Agropecuario. Ministerio de Agricultura y Ganadería. Costa Rica. https://www.mag.go.cr/bibliotecavirtual/L01-11006.pdf

Sustainable agriculture in Italy

SHEEPTOSHIP LIFE PROJECT

Italy Ministry of Agricultural, Food and Forestry Policies (MiPAAF)

Since the launch of 'Europe 2020' – the ten-year strategy developed by the European Commission in 2010 – the European Union has included strategies to combat climate change in all programmes and instruments of economic and social development. The more recent Farm to Fork strategy and roadmap to achieve net zero by 2050 has increased the impetus for member countries to increase their domestic contribution to emission reductions from agriculture.

Europe is second in the world when it comes to sheep numbers. The main production of farms is meat, followed by milk and wool. However, since 2003, sheep milk production in Europe has increased steadily – by 2.1% in the decade 2003-2013 – against a decrease in head count and meat production (by 4% and 10.5% respectively). Globally, sheep and goat farms are responsible for about 6.5% of the greenhouse gas emissions of the entire livestock sector but there has been little research into the potential for sheep farming and climate change mitigation.

" Italy's SheepToShip LIFE Project demonstrates how to achieve a 20% reduction in greenhouse gas emissions within the Sardinian sheep sector over ten years, using sustainable practices. "

Italy Ministry of Agricultural, Food and Forestry Policies (MiPAAF)

The EU-funded SheepToShip LIFE Project aimed to explore this relationship in order to develop good practices and accelerate innovation of agro-zootechnical solutions that will reduce greenhouse gas emissions from the Sardinian sheep supply chain.

The project has quantified how, in reality, the sheep dairy sector of Sardinia – with about 3 million sheep and over 10 thousand active companies – contributes over 5% of the greenhouse gas emissions of Italian agriculture. Through the promotion and diffusion of eco-sustainable production models, the project demonstrates how to achieve a 20% reduction in the greenhouse gas emissions within the Sardinian sheep sector over ten years.

These results will be used to:

- Promote the environmental improvement of production systems and demonstrate the environmental, economic and social benefits of eco-innovation in the agro-zootechnical and dairy sheep sectors.
- Promote the implementation of environmental and rural development policies aimed at enhancing the environmental quality of the local agri-food and sheep sectors.
- Increase the level of knowledge and awareness of operators in the sector, and the general public, on issues related to the environmental sustainability of sheep production, and their role in the fight against climate change.

The project analysed the environmental impacts of dairy in the Sardinian sheep sector through examining the environmental performance of sheep's milk produced for the most predominant products including DOP Pecorino Romano, Pecorino Sardo and Fiore Sardo cheeses. As a result, it drafted guidelines for the eco-innovation of the sheep agro-zootechnical supply chain, which included recommendations to:

- Improve collaboration at a regional policy level to facilitate the transition towards sustainability.
- Improve horizontal coordination of policy areas – e.g. reduction in GHG emissions from electricity production by increasing renewable energy – as outlined in the overall development and energy polices.
- Ensure the inclusion of sustainability, climate change and low-impact sheep farming, among others, in training and awareness efforts in Sardinia.
- Implement the use of climate-environment indicators in the monitoring system.
- Ensure the use of premiums and compensation mechanisms for lost income.
- Ensure adoption of best practice in eco-innovation and structural adjustment.
- Achieve co-development of capacity and knowledge transfer.

The study also outlined the most appropriate technical solutions to combat climate change and optimise the environmental co-benefits for the entire supply chain including:

- Herd management – adherence to innovative monitoring of efficient reproduction, production, and veterinary prophylaxis.
- Silvopasture practices to combine the growing of trees and woody plants alongside crops and grazing livestock, reducing costs to provide livestock feed, improving on-farm self-sufficiency and bringing unique flavours to milk and cheese production from location-specific foraged feed.
- More sustainable land use, by way of extending short- and long-term pasture and meadow areas.
- Sustainable use of energy on farms via consumption control and use of renewable energy.
- Enforcement of a carbon credit and certification system.

The Action Programme borne from the project has defined actions and gradual steps to achieve a 20% reduction in GHG emissions over 10 years, defining the methods of implementation and verification of results, timing and stakeholders.

The study highlights the technological, cultural and economic barriers that may weaken or limit the Action Programme, proposing for each of them the appropriate countermeasures. These measures include:

- Horizontal merging of producers to increase capacity and shorten the supply chain, adoption of eco-innovations, and management of hybrid or results-based payment schemes.
- Adaptation and transformation of organisations in charge of knowledge transfer for better delivery.
- Simplification of incentives to streamline communications at all levels for better relations within the region and with the private sector.

The pilot study is yet to lead to nationwide policy actions but the results of the project could represent good agro-zootechnical practices that could be favorably received in future programming.

Previous experience of rolling out more sustainable agricultural incentives will be paramount to ensuring any future policies formed from the SheepToShip project are received positively by farmers. Italy has successfully scaled up its proportion of organic farming over the previous decade and this now comprises over 15% of Italy's total arable land.

Agricultural policies in Italy have built awareness and ownership amongst farmers in their role as stewards of nature. This 'green' mindset of Italian farmers is evident in the use of pesticides and fertilisers which in the last decade, has radically decreased and almost halved in some cases.

Disseminating the results of the project is a crucial next step and the project has developed a Communication Plan to ensure i) exchange of good practices; ii) transfer of innovative methods and technologies; iii) promotion of the intervention model; and iv) stimulating public interest towards the themes of climate change and the relations between environment and agro-industrial systems. Indeed, the project outcomes are already informing the rural development policy plan for carbon neutral farming in the region of Sardinia.

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Building Resilience

Morocco: Re-orientation of agricultural support to promote transition to sustainable agriculture

COLLECTIVE DRIP RECONVERSION AS PART OF THE GREEN MOROCCO PLAN

Morocco Ministry of Agriculture

The Kingdom of Morocco could face extreme water scarcity by 2050, pushing the country below the extreme water scarcity threshold. Morocco is likely to be affected by three climate impacts: rising temperatures, changes in precipitation patterns, and increased climate aridity. These impacts are associated with an increase in the frequency and intensity of extreme weather events, such as severe droughts, that affect several key sectors of the economy, particularly the agricultural sector.

The effects of climate change in Morocco are already being felt through the decrease in the water supply to dams during drought episodes. For example, during the 2019/2020 agricultural season, the water supply to dams accounted for barely 33% of mean intake. This situation resulted in a low level of filling of the dams, estimated at only 42%. For some perimeters in the south, including the Souss, the filling rate was only 15%. As a result, the water endowment of public irrigated perimeters has significantly decreased, affecting the area of certain crops, and producers' income. Except for northern regions, irrigated areas have experienced a significant decline in fulfilling projected irrigation water needs. In 2019, this rate was only 28%.

Thus, since 2008, as part of its strategy to adapt to climate change, Morocco has set up the National Irrigation Water-Saving Programme (PNEEI), which aims to reconvert gravity-fed irrigated areas to localised irrigation methods. This programme has set the goal of reaching a converted area of 550,000 hectares by 2020.

The PNEEI has two implementation modalities:

- Individual conversion of farms to localised irrigation (which applies water directly where the plant is growing, minimising water loss through evaporation from the soil) with financial incentives from the State (Agricultural Development Fund) on an area of 550,000 hectares by 2020.
- The collective conversion for a faster and larger-scale transition to water-efficient irrigation systems, on an area of 220,000 hectares by 2020, through the modernisation of collective irrigation networks in large irrigated perimeters of large hydraulics.

Collective large-scale hydraulic projects have two components:

(i) Adapting the existing distribution and/or pumping infrastructure to serve drip irrigation projects

(ii) Equipping farmers' plots with a head-end station and drip irrigation material

" Green Morocco Plan's irrigation programmes achieved localised irrigation in 36% of the total national irrigated area (compared to 9% in 2008) with small family farms comprising almost 80% of those supported. "

The State supports the modernisation of collective networks by installing external equipment and granting financial incentives to farmers to adopt localised irrigation systems. The government grants cover 80% of the investment cost and can reach 100% in the case of projects carried out by small farmers (<5 hectares) or as part of the collective conversion.

Morocco Ministry of Agriculture

Challenges and solutions

Collective conversion requires significant investment compared to individual conversion projects because it covers an entire irrigated perimeter. Moreover, collective conversion poses many challenges regarding technical choices and collective management of the network and irrigation. Challenges include:

- The adaptation of farmers to new irrigation techniques and new crops with greater added value.
- Building the capacity of the managers of the collective network (the Regional Offices for Agricultural Enhancement (ORMVA)) in the management and maintenance of the converted networks, the payment of water user fees, technical support for farmers, and the digital transformation in the irrigation sub-sector.
- Structural problems of farm size (mostly less than 5 hectares) and land ownership often present difficulties in carrying out conversion projects.

The implementation of collective irrigation projects is based on a participatory approach through dialogue, consultation of parties, and consensual decision-making. Indeed, in order to guarantee the sustainability of these conversion projects, it is necessary to involve farmers in various stages of the design and implementation of these projects.

These collective irrigation projects can face different types of risks. At the organisational level, it is necessary to build and design rules of collective management. At the relational level, it is a group of individuals with different points of view and interests. These projects offer several advantages, mainly the reduction of the investment cost, collective learning, the pooling of the various risks mentioned above, and the acceleration of the pace of adaptation of agriculture.

The Association of Agricultural Water Users (WUA) is, in this case, the primary mediator between the ORMVA and farmers in terms of information communication and training. The WUA constitutes a space for consultation and dialogue on issues relating to water management and the upkeep and maintenance of collective networks, including the transport network, pumping and filtration stations, distribution networks, and individual irrigation intakes. The WUA office holds working meetings with the members who are the water users. Representatives from the Department of Agriculture (ORMVA, DPA), and occasionally the local authority, are usually present at these WUAs committee meetings. In addition, it should be noted that prior to the implementation of the collective network modernisation projects, the ORMVAs undertake extensive operations to raise awareness and involve farmers and their associations. This involvement and participation of water users and their organisations continues throughout all phases of the project, with the objective of improving the management of irrigation networks and the rational use of irrigation water at the plot level.

Strengths and weaknesses of the taken approach

Although collective conversion is on a large scale and has a substantial impact on the economic, social, and environmental levels, the realisation of this irrigation programme requires:

- Mobilising more funding and resources to complete the programmed projects
- Ensuring farmers buy in to the new approaches and feel ownership of the new model.
- Supporting and encouraging farmers to better value the investments made
- Supporting farmers who have adopted the drip irrigation method to better manage the change in irrigation practices and value this technology through the diversification of crop rotations, the transition to more profitable crops, and the risks associated with the marketing of new products
- Strengthened human resources and capacities of the Water User Associations to enable them to effectively manage the infrastructure transferred to them and establish them as true partners of the administration
- Development of new instruments for managing modernised irrigation networks (remote management, water quotas etc.)

Expected or achieved results and impact against initial objectives

Among the main results, the area equipped with localised irrigation reached nearly 560,000 hectares by the end of 2018, exceeding the 2020 target (550,000 hectares). This area represents 36% of the total national irrigated area, against 9% in 2008.

The modernisation of collective irrigation networks in large irrigated areas totaled 123,000 hectares, in relation to the objective of 220,000 hectares by 2020. Nearly 80% of the farms affected by this modernisation component are small family farms.

From an economic and social point of view, the Green Morocco Plan's irrigation programmes, particularly the collective conversion to localised irrigation programmes, have increased crop yields, water savings, crop intensification, and the adoption of high value-added crops. The increase in the rate of crop intensification between 2008 and 2018 for the individual PNEEI was 32%, and 27% for the collective PNEEI. The average gross margin generated per hectare improved significantly by 166% for the collective PNEEI.

The collective PNEEI has also enabled the overall modernisation of the agricultural and food system, including the water transport network, pumping and filtration stations, water distribution networks, and individual irrigation connections.

Before implementing this modernisation of collective networks in the large irrigated perimeters of Grande Hydraulique, the ORMVA undertook awareness-raising activities with the involvement of farmers and their associations.

Between 2008 and 2018, these programmes also made it possible to:

- Improve the quality of irrigation services in irrigated areas, particularly in irrigated zones that benefited from the modernisation of collective networks, through continuous and on-demand distribution, as well as metering and billing of water consumed by the meter for each farmer
- Contribute to the emergence and development of increased indirect employment and job creation in the wider hydro-agricultural sectors (engineering and consulting, works and equipment companies, irrigation systems installation companies)
- Strengthen the capacities of the Water User Associations of the irrigated perimeters of the (collective) PNEEI and the Small and Medium Hydraulic areas (PMH), as well as the executives of the Provincial Directorates of Agriculture (DPA) and ORMVA. In this context, more than 170 associations (cooperatives, WUAs or agricultural development associations) were strengthened and accompanied to make a successful transition towards the appropriation of the new systems, and the exploitation of the developments carried out
- Improve the performance of the perimeters that have adopted collective conversion. According to a study carried out on two irrigation perimeters (21000 hectares), there has been an increase in yields from irrigated crops, an improvement in production (+25%), crop intensification (+20%), diversification of crop rotation and the adoption of more remunerative crops, improvement in farmers' incomes, and a reduction in groundwater pumping

PROMER collective network modernization project: a success story

One of the success stories is the project to modernise collective networks – PROMER – carried out within the framework of the PNEEI between 2011 and 2017. The project extends over an area of 21,167 hectares for an investment of DH 1 billion, financed 60% by the World Bank, in order to benefit 6,200 farmers. This project has achieved satisfactory results at the level of the Doukkala and Tadla perimeters in terms of increasing irrigated crop yields, improving production (+25%), crop intensification (+20%), diversifying crop rotation and adopting more remunerative crops, and improving farmers' incomes.

Morocco Ministry of Agriculture

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Balancing water scarcity with demand in Jordan

AGRICULTURAL SECTOR MEASURES TO ADAPT TO CLIMATE CHANGE AND ACCESS SUSTAINABLE AGRICULTURE

Jordan Ministry of Agriculture

Background

Jordan faces major challenges in balancing growing water scarcity with growing demand from its population. The per capita share of water in Jordan is one of the lowest in the world and has fallen over the past few years to less than 100 cubic metres. Jordan is classified as a semi-arid region that relies mainly on year-to-year rainfall. Studies have shown a drop in rainfall of up to 20% over the past few decades, primarily due to climate change.

The unstable political situation in the region, including conflicts and wars in neighbouring countries over the past decades, has exacerbated the water crisis caused by the influx of refugees into Jordan. More recently, the Syrian crisis has led to some 1.26 million Syrian refugees crossing the Jordanian border, putting enormous pressure on water reserves. In addition, the 2020 census indicates that Jordan's population has reached more than 10.8 million, indicating that population growth and economic development will continue to increase demand for scarce water sources.

Agriculture plays a crucial role in Jordan's food security and economy. According to available evidence, the total area in production was about 221,000 hectares in 2019, resulting in the production of nearly 3 million tons.

Vegetable cultivation accounted for 14.7% of the total land in production and 67.8% of its total production. Fruit trees covered 36% of the cultivated land and accounted for 20.6% of total production, and field crops accounted for 49.3% of the total cultivated land and produced 11.6% of total agricultural products. These findings highlight the importance of vegetable production. Although the area under cultivation of vegetables does not exceed 14.7% of the total area cultivated, it constitutes a large proportion of Jordanian products.

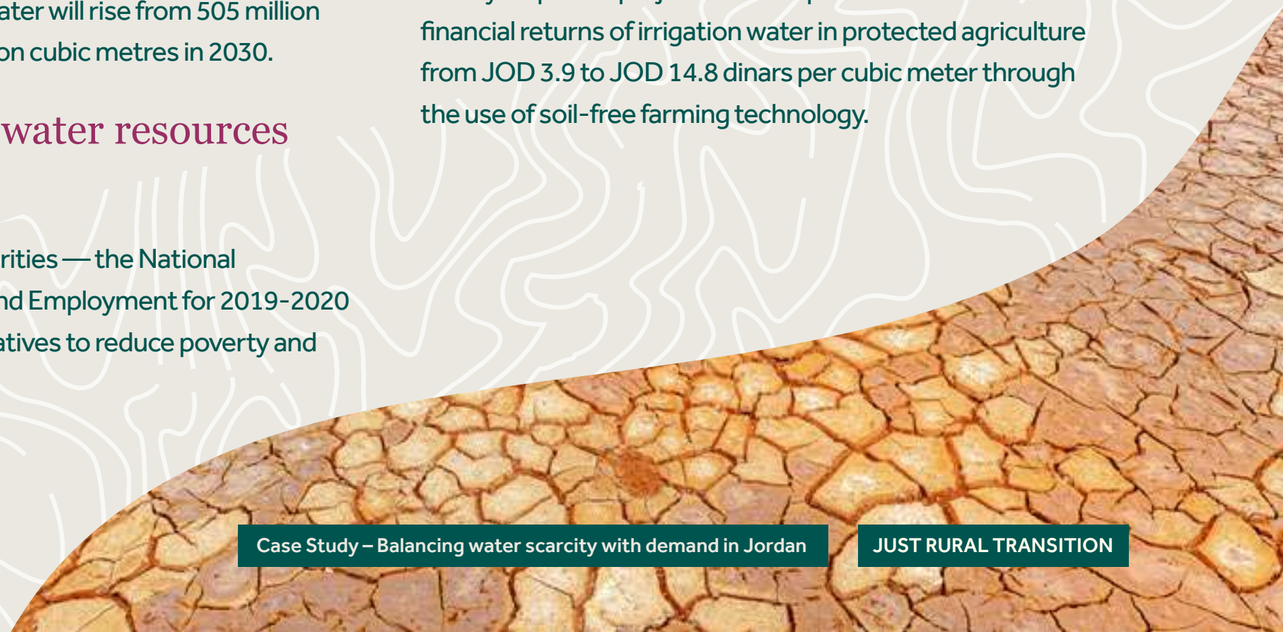
Food production in semi-arid countries such as Jordan is minimal due to irregular rainfall and is heavily dependent on irrigation. However, agriculture creates direct and indirect employment opportunities.

Jordan's water strategies indicate that demand for irrigation water will stabilise at 700 million cubic metres over the next 15 years, while available irrigation water will rise from 505 million cubic metres in 2015 to 550 million cubic metres in 2030.

Climate change and water resources for agriculture

As part of the government's priorities — the National Framework for Empowerment and Employment for 2019-2020 and the Ministry of Labour's initiatives to reduce poverty and unemployment in fragile areas with high levels of poverty and unemployment — the Ministry of Agriculture is introducing modern agricultural technology aimed at increasing the efficiency of water resources, including hydroponics, and introducing mechanisation into agricultural production. This national framework will contribute to sustainable development by increasing irrigation efficiency in Jordan. In particular, the plan aims to:

- Reduce the consumption of water used in agriculture by increasing conversion to hydroponics by about 60%, saving an estimated 46 million cubic metres of water.
- Increase agricultural production of plastic houses by 50%, with production expected to increase from 893,000 tons to 1,339,000 tons - an increase of about 446,000 tons per year.
- The hydroponics project is also expected to increase the financial returns of irrigation water in protected agriculture from JOD 3.9 to JOD 14.8 dinars per cubic meter through the use of soil-free farming technology.



Jordan Ministry of Agriculture

Jordan Ministry of Agriculture

Agriculture is a major sector affected by climate change, both through uncontrolled weather conditions and through its reliance on other sectors such as the water sector. Therefore, this sector must be supported and developed through cooperation between governments

The Ministry of Agriculture is working closely with the Ministry of Environment and other ministries to prepare the recently approved climate change plan. As such, the agriculture sector has submitted proposals for various climate change adaptation projects, which have been outlined in Jordan's nationally defined contribution action plan.

Job creation strategies

The project will provide training services for newly-graduated and unemployed agricultural engineers in modern agricultural technology such as hydroponics and hydroponic methods.

The development objective of the project is to "create agricultural jobs through agricultural mechanisation, develop value chains for agricultural and rural products, and increase the efficiency of the exploitation of available local resources". The project specifically aims to establish 50 agricultural mechanical units benefiting 4,500 farmers, support 1,125 workers with increased social security and health insurance, and implement training for more than 2,000agricultural workers through the implementation of more than 100 training sessions.

- Increase number of agricultural mechanisation units
- Increase agricultural employment opportunities in the project areas
- Increase the number of agricultural workers working in social security and health insurance in the project area
- Increase number of farmers receiving agricultural mechanisation services
- Increase the capacity of public sector employees and agricultural development planning workers

Technology

With regard to the transfer of technology to the agricultural sector, the Ministry of Agriculture has established the National Centre for Agricultural Research to enable farmers to adopt agricultural technology. The centre conducts agricultural research focusing on improving irrigation efficiency. Through agricultural cooperatives, the Ministry of Agriculture has also transferred the use of sheltered houses in the agricultural sector, as well as drip irrigation systems, to increase the

efficiency of irrigation water use at the farm level. The Ministry of Agriculture has also implemented Farmer Field Schools to transfer knowledge on effective farm management and fertigation techniques to increase the efficiency of the agriculture sector. These projects have contributed to improving the investment environment in the agricultural sector, and contributing to job creation through agricultural activities, as well as within businesses related to the agricultural sector.

> **"The national framework aims to reduce the consumption of water used in agriculture by increasing conversion to hydroponics by about 60%, saving an estimated 46 million cubic metres of water."**

Summary of the most important achievements

Through its work, the Ministry of Agriculture has submitted several proposals for climate adaptation projects, completed a sustainable development action plan that includes increasing reclaimed land from 345,000 dunums; implementing income-generating projects reaching some 15,000 poor rural families spread across more than 110 areas; adopting participatory pasture management approaches; and involving pastoral communities in pasture management – within 34 reserves covering an area of 114,000 hectares, where soil conservation techniques and water collection techniques have been implemented in pastures. At the level of earth dams and collecting ponds, the Ministry of Agriculture has drained approximately 120 million cubic metres, distributed in the pastoral lands of the Badia. The area of forested land amounts to 130,000 hectares of protected forests, of which 90 hectares were planted. Many other projects have been implemented, such as the Forest Land Employment Project, where more than 5,000 workers were employed. In terms of training for employment, 2,000 trainees were trained in several agricultural activities. Trainees included agricultural engineers, veterinarians, and agricultural workers.

Jordan Ministry of Agriculture

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Promoting sustainable agriculture in Ghana

PLANTING FOR FOOD AND JOBS INITIATIVE

Ghana Ministry of Food and Agriculture (MoFA)

In Ghana, over 90% of farmers are smallholders who produce the bulk of the country's food needs. These smallholders rely on rainfed agriculture, which makes them vulnerable to climate change, and many have limited access to resources and knowledge to facilitate adoption of improved technologies to build their resilience and foster sustainable agricultural practices. As a result, low productivity continues to dominate smallholder farming, and sustainable agricultural practices are not being adopted. This has led to accelerated degradation of soil nutrients and also contributed to encroachments of forest reserves and protected areas for agriculture.

For over a decade, the Ministry of Food and Agriculture (MoFA) has spearheaded the implementation of the Food and Agriculture Sector Policy (FASDEP I & II) with the vision of modernising the agriculture sector, culminating in a structurally transformed economy and more efficient resource use, improved food security, employment opportunities, and poverty reduction. However, the implementation of the policy over the years has fallen short of expectations, attributed mainly to the inadequate use of improved technologies and support systems to boost agriculture growth and sustainability.

Since 2017, the Government of Ghana (GoG), through the MoFA, has redirected public expenditure from the Fertiliser Subsidy Programme (FSP: 2008-2017) towards its flagship programme, Planting for Food and Jobs (PFJ) which is a more holistic support programme that goes beyond simply providing fertiliser subsidies. The PFJ has five (5) modules namely; Improving Food Security, Planting for Export and Rural Development (PERD), Vegetable Production through the use of Greenhouse Technology, Agricultural Mechanisation, and Livestock Development. Strengthened Extension Services is a cross cutting intervention for all five modules.

The objective of this new programme is to improve targeting of support for smallholders, improving their access to improved inputs, markets, and extension services, with a focus of creating jobs along the value chain. This change in policy was informed by studies which highlighted that inadequate access to agriculture inputs by smallholder farmers was contributing towards the degradation of the natural resource base and deforestation. The aim is to boost sustainable production for improved food and nutrition security and resilience using the No Regret Climate-Smart Agriculture Approach, which promotes climate-smart seeds and precision fertiliser use, among others.

The No Regret CSA and PFJ initiatives are all situated in the medium-term development framework of the government which aims to achieve inclusive development through equal opportunity for all. Through the programme the government has strengthened the extension system by increasing the number of extension officers and investing in tools and equipment to improve service delivery. Investments were also made in establishing warehouses for storage to reduce frictions in the value chain. Spending on these public goods and services, along with improving access to improved inputs and machinery, have led to improved yields and job creation throughout the value chain.

While the PFJ programme exceeded its expected reach, supporting over 1.7 million farmers by 2020, some of the key challenges encountered with the implementation include inefficient targeting, provision and use of agro-ecology-specific weather information services to support climate change adaptation, and market frictions along the value chain. Although the challenges have not been overcome completely, major strides have been made in improving targeting through the use of digital tools as an E-agriculture farmer registration platform was established to monitor input purchases.

" Since 2017, the Government of Ghana has redirected public expenditure from the Fertiliser Subsidy Programme (FSP: 2008-2017) towards its flagship programme, Planting for Food and Jobs (PFJ), targeting smallholder farmers with the aim to increase productivity, which can reduce the rate of agriculture land expansion. Reaching 1.7 million farmers by 2020 has led to improved yields and job creation throughout the value chain. "

Just Rural Transition

UN CLIMATE CHANGE CONFERENCE UK 2021
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Coping with drought and salinity intrusion in Viet Nam’s rice sector

THE USE OF CLIMATE-SMART MAPS AND ADAPTATION PLANS

Vietnam Ministry of Agriculture and Rural Development

Introduction and Context

The Mekong River Delta (MRD) is considered the "rice basket" of Viet Nam. Rice crop inhabits more than 1.7 million hectares out of the total 2.6 million hectares of agricultural land in the region. In 2020, Viet Nam exported 5.35 million tons of milled rice amounting to USD 64 billion, 90% of which was from MRD (MARD, 2020). However, several challenges continuously confront MRD's rice sector, such as population pressure, hydrology- and infrastructure-related issues, and climate-related risks, particularly drought and salinity intrusion.

MRD has experienced severe droughts in recent decades, causing huge crop and economic loss. Drought conditions caused by El Niño Southern Oscillation (ENSO) have intensified salinity intrusion into the delta and have substantially reduced agricultural productivity. This problem of drought and salinity intrusion in MRD, which frequently happens during Winter-Spring (WS), has been a predicament for rice farmers for decades.

During the 2015-2016 ENSO event, El Niño intensified the drought in the region, causing a rice production loss of 1.2 million tons (equivalent to 220,000 hectares). As **assessed** by CGIAR Centers working in Viet Nam, preparations to cope with this particular ENSO event was either lacking or not informed by the early warnings given by the government. The assessment team found that warnings were not translated into agricultural advisories properly; impacts of climate hazards are site-specific, and communication among government agencies in responding to hazards (crop production and hydrological office) is weak. With these findings, the team recommended localising risks and their impacts, facilitating dialogs of local stakeholders; identifying practicable adaptive solutions, and developing adaptation plans/scenarios.

As a response, the Department of Crop Production (DCP) - Ministry of Agriculture and Rural Development (MARD) and the CGIAR Research Programme on Climate Change, Agriculture and Food Security in Southeast Asia (CCAFS SEA) partnered to develop and implement the Climate-Smart Maps and Adaptation Plans **(CS-MAP)** approach. In 2016, DCP and CCAFS SEA started to pilot the process of developing relevant location-specific rice crop adaptation maps to manage the conflicts in land and water management in the 13 provinces of MRD.

Vietnam Ministry of Agriculture and Rural Development

The CS-MAP approach

CS-MAP is a participatory approach that integrates local knowledge and science-based researches in developing climate-related risks maps and adaptation plans, suitable to location-specific conditions. With simple colour coding (red-high risk, yellow-moderate, and green-safe), the rice areas were mapped in terms of risk to salinity intrusion and flooding.

The **five key steps** to developing CS-MAP are: (1) identify climate-related risks; (2) delineate the boundary of risk levels; (3) propose adaptation plans; (4) fine-tune and verify risk maps and adaptation plans; and (5) integrate adaptative plans of the individual province into the ecological zone and regional plan.

CS-MAP is simple, cost-effective, and easy to implement, as it uses secondary databases and the Indigenous knowledge of experts and local stakeholders. Because of its participatory nature, the approach covers the actual capacity of the locality and their orientation in production and adaptation to climate variability and change, making adaptation plans practical and feasible. CS-MAP is also flexible in that it can work at various administrative levels (national, regional, provincial, district, or commune).

Results and outcomes

CS-MAP for MRD was finalised and turned over in 2018 to DCP and the Plant Protection Department in the provinces and had significantly reduced the impact of El Niño in WS 2019-2020. According to DCP data from the local Departments of Agriculture and Rural Development reports, adjusting the seasonal calendar successfully mitigated the crop loss from drought and salinity by 176,000 rice hectares compared to what happened in 2015-2016. This is equivalent to over 73% of the area at risk of salinity intrusion. WS season 2019-2020 was assessed as having more severe saltwater intrusion and drought than WS season 2015-2016 (MARD, 2020). However, the implementation of adaptation measures from CS-MAP by DCP and Plant Protection Department, including early planting and using suitable rice varieties, has significantly reduced rice yield loss from the area affected (Figure 1).

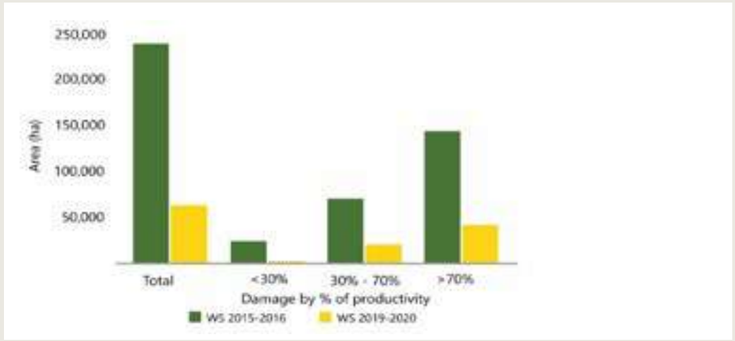

Figure 1. Areas damaged by drought-salinity in the entire MRD in WS seasons 2015 – 2016 and 2019 – 2020

> **"Using Indigenous and local knowledge with science, Climate Smart Maps (CS-Maps) enabled farmers to reduce crop loss and water salinity by 73% during the 2019-2020 El-Nino."**

A recent study conducted by CCAFS SEA assessed the impacts of adjusted crop calendar (specifically, early planting informed by CS-MAP) during the WS 2019-2020 season on the rice farming households' welfare in MRD. Results reveal that early planting added value to smallholders through additional rice farming income of VND 22.80-24.60 million/farmer or VND 8.62-8.77 million/ha during WS 2019-2020 season; annual rice farming income from VND 13.7-17.1 million/farmer or VND 3.2-4.27 million/ha; and rice yield from 5.29-5.67 tons/farmer or 2.51-2.59 tons/ha to the early planters.

The study's findings provide empirical evidence of the economic impacts of CS-MAP, particularly, adjusting rice cropping calendar/early planting as an adaptation strategy to mitigate salinity intrusion and increase rice production and income of rice farmers during extreme climate years.

Vietnam Ministry of Agriculture and Rural Development

Scaling the approach

The application of CS-MAP in the rice production of Vietnam has shown significant outcomes at the policy and field levels. The approach has been scaled out to other agricultural regions of the country and downscaled at the commune levels in the MRD region of Vietnam.

With the successful implementation of CS-MAP in the provinces of MRD, DCP-MARD started to implement the same approach to the provinces of South-Central Coast, Red River Delta, and Northern Midlands in 2020. For the Red River Delta and Northern Midlands, CS-MAP was used to address irrigation water shortages and manage reservoirs. On the other hand, CS-MAP is being applied to eight provinces in South Central Coast to help farmers cope with drought and salinity intrusion problems.

Although national government offices recommend production plans and seasonal calendars, locals should also adjust their adaptation measures to suit their specific conditions and production practices. As a result, CS-MAP, in 2020, has been tested and applied at the district and commune levels to update the maps in more detail to transform the production systems and organise the practices of the farmers.

For 2021, DCP-MARD has also applied CS-MAP in developing risk maps and adaptation plans for rice production in the Central Highlands and the North Central Coast, and fruit trees in the Northern Midlands and the mountainous region.

Ways forward

CS-MAP is originally developed for rice production, but it can be applied to other agri-food management, such as for coffee, tea, and aquaculture, among others. Aside from climate-related risks, it can also address different concerns in agricultural production, such as improved water supply, use of fertiliser efficiency, best performing crop cultivars, infrastructures, and even the interaction of people in the community. Moreover, CS-MAP can be applied to address a wide range of climate-related risks in other countries, such as flooding in Cambodia and drought in Laos and Myanmar, among others.

To further mainstream and integrate the approach to policies, DCP-MARD and CCAFS SEA will conduct a policy dialogue event and publish a guidebook to implement CS-MAP. DCP-MARD is also exploring how CS-MAP can contribute more to sustainable food systems by building resilient farming systems, promoting responsible use of natural resources, reducing carbon footprints, and ensuring regional and global food security.

Supporting documents

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Vietnam Ministry of Agriculture and Rural Development

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Transition to sustainable agriculture in Sierra Leone

ACHIEVING SDGS THROUGH POLICY SHIFT

Introduction and Context

Prior to the COVID-19 crisis, Sierra Leone's economy grew by 5.1% in 2019, driven mainly by agriculture and services. Due to effects of the pandemic, the economy is expected to contract by between 2.3-3.1% in 2021. This adds pressure to the social, economic and development challenges already prevalent in the country, which include declining revenues from the mining sector, low national and per capita income, high poverty rates, high youth unemployment, and poor infrastructure. Sierra Leone is highly vulnerable to climate change and faces multiple threats from climate change impacts.

Climate change and agriculture

Sierra Leone has two seasons with a marked difference in rainfall and temperature. Average annual temperatures have increased by 0.8 degrees since 1960.[1] Drought and bush fires, usually as a result of agricultural activities, contribute to crop failures during the dry season. During the rainy season, flooding and mudslides have become frequent, leading to significant disasters, including agricultural disruption and increased water-borne diseases in both rural and urban areas.

These disasters are exacerbated by climate change and human activities, including shifting cultivation and farming methods, logging and charcoal burning leading to widespread deforestation, and construction of unplanned and uncoordinated settlements. Climate change has added to the scale and complexity of the risks that Sierra Leoneans face, in a country ranked as the third most vulnerable to climate change in the world.[2]

Infrastructure in many areas of the country is poor, in particular rural road networks and access to energy sources (renewable and non-renewable). Whilst fertilisers are still needed to increase productivity on existing farms, to reduce the pressure for agricultural expansion onto fragile uplands and forests, access to supplies is well below domestic requirements. Food insecurity is pervasive, with an estimated half of the population unable to access sufficient nutritious food, whilst chronic malnutrition remains widespread.

The country faces numerous challenges; 1) addressing the triple burden of youth unemployment, poverty and food insecurity; 2) land degradation due to unsustainable agricultural practices, particularly slash and burn, and deforestation due to energy needs (as people seek to meet these using firewood and charcoal); and 3) identifying the right incentives to make farming profitable and engage young people in agriculture.

1. International Growth Centre Commission on State Fragility, Growth and Development (April 2018), 'Escaping the Fragility Trap'.
2. Intergovernmental Panel on Climate Change, 2014

MAF policy shift

In 2019, the Ministry of Agriculture and Forest (MAF) started a Policy Shift in its agricultural input subsidy and service delivery strategies. The objective is to increase productivity and total production of rice (the main staple food) by encouraging private sector participation in food production. This is consistent with the national objective of achieving rice self-sufficiency by 2023 in line with the MTNDP 2019-2023 and various SDGs.[3]

Further objectives of the policy are to make farming attractive and profitable; ensure that farmers have access to affordable farm inputs and mechanisation services; and to improve access to agricultural finance through matching grants (30% to 50% of market price of inputs). By promoting domestic rice production, the new policy aims to reduce the high import bill for rice (about US$200 million annually) and support jobs for over 95% of farmers in the country who cultivate rice.

The challenge is to achieve these objectives in line with climate and sustainability goals.

The policy shift was first piloted in 2019 as part of the Quick Action Emergency Response Programme (QAERP). Through this programme, the MAF collaborated with the private sector to provide inputs, training to women and youth farmer groups in post-harvest management, preservation and marketing of produce, and supported farmer groups with processing tools and mobile tools to Improve their access to market. A total of 390,924 households were supported. At the end of the cropping season, about 600,435 ha was harvested, with average yield increase of 16%, from 1.67t/ha of 1.96t/ha. With this result, the programme was scaled out throughout the country in 2020. Following this, the MAF collaborated with the Ministry of Finance to carry out a national farmers' registration, asset mapping and sensitised the private sector and farmers. Yield increases have a positive benefit for climate impact, reducing the pressure to expand cultivation on to more fragile lands. However, much more remains to be done in reducing greenhouse gas emissions.

As part of efforts toward meeting climate objectives, in 2020, the Government launched a 5-year national tree planting project, aiming to plant five million trees on approximately 14,706 hectares of degraded lands and coastal areas all over Sierra Leone. The project is expected to increase forest cover, enhance the capacity of carbon sequestration and biodiversity, and help reduce the adverse impact of climate change on the country. For example, the additional water used by growing trees may reduce runoff following rainfall events, which in turn could reduce the risk of flooding for downstream populations.

" The Quick Action Emergency Response Programme supported over 300,000 households and resulted in an average rice yield increase of 16%. Yield increases have a positive benefit for climate impact, reducing the pressure to expand cultivation on to more fragile lands. "

3. Particularly SDG s - 1: No Poverty; 2: Zero Hunger; 5: Gender Equality; 8: Descent work & Economic Growth; 9: Industry, innovation & infrastructure, and 13: Partnership for the Goals.

Sierra Leone Ministry of Agriculture and Forestry (MAF)

> **“ In 2020, the government launched a 5-year national tree planting project, aiming to plant five million trees on over 14,000 hectares of degraded lands and coastal areas. ”**

The project is expected to increase forest cover, enhance the capacity of carbon sequestration and biodiversity, and help reduce the adverse impact of climate change on the country. For example, the additional water used by growing trees may reduce runoff following rainfall events, which in turn could reduce the risk of flooding for downstream populations. Restoring forests will also increase evapotranspiration, which helps recycle water back to the atmosphere.

Using forests and tree belts as natural barriers to reduce both wind and water erosion, the project will help combat soil erosion along hills and slopes and aid soil conservation in agricultural areas. The expected co-benefit of the project includes promoting good health, agriculture, employment (initial target 10,000 youth), water conservation, and economic development.

In addition to government policy, Sierra Leone has ensured Climate Change Mitigation measures are embedded in all government and donor funded agricultural development projects.

For example, the IFAD-funded Agriculture Value Chain Development Project is providing seeds and seedlings of economic tree crops such as cashew, cocoa, neem tree, acacia tree, and gmelina tree to increase vegetation cover along water catchments of inland valley swamps.

The EU-funded Boosting Agriculture and Food Security in Sierra Leone supported a national assessment and review of current Climate Smart Agriculture (CSA)[4] approaches by smallholders in all 15 Districts of Sierra Leone. The study showed that there are already a lot of good CSA practices embedded into the farming activities of smallholder farmers that enhance integration and sustainable adaption of elements of CSA approaches. In addition to the comprehensive study, the project has also developed CSA training manual for frontline extension staff and trained Trainers (ToT) for 178 Extension Officers and Block Extension Officers (BES).

Lessons Learnt

Balancing livelihood and sustainability objectives remains a challenge, especially in the context of food insecurity and malnutrition, but good progress can be made when incentives achieve both economic and environmental gains.

With the right support, farmers shifted from cultivating rice on fragile uplands to lowlands, to more productive and suitable lands for practicing climate smart agriculture and provided access to improved high-yielding water- and nutrient-efficient varieties.

Additionally, the government alone cannot achieve change and the private sector must play a role. Crop productivity was increased across farms – reducing pressure for expansion - when the right incentives provided by government were delivered through private sector service providers. This reduced cost to government and reduced opportunities for corruption in the input distribution system.

Development finance has also played a catalytic role in crowding in the private sector, to introduce technologies and support dissemination and adoption by farmers. Relatedly, communication technology has proved vital, not just for disseminating extension messages, but to promote trade transactions and the provision of mechanisation services, thus reducing opportunities for corruption, usually associated with direct support to smallholder farmers.

4. Funded by the European Union in Sierra Leone through its BAFS Project under MAF.

Towards resilient and sustainable agriculture in Malawi

INCREASING PRODUCTIVITY, BUILDING RESILIENCE AND REDUCING EMISSIONS

Malawi Ministry of Agriculture

Introduction and Problem Statement

With a population of 18 million spanning over an area of 118,484 square kilometres, Malawi is densely populated, with its population growing at 2.7% per annum. As per capita land size keeps on dwindling, the population is estimated to reach 44 million by 2050. Approximately 85% of Malawi's population lives in rural areas and rely on agriculture. The agriculture sector accounts for 30% of the country's Gross Domestic Product (GDP), generates over 80% of national export earnings, and employs 64.1% of the country's workforce, comprising mostly of smallholder subsistence farmers.

Malawi experiences several challenges due to climate change and environmental degradation. With the advent of droughts and floods, which are becoming more frequent, agricultural growth has been decimated, correlating highly to reducing the country's growth prospects. Future climate change scenarios suggest an increasing climatic variability and climate change impacts. Pursuing climate action and sustainable development in an integrated and coherent way offers an optimal approach to enable Malawi to minimise the economic and social costs of climate change and to achieve its national and international objectives under the Paris Agreement and the 2030 Agenda for Sustainable Development.

Climate change challenges are strongly anchored within national policy frameworks. Such frameworks include national priorities and goals as contained in the Malawi Growth and Development Strategy (MGDS III) and Malawi 2063, long term vision. Within the agriculture sector, the National Agriculture Policy (NAP) and National Agricultural Investment Plan (NAIP) includes emphasis on agriculture transformation and resilience building as key priority areas. The National Resilience Policy is also in place to guide investments to promote resilience and sustainable agriculture.

Climate change challenges and its impacts on agriculture sector.

Droughts and floods are estimated to have cost the country around 1.7% of GDP per year on average. Regular droughts have frequently reduced maize production resulting in food shortages every two to three years. For example, floods followed by extended drought in 2015/2016 and 2016/2017 resulted in annual production loss of USD 282 million, and reduction of agricultural sector production by 2%.
The resultant decline in maize production impacted food security, leaving 6.5 million people requiring food assistance.

Climate change in Malawi has contributed to increased magnitude and frequency of floods and droughts. Floods are now a recurrent problem in some areas of the country.

This problem affects the socio-economic status of the country through loss of lives, people's property and livelihoods, and infrastructure damage. The floods and drought also contribute to inadequate water resources to meet demand because of increased seasonal variability in run-off, increases in population and demand for industrial production and irrigation requirement.

Droughts and dry spells have had disastrous effects as they cause crops to wither or wilt affecting productivity, and reducing moisture levels in wetlands, which are increasingly becoming a major source of crop production during the winter periods. Furthermore, irregular rainfall pattern, which is resulting in too little or too much rain, has had a greater impact on smallholder farmers. Flooding has also severely disrupted food production in several districts. Floods wash away crops, kill animals and erode fertile soils in the upland gardens. Soil erosion is very high, estimated at 29 metric tons per hectare, driven by land degradation which affects 40-60% of the land.

Scaling adaptation in agriculture

Malawi has developed strategies for transforming agriculture sectors into more sustainable and climate smart. Adaptation in the agricultural sector is a national priority and has been mainstreamed in the National Agriculture Investment Plan (NAIP) under Priority area on "Resilient livelihoods and agricultural systems". To further guide implementation and ensure coherence, the Climate Smart Agriculture (CSA) framework has been developed. CSA aims to tackle three main objectives: sustainably increasing agricultural productivity and incomes; adapting and building resilience to climate change; and reducing and/or removing greenhouse gas emissions, where possible.

> **"Malawi's Climate Smart Agriculture programme aims to: sustainably increase agricultural productivity and incomes; adapt and build resilience to climate change; and reduce and/or remove greenhouse gas emissions, where possible."**

One such intervention which is promoting CSA is the Agriculture Sector Wide Approach Support Project (ASWAp SP II), which is supported by a multi-donor trust fund[1] managed by the World Bank in Malawi.

The project aims to improve productivity and market access of selected commodities/value chains for smallholder farmers in 12 districts of Malawi.

The project has promoted farmer adoption of CSA practices as well as area specific fertilisers. Over 16,000 farmers have adopted CSA practices, with over 15,000 hectares of land under agroforestry, organic manure, conservation agriculture and sustainable land and water management practices. This has helped to improve crop productivity by 12% on average, including maize increase by 18%, ground nuts by 24% and sweet potatoes by 8%. Such efforts have greatly contributed towards increased food security and diversification. Approximately 800 trials on area specific fertilisers were mounted across the country, which led to the development of 422 area specific maps, where nutrients assessments were done to inform blending of specific blends that suits specific soil health.

1. Donors supporting the project include European Union (EU), Government of Flanders, Government of Norway, Irish Aid and United States Aid for International Development (USAID). Total project cost is US$55 million.

Malawi Ministry of Agriculture

> **"One project under Malawi's Climate Smart Agriculture policy saw over 16,000 farmers adopting CSA practices, with over 15,000 hectares of land under agroforestry, organic manure, conservation agriculture and sustainable land and water management practices."**

Efforts to release area fertiliser blends are at advanced stage, and this will contribute towards transforming agriculture sector through improving fertiliser use efficiency, thus providing scope for increased agricultural productivity. Such efforts have resonated towards the development of the National Fertiliser Policy which has been adopted, and the regulatory framework under the pipeline, to further operationalise following out of areas specific fertiliser blends.

The project has also integrated the catchment management approach which aims at scale out adoption of these practices from a landscape perspective. Following recommendations from research led trials which were implemented in the first phase of the project, the CSA have also been customised to agro-ecologies most suited for them, e.g., planting pits promoted in areas with rainfall amounts of less than 1,000 mm per year; and encouraging species characterisation for agroforestry germplasm while also promoting natural regeneration. Although there were challenges with low adoption at the beginning of the project, the impacts of climate change experienced at farm level spurred the increase in numbers of farmers adopting the CSA practices, with farmers learning from their fellow farmers during field days and other campaigns.

The project has also recognised the participation of various stakeholders in scaling out CSA by agreeing to work with members of a local climate smart agriculture alliance platform (coalition of NGOs) for the country as a recognition of the participation of these stakeholders in the agriculture sector, but also to fast track the scaling out agenda so that more farmers are reached through multiple collaborative partnerships of the agriculture sector.

Beyond the ASWAp SP II project, further World Bank support has been mobilised to improve climate resilient and sustainable agriculture. The first phase of Shire Valley Transformation Project (SVTP, US$223 million) is underway, aimed at improving agricultural productivity, commercialisation, and sustainable natural resource management, which targets to put at least 40,000 hectares of land in lower Shire River under irrigation. Malawi Watershed Services Improvement Project (MWASIP, US$160 million) is also under implementation, aimed at scaling up landscape restoration and improving watershed services

Conclusion

Malawi as a country aspires to achieve the goal of sustainable agriculture which is to meet society's needs in the present without compromising the ability of future generations to meet their own needs. Therefore, the Ministry of Agriculture leads all agriculture sector players, including those stakeholders who are part of the agriculture transformation agenda, seek to integrate three main objectives into their work: a healthy environment, economic profitability, and social and economic equity. Every person involved in the food system—growers, food processors, distributors, retailers, consumers, and waste managers—must play a role in ensuring a sustainable agricultural system.

Malawi Ministry of Agriculture

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Annex

Additional India case study summaries

A. Success stories of sustainable development through MOVCDNER

1. Eastern Ri-Bhoi Organic Farmer Producer Company Limited

Eastern Ri-Bhoi Organic Farmer Producer Company Limited, Meghalaya, has 500 members covering an area of 500 hectares spread over 16 villages. Member farmers grow organic certified ginger and turmeric. These villages within a large and targeted area have been successfully weaned out of chemical usage and are adopting local resource-based farming systems. Through the intervention the farmer members have also realised the value of working together in a group and not only improved production and marketability of produce, but also raised the income levels of members leading to improvement in their livelihood. The FPC achieved a turnover of INR15.25 lakhs in FY 2020-2021 and the profit of INR 5 lakhs were distributed to all 500 farmer members as dividends.The FPO has now developed multiple marketing strategies and has also ventured into spice processing by developing value added products of ginger and turmeric such as flakes and powder.

2. Tetelia Agro Organic ProducerCompany Limited

Tetelia Agro Organic Producer Company Limited, Assam, developed under MOVCDNER was formed on 26 July 2017. The company has 914 farmer members covering an area of 1024 hectares in the Kamrup (rural) district of Assam. The annual production from the major crops (ginger, paddy, betel nut, black pepper, banana, orange) is around 5200MT. Through the intervention, support and handholding under the MOVCDNER scheme, FPO has also developed the supporting infrastructure such as custom hiring centres (2), collection centres (3), transport vehicles (4) and are seeking assistance for developing an integrated processing unit for ginger and turmeric. Turnover of FPO for FY 2019-2020 was INR 525 lakhs. The revenue is generated by selling fresh as well processed produce to corporates, local traders and exporters. One of their major achievements was the export of 150 megatonnes of fresh turmeric and ginger to Switzerland and Africa worth INR 57.75 lakhs. With the sustained efforts, the FPO has been able improve the social and economic upliftment of the associated farmer members through reduced cost of cultivation, increased productivity, market linkages, and value addition.

B. Integrated Organic Farming System (IOFS)

1. A holistic approach for doubling farmers' income in the terraced land of Sikkim (Himalayas)[1]

In 2016, Sikkim was declared the first organic farming state of our country. Sustainable agriculture entails using a holistic approach to increasing agricultural productivity and resource management in order to address all three important components of sustainability: economic, environmental, and social. Considering all these, it was required to opt for a multi-disciplinary and holistic approach for the overall development of farming systems and farming community of Sikkim. A basic feature of an Integrated Organic Farming System (IOFS) is waste or by-product recycling and improved space utilization in which the two subsystems essentially occupy part or all of the space required for an individual subsystem (Devendra and Thomas, 2002). Thus, an IOFS represents multiple crops (e.g. cereals, legumes, horticultural crops, agroforestry) and multiple enterprises (e.g. livestock, poultry, and fisheries) on a single farm in an integrated manner (Behera and France, 2016). Keeping these in view, the present research was undertaken with the following objectives: 1) to assess the effect of integration of different enterprises on productivity

1. Ravikant Avasthe*, Raghavendra Singh*, Boniface Lepcha, Prasanta Pathak**, Amit Kumar*, J. K. Singh**, Subhash Babu* and Pallabi Phukan****, *ICAR Research Complex for NEH Region, Sikkim Centre, Tadong, Sikkim-737102 and **ICAR-Krishi Vigyan Kendra, East Sikkim, Ranipool, East Sikkim, Sikkim, India

and profitability of IOFS model; and 2) to study the impact of integration of different enterprises on economic output and energy dynamics of the IOFS model.

Considering the physical, social and economic limitations of farmers in Sikkim an Integrated Organic Farming System (IOFS) model was designed by ICAR Sikkim Centre and demonstrated at a South East district of Sikkim. Various inputs/interventions were provided by ICAR with the purpose of reorienting their traditional farming into an integrated organic farming system (IOFS) to increase the farm income. Major technologies included low-cost micro water storage structure, Jalkund using silpaulin (250 GSM), low-cost plastic tunnels (transparent UV stabilised sheet of 45 GSM) for sequential vegetable cultivation; and the introduction of zero-till vegetable pea, mustard, cole crops, and buckwheat in the village. Strengthening backyard poultry production with Vanaraja, sa cientific method of piggery and dairying, and Napier cultivation as fodder grass on terrace risers were also mediated. Jalkund, a micro water reservoir designed with dimensions of 5 m × 4 m × 1.5 m (capacity of 30,000 L) was introduced to meet the water requirement of crops through a gravitational sprinkler irrigation system, and encouraged the farmers to opt for diversification of the integrated organic farming system. All the package of practices required for crop production were followed.

The economics of each enterprise was calculated based on the economic produce of that enterprise.

Capacity building of the farmers through institutional intervention changed the attitude of farmers and motivated the farming community to adopt improved technological options developed by ICAR Sikkim Centre. Demonstration on buckwheat under scientific management practices paved the way for a higher net income of INR 43,775 per hectare in the village. Average productivity of Kharif vegetable crops was enhanced from 4733 kilograms per hectare before intervention to 6931 kilograms per hectare after intervention. Rabi vegetable cultivation with improved production technology recorded higher productivity (6992 kilograms per hectare) as compared to conventional practices (4598 kilograms per hectare). The benefit to cost ratio of the recommended practice for Rabi vegetables was 2.38 as compared to 1.63 before the interventions were made.

Vegetable crops were cultivated in sequence (broccoli – radish – fenugreek – coriander – spinach) under low cost polytunnel systems with a benefit to cost ratio of 4:1. A total of ten (10) low-cost micro water harvesting structures (Jalkund) demonstrated in the village encouraged the farmers to optimise diversification with the cultivation of cole crops, potato, vegetable pea, fenugreek, coriander etc. during the Rabi season. The overall performance of crop production under the recommended technology was superior over the conventional methods which overlaid the average net income of INR 45,829/- with a 41 per cent yield increase resulting in a benefit to cost ratio of 2.14 from the technology. Higher green fodder was made available during the lean period in the village with the cultivation of hybrid Napier and oat on the terrace risers and stony terraces. Total dairy milk production increased by 64.5% in the village due to technological interventions. Piggery also improved in the village with the introduction of high-yielding crossbreeds (Hampshire x local) and low-cost sheds with better management. During the study these interventions led to total net income of INR 1,71,833/- in the village. ICAR Sikkim initiated backyard poultry farming with the Vanaraja variety. Farmers were given hands-on training and 2152 days-old chicks were distributed during the intervention period. The net earnings from Vanaraja backyard poultry was INR 5,03,313/- in the village with a 91.8% yield increase and benefit to cost ratio of 4.23. Average performance of livestock under recommended technology was also superior over the farmers' practice which produced average net income of INR 2,77,287/- with a 70.4% yield increase by resulting in benefit to cost ratio of 2.55 from the technology.

On the basis of present study, it can be concluded that the IOFS is a holistic and multidisciplinary approach which integrates several components on a single farm in an integrated manner, thereby minimizing the risk to farming communities.

It is enormously important for the efficient management of available resources at the farm level to generate adequate income, enhance resource-use efficiency and recycling of farm by-products, provide balanced and nutritious food which is economically viable, socially acceptable and environmental sound; and creates employment and improvement of their livelihood in a sustainable manner.

Similar IOFS models have been developed at Thanka-Martam and Lower Nandok villages in East Sikkim. The technology has been transferred to the Department of Agriculture, Govt. of Sikkim through ATMA-East Sikkim and KVK-North, South and West Sikkim for demonstrations at farmers' field.

2. IOFS for enhanced system productivity and livelihood of hill farmers in Meghalaya[2]

The objective of the study was to enhance the system productivity and income of resource-poor hill farmers by integration of different resources within the farm under organic management practices.

Flow chart/ steps of technology:

- Identification of suitable land for developing IOFS near the household
- Creation of rainwater harvesting structure (jalkund/) farm ponds
- Establishment of animal rearing unit (dairy/piggery/poultry)
- Construction of compost pit /vermicomposting unit for efficient recycling of animal excreta and other farm biomass like kitchen waste, weeds etc.
- Development of kitchen garden and cultivation of year-round vegetables having high market demand
- Cultivation of cash crops like ginger or turmeric for income generation
- Fruit crops like pineapple, Assam lemon, papaya, banana, guava etc, at corners of the field
- Construction of bamboo machan over jalkund and cultivation of pumpkin, bottle gourd over the jalkund
- Marketing of organic produce

The IOFS model in cluster approach is a real success in the adopted village as evident by higher productivity, income and employment generation than their initial status.

Almost 70% of the seeds and most of the nutrient requirement for the IOFS are met from the villages itself with minimal dependency on external inputs like lime, bio-fertiliser, high-yielding seeds etc. After about five years of practicing IOFS, productivity of various crops, fish and livestock was enhanced by 20-45%, 30-50% and 20-30%, respectively than the initial productivity. The annual income of farmers was enhanced by about INR 15000-18,000/annum. Through collaboration and convergence with government and non-government organizations, IOFS models may be upscaled in other areas of the state and North East for promoting organic farming as means of sustainable rural livelihood.

3. GodhanNyay Yojana, Chhattisgarh[3]

Objectives of GodhanNyay Yojana:

- Increase in income of cattle rearers
- Check on open grazing and stray cattle
- Increasing usage of organic manures
- Ensure availability of manure in rural areas
- Improve soil fertility
- Crop protection, increase of area under double cropping
- Leveraging the Self-Help Group model

2. Jayanta Layek*, Anup Das*, Krishnappa R*, S Hazarika*, N Ravisankar, A S Panwar** and V K Mishra***,All India Network Programme on Organic Farming, *ICAR Research Complex for North-Eastern Region, Umiam, Meghalaya; **ICAR-Indian Institute of Farming Systems Research, Modipuram, Meerut, Uttar Pradesh, India

3. M. C. Bhambri and Sunil Kumar, All India Network Programme on Organic Farming, Indira Gandhi Krishi Vishwa Vidyalaya (IGKV), Raipur, Chhattisgarh

Key Features

GodhanNyay Yojana was implemented in Chhattisgarh on 20 July, 2020 and key features of the scheme are as follows:

1. Animal husbandry and cow dung management to become more profitable for livestock owners.
2. Implementation of GodhanNyay Yojana to generate employment opportunities and additional income.
3. Cow dung to be procured on fixed rate. Production of vermicompost/super compost/bio-enriched compost to be sold from cooperative societies.
4. Along with environmental protection, this scheme will also encourage use of organic manures in farming, which will help in improving soil fertility and health.
5. GodhanNyay Yojana is a village-oriented scheme to empower women from rural areas through Self Help Groups to prepare vermicompost and other products from cow dung.
6. Check on open grazing and stray cattle and increasing area under double cropping.

Table 1 – Progress of the scheme (As on 18.08.2021)

Gothans Established	5634
Cow dung procured	496298.1 tonnes
Vermicompost produced	72650.473 tonnes
Super compost produced	30930.362 tonnes
Sale of Vermi compost	53334.45 tonnes
Sale of Super compost	12961.572 tonnes

4. Organic and natural farming in Himachal Pradesh[4]

Opportunities: Promoting healthy lifestyles, sustainable use of resources, developing local organic manure suppliers, huge regional export market, huge global export market, creating seed sovereignty, conserving local crops, strengthening culture, promoting self-sufficiency and food reliance, reducing dependence on import, growing interest in organic agriculture, premium price, building up soil fertility, consistent yield, strengthening rural community, employment opportunities.

Threats: Impending WTO membership, global competition, variability in climate pattern, yield reduction, dwindling supply of organic sources of manure, pest and disease incidence, higher certification cost, introduction of genetically modified organisms (GMOs).

Success story

Organic cluster in 3 villages under the Rampur development block in the Shimla district of Himachal Pradesh was studied with geo-tagging of households. Out of the total 33 farm households studied, all were certified and the majority of them (82%) were marginal farmers. Out of the 33 hectares under organic farming across three villages, fruits occupied the maximum area (26 hectares) followed by vegetables pulses and vegetables (3 hectares per commodity), whereas, spices had very little area (1 hectare). Analysis of the geo-tagged organic cluster villages in Shimla district showed that the yield of vegetable pea, cabbage, garlic, black gram and tomato were highest NPOF management packages as compared to yield obtained in farmers' fields. To bring farmers' yield levels on a par with experimental yield, need was felt to demonstrate scientific techniques of organic farming on farmers' fields and also through imparting training to the stakeholders.

Organic farming through a cluster approach: Shri. Sarswati Thakur, a progressive farmer, started organic farming in his village and convinced other farmers in the village to practice organic farming. He succeeded in starting this practice of organic production in whole village and formed an organic farming group of 33 farmers at village level. The group is registered as "Jagtamba Krishi Evam Bagvani Organic Group" and Sh. Sarswati Thakur has become leader of the group.

4. D.K. Parmar, All India Network Programme on Organic Farming, Hill Agricultural Research and Extension Centre, CSK Himachal Pradesh Krishi Vishwa Vidyalaya, Palampur, Himachal Pradesh, India

Pest management: The group uses herbal spray prepared from locally available medicinal plants (extract made from onion, garlic, ginger, chillies, urtica, Melia azedarch, Calotropis procera) for control of pests in all crops. They also practice foliar spray of whey (buttermilk) for management of pests in different crops. For the control of soil-borne bacterial diseases, farmers use hot water, Trichoderma, ash and salt and a small quantity of herbal extracts. Foliar spray of vermiwash is another practice of farmers for supplying nutrient to the plants. Apart from applying FYM and vermicompost as organic manures, they also keep a migratory flock of buffaloes in the fields for three months which improves fertility due to their droppings.

Benefits: The profitability of organic crop production in the area is higher than that of conventional farming. Sale prices of organically-grown crops are higher than those of their conventionally grown counterparts. From a social sustainability perspective, the organic cultivation of vegetables, fruits, spices and pulses in the district has resulted in a notable improvement of the employment indicators at the farm level.

Ecosystem services contribution: Although organic agriculture produces lower yields than conventional agriculture on certain occasions, it better unites human health, environment, and socio-economic objectives than conventional systems. In a time of increasing population growth, climate change, environmental degradation, and rising energy costs, such agricultural systems with a more balanced portfolio of sustainability benefits are needed.

5. 'Nalla BhakshanaPrasthanam' (The Safe Food Project), Kerala[5]

Culinary route to healthy living - the 'Nalla BhakshanaPrasthanam' (the Safe Food Project) is a collective of young farmers in Ponnani and Edappal in the Malappuram district of Kerala, which started with an aim to provide healthy food to the community. The cluster was stated in 2009 with less than 20 farmers, who were interested in protecting nature and natural resources in the Edappal panchayath. This cluster was the brainchild of Shri. K. Chandran, Dr. Shambhu Namboothiri and Shri. Ibrahim Kutty. Reduction of health issues caused by continuous use of inorganic fertilisers, pesticides and other chemicals for crop production is the mission of the organic cluster.

Major activities of the cluster: Production of crops including rice, vegetables (ash gourd, bitter gourd, snake gourd, pumpkin, ridge gourd, bottle gourd, ivy gourd, vegetable cowpea, cucumber etc.), fruit crops (banana, mango, jackfruit etc.), plantation crops (coconut, areca nut etc.) and tuber crops (cassava, elephant foot yam, yams and taro), selling of the organic products through the selling outlet at Ponnani, Malappuram, and conducting training programmes on organic practices to the farmers.

Integrated Organic Farming System approach: The cluster promotes an Integrated Organic Farming System and recycling of natural resources produced in the farm itself. One member in the cluster said that by adopting integrated farming system, he could reduce almost 50% of the production cost by using farm animals as the source for manure. It could also reduce the purchase of organic manures like FYM, poultry manure etc. from outside, which is much costlier and contaminated with chemicals from animal feed. Azolla cultivation is also practiced by the famers in the cluster and used as feed for farm animals and biofertiliser for crops like rice. Members of the cluster were aware of the health benefits in organic farming and the consumption of poison-free organic products. Organic manures like cowdung, biogas slurry, poultry manure, goat maure, vermicompost, neemcake, groundnut cake etc. were used for cultivation. They also used jeevamritham, panchagavya, vermiwash etc. Ghana jeevamritham is a product prepared by a member of the cluster using cowdung enriched with beneficial microorganisms.

Krishi Bhavan and KVK provide good-quality planting materials, biofertilisers, organic insecticides, fungicides, farm equipments and other organic inputs to the farmers of the cluster. Small equipments were used by the farmers like power tillers, brush cutters, combine harvesters etc.

5. Suja, G.,Harishma, S.J and Shyam Sasi,All India Network Programme on Organic Farming, ICAR-Central Tuber Crops Research Institute, Thiruvananthapuram, Kerala, India

An 'eco-shop' (selling outlet), where the farmers can sell their organic produce and value-added products at remunerative price, is functioning at Ezhuvathuruthy, Ponnani, Malappuram. This was set up with the financial assistance of INR 10 lakhs from Ponnani block panchayath. Moreover, the eco-shop has a cold storage facility set up, where the excess vegetables can be preserved without decay thus reducing the loss incurred by farmers. The KVK has also provided a vermicompost unit and biogas plant to the farmers for effective organic waste management.

Effective management of soil fertility is being done by use of farmyard manure, poultry manure, goat manure, vermin compost, biogas slurry, neem cake, groundnut cake and bio-fertilisers. Green manuring, residue mulching and in situ incorporation of weeds also increases the soil fertility. Pest and disease management is being done with neem oil, cow urine, mathi-sharkara, garlic spray, chilli spray, Beauveria, Trichoderma, Pseudomonas and Indigenous practices. According to the farmers, pest and disease attack was less frequent under organic management practices. Multiple cropping, intercropping, sequential cropping, relay cropping and crop rotation practices were followed to maintain the soil fertility. Farmers are aware of the role of legumes in the cropping system to improve the soil's nitrogen status.

Socio-economic benefit: Through this cluster, the area under organic rice in Malappuram district could be increased from 20 acres in 2010 to 100 acres in 2017. The cluster also promotes the production of local varieties of rice like 'kuruva', 'cheradi', 'thavalakkannan', 'jeerakasala' and medicinal rice variety 'njavara'. The local varieties are not only resistant to pests and diseases, but also produce sufficient quantity of straw, required for rearing of farm animals. The cluster could reintroduce 17 local varieties of rice within 7 years. These traditional rice varieties have more health benefits compared to new elite varieties. According to the farmers, consumption of such rice varieties imparts disease resistance and can avoid 75 percent of diseases in human beings. In the year 2016-17, 17.81 tonnes of vegetables, 9.29 tonnes of fruits, 2.12 tonnes of tuber crops and 0.2 tonnes of spices were produced by the cluster, relying solely on organic management.

6. Organic farming options for enhancing the livelihood and income of farmers in Cuddalore district, Tamil Nadu[6]

A progressive farmer, this correspondent farmer was instrumental and motivated the fellow farmers. The group consists of 23 men and 6 women farmers. The farmers were not aware about organic farming and also didn't have technical knowledge of organic farming practices. PRA techniques were employed for identification and was felt needed in the organic farming. Based on the PRA technique and based on the request of the farmers, organic paddy cultivation was taught. The following technologies were shown to the farmers. Under organic nutrient management, preparation of vermicompost was demonstrated. Mulching was also taught from the basic under weed management. Necessary pamphlets on procedures for neem-based extract and five leaves extract were provided.

Table 2 – Technologies intervention though capacity building programme

S. No	Technology	No. of beneficiaries
1	Crop rotation and soil health management	29 (23 men and 6 women farmers)
2	Organic nutrient and weed management	
3	Seed treatment techniques	
4	Methods of composting and vermicomposting preparation	
5	Panchagavya production techniques	
6	Fodder production and animal rearing	
7	Eco-friendly pest manazgement	
8	Mushroom cultivation and apiculture	
9	Organic certification, PGS and value addition	

6. S. Manickam and R. Jansirani, All India Network Programme on Organic Farming, Tamil Nadu Agricultural University, Coimbatore-641 003, Tamil Nadu, India

Table 3 – Live demonstration on organic inputs preparation programme

S. No	Demonstration on organic inputs	No. of beneficiaries
1	Seed treatment with biofertilisers	29 (23 men and 6 women farmers)
2	Panchagavya preparation	
3	Jeeamruth preparation	
4	Vermicompost preparation	
5	Neem seed extract preparation	
6	5 leaves extract preparation	

Table 4 – Adoption of organic farming technology among the farmers in paddy cultivation after intervention

S. No	Adoption of organic farming technology in paddy cultivation	No. of respondents	%*
1	In situ of green manure crops	29	100.00
2	Neem seed extract	29	100.00
3	Seed treatment with biofertilisers	24	82.75
4	Foliar spray of 3% panchagavya	21	72.41
5	5 leaves extract (5%)	15	68.96
6	Jeeamruth (5%)	19	65.51
7	Vermicompost	17	58.62

Table 5 – Yield and income of the farmers before intervention and after intervention of SCSP

S. No	Economic returns	Before intervention	After intervention
1	Yield ton/ha	2.5	3.6
2	Net Income (INR/ha)	INR 45,000 (INR 18/kg)	INR 75,600 (INR 21/kg)

Among the group of 25 farmers, a graduate, Mr. Pannerselvam, actively took part in the training by helping the fellow farmers to comprehend along with Mr. Venkatesan the head of the group, resulting in production of panchagavya and jeevamurth by the fellow farmers.

7. Organic poultry farming: a way forward for new livelihood sources, Rajasthan[7]

The poultry sector plays a significant role in improving the socio-economic condition of rural communities, by generating gainful employment and augmenting family income, particularly among the landless labourers, small and marginal farmers.

At the household and local community level, organic agriculture provides access to attractive markets and promotes alternative food chains as well as community-based rural-urban networks.

Traditional farming system

Growing of maize, blackgram and mixed crops in Kharif (July to October) and wheat in Rabi (November to March) season with one or two cows/goats are the major components of farming system followed by the 60-70% of total farmers in Southern Rajasthan. Farmers earn an income ranging from INR 20000 to INR 90,000 per hectare depending upon the monsoon situation and technological support.

Introduction of improved backyard poultry has created new livelihood sources and brought food security to Indigenous communities in the tribal-dominated region. This enterprise suits available space in home or nearby areas, low investment, easy management, and accessible, improved technologies. Farmers of Udaipur and Dungarpur district, Rajasthan, were instrumental in promoting improved organic poultry farming practices, which have benefitted the villagers.

As demand for antibiotic-free and safer eggs and meat increases, production of poultry is gaining momentum. Therefore, under Niche-Area of Excellence on Organic production, technologies for organic poultry production, and a demonstration unit for organic poultry production with a meat processing unit, were developed at MaharanaPratap University of Agriculture and Technology, Udaipur as per standards of National Programmes on Organic Production during 2018-2020.

7. S.K Sharma*., N.S. Rathore*, S.Mishra*, Lokesh Gupta*and N. Ravisankar,** *Maharana Pratap university of Agriculture and TechnologyUdaipur-313001, Rajasthan; **ICAR-Indian Institute of Farming Systems Research, Modipuram, Meerut, Uttar Pradesh, India

The findings of the project indicated that conversion of traditional backyard poultry farming to improved backyard poultry farming and its further conversion to an organic backyard poultry system is more economic (Table 6) and provided new opportunities of enhancing the income of farmers of all categories, especially marginal and small farmers in the region (Table 7 and Table 8).

Table 6 – Main characteristics of the two poultry farming systems

Particulars	Conventional	Organic
Building and space allowance		
Birds per unit	9000	1000
Surface area covered (m2)	521	190
Density (birds per m2 covered surface)	17.27	5.26
Open area m2 per bird	-	0.66
Productive Performance		
Final weight (g)	2000	1500
Age at slaughtering (days)	112	112
Daily weight gain (g/day)	17.89	13.39
Units produced/year	1	1
Feed index	3.0	4.3
Mortality rate (%)	10	20

Organic feed production: Maize, grass and lucerne are grown on the university farm and mixed with oil cakes bought in from elsewhere in Rajasthan to produce organic feed for the farm. The maize is grown on fields adjacent to a small reservoir used for fish production and farm waste. Growing maize organically and without use of pesticides helps to minimize water pollution.

Nutrient cycling and energy generation: Chicken dropping and crop waste (e.g. maize stalks) from the farm are fed into an aerobic digestion pit on site to produce compost. This provides compost for production of organic crops and herbs.

Table 7 – Success story 1: Mr. Shankar Lal, Farmer Rishabhdev, Udaipur, Rajasthan

Sr. No.	Particulars	Actions
1	Number of birds	125
2	Name of breed	Pratapdhan, Kadaknath
3	Housing system	Free range (openside area in day and covered area in night) with backyard system
4	Forage & living area	1 hectare
5	Watering facilities	Tube well and plastic bowls
6	Feed	Maize grain + wheat + Azolla
7	Total egg production	10-12 per day
8	Total meat production (sale of live birds)	2 cock/month at INR 1000 per cock 2 hen/month at INR 600 per hen
9	Mortality	12 (about 10%)
10	Total cost (12 month)	Feed = 3650 kg X INR 15 = INR 54,750 Other costs = 200 X INR 12 = INR 2400 Total = SINR 57,150
11	Gross revenue	Eggs sold = 3650 at INR 30 = INR 109,500 Total cock sale = 24 x INR 1,000 = INR 24,000 Total hen sale = 24 x INR 600 = INR 14,400 Total = INR 147,900
12	Net return	INR 90,750
13	B:C Ratio	1:2.59
14	Employment generation	190-mandays
15	Business status	• Transitioning from conventional organic chicken production to organic poultry production
16	Innovation	• Group Marketing • Integration with Azolla production, goat and livestock
17	Technology	• Organic poultry production
18	Standards	• Under organic management system
19	Feedback	• Organic poultry farming reduces antibiotic use and helps to preserve a pesticide-free environment, resulting in a cost trade-off • The positive impact on the environment should be considered, and incentives should be provided to poultry farmers

Table 8 – Success story 2: Mr. Abbas Chichali, Farmer, Khagdara, Bicchiwara, Dungapur, Rajasthan

Sr. No.	Particulars	Actions
1	Number of birds	700
2	Name of breed	Ankleswar and Pratapdhan
3	Housing System Type	Backyard system with free range (day in openside area and night in covered area
4	Forage & living area	3 hectares
5	Watering facilities	Tube well and plastic waterer, automatic
6	Feed	Maize grain + Azolla and Lucerne
7	Total egg production	60-70 per day
8	Total Meat Production (sale of live birds)	150 cocks at INR 800 per cock 200 hens at INR 600 per hen
9	Mortality	70 (10% of total)
10	Total cost (9 month)	Chicks 700 at INR 110 = INR 77000 Feeds = INR 72,000 Labour = INR 40,000 Total = INR 189,000
11	Gross revenue	Eggs sold= 1600 at INR 20 = INR 32,000 Total cock sales = 150 cocks at INR 800 = INR 120,000 Total hen sales = 200 hens at INR600 =INR 120,000 Total = INR 272,000
12	Net return	INR 83,000
13	B:C Ratio	1:1.44
14	Employment generation	135-mandays
15	Business status	• Transforming conventional organic production to organic poultry
16	Innovation	• Online Marketing • Integration with fish production, goat and livestock
17	Technology	• New dual-purpose high yielding Pratapdhan & Ankleswar breed
18	Standards	• Organic certification is under process
19	Feedback	• Organic farming of poultry birds reduces use of antibiotics and helps in maintaining pesticide-free environment (and therefore trade-off cost) • Positive effect on environmental aspects should be considered and incentives should be given to poultry grower

Citation

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UK supplementary case study

UK Department for Environment, Food and Rural Affairs (Defra)

What is devolution?

Devolution is the process of decentralising government and transferring powers to local or regional administrations. In the UK, this means that some powers have been transferred from the UK Government to the four distinct legislatures and governments in Scotland, Wales and Northern Ireland.

Each devolved legislature has its own unique devolution settlement, established through Acts of the UK Parliament, which sets out the range of policy areas for which they are responsible. Devolved administrations have many powers to make laws and deliver public services. These are often called devolved powers. Reserved powers are those that remain at a UK Parliament level.

Further information about devolution in the UK can be found here.

Legislature	Executive	Responsibility for agriculture
UK Parliament	UK Government	Defra (in England)
Scottish Parliament	Scottish Government	Scottish Government
Welsh Parliament (Senedd Cymru)	Welsh Government	Welsh Government
Northern Ireland Assembly	Northern Ireland Executive	DAERA

Devolution and agriculture policy

Agriculture is a devolved policy area under the devolution settlements of Scotland, Wales and Northern Ireland. This means that now that the UK has left the EU, each administration can take responsibility for shaping new domestic agricultural policies to better suit their farmers. This also means that there will be differences in agricultural policy in England, Scotland, Wales and Northern Ireland.

The UK Agriculture Act 2020 gives powers to England, Wales and Northern Ireland to amend EU retained legislation and introduces new legislative powers. Scotland introduced their own Act, The Agriculture (EU Retained Law and Data) (Scotland) Act 2020. The Act gives similar powers to Scotland to amend this retained legislation.

The Agriculture Act 2020 mostly legislates for England with some UK-wide clauses relating to fertilisers, organic products, the Livestock Information Programme and the Red Meat Levy, and reporting to the UK Parliament on food security.

The Welsh Government has published an Agriculture White Paper in advance of an Agriculture (Wales) Bill to be introduced in the Senedd Cymru (Welsh Parliament). DAERA may similarly introduce new legislation in the future.

What impact does devolution have on the UK's agriculture sector?

The devolution of agriculture in the UK enables respective governments to work more closely with stakeholders to understand and respond to the issues they are facing, allowing for more effective and tailored agricultural policymaking.

It also gives governments the flexibility to deliver policies which better account for the particular geographical, environmental or socioeconomic needs and priorities of the individual parts of the UK. For example: the Welsh Government can deliver policy which reflects the importance of livestock farming to the Welsh economy; the Scottish Government can deliver policy which promotes the interests of Crofting, a system of land tenure unique to parts of Scotland, as well as agriculture more generally; and the Northern Ireland Executive can deliver policy which reflects the importance of the agri-food industry to Northern Ireland's economy.

Devolution has also encouraged innovation in policymaking. Having four jurisdictions in the United Kingdom means that administrations can learn from policies launched elsewhere and then replicate or adapt them if they think they will be effective in their own jurisdiction.

Working with the devolved administrations

Following the UK's departure from the EU, Ministers from the UK Government, Scottish Government, Welsh Government and Northern Ireland Executive have agreed to establish the UK Agricultural Support Framework. The Framework provides for collaboration and cooperation on agricultural support between the four UK administrations.

The aim of the UK Agricultural Support Framework is to ensure effective coordination and dialogue between the devolved administrations on how any changes to legislation and policies in one part of the UK may affect other parts. It also provides a forum for each administration to share their experience and best practice, offering an opportunity for administrations to learn from each other.

The UK Agricultural Support Framework formalises existing mechanisms for officials to discuss agricultural policy plans and monitor markets in order to: enable the functioning of the UK internal market, while acknowledging policy divergence; ensure compliance with international obligations; ensure the UK can negotiate, enter into and implement new trade agreements and international treaties; enable the management of common resources; manage the particular needs of cross-border farm businesses; and (where relevant for agriculture) safeguard the security of the UK.

The path to sustainable farming

England's approach

In England, the UK Government is replacing the Common Agricultural Policy with schemes that reward farmers and land managers for delivering environmentally sustainable actions and producing public goods.

The UK Government is introducing three schemes that reward environmental land management: the Sustainable Farming Incentive, Local Nature Recovery and Landscape Recovery. Together, these schemes are intended to provide a powerful vehicle for achieving the goals of the **25 Year Environment Plan** and the UK Government's commitment to net zero emissions by 2050, while supporting the rural economy. The UK Government's vision for sustainable farming is for a thriving agricultural sector where the majority of farms are profitable, productive and economically sustainable without subsidy through basic payments, and all are making a significant and widespread contribution to environmental, biodiversity and climate change goals.

The Agricultural Transition Plan sets out the UK Government's path to sustainable farming and the changes they will make to agricultural policy in England from 1st January 2021.

Scotland's approach

Scotland's vision for agricultural transformation is one of a sustainable future, with farmers and land managers continuing to produce high quality food, helping to reduce carbon emissions, delivering wider environmental benefits and improved biodiversity, and using the appropriate land to meet Scotland's world-leading emissions targets.

The Scottish Government published its **Climate Change Plan update** (CCPu) in December 2020, setting out a pathway to transform Scottish farming to meet Scotland's ambitious target to reach net zero by 2045. The Scottish Government is committed to taking a Just Transition approach and established five farmer-led groups, as a key initiative to bring together the people who have knowledge and expertise to propose practical workable solutions to ensure that agriculture contributes to Scotland's climate change goals. Their reports were published in March 2021.

Building on the CCPu, the Scottish Government will now establish an Implementation Board for development of new proposals for sustainable farming support. This will comprise a broad range of representatives from farming and environmental sectors who will consider a wide range of material alongside the reports of the farmer-led groups, such as resources from **Farming for 1.5** – an independent inquiry looking at how Scottish agriculture can best contribute to keeping warming to no more than 1.5°C – and the **Just Transition Commission**,

UK Department for Environment, Food and Rural Affairs (Defra)

which was established to provide practical and affordable recommendations to Scottish Ministers.

To establish the future shape of rural support, primary legislation will be required and a new Agriculture Bill will be brought forward in this Parliamentary session (which runs from 2021 to 2026) to set the tone and model of support for the next decade.

Wales' approach

The Welsh Government's policy framework for future agricultural policy and support has the aim of delivering Sustainable Land Management (SLM). SLM is an internationally-recognised concept defined as: 'The use of land resources, including soils, water, animals and plants, for the production of goods to meet changing human needs, while simultaneously ensuring the long-term potential of these resources and the maintenance and enhancement of their environmental benefits.'

The Welsh Government wants to maintain high food safety, animal welfare and environmental standards in Wales, underpinned by a simpler regulatory framework and improved enforcement. For their own and society's benefit, Welsh farmers will need to continue producing high quality food whilst maintaining high production standards. However, there is increasing evidence that agricultural intensification has adverse impacts upon society through reductions in air and water quality, carbon emissions, and a decline in farmland biodiversity. The Welsh Government are therefore proposing asking Welsh farmers to go further, where in-field changes to farming practice will enable sustainable food production from farms characterised by having a very low carbon footprint, increased biodiversity and minimised nutrient losses to air and water.

The Welsh Government propose rewarding farmers through a 'Sustainable Farming Scheme' which will place a proper value on the environmental outcomes they deliver (improved soils, clean air, clean water, improved biodiversity, actions to reduce global warming) alongside sustainable food production. This will help create a sustainable and resilient agriculture sector in Wales for future generations. Amongst a range of actions, the Welsh Government plan to significantly reduce levels of external inputs. Business improvement advice will also be provided to enable farmers to take advantage of new market opportunities and to support the transition away from income subsidy and into the new scheme.

Northern Ireland's approach

Northern Ireland now has a unique opportunity to redefine its agricultural policies and support schemes for the first time in over 40 years with the aim of developing an agricultural support framework portfolio better suited to local needs, and one that will provide for and secure long term sustainability within the industry. Minister Poots' vision for future agriculture in Northern Ireland is defined around four outcomes:

- An industry that pursues increased productivity as a measure of sustained profitability in international terms, closing the productivity gap which has been opening up with our major suppliers. This will create the basis for a profitable sector which can grow market share.
- An industry that is environmentally sustainable in terms of its impact on, and guardianship of, air and water quality, soil health, carbon footprint, and biodiversity.
- An industry that displays improved resilience to external shocks (such as market volatility, extreme weather events etc.) which are ever more frequent and to which the industry has become very exposed.
- An industry which operates within an integrated, profitable, efficient, sustainable, competitive and responsive supply chain, with clear transmission of market signals and an overriding focus on high-quality food and the end consumer.

Minister Poots has tasked officials to begin a conversation with the industry as soon as possible on all areas of future farming support that will deliver against these four outcomes. It is anticipated that the Future Agricultural Policy Framework portfolio for Northern Ireland will be launched in the coming months.

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