PAGE PARTNERSHIP FOR ACTION ON GREEN ECONOMY

PAGE STUDY ON FISCAL POLICY REFORMS FOR SUSTAINABLE AGRICULTURE

Scaling-up finance for nature-based solutions (NbS) and climate-smart agriculture (CSA) in Mauritius

TECHNICAL STUDY AND TOOLKIT

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Authors

This study was written by Dr Roshini Brizmohun and Shane Hardowar, Faculty of Agriculture, University of Mauritius.

Technical contributions by Krystyna Swiderska (International Institute for Environment and Development) and Claire Potdevin (United Nations Environment Programme).

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ABBREVIATIONS

ACASS	Agricultural Calamities Solidarity Scheme
CSA	Climate-smart agriculture
FAREI	Food and Agriculture Research and Extension Institute
MAIFS	Ministry of Agro Industry and Food Security
MSS	Mauritius Sugar Syndicate
NbS	Nature-based solutions
NDC	Nationally Determined Contribution
SFWF	Small Farmers Welfare Fund

CONVERSION FACTORS:

1 arpent = 0.422 hectares = 1.043 acres

1 acre = 0.959 arpent = 0.405 hectare

GLOSSARY

Arpent: An old French unit of area still used in Mauritius. Equivalent units of acres and hectares are given above.

EXECUTIVE SUMMARY

Mauritius joined the UN Partnership for Action on Green Economy (PAGE) initiative in 2021, supporting the government and key stakeholders to pursue inclusive green economy efforts and contribute to the 2030 Agenda on Sustainable Development. As a small island developing state, Mauritius is witnessing the impacts of climate change. Studies published by the Ministry of Environment show that agricultural production may decline by as much as 20–30% in the medium and longer term due to rainfall variability, and sugar yield is expected to fall by 47–65% with an increase in temperature of 2°C. The livestock sector will be affected by heat stress among animals, lowered feed quality and shortage of water. The challenges posed by climate change in agriculture necessitates the scaling up and channeling of finance and investments towards nature-based solutions (NbS) and climate smart agriculture (CSA) in Mauritius to promote more resilient and sustainable food systems. The Nationally Determined Contribution (NDC) of the Republic of Mauritius outlines actions focusing on the potential of NbS for adaptation and mitigation to climate change. The country's National Food Systems Pathway linked to the UN Food Systems Summit, emphasises the need to transition to more sustainable and climate smart agriculture. The COVID-19 pandemic and the Ukraine war have highlighted the need for Mauritius to become more food self-sufficient and reduce reliance on costly imported agrochemicals. Reforming fiscal policies to promote more sustainable and resilient agriculture can contribute to the government's green recovery efforts.

This study assesses the environmental and social impacts of existing agricultural fiscal policy measures and their contribution to the adoption of sustainable, nature-based and climate smart agriculture, and identifies a toolkit of reform options to enhance this contribution. It uses the UNEA-5 definition of nature-based solutions (NbS) as 'actions to protect, conserve, restore, sustainably use and manage natural or modified terrestrial, freshwater, coastal and marine ecosystems which address social, economic and environmental challenges effectively and adaptively, while simultaneously providing human well-being, ecosystem services and resilience and biodiversity benefits'. The Food and Agriculture Organization defines climate-smart agriculture (CSA) as an approach that helps guide actions to transform agri-food systems towards green and climate resilient practices. The study entailed a policy and literature review and interviews with a range of stakeholders.

Agricultural fiscal incentives and policies in Mauritius largely seek to enhance productivity. The types of support provided are subsidies, grants, income tax exemption, value-added tax exemption and agricultural loans. The main agricultural sub-sectors benefiting from this support are the sugarcane sector, non-sugar crop sector and the livestock sector. An analysis of *actual* expenditure by the Ministry of Agro Industry and Food Security (MAIFS) in 2021–2022 estimated that only 2.7% of total expenditure was used to support measures promoting sustainable, organic or climate smart agriculture in Mauritius. Out of the MAIFS' total expenditure on agricultural subsidies in 2021–2022, around 21% of subsidies were allocated to promoting NbS (ie. biofarming) and CSA, while 44% of subsidies supported the use of inorganic fertilisers in the crop sectors, including sugarcane. These subsidies may have partially achieved their intended objectives of increasing productivity, but they also have unintended negative environmental impacts. These include increasing nitrogen runoff and subsequent deterioration of water quality, as well as promoting monocropping instead of biodiverse agroecological farming. Therefore, they conflict with government policies on sustainable agriculture, NbS and CSA. Out of 11 schemes assessed, three were found to have negative environmental impacts: the Fertiliser Subsidy

Scheme for sugarcane planters amounting to MUR 108 million in 2021–2022; a new fertiliser subsidy introduced for the non-sugar sector in 2022 amounting to MUR 60 million; and the Livestock Feed Promotion Scheme which uses imported ingredients such as maize and soybean from Brazil and Argentina. This study recommends reforming these fiscal incentives and schemes to promote climate resilient and sustainable agriculture, while concurrently enhancing food self-sufficiency and lowering dependence on imported inputs.

Financial schemes that have supported biofarming in Mauritius have faced significant challenges linked to inadequate research and knowledge in this area, as well as lack of coordination between stakeholders such as input suppliers, farmers and even consumers, highlighting that the farm to fork linkages for sustainable agriculture should be improved. Although sustainable agriculture is high on the agenda of the government and development partners are supporting the sector, further capacity building is required to strengthen agricultural institutions such as the Food and Agricultural Research and Extension Institute (FAREI) and Small Farmers Welfare Fund (SFWF) to promote NbS and CSA. Farmers who have switched to organic production have faced difficulties in achieving sufficient productivity and income. Thus, further research is needed to develop locally-adapted NbS and CSA approaches, as well as a pull strategy to enhance market demand for sustainable agricultural produce that supports NbS and CSA through certification and labelling and consumer sensitisation campaigns. There is a need to build the capacity of laboratories of the MAIFS for testing and certifying products as safe with pesticide residues within the limits to ensure that organic or Maurigap certification of products is done properly. Better linkages and improved networks among government and civil society institutions will also positively impact the greening of the agriculture sector. Moreover, setting goals and targets to be met in the future can provide a sense of direction for the adoption of NbS and CSA in Mauritius.

Schemes that are promoting chemical fertilisers in the sugarcane and tea sectors may be improved by re-directing the financing towards more sustainable practices that support soil health and long-term productivity, climate resilience and biodiversity resources. Additional incentives for NbS and CSA in the sugar sector may be required, for example to increase the use of biofertilisers. Increasing the number of farmers adopting sustainably produced sugar through subsidised certification schemes is a good strategy for Mauritius. Targeting markets that are purchasing sustainably produced sugar from Mauritius, for example, through Fairtrade labelling for a premium is one way of giving a boost to the sugar industry. Moreover, product derivatives from molasses such as rum and bioethanol can also be Fairtrade certified and therefore marketed for a premium. For the non-sugar crop sector, the government's Sheltered Farming Scheme, with a budget allocation of MUR 30 million for 2021–2022, supports crop farming in protected environments such as polytunnels. This scheme has been extended in 2022–2023 with an increased amount of up to MUR 500,000 per beneficiary. Sheltered farming is being encouraged across the island as climate-smart agriculture promoting a more efficient use of resources and reduced use of agrochemicals. The livestock sector has no schemes promoting sustainable, nature-based or climate-smart approaches specifically, apart from the 'Upgrading of Livestock Farm' grant which promotes ventilation because of increasing temperatures. Incentives for more sustainable livestock production — such as promoting hardy local landraces which can contribute to climate change adaptation and biodiversity conservation — could be introduced by reforming existing livestock breeding schemes.

One major constraint to the adoption NbS and CSA in Mauritius is the lack of supply of good quality commercially produced compost. Although the government allocated funds to promote a circular economy for the manufacture of compost from green waste, the production and supply of compost

is still being awaited. As a consequence, the budget allocated for a compost subsidy scheme was not spent in 2021–2022, and the process of promoting green agriculture is delayed as locally produced inputs are not yet sufficient. Another key constraint is the administrative burden and delay for farmers seeking support under existing schemes — including the biofarming, sheltered farming and water harvesting schemes. The Biofarming Support Scheme has had limited uptake, with 51 growers benefiting in 2021–22, while the Biofarming Promotion Scheme has had no further applications since 2018. The study recommends establishing a cross-institutional committee to streamline the processing of applications and investing in the digitalisation of procedures for accessing schemes and incentives coupled with the use of smart apps. The MAIFS must also create an enabling policy environment for the adoption of NbS and CSA through the new policy which it is currently formulating for the agriculture sector. Consultations with stakeholders (eg. farmers), different government institutions and the public can enhance the policymaking process resulting in more impactful greening and climate-proofing of the agriculture sector.

The above measures could be supported by funds saved from reforming costly fertiliser subsidy schemes to support less costly locally-produced bio-inputs. In Andhra Pradesh, India, input subsidies were used to support a transition to Zero Budget Natural Farming which delivers multiple benefits for livelihoods, climate resilience and biodiversity. New green finance instruments could also be used to channel finance and investment towards sustainable and resilient agri-food systems, such as: green financing for innovative technologies in sustainable and resilient agriculture; green investment promotion schemes; integrating NbS and CSA in green buildings and real estate development; and capacity building for green fiscal instruments by banks.

This study identified some challenges to reforming existing policies and introducing new policy measures and financial instruments. Firstly, smallholder agricultural producers are already burdened with financial constraints and do not want to take additional loans for investment in NbS and CSA. Therefore, providing grants to cover the costs of shifting towards NbS and CSA would be more appropriate. At the national level, all of the existing schemes supporting agriculture are costs to the government and do not generate revenues. Re-directing existing subsidies that are likely to be causing negative environmental externalities to more targeted sustainable ones is proposed. There is a need to strengthen the capacity of agricultural institutions for conducting research, imparting knowledge and developing policies to promote NbS and CSA. Interventions from development partners can contribute to improving such capacities. A very important component for reforming existing policies and introducing new ones is the political economy for promoting NbS and CSA in Mauritius. Although the government is advocating more sustainable agriculture, farmers will adopt NbS and CSA as long as they are able to generate sufficient revenue for their livelihoods. Reforming the sugarcane fertiliser subsidy is likely to require the support of sugarcane growers and corporations that have a long history of influencing the direction of agricultural policies in Mauritius. However, sugarcane growers may be opposed to reduction or repurposing of chemical fertilisers for fear of reduced productivity. To promote greener sugar production, while maintaining the sugar sector, Mauritius can explore marketing a greater share of sustainably produced sugar at premium prices through certification. It may be easier to reform the non-sugar fertiliser subsidy as this has been newly introduced.

Mauritius is a small island state with limited land, therefore safeguarding the quality of land and soil is essential for sustained productivity and food security. It also imports 77% of food consumed, contributing to GHG emissions. Promoting

sustainable local agricultural production provides a way to reduce the carbon footprint of food, reduce vulnerability to external shocks, and reduce reliance on increasingly costly imported agrochemicals. The current global context of the aftermath of COVID-19 and economic turmoil calls for a green recovery approach to reform agriculture and enhance food self-sufficiency. The reforms of existing schemes, instruments and institutional arrangements proposed to increase the adoption of NbS and CSA can assist the government's COVID-19 recovery efforts by creating green jobs (eg. in compost and bio-input production), enhancing incomes for farmers from growing niche markets and supporting the transition to a more sustainable and resilient food system. Directing funding towards sustainable agriculture will be critical to sustain agricultural productivity in the medium and long term, and enhance resilience to climate change and other external shocks. A wide range of complementary financing schemes can be integrated to enhance finance to promote the adoption of CSA and NbS in Mauritius.

1. INTRODUCTION

The agriculture sector in Mauritius is called upon to play a more important role in the coming future, particularly for food security reasons. The challenges caused by the aftermath of the COVID-19 pandemic, rising inflation in the country, devaluation of the local currency, and the ongoing conflict in Ukraine, coupled with the impacts of climate change, is threatening the food security of the small island developing state. Studies published by the Ministry of Environment show that agricultural production may decline by as much as 20–30% in the medium and longer term due to rainfall variability and sugar yield is expected to fall by 47–65% with an increase in temperature of 2°C. The livestock sector will be affected by heat stress among animals, lowered feed quality and shortage of water. Temperature increases may lead to decreased feed intake leading to lowered productivity including low milk production and increased mortality in poultry. Mauritius ratified the Paris Agreement in 2016 and the updated Nationally Determined Contribution (NDC) of the Republic of Mauritius (2021) outlines actions focusing on the potential of nature-based solutions for adaptation and mitigation to climate change. For the agriculture sector, Mauritius has committed to adopting smart agricultural practices including natural farming systems.

The contribution of agriculture to the GDP of Mauritius has decreased over the years, from 6.8% in 2000 to an estimated 3.9% in 2020 (Statistics Mauritius, 2021). The agriculture sector has seen a decreasing trend with total employment in agriculture estimated at 35,400 in 2020 compared to 55,800 in 2000. The share of agriculture in total employment dropped from 11.5% in 2000 to 6.4% in 2020. The uncertainties prevailing in the global supply chain for food and agricultural commodities and rising input prices are leading the government of Mauritius to pursue strategies that can improve food self-sufficiency and sustainability. This situation therefore presents opportunities for investing in and adopting nature-based solutions and climate-smart agriculture which in turn can reduce GHG emissions, improve resilience to climate change, enhance food security and protect biodiversity.

Agriculture in Mauritius can be viewed as comprising of a sugar sector and a non-sugar sector. At the request of the Government of Mauritius, the World Bank prepared a 'Sugar Cane Sector Review: Policy Note' in 2020 to highlight the policy options available to Mauritius for its sugar sector. The underlying reason for the request was the decline in the sugar production over the years and increase in government spending to support the sector. Agriculture is dominated by sugarcane cultivation, which covers around 20% of the land area amounting to 41,897 hectares in 2021, while food crop covers about 7,456 hectares (Statistics Mauritius, 2021). However, the sugar sector is undergoing structural changes resulting from the dismantling of the Sugar Protocol, which provided preferential trade agreements with European Union. On the one hand, the economics of sugarcane production by some 10,500 small-holder growers is becoming a burden for the government to support through taxpayers' money, amounting to 1.12% of the total government budget in 2018 (World Bank, 2020). On the other hand, the social, political and environmental consideration of sugarcane cultivation weighs on the balance to justify the maintenance of the sugar sector. Sugarcane, through the burning of bagasse,[1] a by-product of the sugar milling process, plays an important role in providing biomass for renewable energy production in Mauritius. The sugarcane sector contributes to the production of 16% of the total

1 Bagasse is a fibrous substance that is left behind when the juice is extracted from the sugarcane and it is therefore a by-product of the sugar milling process. Mauritius uses bagasse as biomass for energy generation.

electricity produced (World Bank, 2020). The Renewable Energy Roadmap of the Ministry of Energy calls for an increased share of electricity produced from renewable sources by 2030. From an environmental perspective, the impact of the sugar sector has yet to be quantified. Sugarcane plantations contribute to a lush green landscape, an important consideration for the tourism sector of the island (*MSS-Annual-Report*, 2021). The other environmental benefits claimed from sugarcane cultivation are in terms of protection of soil and water resources. However, the sector uses agrochemicals and has some negative environmental effects, impacting on biodiversity, causing air pollution and releasing other industrial by-products. Therefore, the island faces a dilemma as to the future of the sugar sector. The main recommendations proposed to the government focus firstly on further downsizing of the sugar sector while specialising in speciality sugar, which fetches higher prices on international markets; and secondly, implementing reforms to increase the competitiveness of the sugar sector, which include provision of tax payer support. However, stakeholders of the sugar sector were not in favour of downsizing further and therefore four 'no-regret' policy reforms were proposed by the World Bank: (i) increase the price of electricity produced from bagasse, (ii) support the movement towards high-tech sugarcane farming; (iii) reduce the sugar export logistics costs; and (iv) increase the share of specialty sugars sold. To promote greener sugar production, while maintaining the sugar sector, Mauritius can explore the possibility of marketing a greater share of sustainably produced sugar at premium prices through certification (see Box 1).

The non-sugar agriculture sector in Mauritius contributes to the production of some 110,000 tons of food crops annually (MAIFS, 2016), cultivated by some 8,000 smallholder farmers, with holdings averaging 0.25ha (Statistics Mauritius, 2021). The non-sugar sector is essential for maintaining local food self-sufficiency and plays an important role in food security. It comprises a range of food crops including potatoes, onions, tomatoes, green leafy vegetables, eggplant, squash, as well as poultry, pig breeding and some cattle, sheep, goat and deer. Although past practices for agricultural production laid emphasis on increasing productivity through the intensive use of agrochemicals and hybrid seeds, more recently, a move towards more sustainable and resilient local agricultural production is being emphasised in policy documents. For the non-sugar sector, the government is currently working on an agro-strategic plan as a follow-up to the past policy document, 'The Strategic Plan (2016–2020) for the Food Crop, Livestock and Forestry Sectors' which laid emphasis on the 'need for sustainable agricultural development in a climate-friendly mode as well as safeguarding farmers livelihoods' (MAIFS, 2016). The vision of the MAIFS as laid down in the plan was "An integrated development to build vibrant non-sugar agriculture and agri-business sectors that utilise natural resources sustainably, contribute significantly to national food security and safety, empower producers to higher productivity, and enhance the welfare of the farming community." Therefore, throughout the policy document, much emphasis was laid to shift towards more sustainable agricultural practices leading to safer and better nutrition. It is interesting to note that the Strategic Plan contained bold measures to promote 'biofarming' in Mauritius, indicating the commitments taken at the government level to green the agriculture sector. Therefore, the Ministry of Agro Industry and Food Security implemented several initiatives to promote sustainable agriculture in Mauritius.

Mauritius is considered a net-food importing country, as classified by the World Trade Organization, importing around 77% of food consumed (WTO, 2021). Although the country is considered to be self-sufficient in fresh food crops, most of the inputs for food crop production are imported, including seeds, fertilisers and pesticides. There have been press articles and reports raising alarms on the overuse of fertilisers and pesticides in Mauritius, leading to environmental pollution, affecting soil health and population health through fresh vegetable products with pesticide residues above Maximum Residue Levels (MRLs) (Charles

Telfair, 2018[2]). Although the Use of Pesticide Act 2018 was introduced to control any abuse of the use of pesticides in Mauritius, there are still some flaws in the legislation that need to be addressed such as the introduction of new active ingredients that do not appear in the list of the chemicals to be tested in the Use of Pesticide Act 2018 (L'Express, 2018a[3]; L'Express, 2018b[4]). The livestock sector has limited production except for poultry where the island is considered to be self-sufficient, although the main inputs for livestock production, including feeds are imported. Schemes are however in place to stimulate the production of dairy cattle, goats and sheep in the last government budget (Budget Speech, 2022–2023).

The country has adopted the 2030 agenda for sustainable development. This study aligns with Goal 2 – Zero hunger, Goal 7 – Clean energy, Goal 13 – Climate Action and Goal 15 – life on land. Promoting more sustainable, climate-smart agricultural practices for enhanced resilience, food security and safety are important government priorities which are reflected in key national development policies. The Climate Change Act 2020 was enacted to establish a legal framework towards making Mauritius a climate-change resilient and low emissions country. The legislation addresses the adverse effects of climate change and developing Mauritius into a greener economy, the obligations of Mauritius under the United Nations Framework Convention on Climate Change, the Kyoto Protocol, the Paris Agreement and any other related instrument on climate change. The act calls for the setting up of an inter-ministerial council on climate change including to develop climate change policies and set priorities for adaptation and mitigation in agriculture and other sectors. Under its commitments for agriculture and livestock outlined in the NDC, Mauritius will adopt the following actions: i) reducing the use of fossil energy-based inputs (less gasoil, pesticides, fertilisers) by a shift to agroecological and resilient practices; ii) improving efficiency in the use of inputs (water, chemicals); iii) enhancing the potential of carbon sequestration and improvement of soil fertility; and iv) reducing post-harvest losses. For the livestock sector, agroecological practices will be applied to lower greenhouse gas (GHG) emissions (through sylvo-pastoral production systems, improving feed conversion efficiency and better manure management).

The heavy reliance of the agri-food sector on imports illustrates its environmental footprint in terms of GHG emissions. Moreover, the intensive use of agricultural inputs such as inorganic fertilisers and pesticides is an additional sustainability challenge Mauritius has to deal with. The environmental impacts of current practices in agriculture are likely to cause pollution of soils and water such as contaminating ground water through leaching of nitrates. In addition, the misuse or overuse of pesticides can sometimes lead to negative health impacts of farmers and consumers.

This study uses the definition of the UNEA-5 Resolution which describes nature-based solutions (NbS) as 'actions to protect, conserve, restore, sustainably use and manage natural or modified terrestrial, freshwater, coastal and marine ecosystems which address social, economic and environmental challenges effectively and adaptively, while simultaneously providing human well-being, ecosystem services and resilience and biodiversity benefits'. The FAO defines climate-smart agriculture (CSA) as an approach that helps guide actions to transform agri-food systems towards green and climate resilient practices. The climate-smart agriculture (CSA) concept, launched in 2009, is defined as "agriculture that sustainably increases productivity and resilience (adaptation), reduces or removes greenhouse gases (GHGs) (mitigation) and enhances the achievement of national food

2 https://charlestelfaircentre.com/the-scourge-of-pesticides-overuse-in-mauritius-how-far-are-we-in-the-ongoing-ecological-disaster/
3 https://www.lexpress.mu/node/336478
4 https://www.lexpress.mu/idee/342162/use-pesticides-act-larbre-qui-cache-foret?fbclid=IwAR3FtNdvFu3hQ7r3eBAer80la2jaJ9oy7aPy53r1vzJoSiE6bjpJ3Pg08CM

security and development goals (development) also referred to as the "Triple Wins" (FAO, 2010).

In the context of Mauritius, nature-based solutions (NbS) and climate-smart agriculture (CSA) can be viewed as tools that support the transition towards a more sustainable, biodiverse and healthy food system that is more resilient to climate change and future crises in line with government objectives, and that supports delivery of the SDGs as part of the country's COVID-19 recovery efforts. Targeted and efficient use of public resources and scaling-up financing to support NbS and CSA is critical to support and incentivise this transition. A well-thought design of the fiscal policy framework can also incentivise private sector financing multipliers without expending scarce resources. By aligning public and private finance towards shared sustainability goals, further green investment can be incentivised, which can help to sustainably enhance food security, reduce food waste, and reduce the risks of climate change and future zoonotic disease outbreaks.

2. STUDY OBJECTIVES AND METHODOLOGY

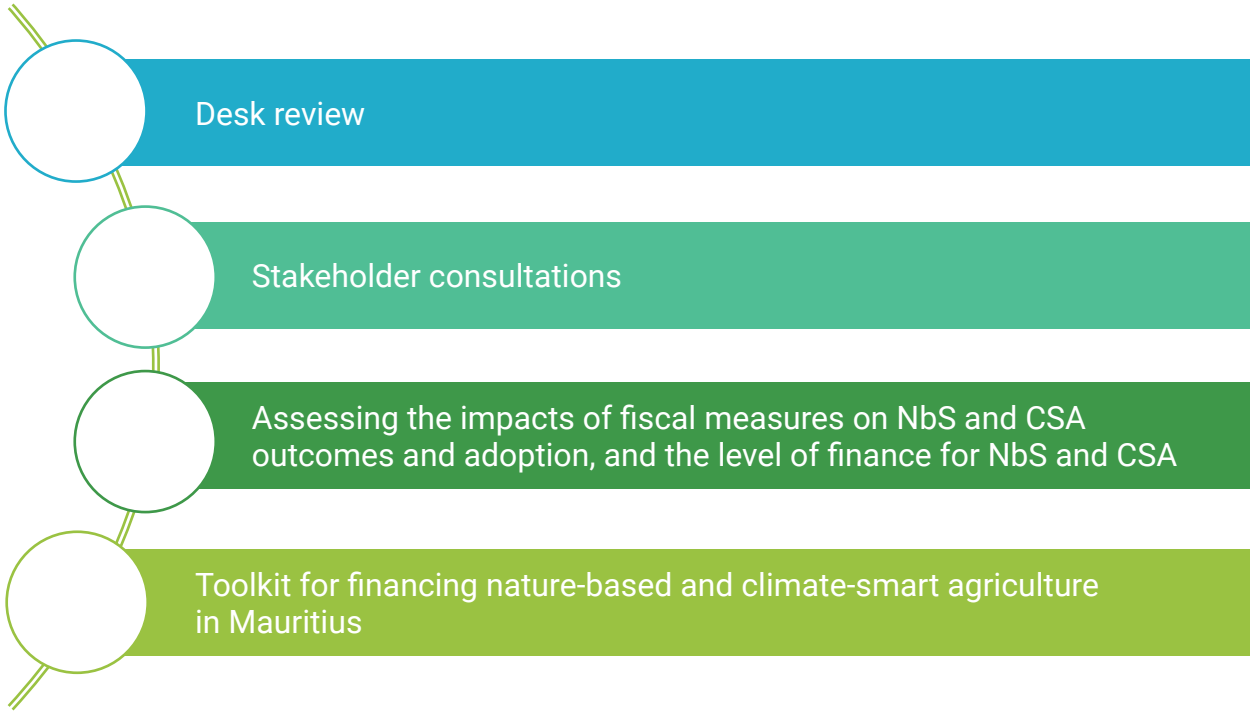
The overarching objective of this study is to support a transition to a more sustainable, resilient food system in the Republic of Mauritius and to set out the current challenges and opportunities for scaling-up and channeling finance and investments towards nature-based solutions (NbS) for agriculture and climate-smart agriculture (CSA). The study provides an assessment of existing fiscal policy measures (including subsidy schemes and grants), financial instruments and institutional arrangements that directly or indirectly affect the adoption of NbS and CSA. It explores the positive and negative impacts of different fiscal policies and schemes on nature and climate outcomes, as well as their economic and social impacts. The study proposes a 'toolkit' of policy reform options and financial instruments that can support the adoption of NbS and CSA to reduce GHG emissions, improve resilience to climate change and adaptive capacity, enhance food security, reduce poverty, enhance employment and protect farmer's health, as well as water, soils and biodiversity. This study is intended to support the efforts of government ministries responsible for agriculture, environment and finance to identify viable pathways for reform.

A three-pronged approach was used to assess the positive and negative impacts of fiscal policies, financial instruments and institutional arrangements for NbS and CSA outcomes and adoption: (i) a desk-based review of existing policies, programmes and government documents including budget speeches; (ii) consultations with relevant national stakeholders and policymakers; and (iii) analysis of how different government schemes and incentives affect NbS and CSA outcomes and adoption.

The desk study reviewed agricultural policies for the sugar and non-sugar sectors. The recent World Bank reports, the Mauritius Sugarcane Sector Review Competitiveness Analysis and Mauritius Sugar Sector Review Policy Note proposed recommendations to the government on the possible options for the sugar sector in Mauritius. For the non-sugar sector, the Strategic Plan (2016–2020) for the Food Crop, Livestock and Forestry Sectors 2016–2020 describe a number of past and on-going schemes that were implemented by the Ministry of Agro Industry and Food Security. The Ministry is currently working on the preparation of its policy document for the non-sugar sector. A major source of information for fiscal measures and instruments in agriculture was extracted from the government budget speeches and annexes to the budget documents. The data collected from budgeted accounts was used as the basis to quantify costs to government for supporting NbS and CSA. In addition to government documents, research and annual reports of local institutions, as well as publications, were reviewed to complement information on fiscal measures and instruments for supporting NbS and CSA.

Interviews were conducted with key government institutions and civil society organisations involved in public finance and promoting sustainable agriculture (see Annex 1). This was to understand how different schemes and incentives affect NbS and CSA outcomes and adoption — both positively and negatively — and to identify opportunities for extending and improving existing measures to increase the uptake of NbS and CSA activities in Mauritius. For each scheme influencing NbS and CSA, the economic, social and environmental impacts were assessed. An assessment of government budget allocation and expenditure for supporting NbS and CSA was then undertaken by comparing the budgeted values and actual expenditures incurred for financial year 2021–2022. This comparison estimated the percentage of actual expenditure used to promote sustainable agriculture and CSA in the island. Moreover, data from stakeholders was used to estimate the percentage of land area allocated for sustainable agriculture practices. Based on the study, a toolkit has been developed that identifies options for reforms to increase the impact of fiscal policies and incentives to promote NbS and CSA in Mauritius.

Figure 1: Methodology for fiscal policy reform study on NbS and CSA in Mauritius



3. STATUS OF NBS AND CSA IN MAURITIUS

Nature-based solutions aim to use ecosystems and native biodiversity to address societal challenges (eg. food security, climate change) while using resources in an optimal way. Similarly, the goal of CSA is to sustainably increase the productivity of agricultural systems while adapting them to strengthen their resilience to climate change and reduce or remove GHG emissions, wherever possible (Lipper et al., 2017). These two approaches are highly relevant for Mauritius to ensure food security and enhance resilience including from climate impacts and economic impacts from disasters. NbS promotes sustainable resource management practices that maintain and strengthen ecosystem services needed for adaptation and mitigation outcomes. Put in simple terms, NbS addresses societal challenges by working with nature and is seen globally as an 'integrated approach for responding to climate change, biodiversity loss, and broad sustainable development challenges' (Zari et al, 2019). Therefore, responding to the challenges of the agri-food sector in Mauritius using these tools can help achieve the aims of increasing agricultural productivity in a sustainable manner without the negative impacts of agriculture on the environment.

However, the concepts of NbS and CSA are still not anchored in the mindset of stakeholders in the agriculture sector in Mauritius. There appear to be different terminologies that are used interchangeably and synonymously among some stakeholders in Mauritius. These range from agroecological practices, climate-smart agriculture, regenerative agriculture, natural practices, biofarming, organic farming, sustainable agriculture, green agriculture, smart agriculture, ecosystems-based approach and zero-based natural farming. For the purpose of this study, the concepts that pertain to the above two definitions of NbS and CSA in agriculture were reviewed and analysed. It is important to note that the terminology 'nature-based solutions' does not appear often in policy documents reviewed, while climate-smart agriculture is more common. Therefore, demystifying and clarifying the terms may be an important starting point when working with stakeholders to ensure that the concepts are clearly understood when used.

Research on the impacts of climate change revealed that farmers in Mauritius have observed changes in weather patterns affecting agriculture. A shift in the start of summer rains has been noted with a decreasing trend of annual rainfall of about 8% since the 1950s (MMS, 2009). The mean annual temperature over the island has increased by 1.39°C in the last 70 years between 1951–2020, compared to the 1961–1990 climatological normal (NDC, 2021). Accelerated sea level rise is causing severe coastal soil degradation and salinisation, increased incidence of flash floods, more intense cyclones and a highly variable climate (NDC, 2021). Farmers have adapted to these changes through shifting planting dates, crop rotation and introducing rainwater harvesting systems (Brizmohun et al, 2014). Climate-smart technologies therefore are recommended as tools to enhance resilience and increase the adaptive capacity of farming communities in Mauritius (Hardowar et al, 2015). Examples of climate-smart technologies disseminated by the Food and Agricultural Research and Extension Institute (FAREI) include practices to conserve soil moisture; use of manure and compost; rainwater harvesting in ponds and from rooftops; water saving technologies such as use of hydrogels to retain soil moisture at the root zone level; and growing drought tolerant varieties such Zebrina for egg plant, Omega melon and Long Tom French bean.

At the institutional level, FAREI set up a Biofarming Unit in 2018. Biofarming in Mauritius refers to farmers who are cultivating crops organically, that is, without the use of chemical products. The annual report of FAREI (*Technical-Highlights-2019–2020, 2021*) indicates that the

number of registered biofarming planters increased from 78 planters covering an area of 153 arpents (64.3ha) in 2018 to 110 planters on an area of 180 arpents (75.6 ha) in 2020. Moreover, the number of growers adopting CSA is growing. One way to monitor the adoption of sustainable and climate-smart agricultural practices by farmers in Mauritius is through monitoring the number of farmers who are 'Maurigap' certified. Maurigap is a local certification standard for Good Agricultural Practice (ie. a local version of the global GAP certification), which applies to open field and hydroponics growers of fresh fruits and vegetables. The scope of Maurigap covers the adoption of environmentally sound practices through the efficient use of inputs (soil, water and farm inputs); crop protection best practices for safer products and biodiversity preservation; pre- and post-harvest best practices; workers' health and safety; and transparency and accountability (UNEP-Switch Africa Green Presentation[5]). There are 43 registered beneficiaries of Maurigap Level 1: MS-184-1, as of July 2022.

An example of both a NbS and CSA project in Mauritius is the UNDP-GEF Small Grants Program project[6] 'Increasing Farmers' Resilience to Climate Change by Adopting an Agroecological Approach' through a grant financing of US$150,000 to support farmer cooperatives La Chaumiere Agricultural Marketing Cooperative Society Limited; Les Jardins Bio de Britannia Mixed Farming Cooperative Society Limited; and Plaine Sophie Mixed Farming Cooperative Society Limited. Project activities include support for agroecological mixed farming practices, infrastructural improvement in drainage, agroforestry and planting of native trees, installation of beehives, and construction of net houses. The context of Mauritius with regards to native species is complex because most plant species used for agriculture have been introduced, however some species are considered local because they have been used for some time and may be locally-adapted.

The European Union is supporting Mauritius to adapt to climate change and improve food and nutrition security through the Smart Agriculture project implemented by the Mauritius Chamber of Agriculture to the tune of MUR 16 million. The action aims to reduce the use of pesticides whilst increasing the resilience of agriculture in the face of climate change and simultaneously enhancing economic results for farmers and ensuring productivity gains, by transitioning from current agricultural systems to agroecological systems. The EU also provides a grant of MUR 120 million to FAREI and the University of Mauritius to invest in research, innovation and training to promote sustainable and modern agriculture, including CSA, under the Development-Smart Innovation through Research in Agriculture Initiative (DeSIRA). In 2018, the University of Mauritius set up a Pole of Research Excellence (PRE) on biofarming, climate change and CSA hosted by the Faculty of Agriculture. The PRE on CSA is very active, with members successfully winning several major research projects such as the Global Climate Change Alliance (GCCA+) Flagship initiative to support CSA for smallholders in Mauritius, and the Development-Smart Innovation through Research in Agriculture (DESIRA), both funded by the European Union. Under the Global Climate Change Alliance +, Mauritius was allocated funding of MUR 15 million to support CSA for smallholders. One project under this flagship initiative is the 'transformation of Belle Mare into a CSA village for climate resilience, food security and poverty alleviation'. Fifteen small planters were trained on CSA technologies to act as demonstrators and role models for other planters in the region, and were provided with water tanks, indigenous drip irrigation systems, composters, sprayers for bio-pesticides, tillers, mulch material, biofertilisers, bio-pesticides, seeds, melliferous plants, insect sticky traps, and other farm inputs. Around 300 other planters in Belle Mare received training on CSA and a CSA Starter Pack, composed of bio-pesticides,

5 https://wedocs.unep.org/bitstream/handle/20.500.11822/33751/SUSAg.pdf?sequence=1&isAllowed=y
6 https://sgp.undp.org/spacial-itemid-projects-landing-page/spacial-itemid-project-search-results/spacial-itemid-project-detailpage.html?view=projectdetail&id=26711

biofertilisers, compost, insect sticky traps, and seeds of vegetables and melliferous plants; and around 100 other small and medium planters in Belle Mare were given a water tank and drip irrigation system each to help them conserve water and use it more efficiently.[7]

The Food and Agriculture Organization, through a Technical Cooperation Programme TCP/MAR/3502 'Development of Organic Farming and Institutional Capacity Building in Mauritius' provided guidance, training and technical support to improve the legal basis, institutional framework, guarantee system and capacities of farmers and agricultural and extension specialists from the public and private sectors in organic agriculture. This support was achieved by conducting workshops in organic agriculture legislation, standards, certification and production. The ten-year national organic farming strategic plan from 2017 to 2027 was drafted to promote organic farming throughout the country. An Organic Bill is currently being finalised. An increased practice of organic agriculture can contribute to mitigating climate change impacts by improving the management of natural resources and can reduce impacts on biodiversity and greenhouse gas emissions by eliminating fossil-fuel based agrochemicals. However, organic farming is not necessarily NbS. To generate benefits for biodiversity, NbS implies not only reducing harmful chemicals but also restoring biodiversity in farming systems, through diversification and agroecology. In its current programming framework for Mauritius 2022–2025, the FAO has identified as a priority to support the country 'Shifting towards climate-resilient agriculture to mitigate the effect of climate change'. One potential avenue for future intervention is the promotion of nature-based solutions in agriculture (Ag NbS), which shift productive landscapes from drivers of environmental impact to environmental solution providers. NbS can provide a triple benefit when properly used — it can increase agricultural production and resilience, mitigate climate change, and enhance nature and biodiversity (TNC, 2019).

For the sugar sector, the Mauritius Sugar Syndicate (MSS) supports sugarcane growers to adopt sustainable practices through efficient use of natural resources to achieve a more resilient supply chain while upholding ethical, environmental, and social principles through Fairtrade certification and BonSucro label (see Box 1). Smallholder sugarcane growers, regrouped in cooperatives, have received Fairtrade certification that upholds and respects environmental norms and good governance. Fairtrade's unique, two-pronged approach helps farmers become more resilient to climate change, whilst at the same time giving consumers, retailers and traders the opportunity to reduce their carbon footprint.[8] Twenty-one cooperatives were Fairtrade certified in 2021. Two of the large sugar corporates abide to sustainability norms under the BonSucro label. Some 2,500 hectares of sugarcane are Fairtrade certified while another 4,000 hectares have received the BonSucro certification (personal comm, Mr. Dookhony, MSS). After a peak in 2015, a decline in Fairtrade certified sugar production has been noted. However, the MSS is working on reversing this trend, with support from the government. A subsidy covering 50% of the cost of certification was proposed in the 2021–2022 government budget to sugarcane grower cooperatives who are Fairtrade certified. Smallscale sugarcane growers are encouraged to regroup into cooperatives and be Fairtrade certified to benefit from the advantages of this certification, including a premium price on the sugar produced and exported. For the year 2021–2022, out of the budget of MUR 2.5 million, around MUR 1.7 million was spent and was included in the calculations as climate-smart agriculture.

7 https://www.uom.ac.mu/index.php/uom-highlights/107-superhighlights2/708-launching-ceremony-climate-smart-agriculture-village-belle-mare

8 https://www.fairtrade.net/issue/climate-change. Firstly, farmers, producers and workers can spend the Fairtrade Premium — that's the extra money they get from sales of Fairtrade certified crops and products — on projects such as tree planting, irrigation, crop diversification and clean energy, which are more sustainable on a local level but also contribute to the global fight against climate change. Secondly, Fairtrade Carbon Credits — in partnership with the Gold Standard — enable farming communities in developing countries to benefit from access to carbon finance to tackle the effects of climate change.

BOX 1 — Greening the supply chain of Mauritian sugar through certification and industry schemes

Fairtrade certification for sugarcane and certification subsidy

Agriculture in Mauritius is largely dedicated to sugarcane cultivation. The sugar sector is facing tumultuous times as the competitiveness for sugar production takes a hit after the dismantling of EU sugar trade preferences. Mauritius benefited from the ACP-EU Trade Protocol which gave preferential access to the EU market for sugar, with price guarantees ending in 2009. The government of Mauritius made significant efforts to transform the sugar sector and increase its productivity. However, rising domestic costs of production and a decline in the price of sugar on the international market from 2005–2019, coupled with some 2,000ha of sugarcane land moving out of sugarcane production since 2006 have countered the effect (World Bank, 2020). Nevertheless, the sector is finding ways to identify niche markets for sustainably produced sugar. Small and medium sugarcane growers are encouraged to regroup in cooperatives and work towards Fairtrade certification. This process started in 2009 and five cooperatives were certified in that year. Given the interest in the label and the premium received for marketing Fairtrade-labelled sugar, the government of Mauritius supported these cooperatives by subsidising the certification process for the first couple of years. In last year's budget 2021–2022, the subsidy was re-introduced to cover 50% of the cost of certification, which resulted in around 16,000 tons of sugar exported through the Fairtrade label from Mauritius, produced by 21 cooperatives over an area of 2,500ha. Producers receive a premium of US$60 per ton over and above the regular price of sugar, which helps improve farm sustainability and profitability, thus increasing planters' resilience. The corporate sector adopts the Bonsucro certification which is a way to connect sugarcane growers, processors and food companies to sustainability along the sugarcane value chain. Although no premium is attached to this label, industrial buyers are increasingly searching for sustainably produced sugar. In Mauritius, two out of the three sugar estates are Bonsucro certified, which comes with minimum production standards of social and environmental sustainability, producing together some 40,000 tons of sugar under this label covering some 4,000ha of land.

Altromercato / Ferrero Sustainable Development Program

This Sustainable Development Program (SDP) was conducted in Mauritius from 2016 to 2020, driven by Altromercato (a federation of Italian cooperatives that buys sugar from MSS). This five year program was set up to improve the economic, environmental and social sustainability of these groups; its main aims were to encourage adoption of best agricultural practices, including increased use of biofertilisers, and to provide enhanced support services to concerned planters (MSS Annual Report, 2021). One of the objectives of the project was to increase the use and reliance by target small planters on both organic fertilisers and biofertilisers in conjunction with appropriate chemical fertilisers, within a perspective of integrated nutrient management (INM), therefore decreasing the negative impact of chemical fertilisers on the environment. Twenty-five cooperatives regrouping some 700 planters participated in the program. The program provided an incentive of €40 per ton of sugar for a maximum of 4,000 metric ton annually. The SDP has proven to be an effective safeguard against productivity loss and cane cultivation abandonment. Part of the incentive was used to set up a local team of 'young professionals' who provided on the ground support to the cooperatives and their members. The overall results of the program were encouraging. However, the program was not renewed.

Source: Mauritius Sugar Syndicate (Pers. Comm, 2022)

4. ANALYSIS OF THE IMPACTS OF FISCAL POLICIES, INCENTIVES AND FINANCIAL INSTRUMENTS FOR FINANCING NBS AND CSA

Over the past decade, Mauritius has made attempts to move agriculture towards a more sustainable development pathway. Fiscal policies implemented by government achieved varying degrees of success. The Strategic Plan (2016–2020) for the Food Crop, Livestock and Forestry Sectors contained schemes implemented for these sectors, which focused on achieving food security, climate change adaptation and mitigation, as well as biodiversity, conservation (MAIFS, 2016). These measures are contributing to different extents towards a more ecological approach for Mauritian agriculture. The process is taking time, as it requires a change in mindsets and attitudes to accept, act and bring about the required changes.

This study comes at an opportune time to assess the positive and negative impacts of current fiscal measures and propose those that are relevant and beneficial to support the greening of agriculture in Mauritius. The government budget of 2021–2022 is used as a benchmark to estimate public financing and expenditure incurred to support sustainable, organic and CSA. Direct expenditure for that period in the form of grants and subsidies indicated that around 37% of the subsidies allocated to the sector supported sustainable agriculture (see Section 5 below). The schemes and incentives funded by the government budget for agriculture and the impacts of the fiscal policy environment and economic incentives are analysed below.

The government of Mauritius currently has a number of fiscal policies, incentives and financial instruments to promote agriculture. This section reviews the schemes influencing positively or negatively, directly or indirectly, the adoption of climate-smart and nature-based agriculture. The types of support provided by the government of Mauritius are subsidies, grants, income tax incentives, tax exemptions of agricultural equipment, and preferential agricultural loan schemes through government owned banks. The mechanism for implementing these schemes and incentives often requires extensive cross-agency coordination prior to financial disbursements of grants and subsidies to farmers. The following types of fiscal schemes were assessed (some schemes include a mix of instruments):

1. Subsidies

Subsidies are used in different forms with different objectives including the correction of existing market imperfections and addressing externalities. Input subsidies are explicit or implicit payments reducing the price paid by farmers for variable inputs such as fertilisers, seeds, pesticides, energy, water or insurance. By lowering the costs of production, input subsidies aim to increase outputs of a specific commodity or non-competitive industry (UNEP, 2020). The impact of fertiliser subsidy programmes is linked to their effect on the use/consumption of fertilisers. However, it is not a straightforward task to estimate the impact of subsidy programmes on total fertiliser use which is dependent on various factors including market prices, existing networks, transport infrastructure, adequacy and reliability of supply, and crowding in/out[9] of commercial fertiliser and programme diversion (UNEP, 2020). In Mauritius, subsidies are provided to different categories of farmers: sugarcane growers, food crop growers and livestock breeders. For the purpose of this study, subsidies that impact on NbS and CSA are discussed below.

9 Crowding-in might occur whereby a government intervention increases demand for a subsidised product and as such incentivises greater private investment in the sector. Crowding-out, whereby the private sector is pushed out of the market due to government intervention, undermines the effectiveness of subsidies (UNEP, 2020).

2. Grants

The Ministry of Agro Industry and Food Security provides grants as fiscal incentives to agricultural producers. A summary of grants for different sub-sectors within agriculture, which are likely to have positive or negative impacts on NbS and CSA, is provided in Table 1 below.

3. Income Tax Incentives

Income derived from the agriculture sector has benefited from income tax relief under the Income Tax Act 1995. Under the Income Tax Act, these categories of income are tax exempt:

- Income derived by a cooperative society from agricultural activities
- Income derived on the first 60 tons of sugar accruing to a planter who is an individual cultivating fewer than 15 hectares of land
- Income derived from a person engaged in biofarming and sheltered farming schemes, approved by FAREI, will be exempted from income tax during eight succeeding income years from the income year in which the person starts his activity.

4. Value Added Tax Exemptions

Value added tax exemptions are provided on some agricultural inputs and equipment or under development schemes under Section 65A of the Value Added Tax Act. The producers under this category are refunded VAT paid on equipment and

Table 1: Summary of grants with likely impacts for NbS and CSA

Sector	Grant scheme	Description
General	Rainwater Harvesting	Grant of 50% (Max MUR 100,000) to acquire rainwater harvesting equipment.
	Purchase of Agricultural / Processing Equipment	Grant of 50% (Max MUR 350,000) for the acquisition of machinery, equipment, etc.
	Technology Introduction And Diffusion	(i) Cash Grant of 75% of costs of consultancy /expert services /equipment/breeding stock/crop/planting material (Max of MUR 1m). (ii) Additional bonus 25% on successful dissemination of project output to other producers.
Crop	Sheltered Farming	Grant of 50% (Max MUR 400,000) to acquire sheltered farming structures.
Livestock	Heifer Productivity Incentive Scheme	Cash Grant of MUR 2,500 payable to breeders per calf (3 months) (Max 30 calves per year).
	Upgrading of Livestock Farm	50% grant (Max MUR 200,000) to upgrade/ construct livestock farms and pig sties.
	Pasture Development	50% grant (Max MUR 20,000/arpent) to produce perennial fodder and maize up to a maximum of 25 arpents.
	Cattle Breeding Scheme	50% Grant up to a (Max of MUR 50,000/head) to purchase heifer/cows of genetically improved breeds (Max 10 heads).
	Goat / Sheep Breeding	50% Grant (Max MUR 15,000/head) to purchase goats/ sheep of genetically improved breed (Max 25 heads).

services specified in the Twelfth Schedule. Planters, horticulturalists, livestock breeders, including pig breeders, apiculturists and tea cultivators are eligible for a VAT refund paid on equipment and services.

5. Agricultural Loan Schemes

The Development Bank of Mauritius (DBM) and the Maubank are the two government-owned banks that provide loan schemes to agricultural producers, offered at preferential interest rates and conditions. At the DBM, several schemes are available to promote agriculture, agro-industry, SME support schemes, rainwater harvesting schemes, women entrepreneurship, microcredit and backyard gardening schemes. The agricultural loan scheme of the DBM provides a maximum amount of MUR 5 million at 2% per annum interest rate, with a moratorium of up to one year and a repayment period of up to seven years. This loan can be used to meet the cost of (i) the construction of greenhouses; (ii) plantation; (iii) purchase of irrigation/fertigation systems and other allied inputs; (iv) fencing; (v) breeders and poultry farming; and (vi) aquaponics. Cooperatives and private companies are eligible for these loans which cover up to 90% of the project value. In 2021–2022, 84 agricultural loans were approved to the tune of MUR 35 million. Other loan schemes available at the DBM for agriculture include a backyard gardening scheme for households, providing up to MUR 100,000 at 0.5% interest rate per annum to meet the costs of setting up a backyard/rooftop garden, to be repaid over four years. In 2021–2022, the backyard gardening scheme provided a total of MUR 840,000 in loans to 18 beneficiaries.

The Maubank has supported the Biofarming Promotion Scheme during 2017–2018, after which no applications were received. Further details are included in the impact analysis below.

IMPACT ANALYSIS OF FISCAL POLICIES AND INCENTIVES

Eleven schemes were selected for analysis because they are thought to have the greatest positive or negative impact on the adoption of NbS or CSA in Mauritius, either directly or indirectly. The list of schemes and reasons for their selection is presented in Table 2 below:

Table 2: List of schemes selected for analysis and reasons for selection

Schemes studied	Why they were selected?
Biofarming Support Scheme	This grant subsidy scheme promotes the adoption of sustainable agriculture through subsidies to farmers on bioproducts.
Biofarming Promotion Scheme	This tax reduction and loan scheme provided agricultural land and fiscal incentives for farmers willing to embark on biofarming/ organic agriculture in Mauritius
Rainwater Harvesting System Scheme	This subsidy scheme provides a grant to farmers for investing in rainwater harvesting systems to make more judicious use of water and enhance resilience.
Agricultural Calamities Solidarity Scheme (ACASS)/ Crop Loss Compensation Scheme	Farmers were compensated for bad weather resulting from the impacts of climate change in agriculture under this scheme, thereby increasing climate resilience.
Sheltered Farming Scheme	This subsidy scheme encourages farmers to shift to protected cultures to adapt to climate change through the adoption of climate smart technologies.
Fertiliser Subsidy Scheme (FSS) [Non-Sugar Sector]	This scheme was analysed as chemical fertilisers can negatively impact on the environment and contribute to GHG emissions.
Compost Subsidy Scheme	This scheme promotes the use of compost by farmers to rehabilitate soil health and improve water retention and reduce chemical inputs.
Fruit Protection Scheme	This scheme provides subsidies for nets to fruit growers as an environmentally friendly way of protecting fruits from pests such as bats, avoiding use of chemicals that can harm biodiversity.
Livestock Feed Promotion Scheme	Provides a subsidy on feed for registered livestock growers. The ingredients for livestock feed such as maize and soybean are imported from Brazil and Argentina and hence contribute to GHG emissions (and possibly also deforestation)
Fertiliser Subsidy Scheme for Sugarcane Planters	This scheme promotes the use of chemical fertiliser which is counterintuitive to the principles of NbS and CSA, encouraging monoculture of sugarcane.
Beekeeping Scheme	Beekeeping is a natural way of promoting the pollination of flowers in the ecosystem and therefore fruiting and increasing crop productivity.

The environmental and socio-economic impacts of 11 agricultural fiscal policies and incentives implemented in Mauritius are analysed below (including changes proposed in the recent government budget). The livestock sector has no schemes promoting sustainable, nature-based or climate-smart approaches specifically, apart from the 'Upgrading of Livestock Farm' grant which promotes ventilation because of increasing temperatures. There are no subsidies for chemical pesticides in Mauritius.

1. Biofarming Support Scheme

Description of scheme	• The Small Farmers Welfare Fund (SFWF) implements the Biofarming Support Scheme, which was initially designed solely for those involved in organic production. • A subsidy of up to 60% is granted to farmers for the purchase of organic inputs, including baits/traps to be used for integrated pest management through a voucher system. • A list of bioproducts eligible for the subsidy is available at the Small Farmers Welfare Fund. • Since 2021, the scheme is accessible to farmers which are registered as 'bio-farmers' or use 'sheltered farming'. • The government budget 2022–2023 has increased the subsidy to 75% on the purchase of liquid fertilisers, biofertilisers and composts by cooperatives.
Introduction	The scheme was introduced in 2016
Number of participants and trend	For the year 2021/2022, 51 crop growers benefited from the scheme.
Estimated annual cost	The contribution of the subsidy paid by government amounted to MUR 918,681.48 for 2021/2022.
Impacts	• **Environmental — Positive:** Reduces the costs of bio-inputs for farmers, but the number of beneficiaries is very limited to have environmental impacts which can be assessed. As it is only open to bio-farmers or sheltered farmers, this may limit its potential environmental impact, although most sheltered farmers use agrochemicals. • **Socio-economic — Positive:** Possible health improvement for farmers using bioproducts in agriculture and for consumers having safer products (compared to agrochemicals). Green jobs created for importers of bioproducts and producers using the bioproducts.
Challenges	• The list of bioproducts under the scheme requires regular updating to include products used by farmers. • Organic producers interviewed indicated that they have not benefited from this scheme as bioproducts are used in small quantities and therefore they avoid the administrative hassle of applying for the vouchers. • Some organic producers import their own bioproducts which are not found on the approved list of SFWF and do not benefit from 60% subsidy. • Some local organic farmers adopt an agroecological approach, promoting NbS rather than systematically using bioproducts for the control of pests. • At the institutional level, implementation of the scheme is challenging as the list of bio/ organic farmers is not readily available. This delays the process as SFWF needs to go and verify. • Enhancing coordination between the MAIF, the SFWF and the extension unit of FAREI will improve the mechanism for supporting biofarmers.

2. Biofarming Promotion Scheme

Description of scheme	• MAIFS introduced this scheme to encourage the development of biofarming activities on a commercial scale. • Individuals, companies and cooperative societies willing to embark in bio/organic farming activities and/or natural farming systems or transition to biofarming/organic agriculture for crop production in either open field or under protected structures were invited to apply. • The fiscal incentives under this scheme mean that farmers are exempt from all income tax payments for the first eight years of operation of an approved biofarming project. • Production equipment and other inputs acquired for the implementation of the project are exempted from value-added tax. • Loan facilities covering up to 90% of the project value with maturity of up to 10 years and interest rate at key repo rate[10] less 1% are provided under the Maubank SME Development Scheme (other agricultural loan schemes have preferential interest rates of 2%). • Land was made available to interested parties at the Britannia Organic Zone. • Farmers receive support from FAREI and successful operators receive a Biofarming Development Certificate.
Introduction	2016
Number of participants and trend	• The Maubank financed five projects (loans) under the Biofarming Promotion Scheme. • This scheme was implemented only within the period 2017 and 2018. No further application was received.
Estimated annual cost	Amount disbursed: MUR 9,032,400 over the period between 2017 and 2018.
Impacts	• **Environmental — Positive:** Adoption of biofarming leads to a reduction in agrochemical use and GHG emissions due to elimination of fossil fuel based inputs, and can support NbS if agroecological practices and local biodiversity are used. However, few applications have limited the impacts. There is a growing interest from young people to promote biofarming, but it is more difficult to change the mindset of conventional farmers. • **Socio-economic — Positive:** Better food quality and healthier fruits and vegetables are produced through biofarming, contributing to the overall health of the population. If uptake was high this could eventually lead to a reduction in health costs to the government. This is also accompanied by better health of farmers, who deal less with agrochemicals. Green labels and eco-services may contribute to improved economic returns to biofarmers. However, some biofarmers interviewed for this study stated that returns on investment in biofarming in Mauritius can be very low initially and it may take time to master agroecological production techniques.
Challenges	• Low returns on investment: The government dedicated 25 hectares (60 arpents) at Britannia Organic Zone for biofarming. Initially, 10 small and medium enterprises were involved and currently only 7 are still farming on half of the area allocated, each promoter on an area of around 2 ha (in some cases smaller plots).

10 The Key Repo Rate is used as the policy interest rate to signal changes in the monetary policy stance in Mauritius.

Challenges *(cont.)*	Others have abandoned the project as returns on the investment are difficult to recoup and producing organic crops in Mauritius is challenging and very risky. The produce harvested is sold together with other conventionally produced vegetables and therefore does not receive premium prices. Farmers are still struggling to obtain sufficient outputs in the initial years which delays their return on investment. Some stakeholders stated that the techniques of organic production still have to be mastered to achieve successful results. Therefore low yields are obtained for these products which, coupled with limited demand for organic produce in the island, hinders returns from organic production. Some farmers indicated that they are not in favour of taking out more agricultural loans as this is an additional stress for them since they are already burdened with loans from previous agricultural projects. • Certification: The issue of certification of organic products remains a major constraint in Mauritius. Some organic producers stated that certification through Ecocert international certification body is very expensive for local farmers. Currently, from the website of Ecocert, only six farms in Mauritius are organic-certified. An alternative is Maurigap, which is a local standard developed by the Mauritius Standards Bureau (MSB) to promote Good Agricultural Practice which establishes the basic requirements for sustainable crop production, focusing on food safety, environmental stewardship and farmer/worker welfare. Currently, 43 operators are Maurigap level 1 certified. Initially, the government had proposed the setting up of the Mauritius Agricultural Certification Body to enforce the Maurigap standards. However, the unit is no longer operational and the MSB has therefore taken the responsibility of both developing and enforcing the standards. Some stakeholders indicated that the MSB cannot be the institution responsible for both developing and enforcing the standards due to conflict of interest. The Use of Pesticide Act 2018 contains the list of molecules for testing of Maximum Residue Levels (MRL) for Maurigap certified produce. However, the act does not cater for newly introduced molecules that are used in pesticides by farmers and therefore these molecules may go undetected. In addition, the Pesticide Regulatory Office (PRO) of the MAIFS require regular capacity building for testing of new molecules in the form of equipment and training. • Marketing of organic produce: lack of certification for organic produce implies that products cannot be labelled and marketed on the local market for a premium price. One organic farmer stated that he uses an online platform to market his produce and is able to obtain a premium based on the trust of his customers. The market for organic in Mauritius is still very small and his main clients are expatriates living on the island. • Bio-inputs: many of the commercial products listed as bio-inputs remain to be tested and proven locally. Moreover, there is a lack of good quality compost for organic producers in Mauritius. The whole process of making compost with labelled amount of macro- and micro-nutrients is not available locally. Consequently, farmers make their own compost from poultry litter and cow manure, which is applied on a trial and error basis to adjust their soil. Mulching for mixing in the compost is sometimes not available. The current budget 2022–2023 is providing a subsidy of up to 50% up to a maximum of MUR 500,000 on the purchase of equipment for composting to planters and cooperatives.

3. Rainwater Harvesting System Scheme

Description of scheme	• The rainwater harvesting scheme encourages crop/livestock farmers to harvest rainwater to optimise use of water resources. • Smallscale farmers obtain a grant of 50% to a maximum of MUR 100,000 for the acquisition of appropriate equipment to collect, store and supply rainwater on-farm for agricultural production solely, and light structures for collection of rainwater.
Introduction	2015–2016
Number of participants and trend	2020/2021 : 5 beneficiaries As of May 2022, 48 beneficiaries have obtained grants.
Estimated annual cost	Amount paid to beneficiaries in 2020–2021: MUR 292,588 Government expenditure up to May 2022 amounted to MUR 2,163.
Impacts	• **Environmental — Positive:** This scheme contributes to CSA outcomes by improving water availability and resilience and improving the efficiency of use of water which would have otherwise have been lost. No studies have been done to assess the amount of water captured through this system. • **Socio-economic — Positive:** The scheme supports agricultural productivity during dry spells, reducing crop losses for farmers.
Challenges	To improve the coordination of the issuance of grant for rainwater harvesting and loan scheme available at the DBM for the same purpose.

4. Agricultural Calamities Solidarity Scheme (ACASS)/ Crop Loss Compensation Scheme

Description of scheme	The scheme compensates small planters growing in the open field for crop losses sustained as a result of the effects of climate change such as excessive rainfall, cyclones and droughts with a view to enabling them to promptly re-start their plantation. • The ACASS scheme, implemented by SFWF, provides financial relief to small farmers to mitigate the effects of crop losses and death of animals caused due to natural calamities. • Farmers registered for the scheme contribute MUR 6,000/year/arpent.[11] • Farmers, whose crops have incurred damages of more than 50%, received a grant of MUR 6,000. • A team from the MAIFS, FAREI and SFWF conducted assessments to identify eligible farmers. • The ACASS scheme is now the Crop Loss Compensation Scheme. • Growers received vegetable seeds to compensate for crop losses incurred due to bad weather. A total of 193kg of beans, cucumber and locally produced pumpkin seeds were distributed to small growers. The seeds were sourced from the MAIFS.
Introduction	Known as Crop Loss Compensation Scheme since 2019.
Number of participants and trend	In 2021–2022, 3,278 planters cultivating around 5,052 arpents (2,122ha) benefited from this scheme.
Estimated annual cost	The SFWF disbursed MUR 32,054,285 to small farmers under this scheme for 2021–2022.
Impacts	• **Environmental — Positive:** Although the scheme does not specifically promote biofarming or agroecology, it enhances the resilience of farmers to the impacts of climate change and helps them adapt, contributing to the objectives of CSA. • **Socio-economic — Positive:** The scheme helps farmers get back on their feet after bad weather or other calamities so that food security is not hampered. It helps stabilise vegetable growers' revenues to ensure their sustainability and reduces the breach in food production which ultimately helps promote national food security.

11 1 arpent = 0.42 Hectares

5. Sheltered Farming Scheme

Description of scheme	• Sheltered farming, as the term is used in Mauritius, implies any controlled environment used for crop production and may include hydroponics systems, crops grown in soil under plastic tunnels or any other structure protecting the crop. • This scheme encourages farmers to shift from traditional open field cultivation to a sheltered farming system, which promotes CSA. • The advantage of adopting sheltered farming in Mauritius is that the environment for plant growth is controlled, therefore improving water use efficiency, fertiliser usage and enabling more efficient pest control methods for crops such as lettuce, cucumbers, sweet peppers, tomatoes, melon, strawberries and flowers. • This scheme offers a grant of 50% on investment costs up to a maximum of MUR 250,000. • The beneficiaries are registered planters, Cooperative Societies, Agricultural Companies and Farmers Associations engaged in production of high value food and horticultural crops on a minimum extent of 0.25 acre (0.1ha) and having a maximum annual turnover of MUR 3 million. • New promoters who are already owners of land or who hold land leases for at least 5 years are eligible. • Any person who derives income from activities under the sheltered farming scheme is exempted from Income Tax during 8 successive years from the income year in which the person starts the activity.
Introduction	2014
Number of participants and trend	For the year 2020/2021, 36 planters were beneficiaries under this scheme. The number of farmers adopting the scheme has stabilised, but the government has once again increased the funding envelope and is expecting a consequent increase in uptake.
Estimated annual cost	Cost to government for 2020/2021 MUR 10,884,817 For the budget 2022/2023, the amount has been increased to MUR 500,000 for a total budget amount of MUR 30 million.
Impacts	• **Environmental — Positive or Neutral:** A better use of resources including water, fertiliser and pesticides can be achieved through the controlled environment, but most sheltered farmers continue to use agrochemicals rather than agroecological practices, hence the scheme does not necessarily support NbS. An increasing number of growers are interested in this scheme, supporting the movement from open field agriculture to sheltered farming, to better withstand the impacts of climate change. The effects of used plastic sheets from sheltered farming systems can be a source of environmental pollution. • **Socio-economic — Positive:** For the farmer, a higher productivity is expected from sheltered farming thereby increasing farmers' revenue.
Challenges	The implementation of this scheme is burdened with high administrative procedures. A grower who has benefited from this scheme indicated that the time taken for disbursement of the funds may be up to two years. Consequently, the quotation submitted at the time of application is no longer valid as costs have increased significantly.

6. Fertiliser Subsidy Scheme (FSS) [Non-Sugar Sector]

Description of scheme	• The fertiliser subsidy scheme is implemented by the Small Farmers Welfare Fund. The aim is to provide support to crop growers to sustain agricultural production and ensure continuous food production to achieve food security. • A subsidy of up to MUR 7,500 per arpent (MUR 3,150/ha) for open field growers, owning land up to 10 arpents (4.2ha), therefore reaching a maximum of MUR 75,000. • Growers using hydroponics systems, cultivating a maximum of 1,500 square metres receive up to MUR 135,000. • This scheme responds to the increasing cost of fertiliser in Mauritius due to global uncertainties and rising fuel costs. • The amount of fertiliser to be applied to crops is based on recommendation from FAREI and therefore a 50% subsidy is calculated based on those values.
Introduction	2022
Number of participants and trend	The scheme was only initiated at the beginning of 2022
Estimated annual cost	Budget allocated: MUR 60 million
Impacts	• **Environmental — Negative:** Chemical fertilisers have been found to create negative externalities including leaching into water ways, polluting groundwater sources, increasing GHG emissions and harming biodiversity. Emissions of nitrous oxides and methane could be reduced significantly if farmers use nitrogen fertilisers more efficiently, and particularly if they switch to organic fertilisers (eg. compost or manure). • **Socio-economic — Positive:** The subsidy reduces the cost of production for smallholder farmers.
Challenges	To ensure efficient use of fertilisers for crops. Ideally the subsidy should be repurposed to subsidise biofertilisers to reduce environmental impacts and reduce reliance on costly fertiliser imports.

7. Compost Subsidy Scheme

Description of scheme	• The objective of this scheme was to assist farmers in reducing production costs and use of chemical fertilisers with a view to simultaneously improving the quality of their land, and hence promote sustainable agriculture. • Locally-produced organic compost (about one ton/arpent/year) was granted free-of-charge to registered planters under this scheme. • The scheme has been suspended following the closure of the only factory supplying locally produced compost (as the quality of the compost was questionable). • The scheme is expected to enhance adoption of sustainable agricultural practices and empower small and medium enterprises as potential suppliers of safe and healthy food. • The 2022–2023 budget proposes to set up a pilot Composting Unit and a Sorting Unit for the separation of dry and wet waste resources for sale to registered recyclers on a Public-Private Partnership basis.
Introduction	The compost subsidy scheme, implemented by the Small Farmers Welfare Fund, started in 2013.
Number of participants and trend	The number of beneficiaries under this scheme amounted to 6,839.
Estimated annual cost	A total government budget of MUR 61 million was spent over the period 2013 to 2018 (average of c. MUR 10 million a year). For the period 2021–2022, although MUR 1 million was budgeted to provide 30% subsidy to small planters for locally produced compost to promote organic inputs, no expenditure was incurred that year.
Impacts	• **Environmental — Positive:** Switching to organic inputs reduces the negative impacts of inorganic fertilisers on natural resources and biodiversity, and reduces GHG emissions from inorganic fertiliser production and use, and from landfill waste. In the last communication by the government to the 3rd National Communication to the UNFCCC, GHG emission reductions (in Gg CO2e) resulting from the composting of food, garden and degradable paper were modelled. The quantity of waste diverted from landfill used in the model is 20% (2020), 30% (2030), 40% (2040) and 50% (2030) relative to their baseline values (Republic of Mauritius, 2016). This incremental composting starts in 2017 at a rate of 2% and increases linearly to the above-mentioned targets. The avoided methane is ~34 Gg CO2e in 2020 and increases to ~393 Gg CO2e in 2030, and to ~1 403 Gg CO2e in 2050. It is assumed that the composting process does not emit any methane, and the compost produced is used in agriculture to support biofarming. • **Socio-economic — Positive:** Can reduce the costs of production for farmers
Challenges	The supply of compost in Mauritius is irregular and there are currently no proper certification standards for locally produced compost except for Treated Farm Animal Manure (MS 196:2018). The Switch Africa Green programme supported the Mauritian Government in establishing and operationalising the 'Specifications for Treated Farm Animal Manure'.

8. Fruit protection Scheme

Description of scheme	• This scheme addresses the problem caused by bats to fruit trees and ensures adequate protection of harvests of seasonal fruits. • The Mauritius Fruit Bat, *Pteropus niger* is an endemic, endangered species which causes damage to litchi, mango and other tropical fruit crops in both orchards and backyard fruit trees across Mauritius. • The scheme provides a subsidy equivalent to 75% of the costs of the nets to fruit tree growers through a voucher scheme.
Introduction	FAREI has implemented the fruit protection scheme since 2009 by providing subsidies to fruit growers to purchase nets.
Number of participants and trend	For 2020–2021, 3,648 fruit tree growers benefited from the scheme.
Estimated annual cost	For 2020–2021, government spending amounted to MUR 21.5 million.
Impact	• **Environmental — Positive:** The nets, made of polyethylene recyclable plastic, are a sustainable and environmental-friendly way to protect the fruit trees against wind, excess sunlight and pests. This pesticide-free method of controlling bats does not harm the bat population in Mauritius, other biodiversity or human health. • **Socio-economic — Positive:** The Fruit Protection Scheme resulted in decreased damage of unprotected trees estimated at between 30% to 50% of total yield (FAREI, 2019), thus benefiting farmers' livelihoods.

9. Livestock Feed Promotion Scheme

Description of scheme	• The Livestock Feed Promotion Scheme grants a subsidy of MUR 8.00 per kg of feed to pig, goat, sheep and cow keepers in Mauritius — all registered livestock breeders receive the feed subsidy. • The latest government budget has increased this amount to MUR 10.00 per kg of feed. • The implementation of the scheme involves the FAREI and the Livestock Feed Promotion Scheme Unit of the Ministry of Agro Industry and Food Security. • A quota certificate is issued by FAREI to determine the amount of feed consumed by the number of heads of livestock every month for each breeder. • Based on this quota certificate, the receipts for the purchase of feeds are compiled by the Livestock Feed Promotion Scheme Unit of the MAIFS, which is then refunded to the breeders.
Introduction	15 October 2009 (at that time, the subsidy for feed was MUR 4.00)
Number of participants and trend	As of May 2022, 225 cattle breeders, 187 goat/sheep breeders and 96 pig breeders were benefiting from this scheme.
Estimated annual cost	For the last financial year 2021/2022, around MUR 21 million was disbursed by the government under this scheme.
Impacts	• **Environmental — Negative:** The increase in livestock production as stated in the Strategic Plan 2016–2020 was used to model the emission of GHG from this sector. Under the business as usual (BAU) scenario, total livestock GHG emissions (combined emissions from enteric fermentation and manure management) are relatively small, changing from 34,000 tonnes CO2eq in 2020 to 37,000 tonnes CO2eq in 2050. Under the Policy scenario that favours enhanced livestock rearing for increasing national food security, there is a significant increase in GHG emissions from 36,000 tonnes CO2eq in 2020 to 50,000 tonnes CO2eq in 2050 (Republic of Mauritius, 2016). Ingredients for livestock feed such as maize and soybean are imported from Brazil and Argentina and hence contribute to GHG emissions (and possibly tropical deforestation). Furthermore, pig waste can be a source of pollution (see Box 2 below). • **Socio-economic — Positive:** The subsidy lowers the cost of production for farmers and the price of meat for consumers.
Challenges	Administrative burden of implementing the scheme: The MAIFS has to compile all the receipts submitted by breeders and ensure that they are properly registered. Some breeders who are registered as cattle breeders seek subsidies for goat or sheep feed.

10. Fertiliser Subsidy Scheme for Sugarcane Planters

Description of scheme	• The Mauritius Cane Industry Authority (MCIA) implements the Fertiliser Subsidy Scheme for sugarcane growers. • This scheme aims to improve the productivity of small sugarcane planters. The quantity of fertiliser provided under this subsidy scheme is linked to the area under sugarcane cultivation. In fact, the sugarcane sector in Mauritius is well structured and the registration of sugarcane growers provides accurate information on the cultivated area. • Small sugarcane growers are provided with a subsidy on fertilisers amounting to MUR 3,519/hectare to those owning fewer than 4.22 hectares and have financed their own replanting cost. • Under the Advance Fertiliser Scheme implemented in 2021, the maximum cost allowable was MUR 981 per 25kg bag of fertiliser instead of the previous MUR 500 per 25kg bag. • Planters needed to refund 50% of the cost of fertilisers from their crop proceeds in 2022 directly from the MSS.
Introduction	October 2018
Number of participants	The number of beneficiaries for the fiscal year 2021–2022 reached out to 7,279 planters for a total amount of 4,715 tons of fertiliser.
Estimated annual cost	The amount approved by the government for the fertiliser subsidy scheme amounts to MUR 57 million in the government budget 2021–2022. However the increase in price of fertilisers over that period resulted in an increase in expenditure, amounting to MUR 108 million spent of the sugarcane fertiliser scheme for that year.
Impacts	• **Environmental — Negative:** Chemical fertilisers can deplete soil health and microbes over time. Overuse of fertilisers has not been detected, but fertilisers can lead to nitrate pollution and negatively impact water and biodiversity. Sugarcane production has negative environmental impacts during cane transport, processing, cultivation and harvest (Ramjeawon, 2004). The coverage of sugarcane cultivation over the island has led to a decrease in the area of native forests. However, biomass generation from sugarcane leads to a reduction in the amount of fossil fuels used for energy generation and accounted for 16% of the country's electricity. It is generated from bagasse, a by-product of the sugar industry, in 2018 (World Bank, 2020). • **Socio-economic — Positive:** The impact of this scheme favours an increase in agricultural productivity and reduces costs for smallscale farmers.
Challenges	Chemical fertilisers are known to be harmful to the environment if wrongly and continuously applied to crops. Therefore ensuring that the correct amounts of fertilisers are applied at the right time in soil which have been tested prior to application is important. Heavy rainfall or flashfloods may lead to leaching of fertilisers, causing pollution in water bodies or contaminating water tables. Therefore appropriate monitoring is required. Substituting chemical fertilisers with biofertilisers should also be considered to reduce negative environmental impacts and restore soil health.

11. Beekeeping Scheme

Description of scheme	• One-off grant of 50% up to a maximum of MUR 20,000 to purchase beekeeping equipment • Training in beekeeping complemented with the provision of starter kits including queen bees • MAIFS purchased 100 beehives for Rodrigues • Access to forest land is provided free of charge to 60 beekeepers. • The government is creating bee zones coupled with newly introduced legislation (currently in draft stage) for beekeepers and includes registration of beekeepers as well as placement of beehives in appropriate locations.
Introduction	Introduced in 2021
Number of beneficiaries	• 15 beneficiaries of one-off grant • Some 100 apiculturist were trained in 2021–2022
Estimated annual cost	For 2021–2022, of the budgeted amount of MUR 4 million, MUR 2.8 million was spent on the beekeeping scheme.
Impacts	• **Environmental — Positive:** Improves ecosystem services — pollination for wild plants and crops, which indirectly supports nature-based and climate-smart agriculture. • **Socio-economic — Positive:** Boosts honey production around the country. Honey production has increased to 30 tons annually from around 15 tons in 2015, benefiting the livelihoods of smallholder farmers. Impact was affected by bee pests: Varroa mite and small hive beetle.
Challenges	• Deforestation in certain areas such as Roches Noires and Bras D'Eau is affecting beekeeping activities, leading to a decrease in the area under melliferous plants in Mauritius. • Where to place beehives is limited in Mauritius. They cannot be placed in residential areas. Beehives can be placed in agricultural zones or forest land but these are becoming scarce in Mauritius. Agricultural pesticides are detrimental to bee colonies. Theft of beehives or honey is becoming a problem in Mauritius.

All the schemes analysed above were found to have positive socio-economic impacts, and most also had positive impacts for the environment or climate resilience. While biofarming schemes aim to support a transition to sustainable and organic farming, no scheme specifically seeks to promote nature-based solutions (ie. agroecology and biodiverse farming). However, three large schemes were found to have negative environmental impacts: the Fertiliser Subsidy Scheme for the sugar and the non-sugar sectors, and the Livestock Feed Promotion Scheme.

The analysis shows that some important schemes have been introduced that can enhance the adoption of practices that support NbS and CSA — however the implementation of these schemes is often hampered by complex administrative procedures that deter applicants, low returns on investment from organic farming, and problems with certification. For example, the Biofarming Support Scheme only benefited 51 growers in 2021–22 because of the administrative burden of applying for the subsidy. As the list of biofarmers is not readily available, this delays the process as SFWF needs to verify farmers. The Biofarming Promotion Scheme has received no applications since 2018 because productivity has been low and many farmers have not been able to fetch premium prices for organic products due to limited consumer demand, high costs of international certification, and the need to improve the Maurigap certification system by establishing an independent body. Lack of quality compost has also been a challenge for biofarmers and for the compost subsidy scheme. The only local compost factory has shut down due to questionable quality and there is no compost certification standard. The Sheltered Farming Scheme promotes climate resilience and resource use efficiency, but applicants can wait up to two years to receive funds.

At the same time, the fertiliser subsidy schemes for the sugar and non-sugar sectors encourage the use of inorganic fertilisers which pose a risk to the environment and biodiversity. Promoting efficient use of fertilisers is important, and repurposing these subsidies to support biofarming should be considered, particularly given their high costs. The cost of the Fertiliser Subsidy Scheme for sugarcane growers almost doubled this year to MUR 108 million. A number of schemes are hampered by insufficient coordination between responsible units at MAIF and FAREI and other institutions (eg. DBM).

Possible conflicts and overlaps between current policies

Fiscal incentives and policies in Mauritius are geared to enhance agricultural productivity. However, in so doing, they can lead to environmental and health hazards for the population and hence conflict with policies that aim to promote sustainable agriculture and health. For instance, the Fertiliser Subsidy Scheme for the sugarcane, tea and food crop sector encourages the application of fertiliser by reducing the cost of production to the farmer. However, any excess fertiliser application or the wrong timing of fertilisers during the rainy season may lead to pollution of rivers and the water table, and is therefore an environmental hazard. Other examples of conflicting policies identified is the beekeeping scheme which provides grants and subsidies to beekeepers, since the siting of the beehives is now becoming an issue. Beehives should not be kept near residential areas but rather in agricultural zones but the application of pesticides by farmers is harmful to the bee population. Placing bees in forest zones was recommended by the MAIFS. However, deforestation in certain forest regions is leading to a decrease in melliferous plants required by bees for pollination. There are also conflicts between livestock production incentives and environmental objectives (Box 2). Pig breeders benefit from the livestock feed subsidy analysed above and from VAT refunds. The VAT refund scheme was not selected for analysis as pig waste is not used for manure for cultural reasons, but pollution from pig waste could potentially have a negative impact on the uptake on NbS.

BOX 2: Pig Breeding in Mauritius and disposal of pig waste

Pig breeding is an activity undertaken by low-income earners in Mauritius as a means to sustain livelihoods. In the current context of the aftermath of the COVID-19 pandemic and the rising cost of living on the island, pig breeding can be an important source of revenue to poorer households, thereby alleviating poverty and simultaneously contributing to ensuring food security in Mauritius. The government therefore provides support to the pig breeders through feed subsidies and VAT refunds. However, pig waste can be a source of pollution, creating negative externalities. Pig farmers require a Preliminary Environmental Report (PER) from the Ministry of Environment, Solid Waste Management and Climate Change to be in operation. Some pig breeders are operating without a PER in regions such as St Croix and Terre Rouge as opposed to the dedicated pig zone located at St Martin and Bassin Requin. Disposal of waste from pig farming in some cases is not done in the proper manner, resulting in untreated effluent discharge in rivers, leading to pollution of the water table and fish mortality along the water body. In other cases, residents in the neighbourhood have complained to the authorities. In circumstances, these pig breeders are issued with an enforcement notice to take corrective actions. Should they not comply and take remedial action, a Prohibition notice or stop notice is issued. On the one hand, the subsidies are incentives for pig breeders to achieve food security but on the other hand, this activity can result in serious environmental damage if not done properly. Therefore, sensitisation by relevant authorities to adopt sustainable animal husbandry practices is key to overcome the conflicting situation. The government proposes to set up pig waste treatment plants in specific locations identified for pig breeding at Bassin Requin and St Martin (Budget Speech 2022–2023).

5. CURRENT LEVEL OF FINANCING FOR NBS IN AGRICULTURE AND CSA IN MAURITIUS

The level of government expenditure to support sustainable agriculture and CSA in Mauritius through subsidies and grants to producers for 2021–2022 is estimated at MUR 58.74 million, which represents around 21% of total subsidies provided to the agriculture sector. However, the percentage of subsidies that promote NbS and CSA outcomes represented only 2.7% of the total expenditure by MAIFS. These estimates were obtained from actual expenditures reported by the Ministry of Finance for the Ministry of Agro Industry and Food Security for 2021–2022 (see Annex 2). The schemes included in the calculation were identified based on their relevance for the promotion of CSA and NbS. For the sugar sector, certification and accreditation to sustainability labels (Fairtrade and BonSucro) was included in the calculation as the latter promotes climate smart practices for sugarcane cultivation.
For the non-sugar crop sector, the calculation included: subsidies provided to fruit growers for the purchase of environmentally friendly nets; schemes to encourage use of biofertilisers which leads to an improvement of soil health and reduces impacts on biodiversity; fruit fly suppression with environment friendly techniques; chemical free biofarming promotion; sheltered farming scheme; beekeeping scheme and rainwater harvesting schemes (see Annex 2). Biofarming in Mauritius is not monocultural but includes diverse local crops and can therefore be considered as NbS. However the Biofarming Support Scheme evolved over time to include sheltered farming which can be monocultural or include only a few crops and hence is not strictly NbS. For the livestock sector, the only scheme included was that to upgrade livestock/poultry farms, which encourages the efficient use of resources (water, energy) and promotes waste management.

About 44% of the subsidies spent by the government supported unsustainable agricultural activities in Mauritius, mostly through subsidies on chemical fertilisers to the sugarcane and tea sector in 2021–2022, amounting to MUR 120 million (US$2.5 million) (Annex 2). This is more than double the subsidies that promote positive outcomes for nature-based and climate-smart agriculture (21%). The remaining subsidies were assessed as being neutral in terms of NbS and CSA.

An estimated 13% of agricultural land is under sustainable agriculture producing sugarcane and food crops in 2021–2022 (see Annex 3). This area includes Fairtrade-certified small sugarcane growers' land, sugar estate land under Bonsucro certification, crop growers who are Maurigap certified and a number of organic/biofarming growers.

6. BEST PRACTICES IN FINANCING SUSTAINABLE AGRICULTURE

Some countries promote sustainable agriculture and encourage organic farming practices, for example, through financial schemes such as reduced tax rates. Norway is one of the first and few countries to have introduced a tax on pesticides, which aims to reduce pesticide use given the risks to human health and the environment. Norway's pesticide tax system is area based, implying that it uses a system of differentiated tax rates per hectare. It is also banded according to patterns of use and potential human and environmental risk, where products having highest risk potential have the highest tax (Spikkerud, 2005).[12] Bio-pesticides used for organic farming practices are exempt of taxes. France introduced a combined tax system with preferential treatment for organic farming practices, whereby a reduced tax rate is applied on bio-pesticides used in organic farming. Italy, Germany, France and Austria apply a lower VAT on organic fertilisers compared to inorganic ones (UNEP, 2020). Some countries offer further fiscal incentives to encourage organic farming practices, for example, in Denmark organic farms are entitled to receive benefits from tax revenues (UNEP, 2020). Box 3 describes the reforms to the Fertiliser Subsidy Scheme in Andhra Pradesh, India, by adopting a Zero Budget Natural Farming project, with the aim of reducing the consumption of chemical fertiliser.

BOX 3: Fertiliser Subsidy Savings through Zero Budget Natural Farming, Andhra Pradesh

The government of India allocates a significant portion of its budget to agricultural subsidies — with fertiliser subsidies being the most dominant, amounting to close to US$9,758 million in 2018–19 and expected to increase by 14% in 2019–20 to US$11,110 million. In Andhra Pradesh alone, the annual outlay on fertiliser subsidies was US$490 million in 2017–18. The Zero Budget Natural Farming project (ZBNF) being implemented by the state of Andhra Pradesh, aims to incorporate 6 million farmers and 8 million hectares of land to synthetic- and chemical-free agriculture by 2024. The estimated reduction in fertiliser consumption from ZBNF varies by crop type. For rice, it ranges from between 83 to 99%. For groundnuts, there is an expected reduction of almost 70% in urea and 91% in Diammonium Phosphate (DAP). Meanwhile, for maize, there is an expected reduction of 84 and 79% in urea and DAP respectively. The benefits of ZBNF are multi-fold and include: a) provision of low cost biological inputs, b) consistent yields, c) restoration of ecosystem services, d) conservation of biodiversity on-farm, e) use of local seeds, f) multicropping with tree cover, g) ability of farms to withstand extreme climatic events, h) safe and nutritious food, i) improvements in health and j) empowerment of women farmers. Thus the programme promotes both NbS and CSA. The potential fiscal savings from the reduction in fertiliser subsidies will depend on the take-up of the programme with estimated savings ranging from US$72 million to US$$300 million.

Source: Gupta, Tripathi and Dholakia 2020. Study on the effects of taxes and subsidies on pesticides and fertilizers, UNEP.

12 https://read.oecd-ilibrary.org/agriculture-and-food/evaluating-agri-environmental-policies/taxes-as-a-tool-to-reduce-health-and-environmental-risk-from-pesticide-use-in-norway_9789264010116-21-en#page1

The design of fiscal policy incentives for CSA and NbS has to be done cautiously taking a cross-cutting approach to ensure positive impacts for both agriculture and biodiversity. Mauritius stands to gain from experiences with policy design and implementation of neighboring countries in Africa. Box 4 illustrates the cross-sectoral policy approach for increasing CSA investment through fiscal incentives in Kenya.

BOX 4: Increasing CSA investment through fiscal incentives in Kenya

Existing fiscal policies and incentives in agriculture, environment and forest sectors in Kenya are inefficiently designed and/or insufficiently managed to drive climate-smart outcomes. The complex regulatory framework, with a range of taxation laws and several national and sub-national institutions, strategies and policies across agriculture, forestry and environment sectors, complicates the analysis of the impacts of a cross-sectoral policy like climate-smart agriculture. Despite the Kenyan government's promotion of a green economy and green growth, fiscal incentives neither effectively include nor target CSA. The cross-cutting nature of CSA complicates the design and implementation of fiscal policies and the current institutional framework for deploying fiscal incentives does not effectively accommodate CSA investment. Therefore, the potential solutions identified for Kenya are to firstly, define and harmonise existing fiscal policies to account for CSA. Secondly, reform perverse incentives that contribute to deforestation, degradation, or other non-CSA outcomes; and finally, design and implement clear policies and policy linkages at the national level. Although the Kenyan government took a more unified perspective on CSA through the 'Kenyan Climate-Smart Agriculture Strategy 2017–2026', the document offered little guidance on how the National Treasury should develop taxes and subsidies which align with the strategy's goal. Policy approaches proposed included a centralised CSA-funding source that could signal policy linkages between uncoordinated laws; creating an 'Ecological Fiscal Transfer (EFT)' to reform existing intergovernmental fiscal transfer allocation formula which included CSA-related indicators; and setting up agricultural growth poles (commonly termed 'agropoles') to deploy public and private sector investment to promote agricultural transformation. The agropoles could offer a platform for joint fiscal policy development at national and county levels.

Source: Adapted from Climate Focus (2018). Increasing CSA investment through fiscal incentives in Kenya. Policy Brief.

7. TOOLKIT FOR FINANCING NATURE-BASED AND CLIMATE-SMART AGRICULTURE IN MAURITIUS

The government of Mauritius has clear intentions to promote sustainable agriculture as indicated in commitments taken under the Paris Agreement and the Nationally Determined Contributions, the National Pathway related to the UN Food Systems Summit and budget speeches from the Minister of Finance, Economic Planning and Development. This study revealed that Mauritius is currently in a learning phase towards the adoption of sustainable agriculture, NbS and CSA. An estimated 13–15% of the land under agriculture is adopting climate smart practices. Although research on the practices of NbS and CSA has been undertaken and implemented in other countries, the microclimate and nature of agriculture in Mauritius requires a contextualised approach for their successful implementation. A number of projects to promote agroecological practices have been implemented over the years by different stakeholders, ranging from smallholder farmers, corporates, international development partners and regional organisations. The success rate of these projects varies greatly and is influenced by the willingness of the promoters to keep going when the going gets tough.

This section proposes a toolkit of actionable and contextualised priority reforms to the economic and fiscal policy environment to improve the adoption of NbS and CSA, based on experience in Mauritius and building on international best practices.

FISCAL POLICY REFORMS TO ADDRESS CHALLENGES WITH EXISTING SCHEMES

The analysis of existing fiscal policies showed the need for reforms to improve the implementation and administration of schemes that support biofarming and climate resilience to enhance uptake; and highlighted the need to repurpose harmful subsidies notably for chemical fertilisers that pose an environmental hazard. The administrative burden for disbursement of subsidies can prevent farmers from benefiting from these schemes, and some products used by farmers that can promote NbS and CSA are not eligible for subsidies under current biofarming schemes. Another constraint for farmers is reliable sources of inputs such as good quality certified compost. The certification of products under schemes such as Maurigap requires capacity of regulatory authorities which sometimes are lacking, for instance, to test newly introduced pesticide residues. Schemes, such as the Fertiliser Subsidy Support Scheme, may require better management and impact assessment to ensure no health or environmental hazards and repurposing to support bio-inputs should be considered. Experience from the implementation of existing fiscal incentives and schemes in Mauritius demonstrates that it is important for farmers to access these support schemes with relatively low administrative burden and within a relatively short period of time. Moreover, for many farmers, the transition from conventional to biofarming or simply the investment in biofarming implies that money and time is invested for returns that will be obtained only after three to five years. During the transition phase, a mechanism to support farmers financially is suggested, for example through grants or payments for ecosystem services.

At international level, investment in NbS for agriculture is increasing, motivated by organisational missions or sustainability commitments (Hallstein and Iseman, 2021). Another reason is that impact sectors contribute

to global commitments, such as the UN SDGs and the Paris Climate Accord. Given the critical opportunities for Agricultural NbS to contribute to climate, biodiversity, and human health and livelihoods, these activities are well-positioned to appeal to investor interest if the business and investment cases are compelling. Countries are increasingly using fiscal incentives to reduce the use of harmful agrochemicals — such as the tax on pesticides in Norway, and the repurposing of fertiliser subsidies in Andhra Pradesh to support Zero Budget Natural Farming, which supports both NbS and CSA outcomes. Kenya's experience shows the importance of improving institutional coordination mechanisms to remove conflicts between different policies and fiscal instruments and provide clear incentives for CSA.

This study identified a number of options for reforming fiscal policies to enhance finance for NbS and CSA in Mauritius:

Streamlining the application and administrative process

Schemes can be streamlined when fiscal incentives are provided by different institutions/organisations. An example is the **Sheltered Farming Scheme** which has a grant component from the MAIFS and a loan at preferential rates financed by the Development Bank of Mauritius. The application and monitoring of the scheme involves FAREI and the SFWF. Requiring a single application which is assessed by a multi-stakeholder committee can accelerate the process and ensure timely approval of both loans and grants. Currently these loans and grants are separate and require different administrative procedures. The amount budgeted in one financial year for the grant scheme is not disbursed in a timely manner because of the administrative burden to process the application. Similarly the **Rainwater Harvesting Scheme** can be streamlined as this includes a grant component from the MAIFS and a loan from the Development Bank of Mauritius. These reforms will need to be integrated in policies prepared for the Ministry of Agro Industry and Food Security.

Biofarming Support Scheme: Improving linkages between stakeholders and testing of bioproducts

The Biofarming Support Scheme requires constant updating of the bioproducts that can benefit from a government subsidy. The range of bioproducts imported into the island is constantly evolving which becomes difficult for relevant institutions to track and provide subsidies accordingly. Addressing this problem requires closer linkages amongst importers, farmers, FAREI and SFWF. One issue raised during stakeholder consultations is that bioproducts are allowed in the island but the efficacy is not known until tried and tested. Sometimes farmers use bioproducts and do not obtain positive results. Therefore, bioproducts should be tested before allowing imports and providing subsidies. The Biofarming unit of FAREI should also aim to provide farmers with locally-available bio-inputs, to reduce reliance on imports, and because local solutions are often based on traditional knowledge that supports NbS and have lower costs and environmental footprints. In addition, a database of registered biofarmers should be made available to SFWF to speed up the approval process.

Biofarming Promotion Scheme: Integrating grant support, NbS and local knowledge

The Biofarming Promotion Scheme is no longer receiving application forms from the Maubank for preferential agricultural loans which were coupled with tax incentives. It appears that although farmers were initially very enthusiastic about organic agriculture, much research still remains to be done to achieve successful results. The number of farmers at Britannia Organic Zone is decreasing with farmers giving up on projects initiated as they face numerous production challenges to maintain organic production, including pests and disease control and supply of compost. It is apparent from experience so far that returns on investments for newly implemented biofarming projects tend to be limited or rather negative, and many farmers are reluctant to take out more loans. The

provision of grants to support farmers to switch to agroecological practices that support NbS and CSA appears to be more appropriate. The setting up of the organic zones should be well designed, including a compost making area (with chipper, compost cubicle provided and accompanied by relevant training) for all farmers within the zone. The concept of NbS should be integrated with the Biofarming Promotion Scheme, where traditional knowledge, locally sourced inputs such as local seeds, biofertilisers and biopesticides, and agroecological practices, such as intercropping for nitrogen fixation, agroforestry, Integrated Pest Management (IPM) strategies are promoted for improved results. This can reduce reliance on imported biofarming inputs which contribute to GHG emissions, may not always be the most suitable and effective in the local context, and may be more costly, while enhancing resilience to climate change.

Digitalisation of procedures and use of smart apps to simplify the application process

The process for applying for grants, subsidies and tax exemptions that promote NbS and CSA can be reformed and simplified. Currently, the system deters some of those who should be receiving those fiscal incentives to apply, leading to a low uptake of biofarming related schemes as evident from the analysis above. Thus, all the good intentions of the government to promote sustainable agriculture are diluted due to complex processes involved. One possible solution is to digitalise the whole process to save time on administrative procedures. The e-government initiative in Mauritius, which aims to transform interaction with citizens, businesses and service delivery by the public sector, is appropriate for the agricultural sector. Improving the linkages among institutions through technology will greatly simplify the process for applicants and target those who are genuinely contributing to greening the agriculture sector and also encourage conventional farmers to shift to greener practices. The development and use of smart apps by farmers can streamline the process and thus improve the uptake and effectiveness of these fiscal incentives. In a recent study by Centre for Coordination of Agricultural Research and Development for Southern Africa (CCARDESA) on Digital Agricultural Country Study for Mauritius[13] 2021–2022, the benchmark assessment shows that Mauritius has a robust and mature digital economy. The process of digitalisation should be led by the MAIFS, in close consultation with the Ministry of Information Technology, Communication and Innovation, to link agricultural departments and institutions falling under its purview. This may contribute to accelerating the process of greening agriculture in Mauritius, with the associated environmental, economic and social benefits. An estimation of the cost of the process of digitalisation is beyond the scope of this study.

Reforming harmful subsidies: Fertiliser and Livestock Feed Schemes

The Fertiliser Subsidy schemes for the sugar and non-sugar sectors encourage the use of inorganic fertilisers which pose a risk to the environment and biodiversity, contribute to GHG emissions and can undermine long term soil health and productivity. These subsidies could therefore be reduced or phased out and repurposed to subsidise bio-inputs and biodiverse, agroecological farming practices (NbS) that contribute to climate adaptation and mitigation (CSA), and to support the reforms identified above. The fertiliser subsidy for the sugarcane sector is particularly costly given that the cost of imported inorganic fertiliser has almost doubled in 2022 — making this subsidy alone amount to MUR 108 million. This subsidy could be reduced to support less costly locally produced biofertilisers and organic certification for niche markets. In addition, the Livestock Feed Subsidy, which was also found to have negative environmental impacts, could be reduced or repurposed to support less costly locally produced feed and fodder and the development of organic

13 https://www.ccardesa.org/sites/default/files/knowledge-products/CCARDESA%20Digital%20Agriculture%20County%20Study%20-%20Mauritius.pdf

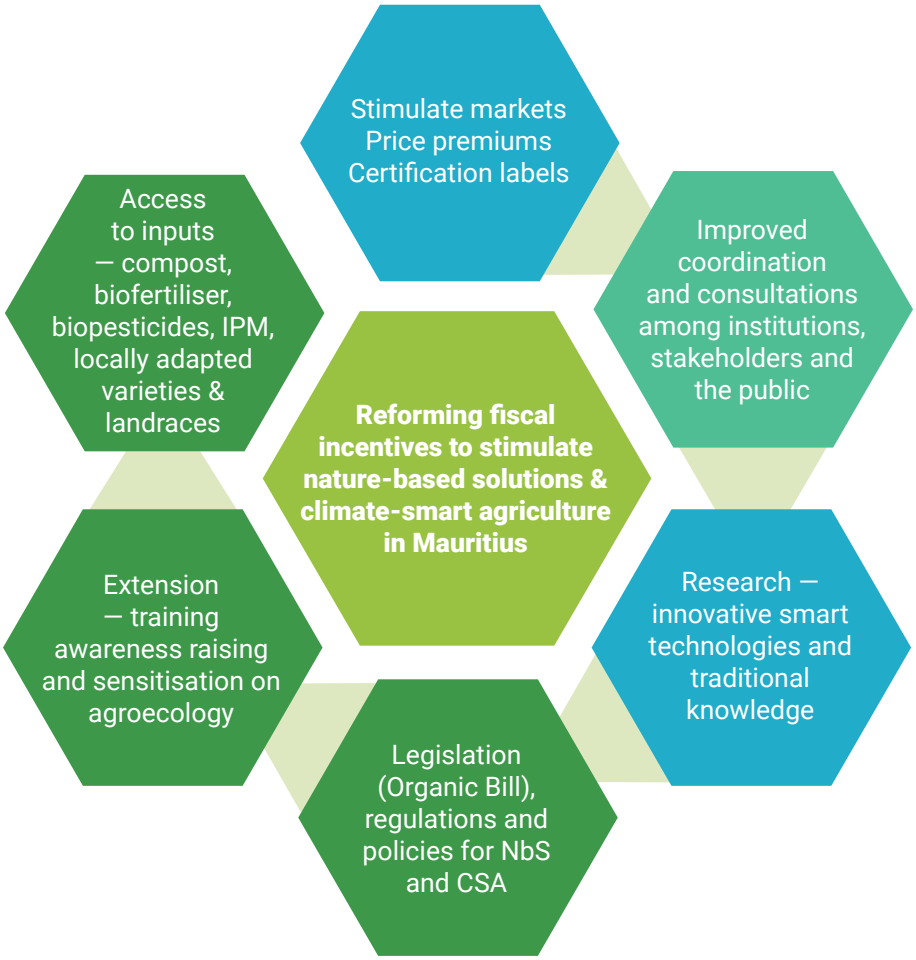
meat products that can fetch a premium. Finally, Mauritius could consider increasing taxes on chemical pesticides to discourage their use, benefit biodiversity and enhance the impacts of the Beekeeping Scheme, while providing additional finance to support the above reforms.

COMPLEMENTARY POLICIES AND MEASURES TO SUPPORT EFFECTIVE FISCAL POLICY REFORMS

Fiscal policies are most effective as part of complementary policies promoting other key drivers to stimulate the systemic and behavioural changes needed to shift towards NbS and CSA. Figure 1 below shows the interactions needed to move along the pathway towards more sustainable agricultural growth. The economic and fiscal policy environment is an important driver to bring about change.

The efficiency and effectiveness of fiscal schemes provided by the government depends largely on their design and implementation. The study found that an important step for reforming the economic and fiscal policy environment to achieve a greater impact is to identify clear policy goals, objectives, outcomes, outputs and indicators when the government allocates a budget for sustainable agriculture. Clear targets are required to increase the effectiveness of these policies. An implementation structure, comprising of a diverse group of stakeholders from different spheres is necessary to provide appropriate guidance on increasing agriculture under NbS and CSA. These

Figure 1: Drivers of NbS and CSA in the pathway for greening agriculture in Mauritius



stakeholders should be well versed on how NbS and CSA can impact the greening of the agriculture sector and able to strengthen cross-linkages among institutions. Undertaking ad hoc actions in isolation limits the impact created by the fiscal policy. A bottom-up approach is important for designing fiscal incentives for NbS and CSA as there appears to be a disconnect between policymakers, farmers and consumers. Lack of information sharing and collaboration is also an impediment for effective implementation of fiscal policies and schemes. Any support provided should be reformed in a way that creates positive incentives and promotes sustainable behaviour changes. An important consideration for reforms in the agriculture sector of Mauritius is the political economy. Sugarcane farmers and corporations have a long history of influencing the direction of agricultural policies in Mauritius. Getting buy-in from such major stakeholders is imperative for successful and impactful reforms promoting sustainable agriculture.

The Strategic Plan 2016–2020 for the food, livestock and forest sectors had ambitious targets of achieving at least 50% of agriculture production through biofarming by 2020, but these targets were far from being met. The timeframe of fiscal schemes is important: do they seek to address short-term pressing goals like increasing a country's food self-sufficiency or more long-term structural objectives? While long-term is preferable, in low-income countries due to weak institutions and endemic market failures, price support, price stabilisation and input subsidies have been used as ways to address short-term objectives on income, poverty and food security, with a perspective to promote long-term economic development (UNEP, 2020). The current preparation of the policy document for agriculture in Mauritius provides a good opportunity to reconsider the timeframe of policy goals and fiscal schemes needed to deliver the incentives and changes in behaviour needed to scale-up NbS and CSA.

The section below further explores some of the complementary drivers of NbS and CSA that can support fiscal policy reforms.

Research for NbS and CSA in Mauritius

The adoption of NbS and CSA in Mauritius requires strengthening of the research institutions supporting greening of agriculture. The limited uptake of the Biofarming Promotion Scheme may be largely attributed to the lack of research and knowledge on biofarming. The Biofarming Support Scheme would have a greater impact if the appropriate bioproducts are recommended to farmers rather than providing subsidies on products for which the impacts are still being studied. Although some research has been undertaken by different institutions, a more coordinated approach to conduct research for the promotion of NbS and CSA is required. A capacity building programme for strengthening the Biofarming Unit of FAREI may support this initiative. Therefore appropriate budget allocation from the government is required, as well as support from development partners.

The European Union is funding the project 'Development-Smart Innovation through Research in Agriculture' (DeSIRA) initiative to the tune of EUR 5,081,000 over a 3-year period (2020–2022). Under this project, the University of Mauritius is implementing the action 'Enhancing climate resilience in agriculture for improved food and nutrition security through research, innovation and training in the Republic of Mauritius'. The overall objective is to strengthen the capacity of the Faculty of Agriculture, University of Mauritius, in research and training to promote sustainable agriculture for improved food security in response to climate change. As part of DeSIRA, FAREI is implementing the activity on 'Supporting Sustainable Agriculture for Improved Food Security and Safety in the Republic of Mauritius — Enhancing FAREI's R&D Capacity for a Sustainable and Modern Agriculture'. It has the objective to foster innovation in agriculture through consolidation of the Research and Development capacity of FAREI to address climate change challenges and development of climate-smart practices for sustainable production. It is expected that the outcomes of the EU-DeSIRA actions and the application of the results of research will

promote NbS and CSA in Mauritius, contributing to adaptation and mitigation of climate change in agriculture.

Research on NbS is limited in Mauritius and therefore calls for further investment. The Country Programming Framework 2022–2025 of the FAO Priority 2 country outcome is to 'Protect, restore and promote sustainable use of terrestrial and marine ecosystems and combat climate change through more efficient inclusive resilient and sustainable agri food systems; and may include a component on research during its development phase. NbS for Mauritius will need to harness traditional knowledge of farmers together with local biodiversity and ecosystem services, and scientific knowledge, in an integrated approach to respond to the agricultural challenges of Mauritius.

Strengthening Extension Services for NbS and CSA

Research undertaken on NbS and CSA should actively engage farmers and the results should be disseminated to farmers through extension services. Capacity building of extension services is a prerequisite for participatory research and dissemination of knowledge on NbS and CSA. The launch of the two Biofarming Schemes in 2016 was done in an abrupt way and extension services had insufficient technical capacity to support farmers, which may have resulted in some farmers abandoning cultivation. Concurrently, farmers should be able to provide feedback to extension services on problems encountered and solutions developed by them for impactful research to be conducted.

Improved coordination and consultations with institutions, stakeholders and the public

Although commitment at higher levels is stated in policy documents, very often the mechanism for implementing the actions required takes time and doed not achieve the expected impact due to insufficient coordination and consultation amongst different stakeholders, at both institutional level and farmer level. The study found that establishing a mechanism for improved coordination among institutions involved in the implementation of fiscal policies and instruments promoting NbS nd CSA is important to increase the efficiency and impacts of the schemes. Therefore, this study recommends the setting up of a multi-stakeholder consultative committee for the adoption of sustainable agriculture practices, comprising of public, private and civil society representatives. Such a committee should help set policy goals and targets and ensure that these are achieved. Proper consultations with farmers and the public is imperative for well-designed schemes that are impactful. The private sector, comprising of both smallholder agriculture producers and larger companies, also has an important role to play in promoting a more sustainable pathway for the agriculture sector.

Legislation (Organic Bill), regulations and policies for NbS and CSA

The Organic Bill is still in draft form and will be a key document for promoting organic agriculture in Mauritius. In addition, the MAIFS is developing a policy document for the agriculture sector which provides entry points for the inclusion of strategies and policies that promote NbS and CSA for sustainable agriculture production and consumption. The policy document should provide the enabling conditions and framework for the adoption of sustainable agricultural practices by ensuring that the drivers and incentives needed to promote NbS and CSA are put in place (Figure 1).

Stimulating markets for sustainable products: Certification and consumer awareness

The Biofarming Promotion Scheme received no further applicants after 2018, largely due to low returns on investment for organic farmers. The farm-to-fork linkages for NbS and CSA-based products are still underdeveloped in Mauritius, with the market share for sustainable agriculture products being relatively small. Unless the demand for such products increases, fiscal incentives

promoting the adoption of NbS and CSA will have limited impacts. Farmers will only invest time and money in products that have a market. Therefore consumer sensitisation campaigns for such products will be required and a budget should be allocated accordingly.

The certification and labelling of products from sustainable agriculture is important for farmers to get a premium. The Maurigap label MS-184-1 is a very good initiative for certifying and labelling agricultural produce which does not use harmful pesticides. The Mauritius Standards Bureau (Certification Mark) Regulations 2021, published on 26 August 2021 to include the MauriGAP Certification Scheme, allows for the issuance of the certificate of registration, valid for a period of three years. Annually, two surveillance visits are conducted whereby samples of produce are collected for Pesticides Residues Analysis. Pesticides used should be in compliance with the Use of Pesticides Act 2018. The government budgeted MUR 2 million to the MSB for green agricultural certification. This study identified some flaws with the current system of certification where the national laboratories do not have the capacity to test certain pesticide residue molecules which are newly introduced in the country and are not included in the Use of Pesticides Act 2018. Therefore capacity building is required for strengthening laboratory testing facilities, with support from development partners. The Mauritius Agricultural Certification Body (MCAB), which was initially proposed for enforcement of the Maurigap standards, has to be properly established. Currently the MSB is monitoring the enforcement of the standards. Some stakeholders stated that conflict of interest may arise when the institution that develops the standard also enforces the standard. Hence, appropriate action at the level of the MAIFS to set up the independent MCAB is required and funding should be allocated accordingly.

Improving access to inputs (compost, biofertiliser, biopesticides, IPM, locally adapted varieties)

An important finding of this study is the limited availability of commercially produced compost in Mauritius, which hinders the adoption of biofarming and the effectiveness of related schemes. Although MUR 1 million was budgeted in 2021–2022 to provide for a subsidy for small planters for locally produced compost, no expenditure was incurred due to unavailability of compost. The government budget also allocated a total of MUR 36 million to to the Ministry of Environment, Solid Waste Management and Climate Change and the Ministry of Local Government and Disaster Risk Management, to promote a circular economy through composting of green waste from households, parks, gardens and markets. Organic farmers indicated that they make their own composts from manure or poultry litter. Other constraints observed is that straw/mulch required to be mixed for compost making is not always available. The government budget 2022–2023 has introduced a scheme to promote production of compost at the farm level. Procedures are under way at the level of the Ministry of Environment to launch the tender for a Private-Public Partnership for the establishment of a commercial compost manufacturing plant at Henrietta in Vacoas-Phoenix. In addition, delays in establishing the administrative procedures for fiscal incentives (eg. approval committees, ToRs) prior to the launch of tenders have reduced the impacts of fiscal incentives. Another issue raised by stakeholders on the Biofarming Subsidy Scheme is that the bioproducts used by farmers are sometimes not eligible for subsidies as per the list of SFWF. Therefore, this limits the impact of the fiscal incentives provided. It is recommended that close consultation among institutions is promoted by setting up a committee chaired by MAIFS to discuss these issues and find solutions.

NbS involves the use of diverse plant varieties and animal breeds which are well adapted to the local context. The MAIFS propagates local varieties of seeds, albeit on a reduced scale because of limited capacity. Therefore building capacity for seed production at the MAIFS through training of staff and modernisation of equipment is necessary, while at the same time building the capacity of farmers to produce disease free seeds of local varieties. The Plant Genetic Resources (PGR) unit of the MAIFS where the genetic material for local varieties are stored is crucial for NbS. Investment in equipment to propagate the accessions stored in the PGR unit is needed. Some propagation of local seeds of pumpkin and squash is achieved through the Quality Declared Seed (QDS) programme of the MAIFS. However, a wider range of local seed varieties require propagation and distribution to local farmers. One measure that will promote NbS and CSA is to encourage local farmers to multiply, exchange, save and store local seeds. Fiscal incentives such as grants could support local seed production and community seed banks. Breeding of livestock species with local genetic material will contribute to NbS and CSA, for instance, the Creole cattle breed is known to be well adapted to the local context, even though production of milk may not be as high. The AU-IBAR project "Conservation and utilisation of critically endangered Creole Cattle in Mauritius" promoted the in-situ conservation of creole breed.[14] Therefore providing incentives to cattle breeders to used locally-adapted cattle breeds as a means to adapt to climate change may be encouraged. The current scheme that provides grants to farmers for newborn animals could be reformed accordingly.

Incentivising a circular economy and composting for greening agriculture

A vision to promote a circular economy for agriculture in Mauritius can be an effective way to re-engineer agriculture production and the agro-value chain for sustainability. However, intense involvement of all stakeholders and commitments at different levels will be required. Although many smallscale farmers use poultry litter as biofertiliser, overall the supply of compost in Mauritius is irregular and insufficient, hence penalising farmers using agroecological practices. Compost manufacturing on a commercial basis is limited and done by small entrepreneurs. Moreover, although capacity building for developing standards in compost making from manure was provided under the UNEP Switch Africa Green programme, the experiment to test the effects of the use of compost on crop yields is still ongoing. Therefore, it is high time that green wastes from households, parks and markets be used for compost making. Budgetary commitment for compost making has been allocated in 2021–2022, while schemes for compost making at the producer level are included in the budget 2022–2023. This provides an opportunity for the creation of green jobs in the value chain for sustainable agriculture. For the system to work, a mechanism for incentivising the collection of green waste is required to bring about changes in behaviour. A pilot project could be initiated in selected regions of Mauritius, linked to urban food systems. For example, the Municipal Council of Vacoas-Phoenix is establishing a composting facility for green waste. An important component of compost manufacturing in Mauritius will be to ensure that proper certification standards for compost are developed and enforced to enable compost factories to operate effectively and stimulate uptake of good quality compost by agricultural producers. Therefore appropriate funds need to be allocated to the Mauritius Standards Bureau for development of compost standards for plant-based compost rather than manure (since there is limited livestock in Mauritius other than poultry, and pig manure is not used for cultural reasons).

14 http://farei.mu/farei/wp-content/uploads/2021/02/Technical-Highlights-2019-2020.pdf

8. POTENTIAL NEW GREEN FINANCE INSTRUMENTS AND TOOLS TO SCALE-UP FINANCE

The study identified the following potential new green finance instruments and tools which could be used to scale-up and channel finance and investment towards nature-based and climate-smart agriculture and sustainable food systems. These are described below:

Green financing for Innovative Technologies in agriculture

The adoption of new technologies, such as remote sensing, GIS for soil profiling and adjustment, and Innovative Drone Technology for use in precision pest management, can improve the efficiency of resource use and promote adaptation and mitigation to climate change in Mauritius. These technologies are highly relevant for Mauritian agriculture as the sector faces multiple challenges linked to climate change, soil degradation, pest and disease control, and unavailability and high cost of labour. Research is needed on the use of new technologies in agriculture, with emphasis on CSA and exploring their potential for supporting NbS and agroecology. Some agricultural stakeholders in the private sector are already embarking on the adoption of these technologies. Tax exemption, grants, green loans and green investments are good mechanisms that should be combined for a successful paradigm shift to adopt such technologies. Incentives have to be developed by the MAIFS in close collaboration with FAREI and the Economic Development Board for investments in these technologies.

Green Investment promotion schemes

Sustainable agriculture may benefit from the expertise of 'green' investors promoting NbS and CSA in Mauritius. It is important for Mauritius to create an enabling environment for innovative sustainable agriculture to emerge. One way is to propose financial schemes to incentivise foreign and domestic companies to set up innovative NbS and CSA enterprises and joint ventures in Mauritius through mechanisms at the level of the Economic Development Board. Mauritius may even consider new schemes at the level of EDB such as a 'debt-for-nature swap' to encourage investment in projects that lead to better conservation of biodiversity through NbS. To increase the impact of such projects, integrating an agro-eco-tourism component and export potential of certified green agro-products, may be beneficial. Such investments will stimulate the agri-value chain for sustainable agriculture with entrepreneurs emerging along the supply chain with the associated multiplier effects on the environment, economy and society. The impacts of such schemes can be multifold, promoting efficient use of resources, adapting to climate change, production of safe and healthy food, conserving biodiversity, and creating green jobs, leading to an overall improvement of the environment of Mauritius. Given the multi-faceted nature of the incentive, a thorough thinking process with the right stakeholders is imperative for designing such schemes. Support from development partners to design a multi-dimensional package may be required.

Integrating NbS and CSA in green buildings and real estate developments

Mauritius is seeing a surge in real estate development. Integrating a component for nature-based and climate-smart agriculture in the design of buildings and real estate is an innovative way to reduce agrochemical use and GHG emissions, reduce pressure on land and biodiversity, promote healthy diets and reduce reliance on imported food. Rooftop gardening and inclusion of vertical farming as part of climate-smart technologies for agriculture should be part and parcel of newly approved building plans. Therefore, collaboration between relevant stakeholders to propose amendments in legislations to facilitate uptake of such proposals is required, and the development of innovative financing schemes to support urban agriculture should be explored. The lead for such schemes may fall within the purview of the Ministry of Housing and Land Use Planning in close collaboration with the MAIFS.

Capacity building for green fiscal instruments by banks

Green loans are available from commercial banks in Mauritius through refinancing by development partners. The Agence Française de Developpement (AFD) has assisted Mauritius in its transition towards a greener, more inclusive, and more sustainable economy since 2009 (SUNREF Mauritius website). In association with three local partner banks, AFD has successfully developed a green finance market with appropriate marketing approaches. With a new credit line of €75 million and the support of the European Union, this part of the programme is promoting professional gender equality alongside climate change adaptation, whilst continuing to encourage "green" investments. However, only a very limited number of agricultural enterprises have benefited from these loans. The riskiness of such projects is high, which is likely to deter CSA or NbS promoters to apply and benefit from these loans. The first hurdle for agri-entrepreneurs is to draft business proposals that are sufficiently explicit to meet the criteria for green loans. Often, applications received by financial institutions lack important information required for assessment of the project. Secondly, at the level of banks, such loans are treated as regular loans, requiring collateral from the promoters. However, the nature of NbS and CSA involve more risks and recouping investment from these activities may take more time, which tend to disqualify the applicant from approval. Therefore, capacity building for farmers for developing NbS and CSA business plans and development of criteria for assessment of green loans is required.

Table 3 below assesses the potential impacts of the fiscal reforms, complementary measures and new green finance instruments described above, and identifies additional fiscal incentives that could be reformed to promote the adoption of NbS and CSA.

Table 3: Assessment of potential impacts of reforms and instruments

Scheme	Description of reform and instruments	Environment	Economic	Social
Biofarming support scheme	Extend a wider product range eligible for biofertiliser and biopesticide subsidy	✓	✓	✓
Biofarming promotion scheme	Provision of grants for the adoption of NbS and CSA rather than providing loans coupled with a mechanism to support ecosystems services	✓	✓	✓
Rainwater Harvesting System Scheme	Integrate the loan component and the grant component into one application, simplifying process for applicant	✓	✓	✓
Sheltered Farming scheme	Integrate the loan component and the grant component into one application, simplifying process for applicant	✓	✓	✓
Fertiliser scheme for sugarcane planters and non-sugar sectors	Review scheme to encourage the adoption of biofertilisers as an alternative to chemical fertilisers	✓	✓	✓
Cattle Breeders scheme	Reform scheme to promote local landraces such as the Creole cattle breed	✓	✓	–
Goat/Sheep/Pig Breeder scheme	Reform scheme to promote local landraces	×	✓	–
Calf Productivity Incentive scheme	Favour local breeds through this scheme to promote NbS	×	✓	–
Investment in research for NbS and CSA in Mauritius	Clearer focus on research to stimulate uptake of NbS and CSA is required by institutions to have greater impact. Interventions from development partners required for strengthening institutions	✓	✓	✓
Strengthening Extension Services for NbS and CSA	Strengthen capacity of extension services for improved knowledge on NbS and CSA	✓	–	✓
Stimulating markets for sustainable products (certification and consumer awareness)	Sensitisation of consumers to create a pull in demand for sustainably produced, certified and labelled produce	✓	✓	✓

Scheme	Description of reform and instruments	Environment	Economic	Social
Improving access to inputs (compost, biofertiliser, biopesticides, IPM, locally adapted varieties and landraces)	Investing in compost manufacturing, together with appropriate reforms to access inputs promoting NbS and CSA are required	✓	–	✓
Improved coordination and consultations with institutions, stakeholders and the public	The buy-in of stakeholders, institutions and the public is required for successful implementation of schemes promoting NbS and CSA	–	–	–
Legislation (Organic Bill), regulations and policies for NbS and CSA	The legislative framework for regulations and policies has to be in place	✓	–	✓
Digitalisation of the procedures coupled with the use of smart apps	Investment in the digital infrastructure for implementation of schemes promoting NbS and CSA for improved impacts	–	✓	–
Incentivising a circular economy for greening agriculture	The process of green waste collection at different levels requires the setting up of incentives that will bring about a change in behaviour	✓	✓	✓
Green financing for innovative technologies in agriculture	The adoption of disruptive technologies requires appropriate mechanisms and a combination of green finance instruments for farmers	✓	–	✓
Green Investment promotion schemes	The Economic Development Board may propose green investment strategies to stimulate FDI in greening agriculture	✓	✓	✓
Integrating NbS and CSA in green buildings and real estate developments	Legislation required to integrate NbS and CSA in new buildings and real estate development, promoting urban food systems	✓	✓	✓
Capacity building for green fiscal instruments by banks	Improving the disbursement of green fiscal instruments by banks through enhanced capacity building may have multiplier effects for greening the agriculture sector	✓	✓	✓

Key for interpretation of impact

✓ positive impact × negative impact – No impact

9. CHALLENGES TO REFORMING EXISTING POLICIES AND INTRODUCING NEW POLICY MEASURES AND FINANCIAL INSTRUMENTS

This section explores some of the key challenges that need to be addressed in order to implement the fiscal reforms and recommendations identified in the previous section, and examines how these could be addressed.

TRAINING AND CAPACITY BUILDING FOR IMPLEMENTING NBS AND CSA IN MAURITIUS

The reform of existing policies and the introduction of new policies that promote the adoption of NbS and CSA requires a good knowledge of these concepts and how to implement them effectively in Mauritius by different stakeholders. A challenge for adoption of NbS and CSA is how to achieve landscape- or ecosystem-level impact, recognising that it will require coordination of multiple actors, reflection of public and private benefit, and consideration of complex interactions and impacts at larger scales. Currently, the meaning of the terms NbS and CSA is still unclear in the minds of many policymakers, decision-makers and even producers. Although much sensitisation and awareness-raising has been undertaken for sustainable agriculture, this has focused less on NbS specifically as this is a relatively new concept, and the turnover of people in the agriculture sector (eg. farmers) implies that those who receive training may no longer be in the sector. In addition, the time delay in implementing cross-cutting fiscal policies eg. for CSA and NbS, that involve ministries of finance, agriculture and environment, sometimes leads to a fall in the initial enthusiasm for bringing about change. Therefore, constant and regular training on NbS and CSA should be scheduled, notably targeted training for producers and farmers (eg. Farmer Field Schools that combine local and scientific knowledge), training on green instruments to banks, and training for MAIFS and other government ministries. The use of social media may be one way to impart local knowledge to farmers through short videos and clips.

Training could be delivered in collaboration with FAREI and universities, and should be linked to participatory research to develop contextualised knowledge on CSA and NbS for the sugar and non-sugar sectors. This may require government investment or requests for international assistance to mobilise ODA and technical assistance from specialised agencies such as IFAD, FAO, UNEP and others. A stronger focus on NbS could be integrated in existing and future CSA research programmes, since NbS supports the objectives of CSA (eg. agroforestry and intercropping can fix nitrogen while increasing resilience to drought, pests and erosion). A return to traditional mixed crop and livestock systems can also enhance availability of manure for farmers. Farmers could enhance their incomes through agro-ecotourism to showcase agroecological practices and value added local speciality foods.

FISCAL ISSUES: MOBILISING FINANCE TO SUPPORT FISCAL REFORMS

Some agricultural producers in Mauritius complained that they are burdened with loans and already have poor credit ratings. They are not interested to take up more loans, let alone green loans which are even riskier. Therefore, fiscal policies and mechanisms that are proposed should take this into consideration, especially in these difficult times with inflation rising and costs of production. The Biofarming Promotion Scheme could be an important instrument to support a shift from unsustainable to sustainable production — but even if the administrative process is improved, that may not lead to new applications, unless grants can be provided and market linkages strengthened (through consumer awareness and improved

certification). Provision of grants is more conducive to adoption of NbS and CSA by farmers given the uncertain nature of agriculture and the time needed to develop effective approaches. However, finding pathways for 'blended finance' — where public and private investment is combined in a single project — to serve as catalytic capital to increase private investment — has been more challenging (Hallstein and Iseman, 2021).

Most of the schemes analysed and the reforms proposed for NbS and CSA are costs to the government and do not necessarily generate revenue for the government. It is therefore proposed that the government reallocate some of the most costly subsidies such as those on chemical fertilisers to promote more efficient and targeted measures that will contribute to more sustainable agriculture. In fact, some chemical fertiliser companies are now producing biofertilisers. Therefore they can work with the government to encourage the use of biofertilisers rather than chemicals, but it may be premature to try to completely phase out chemical fertilisers in Mauritius at this time. The government could also consider introducing a higher tax on harmful chemical pesticides (as Norway has done) to provide additional funds to support the reforms proposed, but this would increase costs for farmers at an economically difficult time. It could also seek ODA from international partners to support the schemes and reforms needed to enable farmers to transition towards climate-smart and nature-based agriculture.

POLITICAL ECONOMY AND GOVERNANCE ISSUES: IMPROVING CROSS-SECTORAL COORDINATION

The creation of an enabling environment for promoting fiscal policy reform requires strong political commitment at the highest level of government and across government ministries and departments. It also requires the support of sugarcane growers and corporations that have a long history of influencing the direction of agricultural policies in Mauritius. Getting buy-in from such major stakeholders is imperative for successful and impactful reforms promoting sustainable agriculture.

The importance of promoting sustainable agricultural practices through NbS and CSA, is not only for short term gain but also to ensure sustained productivity in the medium and long term, reduce exposure to shocks and maintain the environment for future generations. Mauritius as a small island with limited land needs to prevent land and resource degradation to sustain agricultural productivity. However, sugarcane growers may be opposed to reduction or repurposing of chemical fertilisers for fear of reduced productivity and may need targeted support in the form of biofarming support grants to make the transition. The contribution of sugarcane to renewable energy should also be considered in these reforms.

The study revealed that strengthening institutional capacities and cross-sectoral coordination are key to create a more enabling environment for NbS and CSA adoption. Policies and financial measures for CSA and NbS are cross-cutting, integrating tasks from different ministries, organisations and institutions. For instance, Climate Change Division of the Ministry of Environment promotes a circular economy, MAIFS implements schemes for subsidies on compost through the SFWF, while Ministry of Local Government is responsible for waste collection. Therefore the challenge is to integrate the work of the institutions to reach one goal of distributing compost to farmers.

It is also important to simplify the application process to improve implementation of CSA and NbS related schemes — establishing a cross-institutional application committee is one approach. There are cases where disbursements have not taken place during a given fiscal year, for example, under the compost subsidy to crop producers scheme and the scheme to support the development of household micro-gardens. Moreover, in some cases, although the budget was allocated for a scheme, the mechanism for implementation of the scheme was not well defined. Therefore, *a priori*, during discussion for government budget allocation, efficient mechanisms have to be developed and agreed

upon by institutions not to delay disbursement of funds.

The implementation of schemes, such as the Biofarming Promotion Scheme requires more research and capacity building to promote more locally adapted, productive and economically viable approaches. This also calls for more integrated research, both within institutions and across different organisations. For example, crop biofarming is cross-cutting involving researchers from crop production, entomology, soil health, seeds, and economics departments. Therefore the challenge of improving governance within research institutions has to be overcome.

CAPACITY FOR USE OF INNOVATIVE TECHNOLOGIES: SIMPLIFYING APPLICATION PROCEDURES AND ENGAGING YOUNGER GENERATIONS

Many schemes that promote sustainable and climate-smart agriculture are hampered by complex bureaucratic procedures and delays. Developing the digital infrastructure is likely to be key to increase the uptake of the fiscal schemes by farmers. The proposition to digitalise the application procedures for fiscal schemes and use smart apps requires collaboration between different stakeholders to accelerate the e-government initiative. The younger generation of farmers will be more encouraged to invest in climate-smart and nature-based agriculture if technological facilities are made available to them. In Africa for instance, farmers continually accessed digital services such as financial services, agri-food product logistical tracking and real-time prices for agricultural products at local markets through smart phones during COVID-19 lockdowns. Mauritius can surely progress in that direction with the proper investment. A budget allocation for the required digital infrastructure will need be worked out.

OVERCOMING CONFLICTING POLICY PRIORITIES: PHASING OUT CHEMICAL FERTILISER SUBSIDIES

The main purpose of support provided to the agriculture sector through fiscal incentives in the past has been to improve productivity and enhance food self-sufficiency and food security of the island. In the aftermath of the COVID-19 pandemic and the current economic context, Mauritius should reform agricultural policies and incentives not only to increase productivity but also to promote sustainable agriculture and enhance self-sufficiency to reduce the growing food and fertiliser import bill. This study has shown some conflicting policy priorities that arise, for instance, providing subsidies for chemical fertiliser used in sugarcane fields and tea cultivation which can lead to negative externalities, such as polluting rivers through leaching. A more targeted approach such as better timing of fertiliser application and soil analysis to determine more precise soil requirements could reduce the amount of government spending on subsidies for chemical fertiliser and make funds available for schemes that promote sustainable agriculture. A gradual phasing out of increasingly costly chemical fertiliser subsidies and repurposing to support less costly locally produced bio-inputs can support a shift towards nature-based and climate-smart agriculture. The fertiliser subsidy for the non-sugar sector (MUR 60 million) is smaller than that of the sugar sector (MUR 108 million), but may be easier to reform since it was only recently introduced in 2022 and there may therefore be less opposition to its reform from farmer associations and industry lobbies.

10. CONCLUSIONS

Analysis of the current fiscal incentives and schemes in Mauritius has revealed that a relatively small percentage of the government budget for agriculture aims to support sustainable and organic agriculture and CSA — about 21% of the agricultural subsidies budget and 2.7% of the total budget allocated to MAIFS. At the same time, 44% of agricultural subsidies go to schemes that were developed to enhance agricultural productivity, such as fertiliser subsidies which are often accompanied by negative environmental externalities. While a number of schemes that support sustainable, organic and climate-smart agriculture were identified, many of these are hampered by implementation challenges and low uptake.

This study highlights the need to reform existing fiscal policies that harm the natural resource base that underpins future agricultural productivity (soil, water, biodiversity) and to strengthen fiscal policies that support green and resilient agriculture. Three of the 11 schemes analysed generate negative environmental impacts — the Fertiliser Subsidy Schemes for the sugarcane (MUR 108 million) and non-sugar sector (MUR 60 million) and the Livestock Feed Promotion scheme (MUR 21 million last year). Chemical fertilisers have been found to pollute water and can harm biodiversity (eg. through nitrate pollution) while reducing soil quality over time and requiring higher water inputs. The government of Mauritius, notably MAIFS in collaboration with the Ministry of Environment, should explore ways to reduce funding for chemical fertilisers and phase out these subsidies — this may be easier for the non-sugar fertiliser scheme since it was only recently introduced in 2022. The funds saved should be used to support and incentivise the adoption of sustainable, nature-based and climate-smart agriculture. For example, by subsidising bio-inputs, the costs of transition by farmers, and supporting complementary measures needed to make biofarming, NbS and CSA approaches more productive and economically viable.

To succeed, green agricultural fiscal policy reforms need to support farmers to remain in business and contribute to food security. Many farmers are very cautious in their approach to doing business. As stated by one of the growers, before feeding the population, they have to feed themselves. Agriculture producers will not embark on activities that are not generating enough revenue for themselves. Farmers are struggling to make organic farming sufficiently productive and lucrative due to limited consumer demand in Mauritius and a poorly functioning Maurigap certification system. Therefore, instead of loans, farmers will need grants or subsidies to support the shift from conventional agriculture to CSA and NbS agriculture while also compensating farmers for ecosystems services. Creating consumer demand for sustainably produced agri-food products is essential for the adoption of biofarming, NbS and CSA by farmers. This pull in demand can only be reached with proper certification of products and good sensitisation campaigns for consumers on the benefits of ecological food. The Maurigap certification systems should be improved by establishing an independent certification board. In addition, the biofarming schemes have to be reviewed to reflect the local context in terms of availability of bioproducts. The supply of inputs that support NbS and CSA — eg. bio-pesticides, compost, manure, diverse local seeds and locally adapted agroecological practices — should be enhanced to complement the fiscal policies and instruments in place. This means establishing compost quality standards and production facilities. Schemes that promote livestock breeding should also be reformed to support local landrace breeds, which are typically more genetically diverse and resilient than ‘improved varieties’.

The government will also need to streamline procedures and administrative processes to make application easier and speed up disbursement, including by digitalising procedures and introducing smart apps. The work of different ministries

and institutions needs to be integrated to ensure economic, social and environmental dimensions of NbS and CSA and the constraints of farmers can be effectively addressed and to streamline procedures to enhance the uptake of schemes. A cross-sectoral committee should be established by MAIFS to simplify and speed up the processing of applications for beneficial schemes such as the biofarming, sheltered farming and rainwater harvesting schemes. Research on locally adapted NbS and CSA is another area that Mauritius should be investing in to complement existing fiscal policies and instruments. Knowledge generated from both western scientific research and traditional sources has to be shared with farmers for the adoption of more agro-ecological practices, requiring an efficient extension service that actively engages farmers in research and innovation and shares updated information with farmers. Training on NbS and CSA is also important for government agencies, farmers and banks. The regulatory and agricultural policy framework in Mauritius will need to support such reforms, for instance, by including the sustainable, climate-smart and nature-based agriculture objectives of the National Food Systems Pathway and the NDC in the new agriculture policy being developed by MAIFS and identifying clear and realistic targets.

The additional resources needed for these activities could be made available by reducing harmful subsidies on chemical fertilisers, and better aligning international donor support with the goals of biofarming, NbS and CSA. Mauritius is highly vulnerable to sea level rise and extreme weather events. NbS can be effective in supporting CSA goals of adaptation and mitigation, but research is needed to find locally effective approaches that can sustain productivity in the short as well as the medium and long term. While CSA has received growing government and donor attention, there is still relatively little support for nature-based and agroecological approaches. Diversification and agroecological approaches can strengthen CSA efforts and productivity by enhancing resilience to pests and diseases, reduced rainfall, higher temperatures and coastal erosion. Agroforestry for example, can enhance soil and water conservation and reduce erosion, while mangroves can slow the rate of erosion and contribute to fish production for livelihoods.

Mauritius is a small island state with limited land, therefore safeguarding the quality of land and soil for sustained productivity is essential. It is also a net food importer, with 77% of the food consumed travelling long distances before reaching the country, contributing to GHG emissions and enhancing vulnerability to external shocks such as pandemics and rising food and fuel costs. Promoting sustainable local agricultural production provides a way to reduce the carbon footprint of food consumed, reduce vulnerability to shocks, and reduce reliance on increasingly costly imported agrochemicals, while maintaining the natural resource base. The current global context of the aftermath of COVID-19 and economic turmoil in the international scene calls for a green recovery approach to reform agriculture and enhance food self-sufficiency. One way to enhance food self-sufficiency would be for Mauritius to reduce the land allocated to sugarcane for export, but the contribution of sugarcane to renewable energy also needs to be considered and further downsizing of the sector may be resisted by sugarcane stakeholders. To promote greener sugar production, while maintaining the sugar sector, Mauritius can explore the possibility of marketing a greater share of sustainably produced sugar at premium prices through certification.

The reforms of existing schemes, instruments and institutional arrangements proposed to increase the adoption of NbS and CSA can assist the government's COVID-19 recovery efforts by creating green jobs (eg. in compost and bio-input production), enhancing incomes for farmers from growing niche markets and supporting the transition to a more sustainable and resilient food system. Directing funding towards sustainable agriculture will be critical to sustain agricultural productivity in the medium and long term, and

enhance resilience to climate change and other external shocks. It is also important that multi-lateral and bilateral donors adjust their ODA interventions to improve the financing of green agriculture in Mauritius. Currently re-financing schemes are available for green finance which also support agriculture. However, these schemes need to conduct impact assessments and improve the mechanisms for financing. FAO will be providing technical assistance to support climate-smart agriculture and therefore could gear some funding to support locally tailored financing and training schemes that also support NbS. The World Bank can intervene for innovative financing schemes that support investment in green agriculture. Therefore, a wide range of complementary financing schemes can be integrated to enhance finance to promote the adoption of CSA and NbS in Mauritius.

REFERENCES

Brizmohun, R., Ruggoo, A., Facknath, S. Hardowar, S. (2014). A Situational Analysis of Climate Change Adaptation and Mitigation for Agriculture in Mauritius. UoM Research Journal. University of Mauritius.

Carbon and water footprint assessment — Mauritius Sugar Syndicate. (2020). Retrieved July 27, 2022, from https://mauritiussugar.mu/carbon-and-water-footprint-assessment/

Hardowar S., Facknath S, Boodia N, Chooneea M, (2015). A study of Climate Smart Agriculture Practices and Technologies Adopted by Small Farmers in response to Climate Change in Mauritius.

Hallstein, E., and Iseman, T. 2021. Nature-based solutions in agriculture — Project design for securing investment. Virginia. FAO and The Nature Conservancy. https://doi.org/10.4060/cb3144en

Joint Technical Committee (JTC) Report on Sugar. (2018). Ministry of Agroindustry and Food Security.

Lipper, L., McCarthy, N., Zilberman, D., Asfaw, S., & Branca, G. (2017). Climate smart agriculture: building resilience to climate change (p. 630). Springer Nature.

MAIFS. (2016). *Strategic Plan, Ministry of Agro Industry and Food Security 2016–2020*.

Ministry of Finance, Economic Planning and Development (2021). Budget Speech 2021–2022.

Ministry of Finance, Economic Planning and Development (2022). Budget Speech 2022–2023.

Mauritius Meteorological Services (MMS). (2009). Climate Change Impacts on Mauritius.

MSS-Annual-Report-2020-2021.pdf. (n.d.). Retrieved July 16, 2022, from https://mauritiussugar.mu/wp-content/uploads/2021/09/MSS-Annual-Report-2020-2021.pdf

NDC. (2021). Update of the Nationally Determined Contribution of The Republic of Mauritius.

Ramjeawon, T. (2004). Life cycle of cane sugar on the Island of Mauritius. The International Journal of Life Cycle Assessment. Volume 9, 254–260. July 2004.

Republic of Mauritius (2016). Third National Communication: Report to the United Nations Framework Convention on Climate Change. Republic of Mauritius, Port Louis

Statistics Mauritius. (2021). Digest of Agricultural Statistics. Retrieved from https://statsmauritius.govmu.org/Pages/Statistics/By_Subject/Agriculture/Agri.aspx

Stevens, C. (2011) Agriculture and Green Growth. OECD Former Advisor. Retrieved from https://www.oecd.org/greengrowth/sustainable-agriculture/48289829.pdf

The Nature Conservancy (TNC). 2019. Strategies for Operationalizing Nature-Based Solutions in the Private Sector. The Nature Conservancy Business Council, Natural Infrastructure Working Group. (also available at https://www.nature.org/ content/dam/tnc/nature/en/documents/NbsWhitePaper.pdf).

UNEP (2020). Study on the Effects of Taxes and Subsidies on Pesticides and Fertilizers: Background Document to UNEA-5 Review Report on the Environmental and Health Effects of Pesticides and Fertilizers. https://wedocs.unep.org/xmlui/handle/20.500.11822/33582

World Bank. (2020). Mauritius Sugarcane Sector Review Competitiveness Analysis. Retrieved from https://mcia.mu/?page_id=1786

WTO. (2021). Trade Policy Review for Mauritius. Retrieved from https://www.wto.org/english/tratop_e/tpr_e/tp517_e.htm

Zari, M. P., Kiddle, G. L., Blaschke, P., Gawler, S., & Loubser, D. (2019). Utilising nature-based solutions to increase resilience in Pacific Ocean Cities. *Ecosystem Services*, *38*, 100968.content/uploads/2021/02/Technical-Highlights-2019-2020.pdf

ANNEX 1 — STAKEHOLDERS CONSULTED

Institution	Person(s) consulted
Agence Francaise de Developpement	Mr. Abendra Patten
Afrasia	Mr. Alvin PeeUniversityrthy
AFD/Business Mauritius	Mr. Vimal Motee, SUNREF Project Manager
Bank of Mauritius	Mrs. U. Soobarah, Assistant Director Mr. Ramsamy Chiniah Mr. Ramnarainsing S
Ministry of Finance, Economic Planning and Development	Mr. Vikraj Ramkhalawon Mrs. Welahee Doomun
Economic Development Board	Dr. Drishty Ramdenee Ms. Rachna Ramkhelawon
UNDP Page Coordinator	Ms. Joya Bhandari
Small Farmers Welfare Fund	Mr. Roopesh Beekharry Mr. Sewdeen Mr. Dookitran
Food and Agricultural Research and Extension Institute	Mr. Raj Teeluck (Biofarming Unit) Mrs. Veena Doharoo (Biofarming Unit) Mr. P. Erigadoo (DeSIRA project) Mr. M Nathoo
World Bank	Ms. Brinda Dabysing
Ministry of Environment	Mr. Chamilall, Environment Assessment Division
MCIA	Mr. Yash Ramdharee, Farmers Service Agency Mr. Satish Purmessur, CEO
Mauritius Standards Bureau	Ms. Kajaal Mohangoo — Quality Assurance Officer, Maurigap Certification
Farm Basket	Mr. Ravi Rambojoo www.farmbasket.co
Mauribio	Mr. Aman Ramchurn
Organic Farmer	Mr. Greedharry
Mauritius Sugar Syndicate (Fair Trade Initiative)	Mr. Chetanand Dookhony, responsible for FairTrade at MSS
Livestock Feed Promotion Scheme Unit, MAIFS	Mr. Veeramah
Small Crop Growers	Krit Beeharry and Amarjeet Beegoo

Institution	Person(s) consulted
FAO National Correspondent	Mr. P. Khurrun
Mauritius Chamber of Agriculture	Mrs. Jacqueline Sauzier
MAIFS	Dr. Sookar, Entomologist
Faculty of Agriculture, University of Mauritius	Prof. S. Kacknath
SME Mauritius	Mrs. Kisten Leevana
UNDP	Mrs. Pamela Bappoo-Dundoo

ANNEX 2 BUDGET CALCULATION

Budget heading: Competitiveness of the Sugarcane Sector

Budget allocated in 2021–2022: MUR 714,700,000

Item	Budgeted	Actual	Remark
Transfers to MCIA Certification and Accreditation to Sustainability labels (Bonsucro)	2,500,000	1,686,895	The item is the only expense identified in the sugarcane sector that promotes CSA
Subsidies Fertiliser Scheme for Sugarcane planters	57,000,000	108,000,000	This scheme may be reviewed to encourage the adoption of more sustainable practices as an alternative to the use of chemical fertiliser

Budget heading: Development of Non Sugar (Crop) Sector

Budget allocated in 2021–2022: MUR 834,400,000

Item	Budgeted	Actual	Remark
Subsidies **Fruit growers (Litchi and Banana)**	10,000,000	21,500,000	This scheme promotes CSA through the use of environmentally friendly nets
Crop producers (compost)	1,000,000	0	No commercial compost available
Seed Purchase Scheme (potatoes, onion and garlic)	6,000,000	0	These are controlled products in Mauritius. Scheme is available at the Agricultural Marketing Board to provide a subsidy for purchase of seed. Scheme does not promote NbS or CSA.
Tea Sector Support Scheme (Fertiliser Subsidy)	5,000,000	12,400,000	Assessment of environmental impact of subsidised fertiliser application on tea plantations to be undertaken
Scheme to encourage Use of Biofertilisers	1,000,000	1,000,000	There is a need to extend product range eligible for subsidy
Fruit fly suppression with Environmentally Friendly Techniques	500,000	150,000	
Development of Household Micro Gardens	5,000,000	0	Procedure for disbursement of grant recently set up, with initial disbursements through vouchers of up to MUR 15,000 issued.

Item	Budgeted	Actual	Remark
Crop Loss Compensation Scheme	16,000,000	50,000,000	Scheme was extended to farmers who suffered from bad weather conditions that prevailed in 2021–2022
Extra-budgetary Units **FAREI** **Chemical free Bio-food promotion/farming**	500,000	300,000	
Other Expense **Sheltered Farming (including subsidy on sheltered unit nets)**	30,000,000	30,000,000	Mitigate climatic impacts, reduce pesticides use
Beekeeping	4,000,000	2,800,000	Training in beekeeping, complemented with the provision of starter kits including queen bees
Transfers to Private Enterprises **Rainwater Harvesting**	1,000,000	700,000	

Budget sub-heading: Livestock Production and Development

Budget allocated in 2021–2022: MUR 322,900,000

Item	Budgeted	Actual	Remark
Subsidies **Incentives for Livestock (animal feed)**	20,000,000	20,000,000	
Incentives for milk production	500,000	500,000	
Transfers to Private Enterprises			
Cattle Breeders Scheme	2,500,000	0	Reform scheme to promote local landraces such as the Creole breed
Pasture Development Scheme	1,000,000	200,000	
Goat/Sheep/Pig breeder	4,000,000	1,000,000	Reform scheme to promote local landraces
Scheme for purchase of equipment	2,000,000	2,000,000	
Upgrading of livestock farms/ Poultry Scheme	2,000,000	600,000	Use of renewable energy, rainwater harvesting and waste management
Calf Productivity Incentive Scheme	2,500,000	2,600,000	May be reformed to favour local breeds

Summary of actual expenditure on subsidies promoting NbS and CSA

Subsidy	Actual Expenditure
Transfers to MCIA **Certification and Accreditation to Sustainability labels (Bonsucro)**	1,686,895
Fruit Protection Scheme (Litchi and Banana)	21,500,000
Scheme to encourage Use of Biofertilisers	1,000,000
Fruit fly suppression with Environmentally Friendly Techniques	150,000
Extra-budgetary Units **FAREI** **Chemical free Bio-food promotion/farming**	300,000
Other Expense **Sheltered Farming (including subsidy on sheltered unit nets)**	30,000,000
Beekeeping	2,800,000
Transfers to Private Enterprises **Rainwater Harvesting**	700,000
Upgrading of livestock farms/ Poultry Scheme	600,000
TOTAL NbS and CSA Subsidies	58,736,895
Total Subsidies spent for MAIFS (incl fertiliser scheme for sugar and certification) 2021–2022	275,246,895
Govt spending on NbS and CSA as a percentage of total subsidy	21%
Total Expenditure for MAIFS	2,175,460,000
Govt spending on NbS and CSA as a percentage of total expenditure	2.7%
Unsustainable practices (Fertiliser Scheme for Sugar and Tea)	120,400,000
% unsustainable as a percentage of total subsidy	44%

ANNEX 3 ESTIMATION OF AREA UNDER SUSTAINABLE AGRICULTURE IN MAURITIUS

Sector		Area (Ha)
Sugarcane	Small Planters regrouped in Coop and certified Fairtrade	2,500
	Large Sugar Corporate (Bonsucro)	4,000
Foodcrop	Biofarming (FAREI) registered	75.6
	Mauritius Chamber of Agriculture (Smart Agriculture)	20
	Maurigap Certified farms	78.4
	Maurigap Soilless/Sheltered farms	214
	Total area sustainable agriculture	6,888
	Total area under agriculture (sugarcane, foodcrop, tea)	51,852
	Percentage area under sustainable agriculture	13.28

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State Secretariat for Economic Affairs SECO

For further information:

PAGE Secretariat
UN Environment
Resources and Markets Branch
11-13 Chemin des Anémones
CH-1219 Chatelaine-Geneva
Switzerland
page@unep.org

www.un-page.org

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