



ANALYSIS, SCENARIOS AND ACTION PLANS

Subsidies with a negative impact on Rwanda's biodiversity

Report – April 2025 (Revision 3)

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Abbreviations and Acronyms

BAU	Business as Usual
B:C	Benefit-Cost Ratio
BIOFIN	Biodiversity Finance Initiative
BRD	Development Bank of Rwanda
CAADP	Comprehensive Africa Agriculture Development Programme
CCCs	Clean Cooking Companies
CC-RBF	Clean Cooking Results-Based Finance
CIP	Crop Intensification Programme
Ci-Dev	Carbon Initiative for Development
EAQIP	Energy Access and Quality Improvement Project
EDCL	Energy Development Corporation Ltd
FAO	Food and Agriculture Organisation
GHG	Greenhouse Gas
IDA	International Development Agency
IFAD	International Fund for Agricultural Development
IFDC	International Fertiliser Development Centre
IFPRI	International Food Policy Research Institute
IPM	Integrated Pest Management
IVA	Independent Verification Agent
IWRM	Integrated Water Resources Management
LPG	Liquefied Petroleum Gas
LUC	Land Use Consolidation
M&E	Monitoring and Evaluation
MINECOFIN	Ministry of Finance and Economic Planning
MINAGRI	Ministry of Agriculture and Animal Resources
MINALOC	Ministry of Local Government
MININFRA	Ministry of Infrastructure

NDCs	Nationally Determined Contributions
NBT	Nature-Based Tourism
NFP	National Fertiliser Policy
NGO	Non-Governmental Organisation
NST1	National Strategy for Transformation
PSTA4	Strategic Plan for Agricultural Transformation 4
RAB	Rwanda Agriculture and Animal Resources Development Board
RBF	Results-Based Financing
RDB	Rwanda Development Board
REMA	Rwanda Environment Management Authority
REG	Rwanda Energy Group
RRA	Rwanda Revenue Authority
RSB	Rwanda Standards Board
SDG	Sustainable Development Goal
SEZ	Special Economic Zones
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
VAT	Value Added Tax

1.Introduction and Methodology

This report, titled ‘Analysis, Scenarios and Action Plans’ represents Deliverable 3 (revision 3) of the project **‘Study to identify and assess subsidies with possible negative impacts on biodiversity and propose redesign options’**, commissioned by the Rwanda Environment Management Authority (REMA) and in partnership with the United Nations Development Programme (UNDP) Rwanda under the Global Biodiversity Finance Initiative (BIOFIN). The overall objective of this assignment is to map and assess government subsidies and propose plausible redesign options through, for example, greening by introducing biodiversity safeguards or reducing the subsidy value to redirect resources to support biodiversity-positive outcomes, for three prioritised subsidies.

As agreed with the participants of the Inception Workshop, which included government stakeholders and UNDP BIOFIN officials, the term ‘subsidy’ in the context of this assignment is used as outlined in Box 1 below.

Box 1. Defining ‘Subsidy’

1.1. Subsidy Prioritisation Process

The project’s previous workstream, which resulted in Deliverable 2, the ‘Subsidy Inventory Report’, produced a comprehensive list of subsidies with potential negative impacts on biodiversity. However, some of the listed subsidies also demonstrated evident positive impacts, highlighting opportunities to enhance those benefits. Applying a multicriteria decision/prioritisation framework and through stakeholder engagement, including an extensive series of individual interviews with government officials and a one-day stakeholder workshop co-facilitated with REMA, ten subsidies were selected for further investigation. Prior to the development of this report, three subsidies (see Table 1) were prioritised by REMA:

Table 1. Priority Subsidies

Subsidy	Sector	Target (Biodiversity)
Crop Intensification Programme (CIP)	Agriculture	Reduce harm
Clean Cooking Results-based Finance (CC-RBF)	Energy	Enhance benefits
Tax Incentive for Tourism Sector Investments	Tourism	Reduce harm and enhance benefits

It was agreed that while the energy subsidy did not cause any evident harm to biodiversity, it holds significant potential for biodiversity enhancement through a redesign. Similarly, the tourism subsidy, while focused on reducing harm, can also be leveraged to enhance benefits.

1.2. Analytical Approach and Report Structure

The structure of the subsidy analysis follows a consistent and logical format across all three subsidies examined in this report. Each section begins with an overview of the subsidy, outlining its purpose, objectives, and targeted outcomes. This is followed by a background section, which provides context on the motivations for the subsidy's implementation, the policy environment, and its broader implications. Next, the analysis goes into the environmental, economic, and social impacts of the subsidy, with a focus on key themes such as biodiversity loss, emissions reduction, and economic livelihoods.

In line with the [BIOFIN guide The Nature of Subsidies \(2024\)](#), the analysis then examines the mechanism of the subsidy, outlining how it operates, including financing structures, responsible institutions, disbursement procedures, and verification processes. A dedicated table systematically maps out the key institutions involved, their mandates, and specific roles in subsidy implementation. The analysis further discusses the institutional context, highlighting the subsidy's alignment with national policies, international commitments, and best practices from comparable initiatives. A structured approach is used in the financing and implementation section, detailing funding sources, budget allocations, and disbursement strategies, where data is available.

This leads to the subsidy redesign section, where a redesign is proposed. The selection of these options prioritises projected impacts on biodiversity while also considering the political feasibility of implementation. The proposed redesigns follow a justice-based approach, integrating three key elements to ensure biodiversity transitions are fair, inclusive, and economically viable: Firstly, procedural justice – Ensuring inclusive decision-making by involving local communities and affected stakeholders in subsidy reform. Secondly, distributive justice – Equitably reallocating resources by phasing out subsidies harmful to biodiversity and redirecting support towards sustainable livelihoods, conservation incentives, and ecosystem restoration. Thirdly, restorative justice – Compensating impacted groups by providing financial and technical support to workers and communities affected by subsidy reforms or conservation measures.

The final sections, present multiple pathways for the subsidy's redesign, ranging from maintaining the status quo to expanding its reach and effectiveness. A phased action plan, to guide REMA, then provides a roadmap for implementation, structured across preparatory, implementation, and monitoring phases. Each phase includes specific actions, stakeholder engagements, data collection strategies, and proposed policy adjustments. The analysis concludes with considerations for affected stakeholders and potential mitigation measures, ensuring that the proposed redesign balances environmental objectives with economic and social impacts.

2. Crop Intensification Programme (CIP)

The main objective of the Crop Intensification Programme (CIP) is to reduce the cost to farmers of improved seeds and inorganic fertilisers for selected food crops in selected areas in order to accelerate the use of these productivity enhancing inputs, thereby increasing agricultural yields and output and rural incomes, while reducing food prices and improving food security in line with the Ministry of Agriculture and Animal Resources' (MINAGRI) Strategic Plan 4 for Agricultural Transformation (PSTA4)¹ targets.

1. PSTA4 was the latest version that was available at the time of writing of this analysis. At a stakeholder consultation workshop, held shortly before the deadline for submission, attention was drawn to the publication of PSTA5 on-line a few days earlier. Following this workshop, some additional new sources of information were forwarded to the research team. It was not possible to take advantage of these sources in the time available, but perusal of PSTA5 found that, in common with PSTA4, PSTA5 does not mention CIP anywhere or budget explicitly for CIP, although it is possible that CIP activities and CIP expenses are included in some of the many activities, targets and budget lines mentioned. However, some of the recommendations of the proposal for CIP subsidy reform, such as the production and application of more organic fertilizer and associated research and extension activities, do form part of PSTA5.

Furthermore, the instrument aims to address Rwanda's domestic food crop supply constraints with the objective of raising competitiveness in import-competing sub-sectors² and to help rectify the high soil nutrient mining levels on Rwandan farms. At the time of launch of CIP, Rwanda had the highest soil depletion rates for nitrogen, phosphorus and potassium in Sub-Saharan Africa.³

Moreover, the CIP promotes cropland consolidation⁴ to achieve economies of scale that increase efficiency and sustainability and facilitate extension services delivery, which in turn boost household wellbeing and promote greater equity.⁵

2.1. Subsidy Background

'The biggest driver of terrestrial biodiversity loss in the last 50 years has been habitat conversion, in large part due to conversion of natural and semi-natural landscapes to agriculture. Nutrient loading, particularly of nitrogen and phosphorus, much of which derived from fertilisers and farm effluent, is one of the biggest drivers of ecosystem change in terrestrial, freshwater and coastal ecosystems'.⁶

This statement, made in the context of agriculture globally, applies with particular acuteness to Rwanda and its CIP. Aggregate agricultural production grew at the extraordinary average annual rate of 7.5% between 2007 – the year in which CIP started – and 2017, driven by food crops, primarily through expansion of the area allocated to key staples, encouraged by the composition of agricultural expenditure, constituted largely by inorganic fertiliser and seeds subsidies for food crops.⁷ Depending on the season, up to 71% of farmers applied inorganic fertilisers on up to 61% of crop land.⁸ Indigenous forests, grasslands and wetlands have shrunk and been replaced by ploughed fields, perennial crops and forest plantations, with a negative impact on the diversity of plant, animal, fish, insect and soil microbe populations.

This has been exacerbated by the planting of crops on hillsides, often without adequate measures to counter water and wind erosion and consequent topsoil loss. Hillside agricultural land makes up more than half of Rwanda's total surface area and 93% of land under annual and perennial crops.⁹ Before the expansion in the area under cultivation induced by CIP, no less than 80% of farming households in hilly areas were experiencing a decline in productivity related to soil erosion.¹⁰

Against the estimated total arable area of 1.4 million hectares, 1.55 million were being used for crops in 2022 – about 2/3 for annually ploughed seasonal crops¹¹ - as well as 60% of wetland areas.¹² To counter

2. Anderson, K et al., *Incentives in Support of the Agricultural Sector in the East African Community*, International Growth Centre, August 2019 (ref. F-38420-RWA-1)

3. UNEP, MINAGRI, REMA, UNDP, *Effectiveness and Efficiency of Fertiliser Use in Rwanda*, Final Report, December 2016

4. International Soil Reference and Information Centre, *Rwanda National Soil Information System (RwandaSIS)*, 2024

5. USAID/Land Project, University of Rwanda, *Assessment of the Economic, Social and Environmental Impacts of the Land Use Consolidation Component of the Crop Intensification Program in Rwanda*, December 2014

6. UNEP, *Biodiversity and Agriculture: Safeguarding Biodiversity and Securing Food for the World*, 22 May 2008

7. Anderson et al., *op. cit.*

8. NISR, *op. cit.*

9. NISR, *op. cit.*

10. *Ibid.* However, by 2022, more than 90% of farmers reported using some form of anti-erosion measure (NISR, *op. cit.*).

11. NISR, *op. cit.*

12. *Ibid.*

hillside erosion, CIP was designed to add 852 000 ha of radical or progressive¹³ terracing, covering about 63% of hillside agricultural land¹⁴, and 70 dams at an estimated cost of USD 573 million.¹⁵

Bush removal, ploughing and inorganic fertilisers impact negatively on biodiversity in soils. Insect, invertebrate and microbe life is disturbed, reducing the capacity of these life-forms to breakdown and recycle crop residues into soil carbon and thereby, ultimately, soil fertility.¹⁶ This is exacerbated by the use of chemical herbicides and pesticides¹⁷, which also reduce plant and insect diversity. Although CIP has not subsidised either herbicides or insecticides, both usually accompany the intensification of agriculture. Depending on the season, insecticides were applied on up to 92% of land under crops in 2022.¹⁸

Aquatic and wetland biodiversity is also reduced by eutrophication brought about by inorganic¹⁹ fertiliser, herbicide and pesticide run-off into streams, lakes and dams, often far from the land on which have they been applied.²⁰ The estimated average annual cost of pollution from such run-off for the period 2007-2013 was USD 28.65 million.²¹ However, this includes effects beyond eutrophication and accompanying biodiversity loss.

Though impacting on biodiversity only indirectly, the estimated direct cost of soil nutrient loss from run-off in 2016 was USD 571/ha, which equates to about 1/3 of the estimated average value per hectare of crops produced.²² Not only does soil nutrient erosion increase negative environmental externalities through soils enriched with fertilisers being swept into surface water systems, but it also reduces the crop performance possibilities of farms.²³ Recurrent use of inorganic fertilisers can also cause soil biodiversity loss through acidification²⁴, but this is thought not to have occurred on a significant scale in Rwanda because of the widespread use of lime as a neutralizing agent.²⁵ The aggregate budget allocated by PSTA4 for activities to counter biodiversity loss by improving soil health and fertility between 2018/19 and 2023/24 was USD 3.25 million.²⁶

Among the consequences of soil erosion and excessive nutrient run-off, beyond eutrophication, is the reduced capacity of wetlands to act as purifiers and retainers of water and soil and as habitats for animal, bird, aquatic, reptile and insect life, all of which more or less directly also reduce agricultural productivity. This is made worse by the encroachment of cultivation on marshlands and wetlands.

While the many negative effects of agricultural and pastoral intensification on the environment will have added indirectly to biodiversity loss, perhaps the most direct way in which CIP will have reduced biodiversity is through the substitution of monocropping for multi-cropping, inter-cropping and mixed crop-livestock farming, despite CIP supporting the production of a range of crops. From about 28 000ha (5% of harvested land) in 2008, land consolidated under CIP grew to about 600 000ha (40% of harvested land) in 2016.

13, Radical terracing entails the construction of level 'steps', while progressive terracing uses contoured grass strips and furrows to reduce run-off. Radical terracing is required for slopes of between 13% and 55%. (United Nations Framework Convention on Climate Change (UNFCCC), Technology Needs Assessment for Mitigation and Adaptation to Climate Change in Rwanda, https://unfccc.int/TTF_TEI/file.RwandaTAPA3/)

14, NISR, *op. cit.*

15, Cantore, N., *The Crop Intensification Programme in Rwanda: a Sustainability Analysis*, Overseas Development Institute, 2016

16, Foodprint, Biodiversity and Agriculture, foodprint.org/issues/biodiversity-and-agriculture/

17. *Ibid.*

18. NISR, *op. cit.*

19. Organic fertilisers can also contribute to eutrophication, if inappropriately used (Foodprint, *op. cit.*).

20. UNEP, *op. cit.*

21. *Ibid.* (Author's calculations from Table 17, using average annual RWF:USD exchange rates.)

22. *Ibid.* (Author's calculations from Table 27, using average annual RWF:USD exchange rates.)

23. UNEP, *op. cit.*

24. Agriculture Victoria, *Major Effects of Soil Acidification*, <https://vro.agriculture.vic.gov.au/vro/vrosite.nsf>

25. *Ibid.*

26. Rwanda Ministry of Agriculture and Animal Resources, *Strategic Plan for Agricultural Transformation 2018-2024*, June 2018, Annex 3: Detailed Costing (author's calculations using approximate average RWF:USD exchange rate for the 6 years)

2.2. Subsidy Analysis

2.2.1 Subsidy Mechanism

CIP has four major components:

- i) Distribution of improved inputs,
- ii) Land use consolidation,
- iii) Proximity extension services
- iv) Post-harvest handling and storage

The improved inputs distributed by CIP are seeds and inorganic fertilisers, the prices of both of which are subsidised. Subsidies are set and managed by RAB.²⁷ The distribution of fertiliser is regulated by the National Fertiliser Policy (NFP), which was developed in 2014 to support the implementation of a private sector-led, liberalised, competitive fertiliser subsector.²⁸ The Land Use Consolidation Act (LUC), which was enacted in 2008, provides the legal framework for implementing the land use consolidation component of CIP.²⁹ The framework for the programme's extension services and post-harvest handling and storage components and budget for extensive planned improvements is provided by PSTA4.

Research, Extension, and Dissemination

Key components of the subsidy programme are the research, extension and dissemination activities that accompany the increased access to fertilisers. RAB works in close collaboration with the International Fertiliser Development Centre (IFDC) and the One Acre Fund, through its TUBURA programme and the International Centre for Tropical Agriculture (CIAT)³⁰, to conduct these activities, to enable fertilisers to be used effectively by farmers in accordance with the crops grown and the nature of local soils. Until USAID was closed in 2025, RAB had also worked closely with USAID's HingaWeze project. These relationships have led to substantial local capacity development at farm, local co-operative, agro-dealer, public agricultural institution, local government and management levels.³¹

Twigire Muhinzi is Rwanda's decentralized, farmer-led extension model designed to provide nationwide access to agricultural advisory services. Co-implemented by RAB, MINAGRI, and MINALOC at the district level, it combines two complementary approaches. The Farmer Promoters approach rapidly disseminates basic extension messages through village-level demonstrations, while the Farmer Field Schools (FFS) approach offers hands-on, in-depth training at the cell level. This farmer-to-farmer training through village-level Farmer Field Schools which are reported to be one of the most effective dissemination and skills-building mechanisms.

Rice cooperatives in Rwanda play a key role in extension services by hiring specialised extension workers who provide advisory support to farmers³². These workers receive technical guidance from RAB and collaborate with development partners and NGOs to enhance rice farming practices. The Smallholder Market-Oriented Agriculture Project (SMAP), implemented by RAB and JICA, introduced a model that integrates production with market dynamics. By equipping farmers with knowledge on demand, pricing, and seasonality, the SMAP approach shifts their mindset from simply growing crops for sale to strategically growing for market demand, fostering a more business-oriented approach to rice farming.

27 *Ibid.*

28 Rwanda Ministry of Agriculture and Animal Resources, *National Fertiliser Policy*, 2014

29 USAID, *op. cit.*

30 Institute of Research and Dialogue for Peace (IRDP), *Determinants of Inorganic Fertilisers and Improved Seeds Along with Extension Support for Agricultural Productivity in Rwanda: Policy Issues and Recommendations*, Final Report, April 2020, p8

31 UNEP et al., *op. cit.*

32 Rwanda National Rice Development Strategy (2021-2030)

CIP's Role in Agricultural Development

Since its launch in 2007, CIP has been the main vehicle for agricultural sector development. CIP describes a set of interventions including crop regionalisation, land use consolidation, capacity building aimed at promoting priority food crops and input subsidies.³³

The explicit subsidies that are the subject of this study are only those related to the inorganic fertiliser types (regardless of brand) and improved seeds that are available to farmers through CIP. There are no subsidies for pesticides, herbicides or other agro-chemicals.³⁴ Of the market price paid by producers for the inorganic fertilisers concerned, all of which are imported, MINAGRI pays a certain percentage. For example, on three of the most widely used fertiliser types, DAP, urea and NPK, having started at between 20 and 50% (NFP, 2014), from 2015 government's contributions were 35, 30 and 15%, respectively. In 2022, when fertiliser prices rose sharply because of the Russia-Ukraine war, these rates of subsidy increased substantially to between 30 and 50%.³⁵

Only maize, soya and wheat are covered by the seed subsidy programme.³⁶ The degree of subsidy from which farmers benefit is difficult to calculate because much of government's expenditure in this regard is devoted to the development and production of local seed varieties.³⁷ However, it is reported that the rate of subsidy for improved seeds is much higher than for fertilisers, at between 50 and 80%.³⁸ 85% of the budget for seed subsidies is used for maize, because hybrid maize seed is so expensive.³⁹ There are currently no subsidies for the use of imported seeds, and, from 2022, Rwanda is reported to have become fully self-sufficient in terms of maize, soya and wheat seeds.⁴⁰

There are several requirements for qualifying to receive these subsidies and the intensive extension services that accompany them.⁴¹ They apply only to the production of specified national priority food crops, initially only six, but currently 10 qualify: maize, beans, wheat, soya, rice, Irish potatoes, cassava, bananas and other types of fruit and vegetables.⁴² These are mainly produced for marketing locally and own consumption. The basis of selection of these 10 crops is unclear. While they include most of the most widely grown⁴³ and consumed food crops, as well as the main imported crops⁴⁴ - thus contributing to food security and nutrition objectives

33 Rwanda Ministry of Agriculture and Animal Resources, *Strategies for Sustainable Crop Intensification in Rwanda*, 2011, quoted in Anderson et al., op. cit.

34 IRDP, op. cit., p4

35 Calculated from Spielman et. al., op. cit. The prices of fertilisers roughly doubled in 2022. In a first adjustment in 2022, MINAGRI paid 50% of the increase in the prices of imported fertilisers. In a second adjustment, later in 2022, the percentage paid by MINAGRI increased to 60%.

36 Institute of Research and Dialogue for Peace, *determinants of Inorganic Fertilisers and Improved Seeds along with Extension Services Support for Agricultural Productivity in Rwanda: Policy Issues and Recommendations*, April 2020

37 Ibid.

38 African Business, *Rwanda Targets Move away from Subsistence Agriculture*, 16 March 2022, <https://african.business/2022/03/energy-resources/rwanda-targets-move-away-from-subsistence-agriculture#>

39 Spielman et. al., op. cit.

40 RAB, *Rwanda Ends Seeds Import*, <https://www.rab.gov.rw/1-1/news-details/rwanda-ends-seeds-import>

41 USAID, op. cit.

42 Institute of Research and Dialogue for Peace, op. cit.

43 National Institute of Statistics Rwanda (NISR), *Seasonal Agricultural Survey (SAS), 2022 (data for most important of 3 crop-producing seasons)*

44 Logistics Cluster, *Rwanda Food and Additional Suppliers*, <https://dlca.logcluster.org/35-rwanda-food-and-additional-suppliers>

- they exclude others which are also widely grown and are very important for household food security and nutrition, such as sorghum⁴⁵, sweet potatoes⁴⁶ and groundnuts.⁴⁷ Traditional seeds are used almost exclusively for these three crops, whereas for maize and rice typically 50-60% of the crop uses improved seeds and for vegetables and fruit typically 30-40%.⁴⁸

Except for some vegetables, none of these crops are endemic to Rwanda.⁴⁹ For the production of these crops to qualify for CIP subsidies, they must be grown in a region designated by the programme as high potential, determined largely by its natural resource base. Participation in Rwanda's Land Use Consolidation programme to facilitate the realisation of economies of scale in crop production is also a requirement. A consolidated area of at least 5ha for the production mainly of a single priority crop is required.⁵⁰

Farmers who had registered to participate in the programme were initially issued with vouchers for the purchase of fertiliser, distributed through district councils by MINAGRI⁵¹, but difficulties with this system led to its termination in 2014.⁵² Since then, the subsidy has been universally applied.⁵³ So, in practice, 'subsidised fertiliser is likely used by farmers with landholdings both inside and outside Land Use Consolidation sites identified by CIP'.⁵⁴

Fertiliser and Seed Subsidies

The National Fertiliser Policy (NFP) requires that 'government shall put in place an exit strategy from fertiliser subsidies'⁵⁵ and a specific objective of CIP is 'to progressively exit from subsidies while ensuring that the initial purpose of subsidies is achieved'.⁵⁶ Fertiliser and seeds subsidies are not mentioned among the nine policy actions identified to 'increase farm productivity sustainably' in NAP 2018 and PSTA4 and do not appear in the detailed costing of PSTA4.⁵⁷ However, an IFRI analysis records

45 Sorghum is the fourth most important staple crop, after beans, cassava and maize, and is a core component especially of rural households' diets (Nyibigira, T. et al, *Sorghum Farmers' Perceptions of Climate Change, Its Effects, Precipitation and Temperature Trends, and Determinants of Adaptation Strategies in the Central Plateau Zone of Rwanda*, Cogent Food and Agriculture, 10:1, 2334999, DOI: 10.1080/23311932.2024.2334999)

46 Sweet potatoes contribute an average of more than 20% of national calorific input and, by mass, are a more important component of household diets than Irish potatoes (MINAGRI, *The African Potato Association Conference Kicks Off in Kigali*, 2019). Their contribution to national food security is magnified by being able to be grown on marginal land and because they can be grown throughout the year (One Acre Fund, *Scaling Orange-Fleshed Sweet Potatoes*, <https://oneacrefund.org/publications/scaling-orange-fleshed-sweet-potatoes>). It could therefore be argued that there is a stronger case for subsidizing the production of sweet potatoes than Irish potatoes.

47 While groundnuts are typically cultivated on only 5-10% of the area under beans (NISR, *op. cit.*), they are also an excellent, affordable source of folate, which is essential for nutrition in a country such as Rwanda, where animal protein makes up only a small part of most households' diets (Global Alliance for Improved Nutrition (GAIN), et al, *Affordability of Nutritious Foods for Complementary Feeding in Rwanda*, May 2012).

48. NISR, *op. cit.* p52

49. FAO, *The State of Rwanda's Biodiversity for Food and Agriculture*, July 2016

50. Tsakok, I. et al., *Towards a fertiliser Policy for Smallholder Agriculture in Sub-Saharan Africa*, Policy Centre for the New South, 2019 (P-19/16)

51. Nahayo, A. et al., *Factors influencing Farmers' Participation in the Crop Intensification Program in Rwanda*, *Journal of Integrative Agriculture*, 2017, 16(6), 1406-1416

52. Del Prete, D. et al., *Land Consolidation, Specialization and Household Diets: Evidence from Rwanda*, 6th African Conference of Agricultural Economists, September 2019

53. *Ibid.*

54. Spielman et. al., *op. cit.*

55. Rwanda Ministry of Agriculture and Animal Resources, *National Fertiliser Policy*, 2014

56. Institute of Research and Dialogue for Peace, *op. cit.*

57. Rwanda Ministry of Agriculture and Animal Resources, *Strategic Plan for Agricultural Transformation 2018-2024*, June 2018, Annex 3: Detailed Costing

a provision for fertiliser and seeds subsidies in public expenditure data for 2018-2024⁵⁸ and subsidies are still being paid. MINAGRI is reported to be implementing a withdrawal strategy, at present, evidently, by reducing the percentage of fertiliser prices that it pays.⁵⁹

2.2.2 Responsible Authorities

Table 2 maps all responsible authorities and bodies, providing an overview of who they are, their mandate in the process, and a brief role description.

Table 2. Responsible Authorities (Crop Intensification Programme)

Authority/Body	Mandate	Short Role Description
Ministry of Agriculture and Animal Resources (MINAGRI)	Oversees national agricultural policy and development, including the CIP.	Supervises CIP through its Directorate of Agriculture Development.
Rwanda Agriculture and Animal Resources Development Board (RAB)	Manages agricultural research, development, and input supply chain regulation, including seed and fertiliser subsidies.	Oversees seed and fertiliser supply chain, manages input subsidies, and coordinates planning and distribution.
Local Governments	Support implementation of national agricultural programmes at the local level, ensuring coordination and monitoring.	Collaborate in timely supply and distribution of inputs, monitors subsidy implementation, and enforce pricing policies.
Input suppliers and retailers (agro-dealers)	Facilitate the supply and distribution of subsidised agricultural inputs to farmers through established networks.	Act as intermediaries in the distribution chain, ensuring access to subsidised inputs.
District Extension Officers	Ensure proper implementation and monitoring of agricultural input subsidies at the district level.	Monitor and inspect fertiliser distribution, ensuring quality, timeliness, and subsidy effectiveness.

2.2.3 Beneficiaries

The beneficiaries of the CIP are primarily farmers who cultivate designated national priority food crops, including maize, beans, wheat, soya, rice, Irish potatoes, cassava, bananas, and other selected fruits and vegetables. These farmers benefit from subsidies on inorganic fertilisers and improved seeds, which help reduce production costs and enhance yields. However, only maize, soya, and wheat qualify for seed subsidies, with maize receiving the highest allocation due to the high cost of hybrid seeds.

To access these subsidies, farmers must grow their crops in regions identified as high potential under CIP and participate in Rwanda's Land Use Consolidation Programme, which requires a minimum consolidated area of 5 hectares per crop. While initially provided through a voucher system, fertiliser subsidies have since been universally applied, enabling farmers with land both inside and outside designated sites to benefit.

58. '(IFPRI) authors' calculation based on FAO Monitoring and Analysing Food and Agricultural Policies public expenditure data for Rwanda. Since the budget data are compiled from various sources and constitute budget lines beyond the responsibility of MINAGRI, they may deviate from MINAGRI's figures.' (Aragie, E., *Public Investment Prioritization for Rwanda's Inclusive Agriculture Transformation: Evidence from Rural Investment and Policy Analysis Modelling*, IFPRI Rwanda, Strategy Support Program, Working Paper 3, February 2022, p79)

59. UNEP et al., *op. cit.*

2.2.4 Institutional Context

MINAGRI's National Agricultural Policy (NAP 2018) replaces NAP 2004, aligning with Vision 2050 – which aims to transform Rwanda into an Upper-Middle Income Country by 2035 and a High-Income Country by 2050 – and the National Strategy for Transformation (NST1) to increase crop and livestock quality, production productivity and production by modernising agriculture and increasing resilience to climate change. Additionally, NST1 positions the agricultural sector as strategic for responding poverty reduction, food security, health and social protection⁶⁰.

NAP 2018 outlines four key pillars: (1) Enabling institutions, (2) Technological upgrading, (3) Productivity and sustainability, and (4) Inclusive markets. In terms of the third pillar, agricultural production must increase in order to meet socio-economic food and nutrition security needs. The adverse effects on land resources and climate change must be countered with continued efforts to increase or adjust inputs and sustainable climate- and environment-smart practices; protecting agricultural land against fragmentation, erosion and degradation; and shifting production towards higher-value products and introducing land-saving technologies.⁶¹

NAP 2018 aligns with key government strategies, among others, the Private Sector Development Strategy, the Green Growth and Climate Resilience Strategy and, in particular, the 2018-2024 Strategic Plan for Agricultural Transformation (PSTA4)⁶². PSTA4 aligns with the United Nations (UN) Sustainable Development Goals (SDGs).⁶³ Since 2004, successive PSTAs have channelled public resources into a range of critical investment areas, including land consolidation, hillside terracing, irrigation, erosion control measures, research, extension and input subsidies. The flagship intervention involving input subsidies has been the CIP which was piloted in 2007 and scaled nationally in 2010.⁶⁴

As a central part to sustainable development, human dignity and inclusivity, and economic growth, the cross-cutting linkages between the water and the other sectors will be a priority. Rwanda's Green Growth and Climate Resilience Strategy, first adopted in 2011 and revised in 2022 to align with the Vision 2050 has as one its three strategic objectives to achieve Sustainable Land Use and Water Resource Management that results in Food Security, appropriate Urban Development and preservation of Biodiversity and Ecosystem Services. The strategy specifically proposes to enhance agroecology, crop varietal development, promoting cultivars and animal breeds adapted to the impacts of climate change, and enhancing the resilience of export crops, noting that this includes more sustainable production to cater to markets seeking sustainable or organic products.

Though there is much in terms of public policy and accompanying expenditure that could presently be done and/or may need to be done in the foreseeable future to improve, or at least maintain, the effectiveness of fertiliser subsidies, few relate to policies that may to some degree counteract the objectives of CIP's subsidies. Studies indicate that Rwanda's small producers' use of fertilisers is more responsive to crop prices than to fertilisers subsidies.⁶⁵ However, analyses indicate that, relative to the cost to government in terms of fiscal revenue forgone, the productivity and welfare improvements have been small.⁶⁶

60 Rwanda Ministry of Agriculture and Animal Resources, *National Agricultural Policy, 2018*

61 *Ibid.*

62 *Ibid.*

63 SDG1 (zero poverty), SDG2 (zero hunger), SDG5 (gender equality), SDG8 (decent work) and SDG13 (climate resilience)

64 Spielman et al., *op. cit.*

65 UNEP et al., *op. cit.*

66 Anderson et al., *op. cit.*

2.2.5 Financing and Implementation

Table 3 below records estimated fertiliser subsidy expenditure for 2007– 2022/23⁶⁷: To close the gap between actual and targeted productivity, PSTA4 estimated that expenditure of USD 189 million would be needed for fertiliser subsidies and USD 86 million for seeds subsidies for the period 2018-2024.⁶⁸

Table 3. Estimated CIP Fertiliser Subsidies Expenditure, 2007-2022/23

Year	Nominal Expenditure (USD million)
2007	3.75
2008	5.49
2009	9.68
2010	7.82
2011	8,57
2012	11.60
2013	18.95
2014	10.62
2015	11.35
2016/17	5.83
2017/18	5.35
2018/19	6.63
2019/20	11.24
2020/21	10.11
2021/22	15.30
2022/23	29.79

For seeds, no comparable data series had been found at the time of writing. However, the Prime Minister was quoted in April 2019 as saying that the budget for seeds subsidies through the Nkunganire programme grew from about USD 3 million in 2018/19 to more than USD 8.7 million in 2021/22.⁶⁹

By increasing the output of locally grown food crops, fertiliser subsidies have reduced the need for and cost of imports of the commodities concerned. The percentage of maize imported fell from 28% in 2017 to 18% in 2020, with smaller falls in the percentage of rice and wheat imported.⁷⁰ While this has been at the cost of increasing fertiliser imports, it has been calculated that the cost of these has been less than the value of additional food crops produced⁷¹, i.e., that there has been a net positive impact on the country's balance of payments (saving to the country in terms of foreign exchange).

⁶⁷ 2007-2013: UNEP et al., op. cit.; 2016/17-2022/23: Spielman et al., op. cit. Caveat: it is not clear that the bases on which the two series were compiled are comparable. Expenditure for 2014 and 2015 estimated from data in Anderson et al., op. cit., Fig 2, p8 and UNEP, op. cit.

⁶⁸ AU, op. cit.

⁶⁹ Kigali, April 4, 2019 – Office of the Prime Minister, The Prime Minister presented the Government's actions related agricultural input to the Joint Plenary Session of Parliament (primature.gov.rw/news-detail/the-prime-minister-presented-the-government-actions-related-to-agriculture-inputs-to-the-joint-plenary-session-of-the-parliament)

⁷⁰ AU, op. cit.

⁷¹ UNEP et al, op. cit.

The efficiency gains from producing this increase to food crop output on consolidated blocks of land (required to qualify for subsidised fertiliser), suggests that the high levels of soil loss from erosion inherent in production on small, fragmented parcels of land may have declined⁷². However, in the aggregate, growing more food crops on larger areas of land⁷³ will have increased the overall level of soil mining/soil nutrient depletion.⁷⁴

2.3. Subsidy Redesign

Rwanda has 860 marshlands, covering a total surface of 278 536 ha, which corresponds to 10.6% of the country surface, 101 lakes covering 149,487 ha, and 861 rivers totalling 6,462 km in length.⁷⁵ The country's National Land Use and Development Master Plan (NLUDMP) for 2020 to 2050 recognises that: "Wetlands constitute the backbone of Rwanda's green development as they provide various goods and services that millions of Rwandans depend on. Healthy, functioning wetlands are essential for a number of their livelihoods and are crucial for water, energy, and agriculture sectors, which are one of the main branches of the national economy. Wetlands also provide critical habitat for wildlife and play a pivotal role in the ecosystem, e.g., flood control and water storage."

The key environmental concern associated with inorganic fertiliser use is pollution from soil erosion run-off with a high fertiliser content into surface water and its impacts on the health of wetlands and on downstream water quality. CIP has increased agricultural productivity in Rwanda, but its reliance on inorganic fertilisers likely causes biodiversity loss and ecosystem degradation.

This issue will become even more critical, as the NLUDMP highlights the planned expansion of agriculture in unprotected wetlands from 428 km² to 1,283 km² – almost half of the total area of wetlands – by 2050. This expansion requires that certain environmental conditions be met, such as the proposed use(s) of additional land being guided by undertaking an Environmental Impact Assessment (EIA)⁷⁶ to ensure sustainable utilisation. Evidence indicates that inorganic fertilisers have mainly been used to increase the area under rice cultivation, rather than improve yields⁷⁷, as is the intention of CIP. There is a 'low', i.e., less than 30%, rate of adoption of 'efficient soil management in marshlands' and 'efficient use of fertilisers' for rice production⁷⁸.

Excessive fertiliser use leads to soil acidification, loss of soil biodiversity, and nutrient runoff, which pollutes water bodies and disrupts aquatic ecosystems. This not only threatens biodiversity but also weakens the natural functions of wetlands, reducing their ability to filter pollutants and regulate water flows. This loss of wetland functionality can severely undermine Rwanda's ability to manage the increasing frequency and intensity of flood events, as well as promote continued water flows during dry periods. In addition, monocropping and land-use consolidation have reduced crop and seed diversity, undermining genetic resilience and increasing vulnerability to pests and climate shocks. Rice

72 Mean soil loss for Rwanda's districts in 2015 was significantly correlated with poverty, especially extreme poverty. (Nambajimana, J. de D. et al., *Land Use Change Impacts on Water Erosion in Rwanda*, Sustainability 12(50), 2020)

73 Spielman et al. show that the increase in food production in Rwanda during CIP has resulted mainly from the increase in the area under crops, much less from the increase in yields.

74 UNEP et al. record a net increase in soil nutrient depletion as a cost in the cost:benefit analysis that it conducted.

75 REMA (2008). *Etablissement d'un inventaire national rapide des marais et élaboration de cinq avant projets d'arrêts ministériels relatifs aux marais (4 modules)*

76 EIAs are reported to be undertaken by REMA from time to time to inform current actors of the impact(s) of certain interventions or activities on the environment (including biodiversity). These are referred to as Strategic Environmental Assessments (SEAs).

77 Anderson, op. cit., p6; (NISR, op. cit., pp iv, v)

78 World Bank, op. cit. 2015, pp6, 7

cultivation in Rwanda is reported⁷⁹ mostly to be undertaken on a two-seasons-per-year basis, with the only form of crop rotation practised being between long and short grain rice. Intensive monocropping of this nature tends to be accompanied by declining soil quality and yields – generally countered by increasing inorganic fertiliser use – and an increasing incidence of pests and diseases, resulting in the use of more toxic pesticides and fungicides.

While the intention of CIP was to raise yields in order to increase output, in practice, for many crops, including rice, output increases have been driven mainly by area expansion. The expansion of croplands into forests, grasslands, and wetlands – driven by CIP, along with population growth and the desire of all households to produce more – degrades habitats, accelerating soil erosion and depleting soil nutrients, making continued productivity increasingly dependent on synthetic inputs.

The high costs of mitigating these forms of environmental damage, including soil restoration and wetland rehabilitation, highlight the need to redesign CIP. Arguably the most thorough study of fertiliser policy in Rwanda—the 2016 report ‘Effectiveness and Efficiency of Fertiliser Use in Rwanda’, commissioned by MINAGRI and REMA with the support of UNEP and UNDP—made the increase in the organic content of soils, inter alia through the use of manure, its first recommendation.

The redesign of the CIP proposed thus aims to phase out the subsidy for fertilisers used in rice production, reallocating the savings to subsidising the expansion and improved application use of organic fertilisers and to strengthening agricultural extension, research and monitoring and evaluation (M&E) services geared specifically for this task.. Without intervention, ongoing fertiliser-driven degradation will harm biodiversity and increase climate vulnerability – including of croplands – threatening the long-term sustainability of Rwanda’s agricultural sector. By integrating requirements relating to organic fertilisers in the EIAs for expanded agriculture in wetlands, the probable negative impacts of these fertilisers on wetlands can be minimised.

However, as REMA points out in the context of an economic assessment of the Akagera wetland complex, ‘absence of information impairs decision makers and local authorities in solving environmental conservation issues. Little is known about habitat loss, species population dynamics, water quality, endemic or threatened species, fish production, etc. There is a lack of a system to support biodiversity solutions’⁸⁰.

Though rice cultivation was not involved in this assessment, REMA’s observation applies no less to other wetlands where inorganic fertilizers are used to cultivate rice. If policy is to be changed specifically to phase out subsidies that encourage rice production in wetland areas, such a change should be premised on a thorough study of the impact of inorganic fertilizers on the environment, ecology and biodiversity of Rwanda’s wetlands.

(Annexure 2 provides details of other CIP redesign options.)

79 Interview with Head of Department: Agriculture, RAB

80 REMA, *Economic Assessment of Akagera Wetland Complex: Identifying Finance Solutions for Improved Management*, January 2019, pp56-57

2.4. Future Scenarios

2.4.1 Business-as-Usual (No Re-design)

Rice farming persists on 20% or more of Rwanda's wetlands, gradually increasing, supported by fertiliser subsidies. This degrades water quality, reduces biodiversity, and disrupts flood regulation, increasing climate change vulnerability. Excess fertiliser runoff causes eutrophication, harming aquatic life and degrading water quality.

However, Girinka continues for 15-20 years. To the extent that the smallholder rice farmers who are members of large rice-growing cooperatives are also Girinka beneficiaries, this gradually enables more smallholders to blend inorganic and organic fertilisers. MINAGRI supports optimal fertiliser use through research and training. As manure and compost use increases, wetland soil biodiversity improves.

2.4.2 Phase Out Fertiliser Subsidies for Rice Production

The use of inorganic fertilisers for producing rice in Rwanda has been encouraged by subsidies and, in contrast to all other major crops using subsidised fertilisers, the application for rice production has exceeded the recommended rate in some years.⁸¹ This will have exacerbated wetland degradation. Both for this and for a number of other reasons listed below, it is proposed to phase out the subsidy for fertilisers used for rice production over a number of years as many as 5-10 years.

The need to phase subsidies out over an extended period is in keeping both with Rwanda's National Rice Development Strategy⁸² and with the intention of the redesign to retain the benefits of CIP, in particular in terms of the increased volumes of crops produced, while mitigating the negative impact on biodiversity. It is recognized that replacing inorganic with organic fertilisers tends to be accompanied by falling crop yields, until the improvements in soil quality and structure brought about by organic fertilisers are sufficient to compensate in full - and eventually more than compensate - for the reduction in inorganic fertiliser use.

Simulations suggest that rice output would likely decrease by only between 0.4% and 3%⁸³, depending on farmers' sensitivity to price changes, if subsidies for fertilisers used for rice production were terminated immediately. So an extended phasing-out period should have little or no negative impact on rice output.

On the other hand, phasing out fertiliser subsidies will gradually, but progressively, reduce the incentive to apply inorganic fertilisers for rice production, thereby also reducing the negative impact on wetlands' capacity to support the sustainability of agriculture.

81 UNEP et al, *op. cit.*, p22

82 MINAGRI, *National Rice Development Strategy (Period 2011-2018)*, 15 September 2011, p2

83 Spielman et al., *op. cit.*, 2022, p16. The earlier UNEP 2016 study finds that even with fertiliser at unsubsidised prices, rice production would still be profitable enough in Rwanda's risky environment for most existing farmers to engage in it (UNEP et al., *op. cit.*, p28).

The following factors further support for this proposed policy improvement:

- The impact of fertiliser subsidies has mainly been to drive area expansion, not yield increases⁸⁴
- Rice production in the country's most important rice producing regions uses by far the greatest value of subsidised fertilisers per hectare of any crop grown in Rwanda⁸⁵
- There is a 'low', i.e., less than 30%, rate of adoption of 'efficient soil management in marshlands' and 'efficient use of fertilizers' for rice production⁸⁶
- Inorganic fertilisers make up as much as 60% of total production costs, about twice the percentage of total production costs for other major crops⁸⁷
- Much of the rice produced in Rwanda appears not to align well with consumers' preferences⁸⁸
- Domestically produced rice receives a high rate of protection, higher at the farm gate in Rwanda than in any other East African Community country, thereby increasing the price of rice significantly for local consumers⁸⁹
- Climate change is increasing wetlands' importance, but wetlands make up only about 10% of Rwanda's land area⁹⁰
- '30-90% of (tropical) wetlands have already been destroyed or strongly modified for meeting food demand through intensive agriculture (including inorganic) fertiliser use, further exacerbated through double cropping of rice'⁹¹.

The financial savings over time from full subsidy termination could range from USD 85,000 to USD 550,000⁹², while reductions in fertiliser imports could improve the country's balance of payments by between USD 150 000 and 960,000.

Environmental benefits include a reduction in greenhouse gas emissions and potential improvements in biodiversity and climate resilience. It is also recognised that before any such change in CIP policy could take place, it would be essential for MINAGRI to be convinced about the negative environmental and biodiversity impacts of fertiliser use on wetlands. For this reason, a thorough study would need to be conducted in collaboration with REMA.

MINAGRI would also need to consider all of the alternatives to phasing out the subsidy that could possibly achieve the objective of reducing such negative impacts. These would primarily focus on the use of best practices for rice cultivation, such as crop rotation⁹³, optimal inorganic-organic fertiliser blending and application and optimal water management. Indeed, these are best viewed not as alternatives, but as essential complements. If farmers are to maintain yield levels as they decrease inorganic fertiliser use, it will be critical for them to adopt such best practices.

84 Anderson et al., *op. cit.*, p5

85 UNEP et al., p42

86 World Bank, *op. cit.* 2015, pp6, 7

87 Spielman et al., *op. cit.*, p7

88 Anderson et al., *op. cit.*, p6

89 *Ibid.*, p11

90 NISR, *op. cit.*, 2022, p3

91 Nath, A.J., et al., *Managing Tropical Wetlands for Advancing Global Rice Production: Implications for Land Use Management. Land Use Policy*, vol. 68, November 2017, p683, <https://doi.org/10.1016/j.landusepol.2017.08.026>

92 REMA, *Analysis, Scenarios and Action Plans: Subsidies with a Negative Impact on Rwanda's Biodiversity, Report March 2025 – Revision 1, Annexure 4*, p84

93 For example, legume crops, such as faba bean, have been shown to be particularly effective as nitrogen fixers if cropped in rotation with rice (Yang, R. et al., *Effects of Diverse Crop Rotation Sequences on Rice Growth, Yield and Soil Properties: a Field Study in Gewu Station*, *Plants* 2024, 13, 3273, <https://doi.org/10.3390/plants13233273>)

To the extent that such best practices are effectively applied, they could be expected to reduce the damage done by rice cultivation to the environment and biodiversity. But they would not address the experience that subsidised fertilisers have been used more to extend the area of cultivation than to improve yields. Only phasing out the subsidy is likely to reduce the incentive to increase the area under rice, as flagged by NLUDMP.

Both NFP and CIP have committed to reducing and eventually terminating fertiliser subsidies. As participants at the stakeholder workshop noted, rice is arguably the ideal sub-sector for starting to implement these commitments, given that it is relatively small – so the consequences of any missteps would be contained – that it is only sub-sector in which fertilisers have frequently been applied in super-optimal quantities, that fertilisers have tended to increase area rather than yield and that the impact of the damage that it is causing to the functioning of wetlands probably affects other agricultural and aquacultural activities more widely than the application of fertilisers to any other crop.

2.4.3 Subsidise Organic Fertilisers and Increase Spending on Public Rice Research, Extension and M&E Services

About 1.9, or 83%, of Rwanda's 2.3 million farming households own livestock, 74% of whom operate mixed crop/livestock farms.⁹⁴ So, the great majority of crop farmers generate manure on farm. Only in the eastern savannah region and in a small part of the western hillside agricultural region, totalling less than 6% of farmland, is pure rangeland to be found.⁹⁵ This provides enormous scope for animal-based organic fertilisers, particularly manure, to improve soil health in Rwanda.

Most rural and peri-urban farming households that do not benefit from livestock ownership are the poorest.⁹⁶ Over the past two decades, MINAGRI's Girinka programme has sought to address this shortcoming by providing dairy cows to low-income households – one per household – and has now distributed almost half a million cows.⁹⁷

For smallholdings – 77% of farmers have an average of 0,5ha of land⁹⁸ and the National Institute of Statistics of Rwanda classifies more than 98% of crop farmers as smallholders⁹⁹ – Girinka beneficiaries who own a dairy cow could, theoretically, generate as much 12 tons of manure for fertiliser a year¹⁰⁰ on farm, if the animal is well fed and cared for and all manure is collected. More than 98% of rice paddies are operated by smallholders through large scale farming cooperatives. Ideally, the pace of the Girinka roll-out should be accelerated. Part of the savings on fertiliser subsidies could valuably be allocated for this purpose. To date, it appears that rather less than half of eligible households have benefited from Girinka during the 18 years of the programme's existence¹⁰¹ and that it will need to continue for a similar period

94 NISR, *Agricultural Household Survey 2020*, pp iii, vi, vii

95 NISR, *op cit.*, 2022, pp3, 4

96 Kim, S.K. et al., *Revisiting Rwanda's Agricultural Intensification Policy: Benefits of Embracing Farmer Heterogeneity and Crop-Livestock Integration Strategies*, *Food Security* (2022), 14:637-656, p645, <https://doi.org/10.1007/s12571-021-01241-0>

97 See pp52-55 below.

98 NISR, *op. cit.*, 2020, p v

99 NISR, *op. cit.*, 2022, pp28, 29

100 Alice Ferguson Foundation, *Cow In and Out*, <https://fergusonfoundation.org/lessons.cowmoreinfo>

101 Based on the following data and assumptions: (i) approximately 420 000 households received a cow each between 2006 and 2024 (see section 2.2 below); (ii) Rwanda is estimated to have about 2.3 million farming households, of which 61,3% are engaged in crop farming (NISR, *Agricultural Household Survey 2020*, p iii); (iii) it is assumed that all of the 78.1% of farming households engaged in livestock farming have one or more cows and therefore do not qualify for Girinka assistance; (iv) the percentage of farmers in Rwanda that qualify as smallholders is estimated by various studies as being between 70 and 83.1% ([Google.com/search/what percentage of Rwanda's farmers are smallholders](https://www.google.com/search/what+percentage+of+Rwanda's+farmers+are+smallholders) – it is assumed here that the percentage is 75%; (v) on this basis it can be estimated that there are around 1 million eligible households, about 42% (420 000) have already benefited.

to reach all eligible households¹⁰². This manure that livestock owned by these smallholders generates could be used increasingly to blend with inorganic and other organic fertilisers, thereby gradually but steadily replacing the use solely of inorganic fertilisers. It is assumed that rice cultivation already uses the residues from previous seasons' crops as compost, a second major source of organic fertiliser¹⁰³.

The progressive phasing out of subsidies and decrease in the use of inorganic fertilisers will lead to growing savings in the government's subsidy programme for chemical fertilisers. To maximise the benefits, the duration of the Girinka programme should be extended to reach all eligible households.

Still more important in the short- to medium-term, is to strengthen public research, extension and M&E services geared towards rice production to ensure that full advantage is taken of the country-wide soil analysis mapping that has been done to improve fertiliser application. The advice that this valuable source of information provides about fertiliser blending for major crops, such as rice and potatoes, in each district/land pocket currently relates only to inorganic fertilisers.¹⁰⁴ Further research needs to be conducted to extend this to organic-inorganic blending. The results need then to be communicated to rice farmers and support provided for implementation. Farmers will also need to be trained in better water management. This could be done in part by the expansion of Farmer Field Schools and other related initiatives.

However, these interventions will almost certainly need more, appropriately trained, extension staff, calling for additional budget. Among further duties that they will need to perform is in-season M&E¹⁰⁵ to ensure that guidelines are being followed and, where necessary, errors are being corrected and remediated.

Savings from the reduced use of inorganic fertilisers could support MINAGRI's budget for improving organic fertiliser application and enhancing research, extension and M&E services for rice cultivation. With a 10% increase in research and extension funding (around USD 32,700)¹⁰⁶, it appears that the additional costs could be easily absorbed, as this represents only 0.1% of the total budget for fertiliser subsidies. The Girinka programme's existing budget could also help cover these interventions.

¹⁰² The programme budgets to spend 8% more each year (see section 2.2 below), although a significant part of this increment can be reckoned to be absorbed by the rising price of dairy cattle, given the steady improvement in milk production per cow experienced to date (International Livestock Research Institute, Rwanda Livestock Master Plan, 20 August 2017, p27).

¹⁰³ Other potential sources of organic fertiliser for the future include black soldier fly manure, but these are still experimental and very small at present.

¹⁰⁴ Reported by a MINAGRI stakeholder during the Stakeholder Workshop held in March 2025.

¹⁰⁵ Farmers are already required to keep paper diaries prepared by RAB, inter alia, to record their activities and water and input use.

¹⁰⁶ REMA, op. cit., 2025, Annexure 5 provides further details on the indicative budget calculation

2.5 Action Plan for Subsidy Redesign and Implementation

Table 4. Action for Subsidy Redesign and Implementation (CIP)

Objectives	Indicators	Activities	Timeframe	Stakeholders
1. Secure MINAGRI's support for the proposed subsidy redesign	- Formal expression of interest or support from MINAGRI - Joint planning meetings held	1.1 Engage MINAGRI to gain active support for the redesign proposal 1.2 Present evidence of fertiliser subsidy-related wetland degradation, especially in rice-growing areas 1.3 Align messaging with MINAGRI's ongoing internal discussions on fertiliser subsidy reduction	Years 1–2	REMA, MINAGRI
2. Validate ecological impacts of rice cultivation on wetlands	- Environmental study completed and endorsed - Findings disseminated to relevant ministries	1.1 Support MINAGRI in undertaking a comprehensive environmental study on rice cultivation impacts 1.2 Ensure REMA, RWB and relevant actors play advisory roles in the design and review of the study	Years 1–2	MINAGRI (lead), REMA, RWB
3. Develop sector-specific policy framework if study findings support redesign	- Sector policy drafted and aligned with PSTA5, NFP, NRS, CIP	1.1 Collaborate with MINAGRI on development of a sector-specific policy framework based on study outcomes 1.2 Ensure alignment with existing national policies (PSTA5, NFP, NRS) 1.3 Facilitate advisory input from REMA, RWB and RICCA	Years 1–2	MINAGRI (lead), REMA, RWB, RICCA

Objectives	Indicators	Activities	Timeframe	Stakeholders
4. Prepare for phase-out of rice fertiliser subsidies and planning of alternative support measures	- Draft multi-year phase-out plan developed - Complementary measures identified and costed	1.1 Support MINAGRI in planning a multi-year phase-out of rice fertiliser subsidies 1.2 Identify additional interventions (research, extension, M&E for fertiliser and water management) 1.3 Provide technical input from REMA and RWB	Years 1–2	MINAGRI, REMA, RWB
5. Secure Cabinet approval for budget reallocations under CIP	- Cabinet approval granted - Budget adjusted in national planning	1.1 MINAGRI to present the case and proposed reallocation of CIP subsidy budgets to Cabinet 1.2 Work in collaboration with the Ministry of Finance to justify reallocations based on policy framework 1.3 REMA and RWB to support awareness and biodiversity monitoring	Years 1–2	MINAGRI, Ministry of Finance, Cabinet
6. Implement subsidy redesign and related interventions	- Implementation launched - Extension services operational - Monitoring initiated	1.1 MINAGRI/RAB proceed with implementing redesigned subsidy and support programmes 1.2 Ensure provision of extension services via local government 1.3 REMA and RWB to support awareness and biodiversity monitoring	Year 3 onwards	MINAGRI (lead), RAB, Local Government, REMA, RWB

Objectives	Indicators	Activities	Timeframe	Stakeholders
7. Coordinate stakeholder roles and secure buy-in for implementation	- Stakeholder coordination mechanism established - Participation of development partners and local actors	1.1 MINAGRI/RAB to coordinate engagement with key stakeholders including inter-governmental agencies (FAO, IFDC), development partners (World Bank, IFAD), NGOs, universities, farmers' cooperatives and the private sector 1.2 NGOs to support capacity building and community outreach	Year 3 onwards	MINAGRI/ RAB, REMA, RWB, NGOs, FAO, IFDC, World Bank, IFAD, universities, private sector, farmers' cooperatives
8. Evaluate environmental impacts of implementation and support adaptive policy management	- Environmental impact evaluation completed - Policy adjustments recorded - Updated compliance and reporting procedures in place	1.1 REMA to conduct an environmental evaluation after three years of implementation 1.2 Share findings with MINAGRI/ RAB 1.3 MINAGRI/RAB to update policies, compliance mechanisms, and reporting structures based on outcomes	Year 6	REMA (lead), MINAGRI, RAB

3. Clean Cooking Results-Based Financing

The Clean Cooking Results-Based Financing (CC-RBF) scheme under the [Rwanda Energy Access and Quality Improvement Project \(EAQIP\)](#) disburses subsidies to clean cooking companies based on verified results, such as the sale, adoption, and sustained use of clean cooking technologies. Clean cooking technologies are stoves and cooking solutions that improve energy efficiency, reduce harmful emissions, and reduce reliance on traditional biomass fuels: charcoal and firewood. Currently, the CC-RBF subsidises a variety of eligible stoves with fuels including wood, pellets, liquefied petroleum gas, methanol, and electricity, with varying energy efficiency levels.¹⁰⁷

3.1 Subsidy Background

The following describes the motivating factors for the rollout of the CC-RBF before providing details on the instrument's mechanism, involved actors, financials, and results to date. This is an important part of the analysis on which the proposed redesign is based. Investing into clean cooking initiatives has evidently positive impacts on biodiversity in Rwanda (as described in the following), and the objective of the proposed redesign is to enhance these benefits.

3.1.1 Household Reliance on Firewood for Cooking

The majority of Rwandan households rely on firewood as their primary cooking fuel. According to the 5th Rwanda Population and Housing Census (2022), 76.1% of households use firewood as the main cooking fuel. This equates to roughly 2.5 million households (out of ~3.31 million total) primarily cooking with wood. For context, only 17.3% use charcoal and 4.6% use gas nationally. Firewood dependence is higher in rural areas (nearly 94% of rural households) than in urban areas (32% of urban households, where charcoal is more common at ~56%).

Use of wood for cooking has been declining as Rwanda promotes cleaner alternatives. In 2014, an estimated 83.3% of households cooked with firewood.¹⁰⁸ By 2016-17, this had dropped to 79.9%.¹⁰⁹ The latest 2022 census figure of 76.1% reflects continued progress.¹¹⁰

According to the Rwandan Energy Group (REG), a typical Rwandan household that relies on firewood consumes approximately 1.8 tonnes of firewood per year using a traditional three-stone stove.¹¹¹ With approximately 2.5 million Rwandan households primarily use firewood, at ~1.8 tonnes per household-year, this implies on the order of 4.5 million tonnes of firewood consumed per year for cooking in Rwanda ($2.5\text{M} \times 1.8$). These are estimates for context, not an exact official statistic.

¹⁰⁷ Rwanda Energy Group (REG), *List of Eligible Stoves in Result-Based Financing: Increasing Access to Clean Cooking*, February 2024. Available at: [Link](#).

¹⁰⁸ Fourth Integrated Household Living Conditions Survey (EICV4) Results: The NISR's EICV4 Thematic Report on Utilities and Amenities (2013/14) – published in 2016 – provides national data on energy use. The full report is available on NISR's website: *EICV4 Utilities and Amenities Thematic Report* (NISR, 2016). (This is a national report covering water, sanitation, energy, housing, transport, ICT, etc., with the firewood statistic in the energy section.)

¹⁰⁹ Fifth Integrated Household Living Conditions Survey (EICV5) Results: The NISR's EICV5 Thematic Report on Utilities and Amenities (2016/17) – published in 2018 – contains updated figures on household energy sources.

¹¹⁰ Fifth Rwanda Population and Housing Census (RPHC5) Results: The 2022 Census provides the most recent national data. The detailed data are published by NISR in the census housing characteristics report. The full report can be accessed here: *RPHC5 Thematic Report: Housing and Household Characteristics* (NISR, 2023). (This is a national census publication detailing housing conditions, including cooking fuel types. The figure of 76.1% is the national average for firewood use in 2022.)

¹¹¹ Rwanda Energy Group. (n.d.). Biomass. Rwanda Energy Group. Retrieved March 29, 2025. Available at: [Link](#).

It is worth noting that Rwanda's firewood supply comes not only from natural forests but also from tree plantations and on-farm trees, however, the consensus is that Rwanda's firewood consumption is depleting biomass resources faster than they can naturally regenerate. Rwanda has made efforts in reforestation, but still experiences net forest cover loss in some areas.

According to Global Forest Watch data, Rwanda lost about 46,200 hectares of tree cover from 2001 to 2023, which is roughly a 9.3% decrease in tree cover since 2000. This averages to approximately 2,100 hectares of forest loss per year over the past two decades.¹¹² Most of Rwanda's deforestation has been driven by land conversion for agriculture and settlement, given the country's high population density.

According to the Rwanda Forestry Authority, which operates under the Rwanda Environment Management Authority (REMA), deforestation was primarily driven by agricultural expansion and the development of new settlements. In other words, clearing land for crops and homes is the primary cause of permanent deforestation. That said, fuelwood harvesting is a significant contributor to forest degradation. It is important to distinguish commercial woodcutting and subsistence cutting. For the latter, rural households gather firewood from forests or woodlots, as deadwood collection and felling trees, especially when other sources are scarce. Charcoal production (which supplies urban markets) can be even more destructive, as it involves cutting live trees.

In practice, hundreds of hectares of woodland are still being lost annually to meet woodfuel demand. Rwanda's Nationally Determined Contribution (NDCs) recognises unsustainable biomass use as a key driver of forest degradation and promotes curbing woodfuel harvesting through increased adoption of clean cooking technologies.

While land-use changes, particularly towards agricultural land, are the primary cause of deforestation in Rwanda, the dependence on charcoal and wood for cooking puts continuous pressure on forests, contributing to habitat loss and ecosystem degradation. Continual removal of wood cover leads to soil erosion, depleted soil fertility, and disruption of watersheds. As forests shrink, wildlife habitat is lost and biodiversity declines – especially in woodlands outside protected parks.¹¹³

Rwanda's most important natural forests – which are also biodiversity hotspots – include:

- **Nyungwe National Park** (South-West Rwanda): A rainforest covering over 1,000 km², Nyungwe harbors exceptional biodiversity (hundreds of bird species, 13 primate species, rare orchids, etc.). It is one of the largest intact forests in the region. In the context of this study, Nyungwe is considered a hotspot because of its biodiversity value; any deforestation or disturbance here threatens many endemic species.
- **Volcanoes National Park** (North-West Rwanda): A high-altitude forest in the Virunga Mountains, known for the critically endangered mountain gorillas. Volcanoes NP is smaller (~160 km²) but extremely biodiverse. It is relatively well-protected (tourism provides funding for conservation), yet remains at from population pressure around its borders.
- **Gishwati–Mukura National Park** (Western Rwanda): This is a newly established park (created in 2016) combining two forest fragments – Gishwati and Mukura. These forests were heavily deforested in the past. What remains is high in biodiversity (primates, birds, etc.) but fragile. Gishwati–Mukura is considered a hotspot because of its small size and the degree of past degradation. Conservation efforts are underway to rehabilitate it.

¹¹² Global Forest Watch. (n.d.). Rwanda Forest Change Dashboard. Retrieved March 29, 2025. Available at: [Link](#).

¹¹³ United Nations Development Programme (UNDP) Biodiversity Finance Initiative (BIOFIN). (2024). *The Nature of Subsidies: A step-by-step guide to repurpose subsidies harmful to biodiversity and improve their impacts on people and nature*. Available at: [Link](#).

- **Akagera National Park** (East Rwanda): Akagera is a different ecosystem (savannah and woodland) and is Rwanda's largest protected wetland/woodland area (~1,200 km²). It hosts big fauna (elephants, lions, etc.) and diverse bird life. While much of Akagera is open savannah, its gallery forests and woodlands are important.

Other high-biodiversity forests in Rwanda include the remnant gallery forests and wetlands scattered in the Eastern Province and the riverine forests along Akagera. For example, small reserves like Cyamudongo (an isolated patch near Nyungwe) contain unique species and are vulnerable. Overall, Nyungwe and Volcanoes are the top biodiversity priority areas, followed by the Gishwati-Mukura remnants, given their endemic species.

Certain regions in Rwanda stand out for particularly intensive agricultural activity, which is why they are considered hotspot areas for the purpose of this study:

- **Eastern Province (e.g. Nyagatare, Kayanza, Kirehe districts):** The east has expansive relatively flat lands and savannahs that have been converted to large-scale farming and ranching. Here we find extensive cultivation of maize, rice (in irrigated valleys like Kagitumba and Nasho), and cattle pasture. The combination of flat terrain and government irrigation schemes means parts of Eastern Province support mechanised, intensive agriculture (e.g. large rice schemes in the Akagera wetland system).
- **Southern Province – The “Amayaga” region:** The Amayaga refers to a belt of districts in Southern Rwanda (including Nyanza, Gisagara, Ruhango, and Kamonyi) that historically had high agricultural potential and hence were heavily deforested for farming. This region is known for intensive hillside farming (mainly bananas, cassava, beans, etc.). Due to decades of cultivation, it has experienced serious soil erosion and biodiversity loss.
- **Northern Highlands (Musanze, Burera, Gakenke districts):** In Northern Province, the volcanic soils are fertile and population density is very high. Although farm plots are small, they are continuously cultivated (potatoes, wheat, vegetables, etc.) and terracing is widely used on steep slopes.
- **Marshlands and Wetlands:** Across Rwanda, valley bottoms (marshlands) are intensely farmed under government programmes for rice and vegetables. Notable examples are the Rurambi marshland (Bugesera), Rugezi wetland (Burera – though protected for its ecological value), and others.

3.1.2 Emissions, Pollutants, Human Health and Livelihoods

Cooking on open fires or traditional stoves is also a major contributor to Rwanda's overall greenhouse gases – about 14% of GHG emissions in the energy sector come from cooking fuels.¹¹⁴ Non-renewable wood burning for cooking adds CO₂ to the atmosphere that would otherwise be sequestered in forests. Inefficient biomass stoves emit large amounts of particulate matter and soot. Indoor smoke leads to hazardous household air pollution; biomass burning produces black carbon, a potent climate pollutant that adversely affects respiratory health, particularly in children who have developing lungs.

Households in Rwanda face significant financial and time burdens due to reliance on biomass for cooking. For every meal prepared, households using charcoal spend approximately USD 0.068, while those using liquid petroleum gas pay USD 0.073, making both more expensive than modern alternatives

114 Republic of Rwanda. 2020. Updated Nationally Determined Contribution (NDC) under the Paris Agreement. Kigali: Rwanda Environment Management Authority (REMA). Accessible here: [Link](#).

like electric pressure cookers, which cost only USD 0.047 per meal.¹¹⁵ Switching from charcoal to electric pressure cookers saves households up to 30% per meal, with the obvious requirement to have access to electricity – according to REG as of end of 2024 over 80% of Rwandan households have access to electricity.¹¹⁶

Beyond direct fuel costs, households – especially those in rural areas – spend an average of 7 hours per week collecting firewood, time that could otherwise be used for income-generating activities, education, or rest.¹¹⁷ This unpaid labour, when valued at Rwanda’s rural minimum wage, represents a loss of approximately USD 510 per household annually, further compounding the economic disadvantages of traditional cooking methods. Clean cooking solutions not only reduce fuel expenses but also alleviate the immense time burden on households, particularly for women and girls who are disproportionately responsible for fuel collection.

3.2 Subsidy Analysis

The following presents an analysis of the clean cooking subsidy (further referred to as CC-RBF) under its current framework:

3.2.1 Subsidy Mechanism

CC-RBF is classified as a results-based financing instrument, where subsidies are disbursed based on verified sales and usage of clean cooking technologies. CC-RBF operates through a structured mechanism involving multiple stakeholders to ensure efficiency, transparency, and accountability: The Ministry of Infrastructure (MININFRA) oversees Rwanda’s clean cooking agenda, with implementation managed by the REG and the Energy Development Corporation Ltd (EDCL). The Development Bank of Rwanda (BRD) administers the financial aspects in collaboration with EDCL. Funding is provided by the World Bank’s Clean Cooking Fund, which releases funds to implementing organisations based on verified results. An Independent Verification Agent (IVA) ensures compliance before disbursements are made.

Clean cooking companies play a central role. These private-sector entities submit proposals to participate in the CC-RBF and must meet eligibility criteria related to licensing, financial stability, and service quality. Once approved, clean cooking companies procure and distribute certified clean cooking technologies to eligible households. The Rwanda Standards Board (RSB) tests and certifies stoves based on efficiency, emissions, durability, and safety, ensuring that only high-quality products receive subsidies. [Eligible stoves](#) are listed on the REG’s website and frequently updated. CC-RBF follows a performance-based disbursement structure. For PAYGO or credit sales, clean cooking companies receive 50% of the subsidy upon verification of sales, 40% after three months of verified stove usage, and the remaining 10% after one year of confirmed customer service and product usage. For cash sales, 80% of the subsidy is disbursed after sales verification, while the final 20% is released one year later upon independent verification of customer satisfaction and continued stove use.¹¹⁸

To prevent subsidy leakages, the programme applies a cost-sharing model, requiring household contributions that vary based on income level (Ubudehe category) and stove performance tier. This ensures that beneficiaries remain engaged and that the subsidy does not distort market competition.

¹¹⁵ Development Bank of Rwanda (DBR). 2022. Rwanda Energy Access and Quality Improvement Project: Component 3b Increasing Access to Clean Cooking Solutions Operations Manual Ver 03/06.04.2022. Kigali: Development Bank of Rwanda (DBR).

¹¹⁶ Rwanda Energy Group (REG). (n.d.). Electricity access. Retrieved March 7, 2025. Accessible at: [Link](#).

¹¹⁷ Ibid.

¹¹⁸ Development Bank of Rwanda (DBR). 2022. Rwanda Energy Access and Quality Improvement Project: Component 3b Increasing Access to Clean Cooking Solutions Operations Manual Ver 03/06.04.2022. Kigali: Development Bank of Rwanda (DBR).

Additionally, clean cooking companies must provide warranties and after-sales service to promote long-term customer satisfaction and stove adoption. By linking subsidy payments to sales verification and sustained usage, the CC-RBF aims to ensure that financial incentives drive real behavioural change, increasing adoption rates of clean cooking solutions while supporting Rwanda's broader energy transition goals.

3.2.2 Responsible Authorities

Table 4 maps all responsible authorities and bodies, providing an overview of who they are, their mandate in the process, and a brief role description.

Table 5. Responsible Authorities (CC-RBF)

Authority/Body	Mandate	Short Role Description
Ministry of Infrastructure (MININFRA)	Policy oversight and strategic planning	Oversees Rwanda's clean cooking agenda and ensures alignment with national policies.
Rwanda Energy Group (REG) & Energy Development Corporation Ltd (EDCL)	Implementation, technical management, compliance	Implements the programme, manages technical aspects, and coordinates stove certification with the Rwanda Standards Board (RSB).
Development Bank of Rwanda (BRD)	Financial management, subsidy administration	Administers the subsidy, manages disbursements, and collaborates with EDCL to ensure effective implementation.
World Bank's Clean Cooking Fund	Funding, donor oversight, results-based financing	Provides financial support through results-based financing (RBF), ensuring funds are disbursed based on verified outcomes.
Independent Verification Agent (IVA)	Monitoring and verification, compliance assurance	Verifies sales and usage of clean cooking stoves before subsidy disbursement to ensure compliance.
Rwanda Standards Board (RSB)	Product certification, quality Control	Tests and rates stoves based on efficiency, emissions, durability, and safety standards.
Clean cooking companies	Private sector, distribution, customer support	Distribute and sell clean cooking technologies, ensure compliance with programme requirements, and provide warranties and after-sales service.
Steering Committee (Chaired by MININFRA)	Governance, multi-stakeholder coordination	Includes members from MINECOFIN, REG, BRD, RSB, the Ministry of Environment, and other stakeholders; provides oversight and guidance.

3.2.3 Beneficiaries

CC-RBF is designed to support low-income households in Rwanda, particularly those in Ubudehe categories 1, 2, and 3. These households are prioritised to ensure that the most vulnerable populations benefit from affordable, energy-efficient cooking solutions. Each household is eligible for the subsidy only once, ensuring broader coverage across communities. To maintain CC-RBF's integrity, clean cooking companies must meet strict eligibility criteria. Eligible companies must: (1) Be legally registered and licensed in Rwanda; (2) Offer certified, high-quality cooking technologies; (3) Provide fair end-user pricing to ensure affordability; (4) Offer a minimum one-year product warranty and after-sales service to guarantee customer satisfaction and product durability; and (5) Employ at least 10% women in their workforce. CC-RBF also supports local stove producers by providing technical assistance and innovation grants. These initiatives help manufacturers enhance the quality and efficiency of clean cooking solutions while promoting local entrepreneurship. Beyond direct beneficiaries, the CC-RBF benefits the private sector by creating market opportunities for clean cooking companies and ensuring a demand for clean cooking technologies.

3.2.4 Institutional Context

CC-RBF is embedded within Rwanda's broader energy transition and clean cooking agenda, aligning with national and international policy frameworks. It forms part of Rwanda's Energy Access and Quality Improvement Project (EAQIP), which is co-financed by the World Bank's International Development Agency (IDA) and the French Development Agency (AFD). This programme plays an important role in supporting Rwanda's Biomass Energy Strategy (2019–2030), which set targets to reduce reliance on traditional biomass fuels, lower household firewood usage from 79.9% in 2017 to 42% by 2024, and phase out charcoal in urban areas entirely.

The CC-RBF directly contributes to Rwanda's Nationally Determined Contributions (NDCs) under the Paris Agreement, which prioritise emissions reductions in the energy sector by promoting clean and efficient cooking solutions. Cooking accounts for 14% of greenhouse gas (GHG) emissions from the energy sector, making it a key area for climate mitigation efforts.¹¹⁹ By supporting the adoption of clean cooking technologies, the instrument aims to help Rwanda meet its international climate commitments while improving household energy efficiency and health outcomes.

CC-RBF aligns with global best practices in results-based financing, drawing lessons from other World Bank-supported initiatives in Bangladesh, Kenya, and Uganda. Additionally, it contributes to the Sustainable Development Goals (SDGs), particularly SDG 7 (Affordable and Clean Energy) and SDG 13 (Climate Action), by promoting access to modern, energy-efficient stoves that reduce emissions and deforestation.

3.2.5 Financing and Implementation

CC-RBF, which is set to conclude in 2026, has a total budget of USD 20 million, with USD 3 million allocated to technical assistance. CC-RBF is financed under Rwanda's EAQIP, which is funded through a combination of loans and grants from the World Bank's International Development Agency and the French Development Agency (AFD). The exact breakdown between loans and grants, as well as associated repayment obligations, is not fully detailed, however, in 2024 the Development

¹¹⁹ Republic of Rwanda. 2020. Updated Nationally Determined Contribution (NDC) under the Paris Agreement. Kigali: Rwanda Environment Management Authority (REMA). Accessible here: [Link](#).

Bank of Rwanda has signed grant subsidiary agreements with 20 clean cooking companies, leading to the installation of approximately 310,000 clean cooking solutions and reaching over 1.2 million beneficiaries in Rwanda (at a target of 500,000 installed clean cooking solutions by the end of 2026). The World Bank has disbursed around USD 4.1 million in results-based grants to the participating clean cooking companies.¹²⁰ Representatives from BRD report ongoing discussions on the continuation of the scheme beyond 2026.¹²¹ This presents an opportunity for REMA to inform future configurations of the CC-RBF through this study i.e. the proposed redesign described in the following.

3.3 Subsidy Redesign

1. Scale up coverage and target hotspot areas: As stated earlier, a household that relies entirely on firewood consumes approximately 1.8 tonnes of firewood per year. For every 1,000 clean cooking solutions installed (assuming the subsidised stove fully replaces traditional cooking methods), up to 1,800 tonnes of firewood per year could be saved if the subsidised stoves use alternative fuel sources that do not require wood – such as LPG or electricity. Formulating and achieving more ambitious targets for the continuation of the programme would therefore directly reduce pressure on Rwanda’s forests and associated ecosystems. In addition to reaching households, the programme should extend coverage to public institutions such as schools, which are also major consumers of firewood for meal preparation. Targeting schools – especially in rural and peri-urban areas – would not only amplify the reduction in wood fuel use but also foster early awareness and behavioural change among students. Integrating clean cooking solutions into school infrastructure can therefore deliver broader environmental and educational benefits while reinforcing the programme’s long-term sustainability.

While scaling up the programme can be seen as a strategic recommendation in itself, it is proposed that the CC-RBF be redesigned to provide increased incentives in specific hotspot areas (further described below). This increase in incentives is intended to complement, rather than replace, the broader programme focus.

The tension between agriculture and forest conservation remains ongoing. In the context of this study, the areas identified previously in [section 3.1.1](#) are considered hotspot areas where CC-RBF incentives should be increased due to existing pressures on ecosystems.

2. Integrate sustainable fuel alternatives: While promoting efficient stoves, the CC-RBF should also support sustainable fuel alternatives to further reduce pressure on natural forests. The government already advocates for modern biomass fuels (pellets, briquettes) and LPG to complement improved cookstoves. The recommendation is therefore to integrate a new component within the CC-RBF which subsidises – beyond cookstoves – sustainable fuel alternatives. For instance, households could receive bundled discounts or coupons for LPG refills or processed biomass pellets when they purchase an improved stove. This encourages actual displacement of wood fuel. CC-RBF should involve private companies to expand production of biomass briquettes from agricultural residues, providing a renewable fuel that eases the strain on forests. Data from the [Energy Private Developers Association](#) shows several Rwandan companies already produce pellets/briquettes and that institutional users (schools, prisons, refugee camps) have cut firewood use 40–60% by switching to these fuels.¹²²

¹²⁰ Energy Sector Management Assistance Program (ESMAP). 2024. Annual Report 2024. Washington, DC: World Bank. Accessible here: [Link](#).

¹²¹ REMA hosted a two-day stakeholder validation workshop in Kigali on the 27-28 March 2025.

¹²² Energy Private Developers (EPD) Rwanda, Clean Cooking – Pellets and Briquettes. Accessible at: [Link](#).

The Government of Rwanda has identified liquefied petroleum gas (LPG), biogas, and electricity as primary clean cooking solutions, with ethanol fuel and sustainable biomass briquettes also considered emerging alternatives. These initiatives aim to reduce household wood consumption, targeting 42% clean cooking access by 2024 and universal access by 2030.¹²³

In practice, a household using an LPG stove or biogas unit can save ~1.8 tonnes of wood/year (avoiding essentially all of it) – a 100% reduction in wood use, apart from minimal wood needs for a secondary three-stone fire occasionally.¹²⁴

In conclusion, accelerating the clean cooking transition in Rwanda is not only a health or energy initiative but also a pivotal biodiversity strategy. By scaling up coverage, integrating sustainable biomass supply and alternatives into the CC-RBF, and targeting hotspot areas, the current biodiversity benefits would be significantly enhanced.

3.4 Future Scenarios

This section explores three potential pathways for the redesign of the CC-RBF, reflecting varying levels of ambition in addressing clean cooking and deforestation. None of the executing or financing authorities are currently quantifying the CC-RBF's impact on deforestation, nor is there an overview of stove distribution by fuel type. These data gaps limit any modelling of the scenarios presented.

3.4.1 Business-as-Usual (No Re-design)

The CC-RBF continues operating under its current structure, with no significant redesign or expansion until 2026 and likely beyond. While subsidies remain available for clean cooking technologies and hot spot areas are not prioritised. Deforestation persists due to continued reliance on biofuels, particularly in rural and peri-urban areas. Emissions reductions and biodiversity benefits plateau, and Rwanda may struggle to meet its biomass reduction and clean cooking adoption targets. The target of 500,000 households reached by 2026 was missed and a two-year extension was granted. By the end of 2028, the target was achieved, however, the CC-RBF was continued under its current configuration.

3.4.2 Scaling Up and Targeting Hotspot Areas

The CC-RBF expands its reach, prioritising communities adjacent to critical biodiversity hotspots and areas with high rates of deforestation. By 2030, the programme has reached 1,000,000 households, significantly reducing pressure on forests. More efficient stoves contribute to lower biomass consumption, slowing deforestation and reducing greenhouse gas emissions. While progress is made in hotspot regions, continued reliance on biomass fuels means that long-term forest regeneration and emissions reductions remain incomplete.

¹²³ Ministry of Infrastructure, 'Rwanda Launches Energy Compact on Clean Cooking in Partnership with Sustainable Energy for All at COP26' (4 November 2021). Accessible at: <https://www.mininfra.gov.rw/updates/news-details/rwanda-launches-energy-compact-on-clean-cooking-in-partnership-with-sustainable-energy-for-all-at-cop26>

¹²⁴ Rwanda Energy Group. (n.d.). Biomass. Rwanda Energy Group. Retrieved March 29, 2025. Available at: [Link](#).

3.4.3 Scaling Up, Targeting Hotspot Areas, and Integrating Sustainable Fuel Alternatives

CC-RBF integrates not only stove distribution but also fuel transition incentives, promoting LPG, biomass briquettes, and alternative clean energy sources. By 2030, more than 1,000,000 households have adopted clean cooking technologies. 500,000 of which adopted clean cooking solutions that refrain entirely from fuelwood use, saving 900,000 tonnes of firewood ($500,000 \times 1.8$) annually. Deforestation rates decline significantly, preserving thousands of hectares of forest annually. Indoor air pollution and emissions from biomass burning are drastically reduced, improving public health and helping Rwanda meet its climate commitments. Market incentives stimulate private-sector investment in alternative fuels, creating a sustainable clean cooking ecosystem beyond subsidies.

Charcoal producers and distributors will see reduced demand as households shift to alternative fuels, affecting vendors and transporters reliant on charcoal sales. Compensation measures include training and incentives for alternative livelihoods such as briquette production, LPG distribution, or roles in the clean cooking sector. Informal firewood collectors may face economic instability as reliance on firewood declines, particularly in rural areas where collection supports subsistence. Including these households in fuel voucher schemes can ensure affordable access to cleaner alternatives while reducing pressure on forests. Local stove manufacturers producing inefficient models risk losing market access if lower-efficiency stoves are phased out. Technical assistance and financial support should be provided to help manufacturers transition to producing high-efficiency stoves that meet improved performance and emissions standards.

3.5 Action Plan for Subsidy Redesign and Implementation

Table 6. Action for Subsidy Redesign and Implementation (CC-RBF)

Objectives	Indicators	Activities	Timeframe	Stakeholders
1. Ensure stakeholder engagement and institutional coordination	- Stakeholder consultations conducted - Technical Working Group and Steering Committee established	1.1 Engage MININFRA, REG, EDCL, BRD, World Bank, and RSB on redesign; 1.2 Establish technical working group (REG, RSB, RICA, RDB, LODA, BRD, REMA) and a steering committee (MININFRA, EPD, MINALOC, MoE, MINICOM); 1.3 Engage private clean cooking companies, local government, NGOs, and CBOs on capacity to scale distribution	Month 0–6	MININFRA, REG, EDCL, BRD, World Bank, RSB, RICA, RDB, LODA, REMA, MINALOC, MoE, MINICOM, NGOs, CBOs

Objectives	Indicators	Activities	Timeframe	Stakeholders
2. Conduct data collection and baseline assessments	- Beneficiary mapping completed - Monitoring framework established - Biodiversity baseline defined - Reporting gaps identified	1.1 Map current CC-RBF beneficiaries by location and stove type; 1.2 Develop monitoring framework on deforestation and biomass consumption (using satellite data, forest inventories, household surveys); 1.3 Establish biodiversity baselines in hotspot areas (section 3.5); Identify data gaps in stove and fuel usage; 1.4 Update CC-RBF verification system.	Month 0–6	REMA, REG, EDCL, BRD, World Bank
3. Undertake policy and financial adjustments	- Draft amendments proposed - Financial review completed - Co-financing options evaluated	1.1 Propose policy changes to extend CC-RBF subsidies to alternative fuels; 1.2 Review financial structure with BRD and World Bank; 1.3 Assess feasibility of co-financing options for incentivising both stove and fuel providers	Month 0–6	REMA, BRD, World Bank
4. Scale up stove distribution and refine subsidy structure	- Increased number of stoves distributed - Increased adoption in low-income households and biodiversity hotspots - Verified sustained usage	1.1 Expand CC-RBF subsidy pool 1.2 Implement tiered incentives based on stove efficiency and household location 1.3 Engage independent verification agents for periodic usage checks (surveys, sensors, random inspections)	Year 1	MININFRA, BRD, Independent agents, REG

Objectives	Indicators	Activities	Timeframe	Stakeholders
5. Target hotspot areas for focused implementation	- Hotspot mapping used in planning - Distribution hubs operational - Local outreach documented	1.1 Use GIS to identify and prioritise areas with high deforestation or proximity to protected forests 1.2 Establish local distribution hubs 1.3 Partner with CBOs for behavioural support 1.4 Launch outreach to wood-dependent communities (home visits, training, incentives)	Year 1	Local Government, NGOs, CBOs
6. Integrate sustainable fuel alternatives into programme	- Voucher scheme operational; Grants disbursed - Fuel availability improved in rural and urban areas - Subsidy structure launched	1.1 Design fuel vouchers linked to stove purchases 1.2 Provide technical grants for briquette, pellet, LPG investors 1.3 Pilot supply chain interventions to improve rural/urban availability 1.4 Launch progressive fuel-switching subsidy system	Year 1	BRD, Private-sector fuel companies, Local distributors
7. Monitor impacts and evaluate programme performance	- KPI tracking system in place - Regular M&E reports published	1.1 Develop KPIs: (1) Firewood/charcoal use per household, (2) Deforestation rates, (3) Air quality improvements, (4) Alternative fuel adoption, (5) Biodiversity changes; 1.2 Conduct monitoring using sensors, surveys, remote sensing; Publish periodic reports	Year 2 - 5	REMA, BRD, World Bank, Independent evaluators
8. Adjust CC-RBF and integrate into long-term national strategies	- Subsidy model refined - Integration proposal into national policy developed	1.1 Use evaluation findings to refine CC-RBF structure and improve efficiency; 1.2 Propose integration of CC-RBF into Rwanda's long-term energy and climate strategies to ensure continuity and funding	Year 2 - 5	REMA, MININFRA, World Bank

4. Tax Incentive for Tourism Sector Investments

Rwanda's corporate income tax holiday incentive applies to registered investors across several sectors, including energy, manufacturing, ICT, health, and tourism. The following analysis and proposed redesign focuses exclusively on the tourism component of the instrument, which is designed to support the country's ambition to become a high-end, sustainable tourism destination. While the instrument has helped attract investment into tourism infrastructure, the developments it supports come with environmental trade-offs.

4.1 Subsidy Background

The following outlines the negative impacts of tourism development and activities on biodiversity in Rwanda, before examining the mechanisms, key actors, financial aspects, and outcomes of the relevant policy instruments. ***While tourism in Rwanda is widely recognised as a success story – both in terms of economic growth and its regulation to promote 'responsible tourism' – it is important to assess its environmental trade-offs.***

4.1.1 Deforestation and Biodiversity Loss

Infrastructure for hotels, roads, and tour camps can contribute to forest clearance. Rwanda has made gains in reforestation, yet tree cover loss persists – 2,516 hectares of tree cover were lost in 2019 and 3,187 hectares in 2020 alone.¹²⁵ Expanding tourist facilities near wildlife habitats can disturb Rwanda's rich biodiversity. Mountain gorillas remain critically endangered, with only ~880 left globally (600 in Rwanda and bordering countries) after decades of habitat loss and poaching. Increased human presence and construction in park buffer zones threaten other species (e.g. elephants, birds) by fragmenting habitats and introducing noise and light disturbance. Although tourism funds conservation, poorly planned projects risk undermining wildlife protection efforts.¹²⁶ While agriculture drives most deforestation, clearing land for resorts or vistas adds pressure in ecologically sensitive areas.

4.1.2 Land Encroachment

The expansion of tourism can encroach on protected or community lands. Rwanda's national parks are relatively small and isolated; construction of new hotels or trails on their peripheries can extend the human footprint into previously wild areas. For example, wetland parks in Kigali and buffer zones around parks have seen illegal construction and farming until government crackdowns.¹²⁷ Such encroachment not only reduces habitat area but also increases human-wildlife conflict (crop raiding, animal incursions into lodge sites). In some cases, economic interests overrode planning rules – projects proceeded without fully respecting park boundaries or land use plans, highlighting lapses in enforcement. Each of these issues is evident in case studies where tourism development outpaced environmental safeguards, stressing the importance of stronger oversight.

¹²⁵ Deforestation statistics for Rwanda," World Rainforests. Available at: [Link](#).

¹²⁶ Yves Umuhuza Mugisha, "Environmental Impact Assessment in Rwanda: Legal Framework and Challenges," African Legal Studies Blog, 21 February 2025, available at: [Link](#).

¹²⁷ World Bank, "Project Information Document (PID) Appraisal Stage: Additional Financing for Second Rwanda Urban Development Project (P177247)", February 4, 2022. Accessible at: [Link](#).

4.1.3 Water Pollution

Tourist facilities, if not properly managed, can pollute water bodies. Large hotels and lodges generate wastewater that may discharge into lakes and rivers, elevating nutrient and bacteria levels. In Rwanda's urban wetlands, unregulated development historically led to severe water contamination – Kigali's wetland area shrank from 100 km² in 2013 to 72 km² in 2019 due to encroachment, causing loss of natural filtration and polluted runoff.¹²⁸

4.2 Subsidy Analysis

The following presents an analysis of the tax incentive under its current framework. As stated in the introduction to this section, tourism is only one of the sectors to which the incentive applies. The following focuses exclusively on the tourism component.

4.2.1 Subsidy Mechanism

To qualify, investors must commit a minimum of USD 50 million to a tourism project, with at least 30% of this investment financed through equity. The application process begins with investors submitting a detailed investment proposal to the Rwanda Development Board (RDB), outlining the business model, financial structure, and projected economic impact, particularly in terms of employment creation and tourism revenue generation. The RDB, in coordination with relevant ministries, reviews applications to assess compliance with investment priorities, environmental regulations, and financial viability. Upon approval, investors receive formal confirmation specifying the tax holiday's duration and conditions.

Once granted, the corporate income tax exemption applies for seven years. The Rwanda Revenue Authority (RRA) monitors compliance, ensuring that investors maintain the required equity contribution and continue operating within the tourism sector. To maintain eligibility, investors may be required to submit periodic financial and impact reports, demonstrating their contributions to employment and thereby sector growth.

4.2.2 Responsible Authorities

Table below maps all responsible authorities and bodies, providing an overview of who they are, their mandate in the process, and a brief role description.

Table 7. Responsible Authorities (Tax Incentive for Tourism Sector Investments)

Authority/Body	Mandate	Short Role Description
Rwanda Development Board (RDB)	Investment promotion, facilitation, and approval	Reviews and approves investment proposals, assesses compliance with investment priorities, and coordinates investor support.
Rwanda Revenue Authority (RRA)	Tax administration and compliance enforcement	Monitors investor compliance with tax regulations, ensures eligibility for the tax holiday, and conducts periodic audits.
Ministry of Finance and Economic Planning (MINECOFIN)	Fiscal policy oversight and revenue management	Manages the fiscal implications of the tax holiday, ensures financial sustainability, and oversees public finance planning.

¹²⁸ Ibid.

Ministry of Trade and Industry (MINICOM)	Investment facilitation and economic development support	Supports investment-friendly policies, provides guidance on trade and industry standards, and ensures sectoral alignment.
Ministry of Environment	Environmental regulation and compliance monitoring	Ensures environmental sustainability of tourism investments, particularly for projects in protected areas and ecologically sensitive zones.

4.2.3 Institutional Context

Rwanda's institutional framework and policies provide a supportive environment for large-scale tourism investments benefiting from the tax incentive for tourism sector investments. The incentive is embedded within the country's broader economic and development strategies, ensuring alignment with long-term growth objectives.

Vision 2050 establishes tourism as a key pillar of Rwanda's transformation, prioritising high-end, sustainable tourism to drive foreign investment and economic diversification. This vision is operationalised through the [Tourism Master Plan](#), which outlines priority areas for tourism infrastructure, accommodation, and product diversification. Additionally, the [Investment Code of Rwanda](#) provides the legal foundation for fiscal incentives, including tax holidays, and details the conditions under which investors qualify for such benefits.

Complementary policies further strengthen the investment climate. The [Special Economic Zones \(SEZ\) Policy](#) provides additional advantages for investors developing tourism projects within designated zones, potentially granting access to enhanced infrastructure and streamlined regulatory procedures.

4.2.4 Financing and Implementation

Data on the tax incentive for tourism sector investments is limited, as there is no publicly available information on the uptake of the subsidy nor insight into corporate income tax registries. As a result, financial assessments of the incentive rely on assumptions regarding its fiscal impact and economic returns.

While the tax holiday reduces corporate tax inflows in the short term, it is expected to generate substantial indirect revenue through increased economic activity. The expansion of high-end tourism infrastructure, including luxury hotels, eco-resorts, and conference centres, is likely to increase employment and stimulate demand for local goods and services. Additional revenue streams, such as value-added tax from tourism spending and employment-related taxes, help mitigate the fiscal impact of the incentive.

In 2023, tourism revenues reached a significant milestone, surpassing the USD 500 million mark for the first time. This achievement generated USD 620 million from hosting more than 1.4 million visitors who participated in various activities.¹²⁹ Furthermore, Rwanda's emphasis on sustainable and high-value tourism aligns with its broader economic strategy, aiming that long-term returns outweigh initial revenue losses. Government projections suggest that nature-based tourism alone requires an estimated investment of USD 97.5 – 107.7 million by 2030, a gap that private sector investment can help bridge.¹³⁰

¹²⁹ World Bank. *Rwanda AFE Economic Update: Nature-Based Tourism Holds Tremendous Economic Potential*. Press Release,

21 February 2023. Available at: [Link](#).

¹³⁰ Ibid.

4.2.5 Beneficiaries

The tax incentive for tourism sector investments is designed to benefit a range of stakeholders, primarily those involved in large-scale tourism development. However, due to the lack of publicly available data on the uptake of this incentive, it is difficult to determine the extent to which different groups have accessed or benefited from it. Without insights into approved projects, investor profiles, or tax registry data, one can only infer potential beneficiaries based on the incentive's design and policy objectives.

Notable developments and their environmental implications may include the following. It is important to note that no data supports that any of the examples below have benefitted from the tax incentive; they merely serve as illustrative examples of the extent to which tourism developments can involve environmental trade-offs:

Luxury lodge developments: International operators have built premium eco-lodges near national park. For example upscale resorts around Volcanoes National Park in 2019, which were part of a wave of investments in gorilla tourism. While they boost tourism revenue, the lodges sit adjacent to critical gorilla and golden monkey habitat. Construction involved clearing land on park fringes and increasing human activity, which reports warn could disrupt animal movement and increase disease transmission risks if not carefully managed. Thus, the very investments can impact biodiversity unless mitigation measures (like buffer zones and strict visitor limits) are enforced.

Hotel and resort expansion: Beyond primate tourism, Rwanda has promoted investment in conference and leisure hotels (e.g. along Lake Kivu and in Kigali). An example is the Kivu Marina Bay Hotel, a lakeside development supported under the 'secondary city' growth programme. Such projects aim to create jobs and diversify tourism, but they also altered land use on sensitive shorelines. In the Kivu case, the hotel's construction involved lakeshore modification near important fish habitats.¹³¹ Environmental assessments have had to address wastewater treatment to prevent eutrophication of the lake. These large resorts illustrate the trade-off: tourism developments can bring local economic benefits but must be balanced against ecosystem health (in this case, maintaining water quality and shoreline vegetation).

Tourism infrastructure in protected areas: Rwanda has also partnered with private investors for infrastructure inside or adjacent to protected areas, such as safari lodges in Akagera National Park and canopy walkways in Nyungwe. Many of these investments were facilitated by public-private partnerships and generous terms (e.g. discounted concession fees or tax incentives for park facilities) to encourage development. The positive side is improved tourist experiences and revenue for conservation. However, even low-impact infrastructure can have cumulative effects – for instance, additional safari camps in Akagera require new access roads and generate more vehicle traffic, potentially disturbing wildlife. A scholarly review of East African tourism notes that even well-intentioned eco-development can lead to habitat disturbance if density of facilities is not regulated.¹³²

While none of the above cases are confirmed to have benefitted from the tax incentive, it is important to note that the primary beneficiaries are investors – particularly those developing hotels, resorts, and other high-end tourism infrastructure. These investors benefit from a corporate income tax exemption, which reduces their fiscal burden during the critical early years of operation. International hotel chains and high-net-worth tourism operators are especially likely to benefit, as they have the financial capacity to meet the USD 50 million investment threshold and the required 30% equity contribution.

¹³¹ Daniel Sabiiti, "11 Years Later, The 4-Star Kivu Marina Bay Due in June," *KT Press*, May 7, 2019. Accessible at: [Link](#).

¹³² Yves Umuhuza Mugisha, "Environmental Impact Assessment in Rwanda: Legal Framework and Challenges," *African Legal Studies Blog*, February 21, 2025. Accessible at: [Link](#).

Beyond direct investors, the tax incentive is expected to have broader economic spillover effects. Local communities stand to gain from employment and small to medium entrepreneurial opportunities, both during the construction phase and in long-term operations. The expansion of high-end tourism generates demand for local suppliers, including food producers, transport services, and artisans, creating indirect economic benefits. Additionally, tourism service providers, such as travel agencies, tour operators, and companies offering nature-based experiences, may benefit from increased visitor numbers and extended stays facilitated by the development of new tourism infrastructure.

The government and tourism authorities are also indirect beneficiaries, as successful large-scale investments strengthen Rwanda's position as a premium travel destination. Increased visitor spending, foreign exchange inflows, and long-term tourism sector growth contribute to broader economic development goals. However, without official data on investor participation and tax revenue impacts, the full extent of these benefits remains unclear.

4.3 Subsidy Redesign

To better align the tourism tax incentive with Rwanda's environmental and green growth ambitions, a redesign is proposed to broaden access while promoting the adoption of green technologies in the sector. Currently, eligibility for the tax holiday is limited to investors committing over USD 50 million with a 30% equity requirement. This structure limits uptake and excludes smaller-scale but environmentally responsible tourism developers. The revised model introduces a two-category system:

- **Large-scale investment track (current):** Maintains the existing criteria – USD 50 million investment and 30% equity requirement – as an eligibility pathway for the seven-year corporate income tax holiday.
- **Green technology track:** Introduces a new eligibility pathway for smaller tourism investments that integrate certified green technologies. This includes the use of sustainable building materials, energy-efficient systems (e.g. solar power, efficient water use systems), and other technologies that reduce environmental footprint. Investors in this category qualify for the same tax incentive benefits but at a lower investment and equity threshold, subject to REMA-defined green technology criteria and verification mechanisms.

This dual approach maintains investment scale incentives while creating a new pathway for environmentally aligned businesses to access the tax benefit.

Rwanda has made green technology a pillar of its development strategy, with government-led initiatives spanning policy, finance and partnerships. National frameworks like the Green Growth and Climate Resilience Strategy identify ecotourism and conservation as priority areas for green investment.¹³³ The government's 2019 Environment and Climate Change Policy likewise emphasises "greening economic transformation" through low-carbon tech adoption across all sectors, which includes tourism. In practice, this commitment is reflected in several programmes that encourage sustainable technologies in tourism and related sectors.

Recommended green technologies for the proposed green technology track are:

- **Solar energy systems:** Includes solar photovoltaic (PV) panels for electricity and solar water heaters for hot water supply. These technologies are widely used in African tourism operations to reduce dependence on grid power and diesel. They are especially suitable for remote lodges and hotels, lowering energy costs and emissions.

¹³³ Republic of Rwanda. (2020). Updated nationally determined contribution. United Nations Framework Convention on Climate Change (UNFCCC). Available at: [Link](#).

- **Water efficiency technologies:** Technologies such as low-flow fixtures, greywater recycling systems, and rainwater harvesting help conserve water and reduce stress on local water sources. These systems are important for developments in ecologically sensitive areas and support sustainable water management.
- **Sustainable building materials and green design:** Use of locally sourced, eco-friendly construction materials, combined with design principles that maximise natural lighting, ventilation, and thermal insulation. These measures reduce the environmental footprint during both construction and operation. Rwanda's Green Building Minimum Compliance System already promotes many of these elements.
- **Solid waste management solutions:** Adoption of composting toilets, recycling and waste separation systems, and use of biodegradable products in hospitality settings. These technologies align with Rwanda's ban on single-use plastics and national solid waste management priorities, ensuring regulatory compliance and improved environmental outcomes.
- **Electric or low-emission transport:** Includes the use of electric safari vehicles, electric motorcycles for lodge transport, and the installation of EV charging stations. These technologies support Rwanda's e-mobility strategy and reduce the carbon footprint of tourist transport.

4.4 Future Scenarios

This section explores two potential pathways for the tax incentive for tourism investments. Data gaps limit the modelling of the scenarios presented:

4.4.1 Business-as-Usual (No Re-design)

Without a redesign, the tourism tax incentive remains out of reach for most small- and medium-scale developers. Investment continues to concentrate in a few high-capital projects, often with limited environmental innovation beyond compliance. Over time, the sector may risk becoming less responsive to Rwanda's sustainability ambitions, with limited uptake of green technologies and little incentive for developers to go beyond minimum standards. This path restricts market diversity, slows down innovation, and reduces the potential for widespread environmental benefits.

4.3.2 Introducing the Green Technology Track

With the introduction of the Green Technology Track, a broader range of investors – particularly local and regional developers – gain a viable entry point into the market. The incentive encourages the adoption of low-carbon technologies and sustainable design practices across a wider range of tourism projects, from eco-lodges and community-based tourism to mid-sized hotels. Over time, this drives a structural shift in the sector, where environmental performance becomes a competitive advantage. The landscape of tourism investment becomes more inclusive, diverse, and climate-resilient, supporting Rwanda's vision of a green economy. REMA's oversight of standards and compliance ensures that environmental claims translate into measurable impact.

4.5 Action Plan for Subsidy Redesign and Implementation

Table 6. Action for Subsidy Redesign and Implementation (Tax Incentive for Tourism Sector Investments)

Objectives	Indicators	Activities	Timeframe	Stakeholders
1. Align objectives for revised tax incentive	- Formal agreement on redesign objectives among key institutions	1.1 Initiate discussions with RDB, RRA, MINECOFIN, MINICOM, and REMA on proposed dual-track incentive design	Month 0–2	REMA, RDB, RRA, MINECOFIN, MINICOM
2. Ensure institutional coordination for implementation	- Technical Working Group (TWG) established with defined ToR	2.1 Form TWG with REMA, RDB, RRA, and other key agencies to guide policy, including private sector and conservation inputs	Month 1–3	REMA, RDB, RRA, MINECOFIN, conservation organisations, private sector
3. Align legal and strategic frameworks with redesigned incentive	- Legal review completed and amendments drafted	3.1 Review Investment Code and Tourism Master Plan 3.2 Draft legal changes to support green tech eligibility	Month 1–4	REMA, RDB, MINIJUST, MINICOM
4. Define and validate green technology criteria	- Green technology criteria document approved by TWG	4.1 Draft environmental performance criteria (energy efficiency, sustainable materials, etc.) and validate with stakeholders	Month 2–5	REMA, RSB, RDB, private sector experts
5. Pilot the redesigned incentive framework	- At least 2 tourism investments piloting new track	5.1 Select pilot projects integrating green tech under new eligibility 5.2 monitor and document lessons	Month 6–9	REMA, RDB, selected investors
6. Build compliance monitoring capacity	- Training sessions conducted; digital tools in use	6.1 Conduct trainings for REMA and RRA 6.2 develop digital tools for environmental compliance tracking	Month 6–10	REMA, RRA, ICT partners

Objectives	Indicators	Activities	Timeframe	Stakeholders
7. Legislate and operationalise new incentive structure	- Legislative amendments passed and gazetted	7.1 Facilitate submission and passage of legal amendments enabling new eligibility pathway and enforcement rules	Month 6–12	REMA, MINECOFIN, MINIJUST, Parliament
8. Implement full dual-track tax incentive	- Framework operationalised and accessible to both investor categories	8.1 Roll out new framework 8.2 Communicate criteria and eligibility through RDB investment channels	Year 1 - 2	REMA, RDB, MINICOM
9. Monitor and enforce environmental compliance	- Annual compliance reports submitted; site audits completed	9.1 Conduct regular audits and site visits; enforce penalties for non-compliance	Year 1 - 2	REMA, independent auditors, RRA
10. Report publicly on results and impact	- Annual online report published with performance indicators	10.1 Develop dashboard and publish annual performance and compliance summaries	Year 1 - 2	REMA
11. Evaluate impact and refine policy	- Evaluation report completed and endorsed by TWG	11.1 Conduct a full evaluation of environmental and economic outcomes; 11.2 Revise incentive as needed	Year 2 - 3	REMA, TWG, independent evaluators
12. Scale approach and mainstream green investment incentives	- New sectors identified and roadmap for scaling approved	12.1 Identify sectors for replication; 12.2 Engage ministries and partners to expand use of green incentive design	Year 3 - 4	REMA, RDB, MINECOFIN, sectoral ministries

5. Conclusion

The analysis of the three prioritised subsidies and proposed redesign demonstrates significant transition benefits for Rwanda. These vary, including in the extent of the benefit, between subsidies and scenarios, but include direct biodiversity benefits as well as immediate sector benefits (e.g. enhanced agriculture productivity and improved energy access), job and enterprise creation opportunities (e.g. nurseries, manure production) health benefits (e.g. reduced respiratory disease as a result of reduced air pollution) and enhanced climate resilience (e.g. through reduced exposure to floods and landslides).

All these benefits result from mitigating negative biodiversity impacts – or enhancing positive impacts – while ensuring political and economic feasibility. Articulating the benefits arising from redesigning each subsidy summarised in the following will be the focus of this project's forthcoming policy briefs:

Crop Intensification Programme (CIP): Without intervention, the cost of pollution from run-off would be valued at millions of dollars (e.g. period 2007-2013 was USD 28.65 million, including effects beyond eutrophication and accompanying biodiversity loss) in high risk wetland areas. Terminating the rice subsidy would result in financial savings ranging from USD 85,000 to USD 550,000, while reductions in fertiliser imports could improve the country's balance of payments by up to USD 960,000. These savings could be reinvested in Girinka programme, ensuring broader coverage is reached in a shorter time period, along with improved manure application and enhanced research and extension services. As manure use rises, soil biodiversity improves across smallholder farms, with similar trends among larger farmers due to knowledge spillover. Over a number of years, the benefits of reduced damage to soil biodiversity and of increased organic content lead to an increase in yields.

Clean Cooking Results-based Finance (CC-RBF): The clean cooking subsidy is scheduled to conclude in 2026, with the target of reaching 500,000 households potentially unmet. The redesign proposes a continuation with more ambitious targets, i.e. a significant scale-up of the subsidy. Currently, 76.1% of Rwanda's households use firewood as their main cooking fuel, contributing to deforestation across the country. The proposed redesign prioritises hotspot areas (biodiversity-rich areas and regions of high-intensity agriculture identified in this report), ensuring that stoves are distributed where biodiversity loss is most acute. For every 1,000 clean cooking solutions installed – assuming the subsidised stove fully replaces traditional cooking methods – up to 1,800 tonnes of firewood per year could be saved, provided the stoves use alternative fuel sources that do not rely on wood, such as LPG or electricity. Therefore, the redesign also proposes integrating the subsidisation of sustainable fuel alternatives (through a voucher system), in addition to the current focus on stoves.

Tax Incentive for Tourism Investment: The proposed redesign of Rwanda's tourism tax incentive offers benefits by aligning investment incentives with the country's green growth agenda. By introducing a dedicated green technology track, the redesign expands eligibility beyond large-scale investors to include environmentally responsible small and mid-sized developers, thereby democratising access to the tax holiday. This approach encourages the integration of certified green technologies – such as solar power, water efficiency systems, and sustainable building materials – into tourism projects, reducing the sector's ecological footprint. It also incentivises innovation and market diversity, promoting inclusive growth and resilience in line with Rwanda's environmental priorities. Furthermore, REMA's role in defining and verifying green compliance helps ensure that the environmental benefits are both credible and measurable, turning the tax incentive into a tool for both economic development and biodiversity conservation.

Annexure 1 – CIP Background Information

Estimated financial, environmental and social impact

At farm level, the explicit financial impact of subsidies depends on what crops a household produces, as well as on a range of other factors that influence yield. For the five crops, maize, beans, Irish potatoes, rice and wheat, for all of which subsidised fertiliser was available, but subsidised seeds only for maize and wheat, a UNEP-commissioned study¹³⁴ estimated that the average gross revenue per hectare in Rwanda in 2014/2015 was USD 2038, while the average variable cost was USD 1039, leaving an explicit positive gross margin of USD 999/ha and a value:cost ratio of 2,00:1.

Soil nutrient run-off/depletion generates an implicit environmental cost that farming households experience in subsequent years, of which they may be aware but are seldom able to attach even an order-of-magnitude cost to. The same study estimated the average cost of this per season per hectare to be USD 637. If this cost is included, the average net margin/ha for farming households using subsidised inputs was USD 362.

The average cost of fertiliser subsidies per hectare¹³⁵, borne by government, was reckoned to be USD 31. This constitutes a social cost.

Totalling these three types of cost, the average net benefit:cost ratio for Rwandan society was 1.23:1.

Impact on women and vulnerable groups

The NAP 2018, PSTA4, RAB Strategic Plan 2020-2024 and NFP all emphasise the importance of ensuring both inclusiveness and the health of producers and consumers of agricultural output as policy goals, so that the benefits are enjoyed also by women and youth in agriculture and poor farming households, as well as by society as a whole. As an implementation component of these policies, these goals are shared by CIP.

In practice, it appears that at least the inclusiveness goal has been met only to a limited degree. Though the programme was designed to attract and benefit farmers with the smallest land holdings through the economies of scale realised by land consolidation, many such farmers have either not been able or have been unwilling to participate. Wealth¹³⁶, security of tenure, off-farm income, larger size of plot and risk aversion have all been important determinants of farmers' willingness and/or ability to engage, along with access to inputs, mechanisation, irrigation and extension services and participation in planning processes¹³⁷. Those with the greatest resources are most likely to fulfil these requirements. Consequently, 'the programme, including support mechanisms, seems to work well for relatively well-off farmers who have bigger, scattered land areas, whereas it does not work well for poor farmers with smaller plots, which is common in rural Rwanda¹³⁸.

¹³⁴ UNEP et al., *op. cit.*

¹³⁵ Assumed at NPK 20.41kg/ha, DAP 35.7kg/ha, Urea 20.32kg/ha (UNEP et al, *op. cit.*, p44). These are the average applications for the 6 districts in which the study was carried out.

¹³⁶ Weatherspoon, D.D. et al., *Rwanda's Commercialisation of Smallholder Agriculture: Implications for Rural Food Production and Household Food Choices*, Journal of Agricultural and Food Industrial Organisation, March 1, 2021

¹³⁷ Nahayo et al., *op. cit.*

¹³⁸ Muyombano, E., et al., *Land Use Consolidation in Rwanda: The Experiences of Smaller Farmers in the Musanze District, Northern Province*, Land Use Policy, vol. 99, December 2020, 105060. As NISR defines all farmers with less than 10ha of agricultural holdings to be 'small farmers' (NISR, *op. cit.*, p3), about 98% of farmers fall into this category (NISR, *op. cit.* pp28, 29), making this authoritative source of information about the distribution of CIP subsidies near useless for determining the benefits accruing respectively to 'large farmers' and 'small farmers'. The average size of farms in Rwanda is about 0.4ha and 77% of farming households own 0.5ha or less (NISR, *Agriculture Household Survey, 2020*, quoted in AU, *op. cit.*, p2).

This is also partly because smaller farmers prefer to grow a number of different crops on scattered plots, mainly for their own consumption, as a risk management strategy¹³⁹, rather than place all or a large part of their land in a land consolidation programme to produce a single crop, mainly for the market, thereby exposing themselves to greater production and market risks¹⁴⁰. Though this may not achieve CIP's objectives, it is more beneficial for biodiversity, while also potentially enhancing farmer resilience and enhancing their adaptive capacity to climate change.¹⁴¹ Of poor farmers with small plots who do participate, it is mainly those with plots over 1ha – well above the average size for the country – that really benefit¹⁴².

Gender and youth appear to be further important determinants of participation. While women farmers are evidently keen to become involved in CIP initiatives, men are more than 3 times more likely to do so¹⁴³. This may be partly because female-headed households tend to be poorer than their male-headed counterparts¹⁴⁴, but it is also likely to reflect the disproportionate burden of domestic, non-agricultural activities that most women are required to bear. The greater likelihood of men participating may also be misleading because generally, when they decide to do so, it involves the women of the household participating no less. But as this is in the role of unpaid labour, it is debatable whether they benefit from participating in CIP or not¹⁴⁵. Youth participation is reported to be low¹⁴⁶, though no reasons are given.

Overall, though, through the increase in food production¹⁴⁷ and access to productive resources that CIP has certainly generated¹⁴⁸, the programme has had a positive impact on national food security and thereby on health¹⁴⁹. As an important component of agricultural expenditure, it is also helping to reduce the number of poor households in Rwanda¹⁵⁰. However, this has been unequally distributed. While satisfaction and productivity of land have been high (for programme participants), food and nutrition insecurity, vulnerability to shocks and poverty remain a serious problem for Land Use Consolidation farmers. Two thirds of farmers reported their households did not have enough to eat in the past week. In addition, about half had experienced some kind of shock in the previous 3 years that had affected their households' ability to eat or changed their asset ownership and farmers exhibit low levels of per capita expenditure consistent with high rates of poverty¹⁵¹.

139 Bizosa, A.R., *Investigating the Effectiveness of Land Use Consolidation – a Component of the Crop Intensification Programme in Rwanda*, *Journal of Rural Studies*, vol. 87, October 2021, 213-225; Ntshinyurwa, P.D., et al., *The Positive Impacts of Farm Land Fragmentation in Rwanda*, *Land Use Policy*, vol. 81, February 2019, 565-581

140 Clay, N. et al., *Smallholders' Uneven Capacity to Adapt to Climate Change Amid Africa's 'Green Revolution': Case Study of Rwanda's Crop Intensification Program*, *World Development*, vol. 116, April 2019, 1-14

141 In recent years, researchers have investigated the effectiveness of using agrobiodiversity, and crop and crop varietal diversity, as an adaptive practice to mitigate climate-change impacts on agriculture and to contribute to rural household and community resilience. Underpinning this research by CGIAR and others, is the hypothesis that the sustained practice of crop diversification leads to ecological redundancy, which allows farmer households and their communities to produce multiple positive livelihood benefits. The literature is in wide support of this hypothesis, with findings that provide ample evidence of positive outcomes for farmer resilience, including increased yields and household incomes, improved nutrition and food security, new marketing opportunities, reduced poverty, and strengthened adaptive capacity.

142 Nilsson, P., *The Role of Land Use Consolidation in Improving Crop Yields among Farm Households in Rwanda*, *Journal of Development Studies*, 2019, vol. 55(8), 1726-1740

143 Nahayo et al., *op cit.*

144 Bayisenge, F., *Effects of Agricultural Intensification on Gender Relations in Rwanda: Perspectives of Women Farmers Involved in the Land Use Consolidation Programme*, Protestant Institute of Arts and Social Sciences, Rwanda

145 *Ibid.*

146 Rwibasira, E., *Effect of Crop Intensification on Maize Production in Ngayatara, Rwanda*, *International Journal of Agricultural Extension and Rural Development Studies*, vol.3(4), September 2016, 87-102

147 Anderson et. al., *op. cit.*

148 USAID, *op. cit.*

149 Aragie et al., *op. cit.*

150 *Ibid.*

151 USAID, *op. cit.*

A number of studies have attempted to estimate the impact of CIP and related programmes such as LUC on incomes, poverty reduction and job creation. Though it is certainly reasonable to infer a positive relationship, being able to quantify it concretely seems to have been elusive, except through modelling and simulation¹⁵². USAID's flagging of the need for improvement of the accurate and systematic collection of data for this purpose is entirely appropriate¹⁵³.

Beyond policies related directly to agriculture and land use, some tax and trade policies are also being brought to bear to boost the benefits to farmers of input subsidies. The Rwandan government has been concerned to address domestic food supply constraints by increasing the competitiveness of import-competing sub-sectors. While the main instruments used for this have been input subsidies and the strengthening of agricultural infrastructure and support institutions, locally produced processed cereals are exempted from the 18% VAT levied on competing imported products. The intention of this is to allow Rwandan producers to realise higher prices without becoming uncompetitive. Locally produced rice, wheat and particularly maize benefit from these policies.

The management of water within the energy, agriculture, urban, and industrial sectors will require cross-sectoral, coordinated decision making and policies to avoid competition for the natural resource. The government's aim to increase equitable access to water and ensure integrated water resource management has several key components to address to support the water sector's resilience. There is a need to address the funding gap to increase the level of service and reducing the cost of service-provision as a result of depleting water resources. Increasing institutional responsibility and capacity in areas of planning, project management and operation and maintenance; and monitoring systems. Rwanda's vision should focus on sustainable water resource management that results in food security, appropriate urban development, and preservation of biodiversity and ecosystem services.

Challenges and Policy Constraints in Agricultural Market Regulation

Market insulating policies, including the market price support and border protection described above, can be counter-productive for food security. The nominal rate of protection for key imported products, such as maize and rice, has been volatile and has created an uncertain policy environment that makes planning difficult, disincentivises local producers and has a negative effect on farmers' incomes¹⁵⁴.

The positive impact of the same policies on farmers' incomes has also been blunted, inter alia, by a number of supply-side constraints that increase the cost and delay the delivery of fertilisers, all of which are imported. Among these are the regulatory requirements for inspecting and testing fertilisers at ports. While there is a need for testing higher value fertilisers, there may be scope for easing the requirements, particularly for lower-value fertilisers, with associated cost and time savings, which will benefit farmers¹⁵⁵. Similarly, the phyto-sanitary testing of imported seeds has delayed deliveries to agro-distributors and producers, sometimes making their arrival too late for optimal use. In one study, more than 80% of farmers reported late delivery of inputs as an important reason for their not having participated in CIP¹⁵⁶. As imported seeds have usually already been tested in their countries of origin, such delays could be avoided by a change in regulations¹⁵⁷.

The tariffs on imported intermediate inputs for farmers and agro-processors also increase the cost of production¹⁵⁸. For such goods not available in the East African Community, the standard tariff rate is 10% ad valorem. For those that are available elsewhere in the region, the rate is 25%. Agricultural

152 See, e.g., Spielman et al., *op. cit.* and Aragie et al., *op. cit.*

153 USAID, *op. cit.*, p43

154 Anderson et al., *op. cit.*

155 Spielman et al., *op. cit.*

156 Nahayo, A. et al, *op. cit.*

157 Institute of Research and Dialogue for Peace, *op. cit.*

158 Anderson et al., *op. cit.*

machinery and equipment and raw material inputs are not subject to import duties¹⁵⁹. Equipment for blending and bagging fertilisers is exempt from VAT¹⁶⁰. However, agro-processing companies are not exempt from VAT¹⁶¹, although they pay only 50% of standard Corporate Income Tax, i.e. 15% as opposed to 30%¹⁶².

Though there is much in terms of public policy and accompanying expenditure that could presently be done and/or may need to be done in the foreseeable future to improve, or at least maintain, the effectiveness of fertiliser subsidies, few relate to policies that may to some degree counteract the objectives of CIP's subsidies.

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The tariffs on imported intermediate inputs for farmers and agro-processors also increase the cost of production¹⁶⁴. For such goods not available in the East African Community, the standard tariff rate is 10% *ad valorem*. For those that are available elsewhere in the region, the rate is 25%. Agricultural machinery and equipment and raw material inputs are not subject to import duties¹⁶⁵. Equipment for blending and bagging fertilisers is exempt from VAT¹⁶⁶. However, agro-processing companies are not exempt from VAT¹⁶⁷, although they pay only 50% of standard Corporate Income Tax, i.e. 15% as opposed to 30%¹⁶⁸.

Unintended impacts of the subsidy on biodiversity and related economic costs

'The biggest driver of terrestrial biodiversity loss in the last 50 years has been habitat conversion, in large part due to conversion of natural and semi-natural landscapes to agriculture. Nutrient loading, particularly of nitrogen and phosphorus, much of which derived from fertilisers and farm effluent, is one of the biggest drivers of ecosystem change in terrestrial, freshwater and coastal ecosystems'¹⁶⁹.

This statement, made in the context of agriculture globally, applies with particular acuteness to Rwanda and its CIP. Aggregate agricultural production grew at the extraordinary average annual rate of 7.5% between 2007 – the year in which CIP started – and 2017, driven by food crops, primarily through expansion of the area allocated to key staples, encouraged by the composition of agricultural expenditure, constituted largely by inorganic fertiliser and seeds subsidies for food crops¹⁷⁰. Depending on the season, up to 71% of farmers applied inorganic fertilisers on up to 61% of crop land¹⁷¹. Indigenous forests, grasslands and wetlands have shrunk and been replaced by ploughed fields, perennial crops

159 US International Trade Administration, *Rwanda Country Commercial Guide*, trade.gov/country-commercial-guides/rwanda-import-tariffs

160 rra.gov.rw/fileadmin/user_upload/agriculture_inputs_exempted_form_vat__3_.pdf

161 Hakizimana, N., *Impact of VAT Exemption Removal on Agro-Processing Industries in Rwanda*, Rwanda Revenue Authority, September 2016

162 AU, *Rwanda Country Food and Agriculture Delivery Compact*, 20 February 2023

163 Anderson et al., *op. cit.*

164 Anderson et al., *op. cit.*

165 US International Trade Administration, *Rwanda Country Commercial Guide*, trade.gov/country-commercial-guides/rwanda-import-tariffs

166 rra.gov.rw/fileadmin/user_upload/agriculture_inputs_exempted_form_vat__3_.pdf

167 Hakizimana, N., *Impact of VAT Exemption Removal on Agro-Processing Industries in Rwanda*, Rwanda Revenue Authority, September 2016

168 AU, *Rwanda Country Food and Agriculture Delivery Compact*, 20 February 2023

169 UNEP, *Biodiversity and Agriculture: Safeguarding Biodiversity and Securing Food for the World*, 22 May 2008

170 Anderson et al., *op. cit.*

171 NISR, *op. cit.*

and forest plantations, with a negative impact on the diversity of plant, animal, fish, insect and soil microbe populations.

This has been exacerbated by the planting of crops on hillsides, often without adequate measures to counter water and wind erosion and consequent topsoil loss. Hillside agricultural land makes up more than half of Rwanda's total surface area and 93% of land under annual and perennial crops¹⁷². Before the expansion in the area under cultivation induced by CIP, no less than 80% of farming households in hilly areas were experiencing a decline in productivity related to soil erosion¹⁷³. Against the estimated total arable area of 1.4 million hectares, 1.55 million were being used for crops in 2022 – about 2/3 for annually ploughed seasonal crops¹⁷⁴ - as well as 60% of wetland areas¹⁷⁵. To counter hillside erosion, CIP was designed to add 852 000 ha of radical or progressive¹⁷⁶ terracing, covering about 63% of hillside agricultural land¹⁷⁷, and 70 dams at an estimated cost of USD 573 million¹⁷⁸.

Bush removal, ploughing and inorganic fertilisers impact negatively on biodiversity in soils. Insect, invertebrate and microbe life is disturbed, reducing the capacity of these life-forms to breakdown and recycle crop residues into soil carbon and thereby, ultimately, soil fertility¹⁷⁹. This is exacerbated by the use of chemical herbicides and pesticides¹⁸⁰, which also reduce plant and insect diversity. Although CIP has not subsidised either herbicides or insecticides, both usually accompany the intensification of agriculture. Depending on the season, insecticides were applied on up to 92% of land under crops in 2022¹⁸¹. Aquatic and wetland biodiversity is also reduced by eutrophication brought about by inorganic¹⁸² fertiliser, herbicide and pesticide run-off into streams, lakes and dams, often far from the land on which have they been applied¹⁸³. The estimated average annual cost of pollution from such run-off for the period 2007-2013 was USD 28.65 million¹⁸⁴. However, this includes effects beyond eutrophication and accompanying biodiversity loss.

Though impacting on biodiversity only indirectly, the estimated direct cost of soil nutrient loss from run-off in 2016 was USD 571/ha, which equates to about 1/3 of the estimated average value per hectare of crops produced¹⁸⁵. Not only does soil nutrient erosion increase negative environmental externalities through soils enriched with fertilisers being swept into surface water systems, but it also reduces the crop performance possibilities of farms¹⁸⁶. Recurrent use of inorganic fertilisers can also cause soil biodiversity loss through acidification¹⁸⁷, but this is thought not to have occurred on a significant scale in Rwanda because of the widespread use of lime as a neutralizing agent¹⁸⁸. The aggregate budget allocated by PSTA4 for activities to counter biodiversity loss by improving soil health and fertility between

172 NISR, op. cit.

173 Ibid. However, by 2022, more than 90% of farmers reported using some form of anti-erosion measure (NISR, op. cit.).

174 NISR, op. cit.

175 Ibid.

176 Radical terracing entails the construction of level 'steps'; while progressive terracing uses contoured grass strips and furrows to reduce run-off. Radical terracing is required for slopes of between 13% and 55%. (United Nations Framework Convention on Climate Change (UNFCCC), Technology Needs Assessment for Mitigation and Adaptation to Climate Change in Rwanda, https://unfccc.int/TTF_TEI/file.RwandaTAPA3/)

177 NISR, op. cit.

178 Cantore, N., *The Crop Intensification Programme in Rwanda: a Sustainability Analysis*, Overseas Development Institute, 2016

179 Foodprint, *Biodiversity and Agriculture*, foodprint.org/issues/biodiversity-and-agriculture/

180 Ibid.

181 NISR, op. cit.

182 Organic fertilisers can also contribute to eutrophication, if inappropriately used (Foodprint, op. cit.).

183 UNEP, op. cit.

184 Ibid. (Author's calculations from Table 17, using average annual RWF:USD exchange rates.)

185 Ibid. (Author's calculations from Table 27, using average annual RWF:USD exchange rates.)

186 UNEP, op. cit.

187 Agriculture Victoria, *Major Effects of Soil Acidification*, <https://vro.agriculture.vic.gov.au/vro/vrosite.nsf>

188 Ibid.

2018/19 and 2023/24 was USD 3.25 million¹⁸⁹.

Among the consequences of soil erosion and excessive nutrient run-off, beyond eutrophication, is the reduced capacity of wetlands to act as purifiers and retainers of water and soil and as habitats for animal, bird, aquatic, reptile and insect life, all of which more or less directly also reduce agricultural productivity. This is made worse by the encroachment of cultivation on marshlands and wetlands.

While the many negative effects of agricultural and pastoral intensification on the environment will have added indirectly to biodiversity loss, perhaps the most direct way in which CIP will have reduced biodiversity is through the substitution of monocropping for multi-cropping, inter-cropping and mixed crop-livestock farming, despite CIP supporting the production of a range of crops. From about 28 000ha (5% of harvested land) in 2008, land consolidated under CIP grew to about 600 000ha (40% of harvested land) in 2016. Beans of various types are much the most widely grown annually planted crop, accounting for as much as 55% of consolidated land in 2016¹⁹⁰.

Agricultural intensification of this nature can also have unintended negative consequences for genetic erosion through the planting of a smaller variety of improved seeds for each crop type. Over the past decade, intense research has been carried out in Rwanda to develop new seed varieties for priority crops and several new varieties adapted to local conditions, resistant to diseases and pests have been developed and released. These have been disseminated widely to farmers¹⁹¹. However, in 2022, still only 33% of farmers planted improved seeds on 30% of plots, accounting for 32% of land sown with crops¹⁹².

As seed improvement relies on diverse plant genetic resources to facilitate the improvement of yields, the Rwandan government has been mindful to ensure that that indigenous species are preserved. Policy measures taken, starting with the national Biodiversity Policy (2011) and Biodiversity Law (2013), include implementation strategies that span most major economic sectors¹⁹³. For agriculture, these are articulated in NAP 2018 and PSTA4. RAB is responsible for the off-farm collections held at the national gene bank, field stations, experimental/regeneration sites, herbariums and botanical gardens. On-farm, through participatory plant breeding programmes, local communities have been involved in the selection of varieties and in the improvement/breeding process. But farmers participating in CIP are still encouraged to use improved seeds developed by breeders – often partly from exotic strains – rather than indigenous landraces, especially for key food security crops¹⁹⁴. The aggregate budget allocated by PSTA4 for activities to counter biodiversity loss through gene conservation and seed breeding and improvement between 2018/19 and 2023/24 was USD 9.4 million¹⁹⁵.

Summary of benefits and costs of the subsidies (and of accompanying CIP and other public sector measures to offset negative effects of subsidies)

Benefits

- Greater availability, affordability, use of fertilisers, improved seeds
- Increased food production

¹⁸⁹ Rwanda Ministry of Agriculture and Animal Resources, *Strategic Plan for Agricultural Transformation 2018-2024*, June 2018, Annex 3: Detailed Costing (author's calculations using approximate average RWF:USD exchange rate for the 6 years)

¹⁹⁰ Del Prete et al., *op. cit.*

¹⁹¹ FAO, *The State of Rwanda's Biodiversity for Food and Agriculture*, July 2016

¹⁹² NISR, *op. cit.* (data for most important of 3 crop-producing seasons).

¹⁹³ *Ibid.*

¹⁹⁴ *Ibid.*

¹⁹⁵ Rwanda Ministry of Agriculture and Animal Resources, *Strategic Plan for Agricultural Transformation 2018-2024*, June 2018, Annex 3: Detailed Costing (author's calculations using approximate average RWF:USD exchange rate for the 6 years)

- Improved food crop yields
- Reduced food crop imports
- Improved food crop prices for farmers (but little change for consumers)
- Increased household incomes
- Decreased poverty
- Increased household and national food security
- Improved nutrition and health
- Increased percentage of food crops marketed, less 'subsistence farming'
- Stronger extension services
- Greater farmer technical skills
- Improved post-harvest handling and storage capacity
- Reduced levels of soil mining/nutrient depletion
- Less soil erosion, run-off
- Better environmental/biodiversity conservation legislation
- New/stronger agricultural R&D and conservation-focused public institutions, e.g., gene bank
- Development of local improved seeds breeding, production capacity
- Reduced exotic seeds imports
- Substantial donor support for CIP and related public sector initiatives

Costs

- Substantial public expenditure on/opportunity costs of CIP and related public sector initiatives
- Increased fertiliser imports
- Increased social differentiation from participation/non-participation in CIP; strong income category and/or gender-based dimensions
- Extensive negative impacts on environmental/biodiversity conservation from, inter alia:
 - Conversion of natural and semi-natural landscapes to agriculture
 - Excessive external nutrient loading in local ecosystems, particularly from the use of inorganic fertilisers
 - Soil acidification
 - Reducing the size and capacity of wetlands to act as water and soil purifiers and retainers and as habitats for animal, bird, aquatic, reptile and insect life
 - Greenhouse gas (GHG) emissions
 - Reduced diversity of seeds, crops/crop varieties planted
 - Soil erosion and nutrient depletion from the increased use of hillsides for crop farming
 - Reduced in-soil biodiversity and organic matter content from vegetation removal, ploughing and the application of agro-chemicals
- Expenditure on/opportunity costs of public sector environmental/biodiversity conservation countermeasures

Value for money

In respect of value for money, perhaps the most immediate measure is the current benefit:cost ratio. The benefit:cost (B:C) analysis undertaken for MINAGRI, REMA, UNEP and UNDP indicates that when social and environmental costs are taken into account, for five key crops – maize, rice, beans, wheat and Irish potatoes - the use of subsidised fertilisers to implement CIP is viable at farm level ($B:C > 1$) but not at national level ($B:C < 1$)¹⁹⁶.

The use of fertilisers significantly contributed to the aggregate output achieved for the five key crops in the study conducted for MINAGRI, REMA, UNEP and UNDP¹⁹⁷. Together, the use of inorganic fertilisers and improved seeds accounted for more than 90% of increases in output growth. However, the responsiveness of output to increases in fertiliser input was low: 2.85 tons of fertiliser were needed to realise a 1-ton increase in crop output for the five crops combined, with maize being most responsive, followed by beans and rice, while for Irish potatoes and, particularly wheat, the benefit of using more fertiliser was least. For seeds, the association with increased output was also significant, but weaker. When the risks and costs of capital costs from fertiliser use are taken into account, the study indicates that the returns expected were sufficient for most farmers to want to buy fertiliser at subsidised prices ($B:C = 1.23$), except in the instance of Irish potatoes. Without subsidies, the incentive was much smaller. Overall, the finding of the study was that ‘the use of subsidies has been worthwhile to reduce the risks faced by farmers’¹⁹⁸.

At the national level, the benefit: cost ratio includes not only yields, but also associated economic, social and environmental costs and benefits. The environmental costs relate to the impact of fertiliser use on surface water resources, soil acidification and GHG emissions. Including these costs, the B:C ratio was as low as 0.32, indicating that, as currently implemented, the fertiliser programme has not achieved viability. This is ascribed by the study mainly to the high rates of soil nutrient depletion and of nutrient run-off into ecosystems, as well as to the low gross margins from fertiliser use. If CIP were enabled to reach full maturity over a long period, with soil depletion reduced to zero, the B:C ratio would reach 0.82¹⁹⁹. While some degree of run-off is difficult to avoid, improved application through more effective training, research and extension could help lower this. Achievement of breakeven is more likely to be brought about by favourable movements in international commodity prices, leading to increased gross margins, but this is also likely to be a more volatile route to viability at the national level.

Other measures of value for money include:

1. Whether the current input subsidy levels and rates and the current implementation regime are proving, or can be expected to prove, adequate to meet the targets for crop production set in PSTA4
2. Whether the subsidies are well targeted
3. The sustainability of subsidies from a fiscal perspective
4. The sustainability of benefits generated, in the absence of, or reduced levels of, subsidies
5. Opportunity costs, i.e., how else the funds invested could be deployed, perhaps more effectively

These are discussed in turn:

Are subsidies proving effective in meeting targets?

Input subsidies have certainly helped the use of fertiliser and improved seeds to grow steadily – rapidly in recent years for fertiliser²⁰⁰ – and, in some instances, reach the levels targeted by PSTA4, that is, at

¹⁹⁶ UNEP et al., *op. cit.*

¹⁹⁷ *Ibid.*

¹⁹⁸ *Ibid.*

¹⁹⁹ *Ibid.*

²⁰⁰ The quantity of inorganic fertiliser sold more than doubled between 2017/18 and 2021/22. (Spielman et al., *op. cit.*)

least 75% of farmers are using improved seeds and at least 75kg/ha of inorganic fertiliser annually on land in LUC sites by 2024²⁰¹.

Data available from NISR do not distinguish between the use of inputs on LUC and other land and as explained earlier, it is almost certain that some subsidised inputs are applied on non-LUC land. But, by 2021/22, the percentage of households with some LUC land that used fertiliser was 64% for maize, 76% for rice and 62% for Irish potatoes²⁰². For improved seeds, the percentage of farmers on LUC and non-LUC land in 2020 varied between 47% for small farmers and 76% for large farmers for maize, between 27% and 69% respectively for rice and between 3% and 49% respectively for Irish potatoes²⁰³.

However, total output²⁰⁴ is still well short of PSTA4 targets²⁰⁵, with maize in 2021/22 reaching 458 522 tons against the target of 601 275 tons (76%), rice 135 074 tons against the target of 155 755 (87%) and Irish potatoes 846 073 tons against the target of 1 194 677 tons (71%).

And, nationally, yields are also still well below targets in most instances, with maize at 1.595 tons/ha in 2022 against the target of 2.53 tons/ha (63%) and Irish potatoes at 8.612 tons/ha against the target of 11.25 tons/ha (77%). But rice achieved 4.246 tons/ha against the target of 3.48 tons/ha (122%). However, MINAGRI's Annual Report 2020-2021, reports yield on 'LUC land with the proper input use of fertilisers and improved seeds and with Good Agricultural Practices ... of 4.45tons/ha for maize, 5.2 rice ... and 18.6 for Irish potatoes'²⁰⁶.

One study²⁰⁷ notes that in recent years Rwanda seems to have experienced a deceleration in the growth of yields and output. This may be an indication that, while a growing percentage of farmers are using fertiliser, this may be concentrated among an increasing number of small-scale farmers using fertiliser at relatively low application rates, that is, that growth is being driven more by extensive than intensive use.

Collectively, the data suggest that, while the targets for fertiliser and improved seeds use for major crops may not be achieved by 2024, utilisation levels can be expected to continue approaching them, at least if the increased rate of subsidisation that followed the COVID-19/Russia-Ukraine war fertiliser price spike is maintained and/or if commodity prices remain favourable. Output and yields can be expected to improve towards targets, but improvement may become slower and more difficult to achieve. So, although the value for money of expenditure on subsidies is certainly not presently as good as was hoped when CIP was launched, it appears to have improved substantially and may continue to improve gradually, if current levels of expenditure are maintained. The likelihood of the latter occurring is considered further below.

201 *Ibid.*

202 *Ibid.*

203 *Ibid.*

204 *NISR, op. cit. (data for Season A)*

205 *Rwanda Ministry of Agriculture and Animal Resources, Strategic Plan for Agricultural Transformation 2018-2024, June 2018, Annex 6: Data Summary*

206 *It is difficult to reconcile the yields for maize and Irish potatoes with those reported by NISR, as the total areas under maize and under Irish potatoes recorded by the latter more or less equal the LUC areas for these crops reported by MINAGRI. Had the LUC areas been only a limited part of the national totals, it might have been able to explain the wide differences in yield by concluding that the yields on non-LUC were extremely low. MINAGRI does not provide information on LUC land under rice.*

207 *Spielman et al., op. cit.*

Are subsidies well targeted?

If the objective is to attract farmers into participation in the LUC programme by restricting subsidies only to farmers and crops grown on LUC land, as was initially intended, then the targeting of subsidies in this way has clearly been, at the best, sub-optimal, given the extent to which it subsidised inputs appear to be being used on non-LUC land and the evident lack of official capacity and/or will to sharpen targeting.

If the objective was to ensure inclusive participation in the benefits of subsidies, CIP has also succeeded in only partially. As was seen earlier, it is mainly farmers with larger plots who have benefited, increasing social differentiation on a wealth and probably a gender basis. In both instances, the value for money represented by expenditure on the subsidies will have been limited.

However, if the objective has since evolved to become simply increasing the usage of inorganic fertiliser and improved seeds, regardless of land consolidation and social equity considerations, then targeting is much less a concern and the value for money of expenditure will be as discussed previously. At the time of writing, no clarity on the possible evolution of the programme's objectives had been gained.

Are the subsidies fiscally sustainable?

Expenditure on the subsidies was detailed previously. For fertilisers and seeds combined, the total was about USD 34 million in 2021/22. In 2022/23, the amount for fertilisers alone was almost USD 30 million. And it is likely that aggregate demand for fertiliser will continue to increase and, with this, growing pressure for public spending on subsidies²⁰⁸, despite government's stated intention 'to progressively exit from subsidies while ensuring that the initial purpose of subsidies is achieved'. As noted earlier, the exit strategy manifested itself in reductions on the rates of subsidy before COVID-19 and the Russia-Ukraine war, but these were then reversed and spending on fertiliser subsidies trebled between 2020/21 and 2022/23.

With fertiliser prices having fallen significantly since then, total expenditure on subsidies is likely to have declined and MINAGRI may find it possible to reduce the rates of subsidy, thereby helping to reduce public spending further. But if the initial purpose of the subsidies was to encourage farmers to use more fertiliser to increase yields and output, IFPRI's analysis finds that this may negatively affect the growth of fertiliser use, use intensity and yields, output and food prices. On the other hand, it also finds that maintaining subsidies at their current rates, as well as the overall budget allocation for fertiliser subsidies, may lead to shortages and rationing of subsidised fertiliser and/or to growing shortfalls in the budget allocated for subsidies, for which government ultimately has to foot the bill.²⁰⁹

In this context, it is important to note that about half of all public expenditure on agriculture in 2015/16 was focused on assisting priority groups of commodities and that of this, CIP priority crops (food crops) absorbed 79%. This equates to no less than about 40% of total public sector agricultural spending and 2.4% of total government spending, mostly in the form of input subsidies. Just as important is that while about half of all public expenditure on agriculture was covered from donor sources, donors preferred not to fund subsidies and contributed only about 30%²¹⁰. So, the fiscal strain of funding subsidies for CIP, mainly for fertiliser, is substantial. Few other specific subsidies, if any, will have equalled or exceeded this. This makes it particularly important to monitor the impact of CIP spending carefully, not only in respect of the objectives mentioned in section 1, but also in respect of biodiversity.

208 Spielman et al., *op. cit.*

209 *Ibid.*

210 FAO, *Analysis of Public Expenditures in Support of Food and Agriculture in Rwanda, 2011/12-2015/26, 2017*. MINAGRI's Annual Report 2020-2021 records only a small fraction of this expenditure for CIP.

IFPRI concludes by recommending the ‘cautious, time-bound continuation of (CIP) subsidies, accompanied by strategic reductions in subsidy rates, an increase in the budget allocated to subsidies and extensive changes to subsidy management, credit provision, targeting and the open market for inputs’²¹¹. It remains to be seen if the budget allocated for CIP subsidies will be increased, or even maintained. That is, whether government considers the subsidies to be delivering adequate value for money.

A key question for any subsidies aimed to increase economic activity to answer is how long they are justifiable, bearing in mind the inherent opportunity costs to society. Although there is also clearly a social equity dimension involved – a high percentage of the poorest households in the country benefit from CIP subsidies – if the primary aim is to boost local production to increase national food security and reduce the country’s reliance on food imports, then subsidies – whether in the form of input subsidies or of import tariffs – can really only be justified on an ‘infant industry’ basis. That is, as a way to ‘kickstart’ the efficiency of local producers to enable them to reach a level of productivity at which they can compete on an unsubsidised basis with imports, recalling that they do always have the inward transport costs of imports as a measure of protection.

With CIP input subsidies now having been provided for 17 years, it is an open question how long their high opportunity costs to Rwandan society at large should continue to be borne.

Sustainability of benefits in the absence of, or reduced levels of, subsidies

A list of benefits of the subsidies was provided previously. Of these some, including purchases of fertiliser, yields, food production, food security and nutrition, are direct and will be directly and negatively affected by reductions in the rates of subsidy and/or in public expenditure on subsidies. While IFPRI’s analysis confirms this, it does not attempt to estimate the size or incidence of the likely impact, and no attempt will be made to do so in this short report.

Other benefits listed, such as extension services and the operation of the national gene bank, are less likely to be negatively affected and may even be positively affected in some instances if they are seen as being able to compensate for a reduction in the rates or levels of subsidy. Extension services, for example, may be one such instance. Benefits least likely to be affected negatively by reduced spending on subsidies may be viewed as representing most enduring value for money.

Opportunity costs of subsidies

For an amount as large as 2.4% of national public expenditure, the opportunity costs are commensurately large. While they obviously extend to all aspects of public spending for the benefit of Rwandan society, only options for improving the biodiversity footprint of CIP, while minimising any negative impact on the achievement of the programme’s objectives, are relevant in this report. These are considered below.

Transparency The transparency of subsidies relates to the degree to which all relevant details about its objectives, scope, mechanisms and requirements for potential beneficiaries are known by the public, as well as to knowledge about how closely the subsidies are adhering to their design and how well they are performing. Publication and monitoring and evaluation (M&E) are important for assessing, inter alia, equity, effectiveness and efficiency and for good governance.

Little explicit information is available about how well CIP and its subsidies were and are publicised. But, judging by the rapidity of the roll-out from 2008 of the LUC programme, as an integral part of CIP, it would appear that most rural households were at least well aware of CIP from early on. This would almost certainly have involved a basic understanding of CIP and of the need to participate in land consolidation to qualify for CIP benefits, including subsidies and extension support. By the end of 2008, 85 000 households were already participating in LUC/CIP. Two years later, at the end of 2010,

211 Spielman et al., op. cit.

this number had grown to 750 000²¹². The main methods for disseminating information, beyond word of mouth, were radio, TV and community meetings²¹³.

Neither LUC nor CIP include ‘a systematic and consistent reporting process to generate accurate and detailed official data related to the programme’²¹⁴. However, MINAGRI does provide high level coverage of CIP and LUC performance and expenditure against budget²¹⁵ in its annual reports and, since 2012, NISR has provided much more detailed annual series on, inter alia, crop production, cultivated and harvested area, crop yields, agricultural inputs and practices, crucial for monitoring progress on agricultural programmes and policies in Rwanda. These series include information about the use of inorganic fertiliser and improved seeds, by crop. A limitation is that all NISR series are assembled on a national or district basis, not on progress in respect of LUC consolidation or on CIP subsidised programmes specifically. However, together, these two annual publications do offer a rough and ready way of monitoring CIP and LUC implementation and performance, even if few programme participants are likely to try to do this. This indicates a reasonable degree of transparency.

Political will and appetite for subsidy reform

CIP’s fertiliser and seeds subsidies are certainly costing a great deal: 2.4% of total public expenditure is a very substantial amount for a single development programme and might well justify a reduction. But considering that as much as 70% of Rwanda’s working age population and 80% of households²¹⁶ are employed in agriculture²¹⁷, that the target for the percentage of the national public sector budget allocated to agriculture set by CAADP for all African countries is 10% and that agriculture generates no less than 31% of GDP²¹⁸, of which the food crops qualifying for CIP subsidies contribute almost 80%²¹⁹, the amount does not seem out of proportion.

A recent analysis conducted by IFPRI concludes that ‘the continued importance of public expenditure and investment for growth and job creation beyond agriculture and for poverty reduction and diet quality improvement among rural and urban households ... justifies an increase in the budget allocated to MINAGRI, which has been stagnant, even declining when measured in constant prices, since PSTA4 began in 2018 ... increasing the share that is allocated to input subsidies targeting those crops that are already grown in areas with developed progressive terraces can improve returns to total agricultural expenditure. This is because productivity gains are modest on progressive terraces without adoption of modern inputs and better management practices’²²⁰. As 53% of the 59% of Rwanda’s land area used for crops (excluding tea plantations) is classed as hillside agriculture²²¹ and 90% of terracing is progressive (as opposed to radical)²²², the implication is that increasing spending on CIP subsidies would increase the rate of return on agricultural expenditure in terms of output, jobs, poverty reduction and diet quality. If reform were to involve a reduction in spending on CIP subsidies, it would be hard to justify from both an economic and a social perspective, as well as politically, given that such a substantial proportion of the voting population benefits from them.

212 USAID, *op. cit.*

213 IRDP, *op. cit.*

214 *Ibid.*

215 Caveat: MINAGRI’s information about spending on CIP does not appear to be comprehensive and the information that it provides on yields is difficult to reconcile with NISR’s (see footnotes 109 and 113 above).

216 NISR, *Agricultural Household Survey, 2020*

217 NISR, *Labour Force Survey Trends, May 2023*, <https://www.statistics.gov.rw/file/download>

218 Rwanda Development Board, *Agriculture Overview*, <https://www.rdb.rw/investment-opportunities>

219 Food crops make up 58% and horticulture (fruit, vegetables and flowers) 22%, but flowers are not included in CIP. *Agroberichten Buitenland (TRAIDE)*, Rwanda’s Agri-Economic Outlook, April 2024, <https://www.agroberichtenbuitenland.nl/binaries/>

220 Aragie, E. et al., *Public Investment Prioritization for Rwanda’s Inclusive Agricultural Transformation: Evidence from Rural Investment and Policy Analysis Modeling*, IFPRI, Rwanda Strategy Support Programme, Working Paper 03, February 2022, p4

221 NISR, *op. cit.*, 2023

222 RAB, *Land Husbandry Unit and Interventions*, June 2016; see also footnote 81 above.

While there is no indication that the outgoing government's²²³ spending on agriculture or subsidies have been an issue of political controversy – on the contrary, its development transformation has received widespread support²²⁴ - this does not indicate that there is no political will or appetite for reform, because reform does not necessarily involve political costs. The commissioning of an investigation into the effectiveness and efficiency of fertiliser uses by MINAGRI and REMA in 2016²²⁵ suggests the opposite and, as IFPRI notes, ‘the Rwandan government and its partners continually ask themselves whether PSTA budget allocations represent the best use of scarce public resources’²²⁶. So, there is evidence of both political will and political appetite for reform, but perhaps more to increase the efficiency and effectiveness of spending on input subsidies than to reduce their impact on biodiversity. However, to the extent that biodiversity concerns are a subset of broader environmental concerns, there is no doubt that they are also an important priority for MINAGRI and REMA in respect of fertiliser subsidies, because the 2016 study ‘was conducted ... to improve the cost-effectiveness and ecological sustainability of inorganic fertiliser, both from a farm and a national perspective’²²⁷.

Annexure 2 – CIP Redesign Options (Details)

Table 5 below outlines plausible options for a CIP redesign aimed at reducing harm to biodiversity while considering political feasibility to ensure both environmental benefits and practical implementation. **More details provided below the table.**

Table 8. Redesign Options (CIP)

Redesign Option	Details	Biodiversity Impact and Political Feasibility
Subsidise production of animal-based organic fertilisers	Encourage on-farm use of manure by promoting best practices in livestock management. Support larger farms in integrating livestock through zero-grazing systems, ensuring that manure is effectively collected and used to improve soil fertility.	High biodiversity impact – strong potential to improve soil fertility and reduce inorganic fertiliser use. Politically feasible if link to existing livestock programmes (Girinka) is established.
Subsidise agroforestry	Promote tree planting within cropland to improve soil stability, enhance biodiversity, and reduce erosion. Provide subsidies for appropriate tree seedlings to incentivise uptake, especially for smallholder farmers.	High biodiversity benefits – soil health improvements and erosion control. Politically viable with moderate investment and farmer engagement.
Re-evaluate fertiliser subsidies for rice in wetlands	Re-evaluate fertiliser subsidies for rice in wetlands due to high environmental costs, including water pollution and habitat degradation. Consider a phased reduction of subsidies with compensation for affected farmers.	Reduces wetland degradation, thus increasing flood regulation capabilities, thereby increasing climate resilience – but affects major rice producers; politically sensitive and requires compensation measures.

²²³ A national election is being held at the time of writing.

²²⁴ Bloomberg, *Rwanda's Besieged opposition Lives in the Shadow of Paul Kagame*, 12 July 2024

²²⁵ UNEP et al., *op. cit.*

²²⁶ Aragie et al., *op. cit.*, February 2022, p5

²²⁷ UNEP et al., *op. cit.*, pv

Subsidise improved fallows	Encourage planting of leguminous cover crops during fallow periods to enrich soil nitrogen and improve biodiversity. Support farmers with seed subsidies and technical assistance to maximise soil fertility restoration.	Enhances soil fertility and biodiversity – feasible if integrated with existing seed subsidy and research programmes.
Expand seed subsidies to indigenous crops	Support the production and use of indigenous crop varieties alongside improved seeds to maintain genetic diversity. Ensure continued cultivation of indigenous varieties through targeted subsidies for selected farmers.	Supports genetic diversity and resilience but requires monitoring to ensure indigenous seed use. Politically feasible if framed as food security enhancement.
Increase the number of crops eligible for fertiliser subsidies	Expand the list of crops eligible for fertiliser subsidies to promote crop diversity and reduce monocropping. Support broader adoption of climate-resilient and regionally suitable crops.	Encourages crop diversification but biodiversity gains are likely to be limited, with potential for increased biodiversity loss. Politically feasible but with marginal impact.
Subsidise off-farm production of plant-based organic fertilisers	Support rural enterprises in producing plant-based organic fertilisers, including compost and bio-fertilisers, to improve soil health and reduce dependence on inorganic fertilisers. Promote localised production to minimise transport costs.	Moderate biodiversity benefits through improved nutrient cycling; politically feasible if linked to existing subsidy budgets.
Subsidise use of organic fertilisers	Encourage greater use of animal and plant-based organic fertilisers as a complement to inorganic fertilisers. Provide training on composting techniques and improve accessibility of organic inputs.	Supports soil fertility and reduces inorganic fertiliser reliance, but transport and scaling challenges limit feasibility.
Subsidise reduced/ no-tillage conservation agriculture	Promote conservation agriculture practices such as reduced tillage and residue retention to protect soil structure and microbial life. Ensure adequate training and availability of organic amendments to prevent yield losses.	Reduces soil degradation and carbon emissions but may require financial support during transition; moderate feasibility.
Subsidise Integrated Pest Management (IPM)	Support intercropping and alternative pest control methods to reduce reliance on chemical pesticides. Promote crop rotations and natural pest-repellent plants to enhance biodiversity and pest resistance.	Improves biodiversity and reduces chemical use but requires training and additional labour; moderate feasibility.
Subsidise increased fallows	Provide incentives for leaving land fallow periodically to allow soil fertility and biodiversity to regenerate. Compensate farmers for short-term income losses to encourage wider adoption.	Restores soil health and biodiversity but reduces short-term farm output; politically challenging due to potential income losses.

Expand seed subsidies for all crops receiving fertiliser subsidies	Extend seed subsidies to all crops currently receiving fertiliser subsidies to promote more diverse crop production. Ensure improved seed access for smallholder farmers to enhance productivity.	Encourages crop diversification but biodiversity benefits may be uncertain; politically feasible but marginal impact.
Make compliance with best practices a condition for subsidies	Introduce regulations requiring subsidy recipients to follow best farming practices, such as soil conservation techniques and responsible fertiliser use. Strengthen extension services to ensure compliance.	Ensures responsible fertiliser use but requires significant monitoring capacity; politically feasible but logistically challenging.
Target subsidies to small farmers, women, and youth	Direct subsidies towards disadvantaged groups to improve equity while reducing large-scale monoculture expansion. Prioritise small farmers, women, and youth to ensure broader participation in sustainable agriculture.	Improves social equity and biodiversity but requires strong implementation mechanisms and biodiversity loss mitigation measures; politically feasible.
Establish buffer zones along water bodies to reduce runoff	Establish protective buffer zones along rivers, lakes, and dams to prevent fertiliser runoff and protect aquatic biodiversity. Implement strict monitoring and support alternative farming practices in affected areas.	Protects water bodies and aquatic biodiversity but may reduce farmable land; politically difficult without compensation.

1. Subsidise the off-farm production of plant-based organic fertilisers to encourage their wider application

Using the correct combination of inorganic and organic fertiliser also requires that adequate quantities of both are on hand. Having sufficient inorganic fertiliser is a function, on the one hand of the distribution system and, on the other, of farmers' cash resources. Both have been the subject of analyses that have focused on the effectiveness, efficiency and economic sustainability of subsidies which have recommended, inter alia, the accelerated privatisation of distribution services and greater attention by government, NGOs and the private sector to credit provision²²⁸.

In respect of organic fertiliser, there is evidence that organic fertiliser is often in short supply²²⁹, even though it is widely used. Organic fertilisers were used on between 52% and 85% of agricultural land in 2022, depending on the season²³⁰, though it is not recorded what part of this was plant-, rather than animal-based. Being a high bulk, low value item, it is seldom cost-effective to transport it any significant distance, particularly on poor rural roads. So, farming households either have to produce it themselves - from crop residues, for plant-based organic fertiliser - or it has to be produced by someone else nearby. As this too involves the cost of transport of high bulk, low value raw material, it is no less difficult to make profitable. For maize – by far the most important cereal crop – the recycling of crop residues for fertiliser is surprisingly low – less than 30%²³¹ – perhaps because most is used for livestock feed.

A subsidy for off-farm plant-based organic fertiliser production, with the objective of making it a financially worthwhile business opportunity for rural youth, but that could also help to increase the returns on existing CIP subsidies by helping farmers to apply best practice Integrated Soil Fertility

228 See, e.g., Spielman et al., *op. cit.*

229 IRDP, *op. cit.* An evaluation that the author undertook of the small-scale organic sector in South Africa in 2023 revealed the same.

230 NISR, *op cit.*, p iv

231 World Bank, *Climate Smart Agriculture in Rwanda*, 2015, p8

Management, could therefore be justified. The product range could readily be extended to include moisture-retaining mulch, which is made from similar inputs, also helps to increase soil productivity and is integral to conservation cultivation²³².

There would need to be reasonable prospects for improved rural roads, or for the development of more efficient processing technology – perhaps with the assistance of public agricultural R&D services – or for enterprises to achieve economies of scale through growth, for the industry to sustain itself without on-going subsidies.

In principle, funding for such a subsidy could be generated by a deduction from the amount allocated for inorganic fertiliser subsidies, without any negative effects on yield, etc., on the grounds that being able to apply organic fertilisers/mulches more widely should sustain yields at the same time as having a beneficial impact on environmental sustainability and biodiversity.

But in practice, this might not be seen as equitable, because many farmers will not purchase fertiliser produced by such enterprises but will nevertheless receive a smaller subsidy on the inorganic fertiliser that they use, even if the reduction is small, and might therefore buy less, with negative consequences for yield, etc. So, if a subsidy is to be introduced to boost the off-farm production of organic fertiliser, it would be better to fund it either from savings generated by lower international fertiliser prices or by reductions in subsidy rates made possible by lower international prices or from a youth enterprise development fund.

The costs of monitoring any such subsidy should not be greater per enterprise than for monitoring farm enterprises. Given the difficulty of monitoring the quantity of organic fertiliser produced by an enterprise or to verify sales, it would be most practical either to make the subsidy a uniform amount, payable annually on proof of production and income from sales, or, as this would disincentivise growth, a fixed (or even a gradually increasing) percentage of income from sales, to encourage growth.

Perhaps most important is that yields should not fall on the partial substitution of organic for inorganic fertilisers. For this to be achieved, the combination of the two needs to be correct. This requires research, experimentation and effective farmer education – all time and human resource consuming. It is critical that sufficient provision be made for this in public sector planning and budgeting. Failure to do so may result in yield losses and unfairly discredit what should be a technological adaptation that benefits both income and biodiversity.

2. Subsidise the production of animal-based organic fertilisers to encourage their wider application

A second major source of organic fertiliser is animal excreta, that is, manure. Arguably the most thorough study of fertiliser policy in Rwanda – the 2016 report ‘Effectiveness and Efficiency of Fertiliser Use in Rwanda’, commissioned by MINAGRI and REMA with the support of UNEP and UNDP – made the increase in the organic content of soils, inter alia through the use of manure, its first recommendation²³³.

About 1.9, or 83%, of Rwanda’s 2.3 million farming households own livestock, 74% of whom operate mixed crop/livestock farms²³⁴. So the great majority of crop farmers generate manure on farm. Only in the eastern savannah region and in a small part of the western hillside agricultural region, totalling less than 6% of farmland, is pure rangeland to be found²³⁵.

²³² REMA, *op. cit.*

²³³ UNEP, *op. cit.*, 2016, p65

²³⁴ NISR, *Agricultural Household Survey 2020*, pp iii, vi, vii

²³⁵ NISR, *op cit.*, 2022, pp3, 4

Most rural and peri-urban farming households that do not benefit from livestock ownership are the poorest²³⁶. Over the past two decades, MINAGRI's Girinka programme has sought to address this shortcoming by providing dairy cows to low-income households – one per household – and has now distributed almost half a million cows²³⁷.

For smallholdings – 77% of farmers have an average of 0,5ha of land²³⁸ and the National Institute of Statistics of Rwanda classifies more than 98% of crop farmers as smallholders²³⁹ – Girinka beneficiaries who own a dairy cow could, theoretically, generate as much 12 tons of manure for fertiliser a year²⁴⁰ on farm, if the animal is well fed and cared for and all manure is collected. All Girinka livestock are required to be fed on a zero-grazing basis, i.e., stall-fed with livestock feed, though it is not clear how widely this is enforced. This output of manure should be more than adequate for all of 0.5ha of cereal and even vegetable crops²⁴¹. While most households own smaller livestock, these generate negligible quantities of additional manure, even if some – such as chicken manure – are better fertilisers.

So no subsidy incentives should be needed to increase manure production. On the contrary, some savings should be possible for CIP, as less inorganic fertiliser should be needed. As there is some disagreement in international literature as to whether the substitution of organic for inorganic fertiliser results, at least initially, in a drop in yields, such savings could constructively be redeployed to cover any reduction in yields and income, which should be of a short- to medium-term nature. For areas averaging 0,5ha, the labour intensity of the process should not constitute a significant barrier. For areas averaging 0,5ha, the labour intensity of the process should not constitute a significant barrier.

The roll-out of the Girinka programme should be continued until all eligible low-income households have been reached and greater emphasis should be placed on strengthening public research and extension services to improve livestock maintenance and the application of manure, in accordance with the key recommendations of the 2016 MINAGRI/REMA report²⁴². Amongst others, this could involve the employment of more agricultural extension staff and local government agronomists and increasing the number of Farmer Field School staff and meetings with local communities²⁴³. The cost of all of these is borne by central or local government, as CIP itself makes no provision for these services²⁴⁴. So a workable mechanism would need to be found to transfer CIP savings to other government entities.

Ideally, the pace of the Girinka roll-out should be accelerated. To the extent that savings on CIP subsidies from substituting organic for inorganic fertiliser materialize, an alternative or complementary use of such savings would be to allocate them for this purpose. To date, it appears that rather less than half of eligible households have benefited from Girinka during the 18 years of

236 Kim, S.K. et al., *Revisiting Rwanda's Agricultural Intensification Policy: Benefits of Embracing Farmer Heterogeneity and Crop-Livestock Integration Strategies*, Food Security (2022), 14:637-656, p645, <https://doi.org/10.1007/s12571-021-01241-0>

237 See pp52-55 below.

238 NISR, op. cit., 2020, p v

239 NISR, op. cit., 2022, pp28, 29

240 Alice Ferguson Foundation, *Cow In and Out*, <https://fergusonfoundation.org/lessons.cowmoreinfo>

241 Farmers Weekly, *Using Manure as Fertiliser: Mistakes to Avoid*, <https://www.farmersweekly.co.za/how-to-crop/using-manure-as-fertiliser>

242 UNEP, op. cit., 2016, pp65, 66

243 Ibid., p59, 60

244 Ibid., p61

the programme's existence²⁴⁵ and that it will need to continue for a similar period to reach all eligible households²⁴⁶.

For larger farms, most of which will not have participated in the Girinka programme, and most of which will probably have prioritized producing crops over integrating livestock into their farming models, on-farm manure will not be in such ready supply. For them, finding adequate nearby supplies, transport costs and the labour intensity of applying manure do all present challenges with accompanying costs.

Again, savings for CIP from the reduced demand for inorganic fertiliser could be used to help cover these costs to incentivize greater use of organic fertiliser, as well as any temporary fall in yields. To avoid such a subsidy becoming a permanent commitment for CIP, its availability could be limited, say, to the period during which yields might be expected to recover to the level they were at before the reduction in inorganic fertiliser use. However, this might possibly result in large farms becoming less enthusiastic about sourcing and applying manure. An alternative approach would be to incentivize large farms to build their own dairy herds on a zero-grazing basis, similar to Girinka, to avoid using crop residues for feed rather than compost. Not only would this generate more manure on farm and increase the supply of milk, but large farmers should also be better placed to secure the capital needed for this, either from their own sources or through loans. The savings for CIP on fertiliser subsidies could be used to subsidise the cost of commercial borrowing for this purpose. Again, emphasis should be placed on strengthening public research and extension services to improve livestock maintenance and the application of manure.

Subsidise agroforestry

CIP has impacted negatively on biodiversity both above ground, by reducing the number of plant types and natural vegetation cover, and below ground, by reducing soil organic content and disturbing or destroying in-soil insect, invertebrate and microbe life through ploughing. In addition, through expanding cultivation on hillsides, the programme has tended to increase water and wind erosion and nutrient run-off.

The planting of trees, interspersed with crops, can be used to counteract all of these unintended negative consequences. The relatively unmechanised techniques used on most of the small-scale farms and the hillside agriculture that dominate Rwandan agriculture make this style of farming are well suited to agroforestry. Many small farmers are aware of the benefits for erosion, soil composition and biodiversity that trees bring and do already engage in low levels of agroforestry²⁴⁷. However, tree seeds and seedlings represent a further investment cost for farmers beyond fertiliser and annual crop seeds, but with fewer immediate, although more long-term, benefits. This makes many farmers, particularly those with lower incomes, reluctant to spend on seedlings.

A subsidy for appropriate species of seedling could be used to encourage purchase and planting. As trees take a number of years to grow and deliver benefits, farmers are often reluctant to spend on

245 Based on the following data and assumptions: (i) approximately 420 000 households received a cow each between 2006 and 2024 (see section 2.2 below); (ii) Rwanda is estimated to have about 2.3 million farming households, of which 61.3% are engaged in crop farming (NISR, Agricultural Household Survey 2020, p iii); (iii) it is assumed that all of the 78.1% of farming households engaged in livestock farming have one or more cows and therefore do not qualify for Girinka assistance; (iv) the percentage of farmers in Rwanda that qualify as smallholders is estimated by various studies as being between 70 and 83.1% (Google.com/search/what percentage of Rwanda's farmers are smallholders – it is assumed here that the percentage is 75%; (v) on this basis it can be estimated that there are around 1 million eligible households, about 42% (420 000) have already benefited.

246 The programme budgets to spend 8% more each year (see section 2.2 below), although a significant part of this increment can be reckoned to be absorbed by the rising price of dairy cattle, given the steady improvement in milk production per cow experienced to date (International Livestock Research Institute, Rwanda Livestock Master Plan, 20 August 2017, p27).

247 Mugabowindekwe, M., et al., *Trees on Smallholder Farms and Forest Restoration are Critical for Rwanda to Achieve Net Zero Emissions*, Communications Earth and Environment, 5, Article no. 113, March 2024, p9

them²⁴⁸ Important advantages are that it would have only a small negative impact, if any, on the area cultivated by farmers and on their use of inorganic fertiliser and improved seeds. No targeting would be needed – all CIP participants qualify – it would be easy to administer, and it might be subject to fewer leakages than fertiliser and seed subsidies.

In addition, the benefits in terms of trees planted would be long lasting, making it easy to terminate the subsidy without negating its positive effects. An appropriate rate of subsidy would need to be determined, as well as the likely appetite for subsidised seedlings, budget needed, funding available and expected impact. Accompanying measures needed include awareness building, training and research and extension support.

3. Subsidise reduced/no tillage conservation agriculture

Conventional use of inorganic fertilisers involves a number of ploughing activities to prepare the soil for maximum up-take and highest yields. As already noted, all ploughing disturbs and damages soil biodiversity. In addition, mechanised ploughing generates GHG emissions and causes soil compaction, especially after heavy rains, and the soil then needs to be loosened again to allow for better moisture absorption from subsequent rains and to control weeds, involving further ploughing²⁴⁹.

Conservation agriculture involves reduced, or even no, tillage, crop rotation or intercropping and the retention of residues and/or use of mulch²⁵⁰. While this damages soil biodiversity to a lesser extent – or not at all, for no-till – and is cost-saving, the capacity of soils to absorb inorganic fertiliser distributed on the surface is reduced. The less tillage, the slower is absorption and the greater is the likelihood of loss of fertiliser through wind or water erosion. For this reason, the use of inorganic fertiliser is usually accompanied by organic fertiliser and/or mulch. The amounts needed of these supplements vary inversely with the intensity of tillage²⁵¹.

Over a number of years, the benefits of reduced damage to soil biodiversity and of increased organic content lead to an increase in yield, but the years following the reduction in the application of inorganic fertiliser, yields tend to fall²⁵², with all of the negative impacts on output, incomes, food security and nutrition that it was accepted should be avoided.

So, while in principle it might be justified to subsidise the use of minimum or no-till techniques to improve soil biodiversity and to reduce the quantities of inorganic fertiliser needed for conventional cultivation, thereby also reducing the high cost of CIP, if this were to be done, it would have to be accompanied by some form of income supplementation for farmers who adopt these techniques. In addition, if adoption were rapid and widespread, increasing imports of the commodities concerned would also be necessary. These additional costs would offset or even negate the savings on inorganic fertiliser subsidies. To avoid this, a further requirement would be for the uptake of a conservation farming subsidy to be gradual and controlled.

248 Stainback, G. et al., *Smallholder Agroforestry in Rwanda: A SWOT-AHP Analysis*, Small-Scale Forestry, 2011, DOI 10.1007/s11842-011-9184-9

249 See, e.g., Grain South Africa, *Conventional vs Minimum Tillage and Its effect on Soil*, January 2018, <https://www.grainsa.co.za/conventional-vs-minimum-tillage-and-its-effect-on-soil>

250 See, e.g., Rushemuka, P.N., et al., *Enhancing Agricultural Resilience in Eastern and Southern Africa: Key Findings and Recommendations for Rwanda*, CIMMYT/RAB, undated (2018?)

251 A recent study in Kenya found that as much as 5 tons/ha of crop residue/organic fertiliser were needed on no-till land. (Kinyua, M, et al., *Optimizing Interaction between Crop Residues and Inorganic Nitrogen under Zero Tillage systems in a Sub-Humid Region of Kenya*, Heliyon, vol. 7, Issue 9, September 2021, <https://doi.org/10.1016/j.heliyon.2021.e07908>

252 See, e.g., REMA, *op cit.*, 2010, p4

There would also be a number of practical challenges. Perhaps the most significant of these is that choosing the right technique depends on a range of factors, soil characteristics, slope, moisture content, climate, crop type, season, etc.²⁵³. As with applying a mix of organic and inorganic fertiliser optimally, this needs the assistance of agricultural research and extension services, whose capacity is limited. It also calls for adequate quantities of organic fertiliser/mulch to be available on-farm or nearby. And it makes the basis for determining the subsidy complicated and perhaps difficult for farmers to understand.

Desirable as it may be subsidising conservation tillage may therefore not be a priority option for CIP subsidy redesign.

Some conservation good practices, such as crop rotation, should not need subsidy, as they ought not to involve significant costs for farmers. CIMMYT's recommendation of maize-bean crop rotation²⁵⁴, may have particular relevance for CIP participants. Other conservation good practices, such as regenerative and organic techniques, exclude or do not necessarily involve the use of inorganic fertilisers and are therefore not relevant for this study.

4. Subsidise Integrated Pest Management (IPM)

During the two main annual extensive field crop seasons, typically between 15% and 20% of farmers use chemical herbicides. But during the main vegetable and rice growing season, as many as 90% do²⁵⁵. IPM offers an environment-friendly alternative or complement to chemical herbicides for pest control that also increase plant, soil and insect biodiversity²⁵⁶.

There are several ways in which IPM can be implemented. Some, such as the planting of pest resistant varieties, are already encouraged through CIP's subsidy for improved seeds²⁵⁷. Intercropping food crops with other crops, which may themselves be other food or non-food crops, is another standard IPM technique²⁵⁸. For example, edible herbs, such as sage, rosemary and basil, and marigolds help repel pests that attack many types of vegetable²⁵⁹. For extensive field crops, such as maize, legumes as well as some types of vegetable, and even other extensive field crops, such as wheat, can be used²⁶⁰. So, it would be logical for subsidy redesign for CIP to include a subsidy for intercropping to promote IPM to increase biodiversity, while maintaining or boosting yields, both for extensive and intensive field crops.

However, there are again challenges. Like most other redesign options, training at scale would probably need more capacity in extension services. For intercropping to be applied in a way that does not lead to yield losses, training and experience gathered over a number of seasons is needed. Self-selection may make it possible to avoid the complications of targeting, but because there are so many variables in intercropping, it may be difficult to find a basis for determining the subsidy that farmers can easily understand and see as equitable.

253 Ibid.

254 Rushemuka et al., *op. cit.*

255 NISR, *op. cit.*

256 Gardening4Joy, *Companion Planting for Pest Management in the Vegetable Garden*, 27 April 2021, <https://www.gardening4joy.com/companion-planting-for-pest-management-in-the-vegetable-garden>

257 African Union, *Rwanda Food and Agriculture Delivery Compact*, undated, p9; International Potato Centre, *Cultivating Innovation: Transforming Rwanda's Potato Industry with New Varieties*, <https://cipotato.org/blog/cultivating-innovation-transforming-rwandas-otato-industry-with-new-varieties>, 10 May 2024

258 Mir, M.S. et al., *Role of Intercropping in Sustainable Insect-Pest Management: A Review*, *International Journal of Environment and Climate Change*, Vol. 12, Issue 11, 27 October 2022, DOI 10.9734/ijec/2022/v12i111390

259 Gardening4Joy, *op. cit.*

260 ScienceDirect, *Crop Diversification to Promote Arthropod Pest Management*, <https://www.sciencedirect.com/science/crop-diversification-to-promote-arthropod-pest-management>

From farming households' point of view, the most important disadvantage is that IPM intercropping is usually much more time consuming than spraying herbicides. More effort is needed for planting, weeding and harvesting than for single crops. This makes IPM more practical for smaller areas of intensive crops, such as vegetables, than for larger areas of extensive crops. In Rwanda, the burden of extra work is most likely to fall on women and impinge further on their already busy schedules²⁶¹. A further social complication is that farmers not involved in IPM may oppose the adoption of IPM by their neighbours, if they see it as increasing the risk of pests migrating to their crops.

A subsidy for IPM would need to be large enough to compensate for any additions to labour time for it to be attractive. While payment could be justified during the training and experience gathering period, the additions to yield would need to be sufficient to make the extra work involved worthwhile after the subsidy is terminated. As these may often not materialise, the benefit for biodiversity may last only as long as the subsidy, making this option for redesign difficult to sustain.

5. Subsidise increased fallows

Leaving land fallow after crops have been harvested is a traditional, low-cost method of helping replenish soil fertility and restore soil biodiversity the world over. Improved fallows entail the planting of fast-growing species, usually legumes, to accelerate replenishment and restoration through increasing nitrogen levels in soil and vegetation.

Currently, during the two main cropping seasons, only about 10% of arable land is left fallow. This indicates that, on average, it is only once every 10 years that a plot is allowed to regain fertility through fallowing. During the third season little or no land is left fallow²⁶².

A uniform per hectare subsidy for additions to the number of hectares left fallow could be used to encourage farmers to leave more land fallow. Advantages are that this could be funded by the amount saved on fertiliser and seeds subsidies and that it would not need to be targeted – as with an agroforestry subsidy, it would be open to all farmers. Also, a uniform per hectare basis for subsidy ought to be simple to administer, equitable and easy for farmers to understand.

A major challenge is that the benefits are long term, while the costs – in terms of food crop output forgone while land is left fallow – are short term. CIP fertiliser subsidies have incentivised farmers to use inorganic fertilisers to boost fertility and keep cultivating and earning income every year, rather than boost fertility through fallow²⁶³ and lose a year's income. A subsidy for increasing the area left fallow would need to compensate adequately for a year's lost income on the land involved. And, like some of the other redesign options, it is probable that many farmers would revert to their pre-subsidy practice regarding fallow if and when the subsidy was terminated, making its benefits difficult to sustain.

6. Subsidise improved fallows

Alternatively, as genetic diversity of the varieties planted is critical for the productivity of fallows²⁶⁴, a subsidy on selected legume and other seed types could be used to incentivise farmers to improve fallows, as part of their cultivation routine for CIP crops. This could help both improve yields and increase biodiversity. It would have the same advantages as a subsidy for increasing the area left fallow, while it would not suffer from the same disadvantages. However, if the percentage of arable land left fallow remained at 10%, the impact of improving fallows on biodiversity would be limited. If the impact on biodiversity is to be increased, it would be necessary to combine improvement with

261 REMA, *op. cit.*

262 NISR, *op. cit.*

263 Huggins, C., *Curbs on Land Rights in Rwanda: the 'Bundle of Rights' in Context*, Gates Open Research, 2019, <https://www.gatesopenresearch.org/documents/pdf>

264 Sanchez, P.A., *Improved Fallows Come of Age in the Tropics*, Springer Link, December 1999, vol. 47, pp3-12

fallow area expansion.

Additional funding would be needed for seed subsidies. A further challenge is that, though the use of this approach is reported to be spreading rapidly in tropical countries, a critical limiting factor in Africa is the supply of germplasm for improved fallow species²⁶⁵. As noted earlier, Rwanda has established a gene bank and has developed the capacity to produce improved seeds, inter alia, for use in CIP. But to date the focus appears to have been on improving seeds for food crops²⁶⁶, rather than on the varieties planted to improve fallow. It is unknown whether enough seeds of this kind would be available from local seed producers, but if not, they could easily be imported. Expanding the supply would be a business opportunity for local improved seed producers.

Extension services support would be needed for effective promotion and implementation of this subsidy.

7. Subsidise seeds for all crops for which fertiliser subsidies apply

At present, seed subsidies apply only to maize, soya beans and wheat²⁶⁷. If these were broadened to include all crops for which fertiliser subsidies apply – and to improved fallow seeds, if the subsidy as outlined in before is implemented – it might increase the diversity of crops grown. But this is uncertain. Also, it would probably come at the cost of reducing the diversity of varieties of each crop grown, as improved seeds would tend to displace indigenous varieties. So, there might be no net improvement to biodiversity.

8. Subsidise seeds for all crops for which fertiliser subsidies apply as well as for some indigenous crop production

An alternative would be both to broaden the seeds subsidy to include all crops for which fertiliser subsidies apply and, simultaneously, to subsidise or pay at least some farmers to continue to grow indigenous varieties of these crops, either exclusively or in tandem with subsidised improved varieties. This would help support biodiversity both during the growing season and in the long term, through helping preserve the national gene pool.

To manage the cost, it might be necessary to limit the number of farmers supported to continue to grow indigenous varieties in each district, perhaps on a first-come-first-served or a stratified or a social equity basis. A uniform, small subsidy, irrespective of the area on which indigenous seeds are sown, might be best to achieve the biodiversity goal, while appealing most to small farmers and limiting cost. A subsidy of this nature would be transparent – although there might be some concerns about fairness – and no additional extension services support would be needed, but sustainability of the beneficial impact on biodiversity is uncertain after termination of the subsidy.

9. Make appropriate use of fertiliser and seeds a requirement for receiving CIP subsidies for these inputs²⁶⁸

In principle, this is a sound option for redesign. It can reasonably be assumed that the intention of the programme is for its subsidies to be used in ways that achieve its objectives²⁶⁹ without causing harm, inter alia, to the environment and biodiversity. If not already required, subsidy recipients should be made aware of this and be obliged to agree to comply. If not already provided for, the penalty for non-compliance could be disqualification from receiving subsidies.

In practice, while this would disincentivise non-compliance and possibly assist biodiversity, it is not clear how effective the measure would be. A critical shortcoming would be difficulty in proving non-

²⁶⁵ Sanchez, *op. cit.*

²⁶⁶ IRDP, *op. cit.*

²⁶⁷ *Ibid.*

²⁶⁸ See section 4d above.

²⁶⁹ See section 1 above.

compliance. In some instances, such as not applying appropriate terracing measures, it might be easily visible, but in others, such as using fertilisers appropriately, it would be much more difficult to detect and prove. In both instances, it would also place a substantially increased burden on public sector monitoring capacity. Rather than follow a punitive approach, a more constructive way of achieving compliance would be to strengthen farmer training through public sector extension services. This is the approach adopted by government²⁷⁰.

10. Subsidise precision farming to improve the application of fertilisers

Precision farming is ‘the science of improving crop yields and assisting management decisions using high technology sensor and analysis tools ... (It is used) to increase production, reduce labour time and ensure effective management of fertilisers and irrigation processes’²⁷¹, ‘particularly where intra-field variability in yield is high’²⁷². In principle, precision farming could therefore assist Rwandan farmers to achieve better yields and use less fertiliser at the same time as limiting the negative impact on the environment and biodiversity.

In practice, this is unlikely to be an economically viable option. Although a wide range of technology options is available, all are knowledge-intensive and involve high initial outlays on equipment and systems, both for individual farmers and for satellite-based remote sensing systems for which public investment is generally necessary. They are most widely used in extensive arable farming, where fields are large and intra-field soil quality and moisture levels vary significantly.

Given the large capital outlays needed, institutional capacity needed, knowledge gaps at farm level and the very small average size of farms, even where these have been subject to land use consolidation, it is unlikely that the return on investment would be sufficient to make precision farming an economically viable option²⁷³ anywhere in Rwanda without subsidisation by government on a scale that would be hard to justify.

11. Increase the number of crops that qualify for fertiliser subsidies

Increasing the number of crops that qualify for fertiliser subsidies could increase biodiversity. The original 6 qualifying crops has already been increased to 10 and a case can be made for expanding the number still further, or, possibly, for substituting some presently excluded for others presently included²⁷⁴. However, this could be expected to increase biodiversity only marginally, if at all. Also, as noted earlier²⁷⁵, none of the crops qualifying is endemic to Rwanda. To gain greater biodiversity mileage, it would be advantageous to combine this redesign option with a previously described option: *Subsidise seeds for all crops for which fertiliser subsidies apply and some indigenous crop production*.

12. Target subsidies towards (i) small farmers, (ii) women and youth, (iii) non-hillside land, (iv) non-wetland land

Small farmers: It was noted earlier that, for a number of reasons, CIP seems to work well for relatively well-off farmers who have bigger, scattered land areas, whereas it does not work well for poor farmers with smaller plots, which is common in rural Rwanda²⁷⁶. As poor farmers with smaller plots are less likely to engage in monocropping, because they are more risk averse, it could be argued that to increase not only social equity, but also biodiversity, subsidies should be

270 RAB, PSTA4

271 <https://www.sciencedirect.com/topics/precision-agriculture-an-overview>

272 OECD, *Is Precision Farming the Start of a New Revolution?*, p138, <https://www.oecd-ilibrary.org/is-precision-agriculture-the-start-of-a-new-revolution>

273 *Ibid.*

274 See section 4d above and footnote 34.

275 *Ibid.*

276 See section 9b above.

targeted towards this category of farmers. However, this would raise difficulties both about how to define such farmers and about ensuring that those who claim this status do, in fact, qualify. Effective enforcement would place an inordinate monitoring burden on public extension services. In addition, it would conflict with the requirement that farmers qualifying for subsidies should participate in the LUC programme, the objective of which is to achieve economies of scale through monocropping²⁷⁷.

Women and youth: It was also noted earlier that women and youth farmers are less likely to benefit from CIP subsidies than men²⁷⁸. To address this, it could be argued that subsidies should be targeted towards women and youth. It would certainly be easier to ensure that claimants did qualify for subsidies. But there is no obvious reason to expect that women and youth would farm on a more biodiverse basis than men, making targeting of this nature of questionable relevance for increasing biodiversity.

Non-hillside land: There is evidence that much hillside land is being cultivated in a way that detrimental to the environment and to biodiversity²⁷⁹. It could therefore be argued that subsidies should be targeted towards non-hillside land. But, as no less than 93% of Rwanda's arable land is hillside land²⁸⁰, this would mean that most farms would be excluded, thereby putting the output, income, food security and nutrition gains that the programme has achieved at risk.

Non-wetland land: Wetlands make up about 5% of Rwanda's surface area²⁸¹. Of the roughly 128 000ha concerned, a little less than 60% is cultivated, about 20% for rice and 40% for other undefined crops, perhaps mainly vegetables²⁸². Rice is produced almost exclusively by large scale farmers²⁸³, more than 90% of whom use subsidised fertilisers²⁸⁴.

Following the introduction of CIP subsidies, production grew steadily until 2017, driven entirely by area expansion. In contrast with other major crops using subsidised fertiliser, average rice yields actually fell slightly between 2007 and 2017²⁸⁵, although the area planted, and production have fallen substantially since then and yields have risen somewhat²⁸⁶. 'The use of fertiliser subsidies has been worthwhile to reduce the risks faced by farmers ... (even though) for rice and maize the protection against risk is quite marginal.'²⁸⁷ Production is dominated by large-scale farmers, who occupy about 98% of land used for rice production²⁸⁸.

Rice is a major component of Rwandan households' diets: at a national level, more is spent on rice than on maize – the two most important cereal crops – roughly half on locally produced and half on imported rice²⁸⁹. As rice is the country's second largest agricultural import by value²⁹⁰, increasing local production to reduce the country's reliance on imports is a key objective of Rwanda's National

277 See section 4d above.

278 See section 9b above.

279 See section 10c above.

280 Ibid.

281 NISR, *op. cit.*

282 Ibid.

283 NISR, *op. cit.*, pp28, 29. This might possibly be related to wetlands, as 'national land', falling outside the areas on which traditional tenure systems have long applied. (Convention on Biological Diversity, Nile Basin Initiative, Rwanda Wetlands Governance and Management Profile <https://chm.cbd.int/api/documents/attachments>, p9)

284 Spielman et al., p10.

285 Anderson et al., *op. cit.*, p6

286 In 2017, about 31 500ha were under rice, producing an average yield of 3.5t/ha (Anderson, *loc. cit.*). By 2022, the area sown had almost halved to about 16 000ha, while yields had risen to about 4.1t/ha (NISR, *op. cit.*, pp iv, v)

287 UNEP et al., *op. cit.*, p28

288 NISR, *op. cit.*, pp28, 29

289 Anderson, *op. cit.*, p7

290 World Bank, *op. cit.* 2015, p2

Rice Development Strategy²⁹¹. However, the quality of the local product is reported to be low and mostly short grain, while consumer preference is generally for long grain varieties²⁹².

Given that:

- The impact of fertiliser subsidies has mainly been to drive area expansion, not yield increases
- Rice production in the country's most important rice producing region²⁹³ uses by far the greatest value of subsidised fertilisers per hectare of any crop grown in Rwanda²⁹⁴
- There are indications and that, of all the major crops using subsidised fertilisers, rice has been the only crop for which there was no deficit in urea application and that, at least in some years, more than the recommended rate of NPK has been used for rice production²⁹⁵
- Inorganic fertilisers make up as much as 60% of total production costs for large scale farmers, who produce most of Rwanda's rice, about twice the percentage of total production costs for other major crops²⁹⁶
- There is a 'low', i.e., less than 30%, rate of adoption of 'efficient soil management in marshlands' and 'efficient use of fertilisers' for rice production²⁹⁷ Very few small farmers benefit from subsidies for fertilisers used for rice production
- The rice produced in Rwanda does not align well with consumers' preferences
- Domestically produced rice receives a high rate of protection, higher at the farm gate in Rwanda than in any other East African Community country²⁹⁸, thereby increasing the price of rice significantly for local consumers
- Wetlands make up such a small percentage of Rwanda's land area
- Climate change is increasing wetlands' importance²⁹⁹
- '30-90% of (tropical) wetlands have already been destroyed or strongly modified for meeting ... food demand through intensive agriculture (including inorganic) fertiliser use, further exacerbated through double cropping of rice'³⁰⁰, a further logical redesign option would be for fertiliser subsidies for rice to be re-evaluated with a view towards their possible exclusion.

Alternatively, the onus could be placed on farmers wanting to access fertiliser subsidies to prove to the satisfaction of MINAGRI and REMA that the techniques being used to produce rice are environment- and biodiversity-friendly³⁰¹, though this would not address the high economic costs of subsidising and protecting local rice production.

An important practical difficulty in targeting fertiliser subsidies away from rice production is to ensure that subsidised fertilisers are not used for this purpose. While farmers may be required to undertake not to do so, compliance would be entirely voluntary, as surveillance, monitoring and soil testing would be difficult and the likelihood of collusion between farmers not to disclose the covert

291 MINAGRI, *National Rice Development Strategy (Period 2011-2018)*, 15 September 2011, p2

292 Ibid., p6

293 Eastern province (UNEP et al., op. cit., p42); NISR, op. cit., pp27, 28

294 UNEP et al., p42

295 Ibid., p22, based on data for 2011

296 Spielman et al., op. cit., p7

297 World Bank, op. cit. 2015, pp6, 7

298 Anderson et al., op. cit., p11.

299 See, e.g., International Water Management Institute, *Three Ways Wetlands Can Influence Climate Change*, 2 February 2021, <https://www.iwmi.cgiar.org/Blogs/>, and Zurich Insurance Group, *What are Wetlands and How Do They Help with Climate Change?*, 2 February 2024, <https://www.zurich.com/media/magazine/>

300 Nath, A.J., et al., *Managing Tropical Wetlands for Advancing Global Rice Production: Implications for Land Use Management. Land Use Policy*, vol. 68, November 2017, p683, <https://doi.org/10.1016/j.landusepol.2017.08.026>

301 Nath et al., op cit., propose a '3-tier rice production system ... to advance global food security without degrading the ecosystem services of wetlands'.

application of subsidised fertilisers by neighbours high. It would also not be reasonable or practical to require fertiliser suppliers to try to enforce a prohibition³⁰².

To incentivise voluntary compliance, probably the most important mechanism would be to ensure that, to the extent that the area under rice in wetlands and yields decreased, the farmers concerned – and any employees negatively affected – are fairly compensated, as per the restorative and distributional justice principles. To meet the need for procedural justice, the change would need to be discussed and, ideally agreed, with the same two parties.

It is not possible to calculate what the loss of income from decreased area and yield would be. However, an estimate of the saving on fertiliser subsidy expenditure that would be generated from which farmers and workers could be compensated³⁰³ indicates that the amount could be of the order of a few hundreds of thousands of USD, i.e. a fairly substantial sum, which it might not be necessary to augment from other sources in order to provide fair compensation.

While, in principle, fertiliser subsidies could be withheld from all crop production on wetlands, because many non-rice crops grown in these areas can also be grown elsewhere, where environmental/biodiversity concerns are not as great, it would not be possible to exclude them on a crop-type basis. Application on an area basis could work but would require seasonal monitoring and would be difficult for farmers who cultivate land both inside and outside wetlands.

13. Create buffer zones along stream/riverbanks and next to dams/lakes to reduce water pollution from fertiliser run-off

To the extent that this is not already done through agricultural/environmental regulations, there should certainly be a gain for biodiversity and environmental conservation by doing this. However, effective implementation might mean taking substantial areas of crop land out of production. While this would save on fertiliser subsidy expenditure, it could therefore also entail having to compensate the farmers affected for the loss of income and this would clearly exceed the savings. So there could be a substantial net financial cost for government, even though this would be offset, at least implicitly, by the value of the environmental gains.

Without much more information, it is not possible to estimate the size of this cost. But whatever the magnitude, the sources for covering it are unclear, especially as government has probably been keen to reduce the size of the fertiliser subsidy budget from the spike level that it reached in 2021-2022. More imports to substitute for the loss of crop output would also follow, reducing national food security, though possibly adding a little to Rwandan tariff revenue, depending on the sources of imports.

302 Fertilisers can, of course, be used for many crop types and about 90% of the two fertiliser types used most widely for rice production – urea and most NPK formulations – is sourced from 'agro-dealers' and 'NGOs/companies', i.e., non-government, non-cooperative institutions (NISR, op. cit., p64).

303 See Scenario Development: the termination of fertiliser subsidies for rice but no agroforestry subsidy (pp71-73 below).

Annexure 3 – Girinka Programme (Overview)

The Girinka Programme is a key initiative in Rwanda aimed at reducing malnutrition, particularly child malnutrition, and poverty among households, while fostering a sense of shared national identity through the traditional practice of gifting cows.³⁰⁴ Coordinated by the Rwanda Agriculture Board (RAB) under the guidance of the Ministry of Agriculture (MINAGRI) and the Ministry of Local Government (MINALOC), Girinka is implemented at the national level, with local governments handling monitoring and evaluation. Provincial governments, supported by the private sector, civil society organisations (CSOs), and non-governmental organisations (NGOs), ensure local execution of the programme.³⁰⁵

The selection of beneficiaries is conducted through community involvement, known as Ubudehe. Eligibility criteria include not owning a cow, having land between 0.25 and 0.75 hectares (which can be shared among multiple beneficiaries), constructing a cowshed, and participating in training on basic animal husbandry practices. Additionally, beneficiaries must be considered poor by their community and be regarded as people of integrity (Inyangamugayo). Once selected, beneficiaries receive a pregnant dairy cow or an equivalent loan and a support package that includes fodder seeds, animal drugs, and inputs for artificial insemination. The first female calf born must be passed on to another beneficiary in the community, reinforcing social cohesion.³⁰⁶

Girinka is one of Rwanda's Home Grown Initiatives (HGI), which draws on culturally rooted practices translated into government development programmes. The programme is prominently featured in Rwanda's Strategic Plan for Agricultural Transformation 2018-24 and RAB's Strategic Plan for 2020-24. Rwanda's Vision 2050 also highlights Girinka as central to the country's socio-economic development.³⁰⁷ The programme is largely funded by the Government of Rwanda, supplemented by donations from NGOs like the African Development Fund, and contributions from private citizens. The Rwanda Agriculture Board (RAB) manages the purchasing of cows when the programme budget is allocated, or donations are received. In some cases, the donations are non-financial, such as cows donated by individuals that meet RAB's standards.³⁰⁸

The costs of the Girinka Programme are significant, but so are the benefits. In 2024, the programme was estimated to cost USD 17.9 million, with cumulative costs from 2018 to 2024 reaching USD 89.3 million. The government planned to increase expenditure by an average of 8% per year over this period, based on calculations from Rwanda's Strategic Plan for Agricultural Transformation.³⁰⁹ Since its launch in 2006, the programme has distributed over 420,000 cows, exceeding the target of 486,230 cows by 2024. On average, around 27,500 cows are distributed annually.³¹⁰ Many beneficiaries have reported improved livelihoods, with some earning additional income by selling surplus milk at local markets. A 2014 Rwanda Governance Board (RGB) report indicated that 87.5% of beneficiaries saw an increase in monthly monetary income, while a USAID study found that annual household income increased between USD 150 and USD 798 for beneficiaries.³¹¹

304 Rwandapedia. (n.d.). Girinka - How it works. Retrieved August, 2024, from <https://rwandapedia.rw/hgs/girinka/how-it-works>

305 Rwanda Agriculture and Animal Resources Development Board (RAB). (2020). RAB Strategic Plan 2020-2024. Huye, Rwanda. Rwanda Agriculture and Animal Resources Development Board (RAB).

306 Rwandapedia, Girinka - How it works.

307 Government of Rwanda. (n.d.). Vision 2050. Kigali, Rwanda: Ministry of Finance and Economic Planning.

308 Rwanda Agriculture and Animal Resources Development Board (RAB). (2020). RAB Strategic Plan 2020-2024.

309 Ministry of Agriculture and Animal Resources (MINAGRI). (2018). Strategic Plan for Agriculture Transformation 2018-24 (PSTA

4). Kigali, Rwanda: Ministry of Agriculture and Animal Resources.

310 Ministry of Agriculture and Animal Resources (MINAGRI). (2022). Annual Report 2021-2022. Kigali, Rwanda: Ministry of Agriculture and Animal Resources.

311 Harris-Coble, L., Balehegn, M., Adesogan, A. T., & Colverson, K. (2022). Gender and livestock feed research in developing

The Girinka Programme has had notable success in improving food security, increasing milk production, and reducing child stunting. According to Rwandapedia, milk production increased by 119% between 2010 and 2019, allowing many beneficiaries to sell surplus milk for extra income.³¹² Additionally, food insecurity in Rwanda decreased from 28% of households in 2006 to 19% in 2018, with Girinka contributing significantly to this improvement. Health outcomes have also improved, as stunted children decreased from 51% in 2005 to 33% in 2020, wasted children reduced from 5% to 1%, and underweight children dropped from 18% to 6%.³¹³ These improvements are attributed, in part, to Girinka's positive impact on nutrition.³¹⁴

However, Girinka faces environmental challenges. The programme requires zero-grazing practices due to Rwanda's limited land availability, but a study by the University of KwaZulu-Natal (2013) beneficiaries let their cows graze freely.³¹⁵ Although more than a decade has passed since the study was conducted, there remains no documentation indicating that free-grazing has been identified as a challenge requiring attention. Free grazing can lead to overgrazing, which degrades soil and reduces biodiversity.

Furthermore, the widespread use of Napier grass (Elephant grass) as fodder presents environmental risks, as it is an invasive species that outcompetes native plants, affecting local biodiversity. Cows that consume high-fibre forage like Napier grass produce more methane, a potent greenhouse gas, compared to cows fed grains. This contributes to increased methane emissions from livestock.

The socio-economic benefits of Girinka are perceived as very high by stakeholders who participated in our interviews and workshops. Many emphasised that the programme's positive effects on poverty reduction, food security, and social cohesion far surpass its environmental costs. Moreover, the programme was perceived to offer good value for money, attracting external investment due to its demonstrated success in reaching vulnerable households.

countries: A review. *Agronomy Journal*, 114, 259–276. <https://doi.org/10.1002/agj2.20875>

312 Rwandapedia, *Girinka - How it works*.

313 *Ibid.*

314 *Ibid.*

315 Kayigema, V. (2013). *An Assessment of the Girinka (One Cow per Poor Family) Program and Poverty Alleviation in Rwanda: A Case Study of Bugesera District*.

Annexure 4 - Terminate fertiliser subsidies for rice production

The impact of terminating subsidies on fertilisers depends heavily on the sensitivity of farmers to changes in the price of fertilisers. Spielman et al. conducted simulations to model both very (fertiliser) price sensitive and price insensitive responses by farmers. For rice production, urea is much the most widely used inorganic fertiliser in Rwanda's main rice producing regions (the Eastern and Southern Provinces³¹⁶), followed by various formulations of NPK. Very roughly, about twice as much urea tends to be used as NPK³¹⁷.

Spielman et al. find that the worst outcome of the termination of fertiliser subsidies for rice is that rice output (about 67 500 tons in 2022) would fall by 3%³¹⁸, i.e., by about 2 000 tons, if farmers are very price sensitive. This is supported by the fact that about 60 000 tons of rice were produced in Rwanda in 2006, prior to the commencement of CIP in 2007³¹⁹. The model indicates that urea demand would fall by 13% and NPK demand by 8%, in the case of high price insensitivity, resulting in a loss of only 0.4% (as little as 270 tons) of rice output. Depending on farmers' price sensitivity, the impact on local production, imports and rice prices³²⁰ is therefore likely to be small.

In terms of inorganic fertiliser use³²¹, at current (2024) subsidy rates³²², a total of roughly 3 200 tons are used for rice production, roughly 2 200 tons of which is urea and 1 000 tons NPK³²³. If farmers are highly insensitive to fertiliser prices, this indicates that about 285 fewer tons of urea and 80 fewer tons of NPK would be used., i.e., about 1 915 tons of urea and 920 tons of NPK would still be used.

As the subsidy was as high as USD 500/ton for urea and USD 460/ton for NPK in 2022, the total saving on subsidies, if subsidies for these two fertilisers were terminated for producing rice, would therefore have been of the order of USD 1 380 000 in 2022. With urea and NPK prices having fallen by around 60% between 2022 and 2024³²⁴, the current (2024) saving on subsidies would be an estimate of USD 550 000, if farmers are highly price insensitive. This is the maximum that could be saved by terminating subsidies on fertiliser used for rice production.

316 NISR, *op. cit.*, pp39, 40

317 UNEP et al., *op. cit.*, p42; Spielman et al., *op. cit.*, p14

318 Spielman et al., *op. cit.*, p16. The earlier UNEP 2016 study finds that even with fertiliser at unsubsidised prices, rice production would still be profitable enough in Rwanda's risky environment for most existing farmers to engage in it (UNEP et al., *op. cit.*, p28).

319 UNEP et al., *op. cit.*, p24

320 As locally produced rice is already heavily protected, importing additional quantities should not increase or decrease the price that local farmers receive.

321 Some farmers do also use organic fertiliser for rice production (*ibid.*).

322 The subsidy rates in 2022 were approximately 30% for urea and 15% for NPK. The reason for approximation is that the subsidy rates were adjusted more frequently than usual (annually) during the spike in fertiliser prices that occurred with COVID and the start of the Russia-Ukraine war in 2022. The steep increase in the cost of fertiliser was at first shared 50:50 between government and farmers, but subsequently government increased its share to 60% (Spielman et al., *op. cit.*, p11). It is not known, at the time of writing, how this division has changed with the steep drop in fertiliser prices in 2023-24.

323 Large-scale producers, who produce about 99% of Rwanda's rice (NISR, *op. cit.*, pp28, 29), use an average of about 200kg of all fertilisers per hectare (Spielman et al., *op. cit.*, p10), on average about 69% of which is urea and 31% NPK. DAP makes up less than 1%. Rice is cultivated on about 16 000 hectares. (Author's calculations from UNEP et al, *op cit.*, p42, Spielman et al., *op. cit.*, p14 and NISR, *op. cit.*, pp28, 29; data for 2022).

324 Data for urea, World Bank Blogs, *Fertiliser Prices Edge Lower Amid Lower Input Costs and Improved Production Prospects*, 8 July 2024, www.blogs.worldbank.org/en/opendata/fertiliser-prices-edge-lower-amid-lower-input-costs-and-improved and for NPK, IFPRI Blogs, *Who's Afraid of High Fertiliser Prices?*, 21 March 2024, www.ifpri.org/blog/whos-afraid-of-high-fertiliser-prices/

If the subsidies are terminated and farmers are highly sensitive to fertiliser price movements, Spielman's model indicates a wide range of possible outcomes for fertiliser use – and consequently for savings in the instance of subsidy termination – depending on the level of sensitivity.

To try to put figures to these outcomes, the following approach could be adopted: if a 0.4% reduction in rice output results from the use of 13% less urea and 8% less NPK being used, if farmers are highly insensitive to fertiliser price changes, but a drop of 3% in output – i.e., $3/0.4 = 7.5x$ as large an impact – would occur if farmers are highly price sensitive³²⁵, then, proportionately, it could be expected that a 3% drop in output would result in the use of $7.5 \times 13\% = 97.5\%$ less urea and $7.5 \times 8\% = 60\%$ less NPK being used – i.e., only 2.5% of the 2 200 tons of urea and 40% of the 1 000 tons of NPK currently used, or only 55 tons and 400 tons respectively³²⁶. In this instance, the saving on fertiliser subsidies would be far smaller: only about USD 85 000 at current prices. This is the minimum that could be saved by terminating subsidies on fertiliser used for rice production.

To sum up, the benefits of this scenario, insofar as they can be estimated, include:

- Savings on subsidy outlays of between USD 85 000 and USD 550 000, depending on the sensitivity of farmers to changes in the price of inorganic fertilisers.
- Reductions in fertiliser imports of between 285 and 2 145 tons of urea and between 80 and 400 tons of NPK, again depending on the sensitivity of farmers to changes in the price of inorganic fertilisers; at current prices³²⁷, these reductions would improve Rwanda's balance of payments by between about USD 150 000 and USD 960 000.
- For government, but not for consumers, additional rice imports tariff revenue, ranging between zero and as much as USD 720 000, depending on the additional tonnage imported and the country or countries of origin, but probably tending towards the lower end of this range³²⁸.

In respect of environmental impacts, there are likely to be benefits for biodiversity, erosion, water resources, climate resilience, and GHG emissions – though not for soil nutrient content – but such impacts have received little empirical attention in published studies to date³²⁹, making it difficult to estimate their magnitude and monetary value. However, it can be estimated that reductions in the use of these fertilisers would bring down Rwanda's GHG emissions from crop production by between about 4 and 15%³³⁰, depending once more on the sensitivity of farmers to changes in fertiliser prices, thereby

325 See second paragraph of this scenario, above.

326 These estimates align well with the findings of UNEP et al. (op. cit., p22), which show that, prior to the introduction of CIP subsidies, the only fertilisers that were widely used for major food crop production (including rice) were NPK formulations. Only after the launch of CIP in 2007 did the use of urea and DAP become popular.

327 Estimated from September 2024 international price for urea USD307.50/ton (Trading Economics, Urea Price Historical Data, <https://www.tradingeconomics.com/commodity/urea>) and IFDC, Rwanda Market Comments (September 2023) – Africa's Fertiliser ... (https://wp.vifaakenya.org/uploads/september/2023/Rwanda-Market-Comments-September-2023-Edition_EN_.pdf), assuming a 20% fall in the price of NPK fertilisers in Rwanda between September 2023 and July 2024, based on World Bank Blogs, op. cit. fertiliser price index.

328 If all additional imports came from other EAC countries, there would be no addition to tariff revenue. On the other hand, if the entire amount came from non-EAC countries and as much as 2 000 extra tons was imported, the addition to tariff revenue would be about USD720 000, based on the average import price of about USD 480/ton for non-EAC countries in 2021 (World Bank, WITS, op. cit.). If only 1/3 came from non-EAC countries (see footnote... above), the addition to tariff revenue would be about USD 240 000. If only 270 extra tons was imported, all from non-EAC countries, the addition to tariff revenue would be about USD97 000. If only 1/3 was imported from non-EAC countries, this would fall to about USD 32 000. The price of imports from Tanzania was about USD 613/ton in 2021, whereas the average for non-EAC countries was about USD 479/ton. Adding a tariff of 75% to the latter indicates that the landed price of non-EAC imports would be about USD 838/ton, excluding transport and related costs. It can therefore be assumed that private sector companies importing rice would prefer to source part, if not all, from other EAC countries. As well as Tanzania, Uganda has been a major supplier in recent years (Levard, L et al., Intra-Regional Trade Limitations for Agricultural Commodities in the East African Community, GRET Professionals for Fair Development, December 2012, p2). In the absence of logistical constraints in the region, this suggests that, in practice, the addition to tariff revenue would tend towards zero.

329 UNEP et al. (2016), op cit., p 56

330 Author's calculations from data in Spielman et al., op. cit., p9 and UNEP et al., op. cit., p36

contributing to the country meeting its Nationally Determined Contributions (NDC) to mitigation under the UN Framework Convention on Climate Change (UNFCCC).

The costs of this scenario, insofar as they can be estimated, include a decrease in local rice output and a corresponding increase in rice imports of between 270 and 2 000 tons, valued at between about USD 130 000 and USD 1 230 000, depending on the sensitivity of farmers to an increase in the price of fertilisers and the countries of origin of additional imports³³¹. This would have a correspondingly negative impact on Rwanda's balance of payments, but the impact on the price of rice for consumers would be negligible³³². As the import of urea and NPK fertilisers appears to be duty-free³³³, the reduction in the quantity of fertilisers imported under all scenarios should carry no cost for government in terms of fertiliser tariff revenue forgone.

Annexure 5: Budget reallocation for fertiliser subsidy

It could be argued that savings of more than USD 10 million annually on the expenditure that was needed for fertiliser subsidies at the peak of the price spike in 2022/23³³⁴ would create substantial scope for funding an addition to the budget for biodiversity-positive approaches. But it should also be borne in mind that neither the Rwandan government nor donors may have had the capacity or appetite to continue funding fertiliser subsidies at the level that they did in 2022/23, especially given that the percentage paid by the Rwandan government is as high as 70%³³⁵.

If the amount spent on fertiliser subsidies were to need to fall back to the average (at constant 2017 prices) for the period 2010-2020 (i.e., before the spike) to be sustainable, fertiliser expenditure would likely be of the order of USD 11 million annually³³⁶, leaving little or no scope to fund additions to pay for biodiversity-friendly budget items.

The existing Girinka budget will pay for all, or most, of the interventions outlined in section 2 and 3 of Annexure 2. Savings derived from reductions in CIP subsidies for inorganic fertilisers can be used to boost MINAGRI's budget for research and extension services aimed at increasing and improving the application of manure.

As noted earlier, it is not possible to estimate what the quantum of the latter might be with any accuracy. However, some illustrative calculations may be helpful. At the time of MINAGRI/REMA's 2016 fertiliser study, CIP employed 90 technical extension workers, while local government employed 446 agronomists. The private sector and NGOs employed 1 883 Farmer Field School facilitators³³⁷.

331 See above.

332 Currently, about 67 500 tons of rice are produced annually in Rwanda and about 150 000 tons imported (World Bank (WITS), op. cit.), totalling about 187 500. So, a change even of 2 000 tons in the mix would affect only about 1% of the total sold.

333 Tralac, op. cit., p3. Almost all imported chemical products carry no import duty. While urea and NPK are not mentioned specifically, DAP fertilisers are and imports are duty free (Tralac, op. cit., p5).

334 Author's calculations at constant 2017 prices (see also footnote... (56) below).

335 See Section 12g above. For fertiliser subsidies, the percentage borne by donors is considerably less than the average assistance for all government agriculture programmes, which is about 50%.

336 Estimated from data for expenditure in Table 1, Section 6a, deflated to constant 2017 prices using average annual RWF:USD exchange rates from World Bank Group, Official Exchange Rate (local currency unit per US\$, period average) – Rwanda, <https://data.worldbank.org/indicator/PA.NUS.FCRF?locations=RW>. If expenditure for 2012 and 2022 is included, the average rises to about USD12.5 million.

337 UNEP, op. cit., 2016, p60

For 2023/24, MINAGRI's Fourth Strategic Plan for the Transformation of Agriculture (PSTA4)³³⁸ allocated:

- RWF 10 213 318 each for 'staff/technical assistance for developing Integrated Soil Fertility Management technologies', for 'staff/technical assistance for research on bio-fertiliser technologies' and for 'staff/technical assistance for developing site-specific fertiliser recommendations'
- RWF 20 426 675 for 'staff/technical assistance for soil diagnosis, including mobile soil testing, and
- RWF 361 722 374 for mobile soil testing equipment/GIS technologies.

The total budgeted for these items/services in 2023/24 was therefore RWF 412 789 003 or about USD 327 000³³⁹. If this amount were to increase by 10% to improve the application of manure, a saving of about USD 32 700 would need to be generated by CIP through reduced inorganic fertiliser use, if this were to be the only source of funding. As this constitutes only about 0.1% of the total budget for CIP³⁴⁰, such an increase in expenditure on research and extension support should be entirely possible.

No information could be found about the cost of Farmer Field Schools, but it can safely be assumed that the cost of an increase in the number of meetings could comfortably be absorbed by savings generated on CIP expenditure.

338 MINAGRI, *op. cit.*, June 2018, p140

339 The RWF/USD exchange rate at the end of 2023 was RWF1 262.50/USD1.00 (exchange-rates.org/exchange-rate-history/usd-rwf-2023)

340 See Table 1, p16 above.

