



Building the Case for Regenerative Coffee Production

Ethiopia Arabica

April 2025



Coffee
growing on a
hillside in
Jinotega,
Nicaragua.
(TechnoServe)



Coffee Sector Transformation through Regenerative Agriculture

The Challenge



- **Coffee is a vital sector of the economy.** Coffee sustains 12 million smallholder farms supporting 60 million individuals worldwide, while serving as a critical export and foreign currency source for many global south economies.



- **Coffee farming is under pressure.** Long-standing challenges to coffee farmer profitability—like land fragmentation and limited access to best practices or investment—are being intensified by climate change. Most farms are ill-equipped to withstand climate shocks or adapt to rising temperatures and shifting weather patterns.



- **In many regions, current farming practices are depleting the very natural resources farmers depend on.** Carbon emissions, water overuse, soil degradation and natural habitat loss further threaten long-term production viability.

The Opportunity

- **Regenerative agriculture, an approach to farming that regenerates soils, improves the water cycle, and increases biodiversity and climate resilience, is hailed as a solution to these challenges.**
- The objective of this study is to provide the evidence base to assess this opportunity, by addressing a few fundamental questions:
 1. Can environmental, economic, and market priorities be aligned effectively?
 2. How should solutions be adapted across diverse growing regions?
 3. What specific investments are needed to enable a successful transition?
 4. How can the business case resonate with all stakeholders?

This roadmap presents a practical transition to regenerative farming that can be achieved at scale and with a positive investment case for farmers, nature, industry and governments.

Ethiopia can become a beacon of regenerative coffee production, with at scale impact on livelihoods and export revenues, building on an already low carbon base

ECONOMY

Exports



39%

**increase
in country exports
of Arabica¹**

PEOPLE

Farmer Income



88%

**increase in income
for 1.1 million farms²**

NATURE

GHG Emissions



n.a.

**Decrease in coffee
emissions³**

¹ Assumes all incremental production is absorbed by export markets

² Assumes 50% adoption of regenerative practices among the 6.5 million smallholder farms within selected origins and archetypes

³ In Ethiopia, GHG emissions decrease from 0.0 to -0.01 Kg CO₂e/Kg GBE delivers a disproportionate % change

Investment needed to take Ethiopia from “organic by default” to a beacon of regenerative coffee is relatively modest given massive benefits expected



Business Case for Investment in Ethiopia

Ethiopia presents a high-impact investment opportunity benefiting 1.1 million smallholder farmers across 440,000 hectares. The primary recommended practice—stumping aged trees—can double productivity from a low base of <500 kg GBE/ha, significantly increasing farmer incomes.

To achieve this, farmers need short-term support to offset income losses during the three-year recovery period, along with hands-on training and on-farm demonstrations to build confidence. At just \$473 per farm, the investment delivers \$617 in annual income gains, with potential funding from a 39% increase in coffee exports.

From a decarbonization standpoint, most Arabica farmers are “organic by default”, meaning higher yields do not raise total GHG emissions.

Additional Benefits of Proposed Transition

Higher incomes will improve social and living conditions for 1.1 million coffee-farming households. These adaptive practices, applied across 440,000 hectares, also help farmers manage rising temperatures and unpredictable rainfall.

Healthier trees are more resilient to threats like Coffee Berry Borer, while practices such as staggered stumping, optimized agroforestry, integrated weed management, and composting improve soil health, water retention, and create biodiversity-supporting habitats.

¹Sum of investments needed over a 7-year transition period; ² Assumes all incremental production is absorbed by export markets; ³Farmer net income at steady state versus baseline for farms that adopt selected regenerative practices, assumed as 50% of all farms in the archetype ⁴ Variance in GHG emissions for coffee produced on adopting farms, based on Cool Farm Platform. Minimal change given baseline 0.0 to -0.01 Kg CO₂e/Kg GBE. See appendix for all calculation inputs and assumptions

A In Ethiopia, experts predict an 85% reduction of indigenous Arabica localities by 2080 and more volatile production volumes due to rising temps., changing rainfall, droughts, and frosts

Effects of climate change on local environment

Gradual
climate
shifts



Rising temperatures

- From 1960-2006 mean annual temperature increased by 1.3°C and predicted to increase 1.1-3.1°C by 2060, with hot days and nights expected to become more frequent.



Changing seasonality

- Farmers report increasing uncertainty regarding the onset of the wet season, as well as a prolonged dry season.



Changing rainfall

- Rainfall is very variable. General circulation models do not agree on future projections of precipitation change
- Rainfall has declined by ~10% across Ethiopia (1948-2006), the decline is greater for spring/summer rains

Extreme
weather
events



Frequent heatwaves, droughts, and frosts

- Warming is projected for all four seasons, which can cause more frequent heatwaves
- Drought is the most significant climate hazard
- Frosts can be especially damaging to young trees

Impact on coffee production absent adaptation



- Forecasts predict an 85% reduction of areas where indigenous coffee Arabica is growing naturally by 2080
- Cultivation is starting in higher elevation areas, previously too cool for Arabica



- Erratic rainfall at the beginning of the rainy season can cause abortion of flowers
- High temperatures (> 28-30°C) have been observed to reduce flower bud formation and cherry production



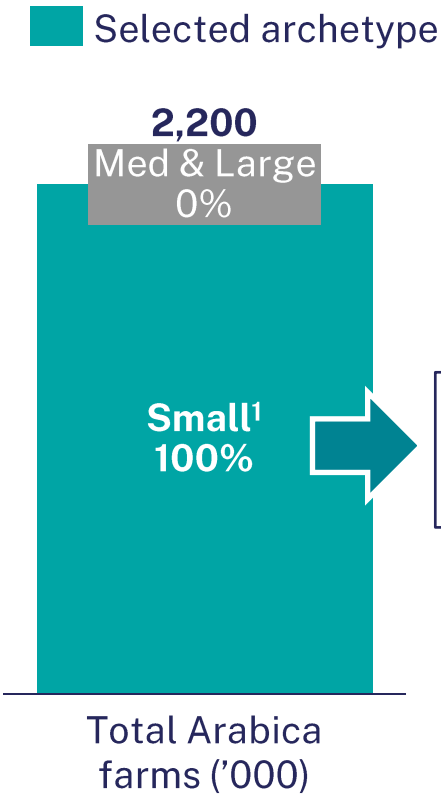
- The increasing temperatures create a more favorable environment for the Coffee Berry Borer. Losses caused by the insect are expected to increase

- **Increased volatility of production volumes** (e.g. frost in 2016 damaged many plants, decreasing quality and yield)

Without adoption of regenerative practices to fuel adaptation, yield likely to decline over the medium term and production is at risk annually from more frequent extreme weather events

A This business case analysis is focused on low input use, shade grown Arabica farms in Sidama and SERS regions under 2 ha; representing 750k farms

Farm size breakdown¹
% of total Arabica farms



2,200k
Arabica farms

~86% of total production

~880k hectares

~750k
Arabica farms in Sidama and South East Regional State (SERS) regions⁴

Additional descriptors of selected archetype



Arabica
100% Arabica production¹



Rain-fed
Limited access to irrigation; yields highly sensitive to rainfall patterns³



Low Mechanization
Limited access to machinery and high reliance on manual labor³



Shade grown / high diversity
Garden systems typical in regions of focus, Sidama and SERS, with 4+ shade tree species (e.g., indigenous trees, bananas, ensete, avocado)³



Low Input Use
Organic-by-default due to limited access and prohibitive costs of synthetic inputs³



No on-farm processing²
Deliver cherry to wet mill collection sites for processing³

¹Enveritas, GCP (2018), Small (<2ha), Medium & Large(>2ha). Excludes 2.8 million marginal smallholder coffee farms with <20 trees/farm. Of the 2,200k farms, 300-1,000 are medium and large farms (0.03% of total) that account for 14% of total production. ² Analysis considers only on-farm processing. Archetypes that process coffee off-farm are denoted as “No on-farm processing” for the purpose of our analysis. ³TechnoServe analysis & expert interviews. ⁴Enveritas, GCP (2018) See appendix for descriptor definitions

A Ethiopia’s Arabica farmers are already largely “organic by default”

Pillars	Current adoption of practices
1 Renovation, Rehabilitation, and Coffee Varieties	Pruning Rejuvenation (incl. stumping) Grafting Replanting ✓✓ Use of improved varieties ✓ Variety diversification ² ✓✓✓
2 Agroforestry systems & Shade	Shade management ✓✓ Shade tree species diversity ✓✓✓
3 Soil conservation and Cover cropping	Cover cropping Intercropping ✓ Physical structures ✓ Contour planting Minimizing soil disturbance ✓
4 Integrated Weed Management (IWM)	Mulching w/ organic residue ✓ Physical control of weeds ✓✓✓ Spot chemical applications

() < 5%
✓ 5 - 30%
✓✓ 30 - 60%
✓✓✓ > 60%

Pillars	Current adoption of practices
5 Integrated Pest & Disease Management (IPDM)	P&D identification & monitoring Field hygiene practices ✓ Biological control ✓✓✓ Traps Precision application of selective pesticides
6 Integrated Nutrient Management (INM)	Soil analysis & field observation Soil amendments Composting & vermi-composting Optimal fertilizer mgmt. (4R strategy) ✓✓ Biofertilizers and/or beneficial microorganisms
7 Efficient Water Use	Rainwater harvesting ✓✓ Improved irrigation management N/A Efficient water use in post-harvest processing N/A
8 Wastewater Management	Wastewater treatment N/A
9 Waterbody Protection	Riparian buffers ✓
10 Waste valorization & production of organic inputs	Biochar production Anaerobic digestion N/A

A

Recommended practices focus on boosting productivity solely through nature-based solutions

Opportunities for farms within archetype, given baseline practices

Practices	Short/medium-term incremental opportunities
1Renovation, Rehabilitation, and Coffee Varieties	➤ Implement staggered stumping with appropriate timing and regrowth management ➤ Replant trees only with disease issues and stump others ➤ Incorporate varieties with greater pest and disease resistance
2Agroforestry systems and Shade	➤ Plant additional shade trees (esp. in lower altitude garden coffee farms found in Sidama), prioritizing indigenous trees & those w/ opportunity to use produce on farm (e.g., banana, ensete trees)
3Soil conservation and Cover cropping	➤ Introduce intercrops in stumped or newly planted areas, prioritizing nitrogen-fixing leguminous crops ➤ Plant vetiver grass that anchors soil to its strong root system ➤ Reduce extent of digging for weed management with use of hand tools (see practice 4)
4Integrated Weed Management (IWM)	➤ Ensure optimal layer of organic mulch is present around root base of trees (especially for stumped coffee or new planting) by leaving leaf litter from coffee and shade trees ➤ Implement consistent targeted manual weeding practices using hand tools rather than digging

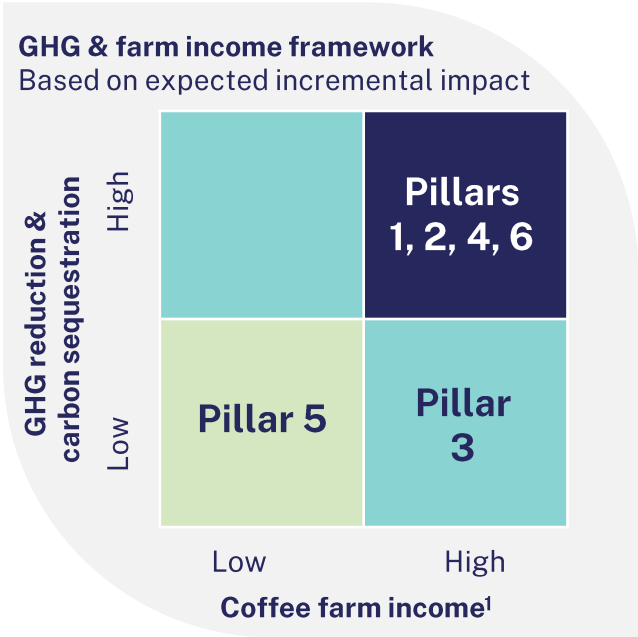
Regen. Ag. practice pillars prioritized based on based on assessment of relative impact on GHG mitigation and coffee farm income. Included in GHG and farmer business case analysis

Practices	Short/medium-term incremental opportunities
5Integrated Pest & Disease Management (IPDM)	➤ Implement routine monitoring to track infestation and inform integrated pest and disease management techniques used ➤ Implement consistent field hygiene practices to remove diseased parts and decrease disease spread
6Integrated Nutrient Management (INM)	➤ Implement routine field observation practices to detect nutritional deficiencies ➤ Optimize organic fertilizer application with right rates and placement (e.g., under tree canopy) according to nutritional deficiencies detected through visual observation ➤ Optimize composting mgt practices (e.g., produce in heaps, proper aeration) and facilitate access to organic inputs (e.g., pulp and husk residue from wet mills)
7Efficient Water Use	No opportunities identified
8Wastewater Management	Not applicable to farmer archetype
9Waterbody Protection	No opportunities identified
10Waste valorization & Production of organic inputs	No opportunities identified

For additional detail on baseline practices, barriers to adoption and incremental opportunities, see appendix 2

B

For farmers within this archetype, renovation, rehabilitation, and new coffee varieties; agroforestry systems and shade; integrated weed mgmt.,; and integrated nutrition mgmt., deliver highest GHG and income impact



GHG & Income Pillars	Specific practices	GHG impact area(s)	Income impact area(s)
1 Renovation, Rehabilitation, and Coffee Varieties	➤ Rejuvenation (incl. stumping) ➤ Replanting ➤ Use of improved varieties	• High yield increase	• High coffee production increase • Improve farm resilience to shocks
2 Agroforestry systems and Shade	➤ Shade management	• Medium yield increase • Increase tree biomass	• Medium coffee production increase • Improve farm resilience to shocks
4 Integrated Weed Management (IWM)	➤ Mulching w/ organic residue ➤ Physical control of weeds	• Medium yield increase • Improve crop residue & waste mgmt.	• Medium coffee production increase • Improve farm resilience to shocks
6 Integrated nutrient management (INM)	➤ Soil analysis ➤ Optimal organic fertilizer mgmt. ➤ Composting	• Medium yield increase • Improve crop residue & waste mgmt.	• Medium coffee production increase • Improve farm resilience to shocks
Other Regen. Pillars	Specific practices	GHG impact area(s)	Income impact area(s)
3 Soil conservation and Cover cropping	➤ Intercropping ➤ Physical structures ➤ Minimizing soil disturbance	• Low yield increase	• Low coffee production increase • Improve farm resilience to shocks
5 Integrated pest & disease management (IPDM)	➤ P&D identification & monitoring ➤ Field hygiene practices	• Low yield increase	• Low coffee production increase • Improve farm resilience to shocks

¹Defined as long-term potential income from coffee growing area (including income from intercrops)
Note: Some areas excluded from prioritization as they were not applicable to farmer archetype (wastewater mgmt) or did not have short/medium-term feasible opportunities (efficient water use, waterbody protection, waste valorization & production of organic inputs)

C Selected pillars also provide other environmental benefits related to soil health, water conservation and quality, and biodiversity and land use

GHG and income pillars	Specific practices	Impact area(s)		
		 Soil health	 Water conservation and quality	 Biodiversity and land use
1 Renovation, Rehabilitation, and Coffee Varieties	➤ Rejuvenation (incl. stumping) ➤ Replanting ➤ Use of improved varieties	 • Cover soil and reduce erosion with stumped materials	 <i>Limited potential for impact given no use of fungicides, insecticides</i>	 • Allow for more efficient use of available land, reducing pressure on remaining forest
2 Agroforestry	➤ Shade mgmt.	 • Protect soil against water and wind erosion • Enhance soil life, fertility, and nutrient cycling	 • Improve water regulation and retention (“hydraulic lift” and “nutrient pump” effects)	 • Provide habitats for insects, plants, birds, soil fauna, and microbes with tree canopies and litter
4 Integrated Weed Management (IWM)	➤ Mulching w/ organic residue ➤ Physical control of weeds	 • Help control soil erosion and runoff with mulching cover	 • Improve water infiltration with mulching cover	 <i>Limited potential for impact given no use of herbicides</i>
6 Integrated Nutrient Management (INM)	➤ Soil analysis ➤ Optimal organic fertilizer mgmt. ➤ Composting	 • Stimulate nutrient cycling and retention with use of organic resources • Strengthen soil carbon stocks with organic inputs	 • Enhance soil water retention with improvements in organic resource management	 • Support soil microbial diversity with a balanced and nutrient-rich soil environment • Help to protect wild biodiversity on farm and in the surrounding landscape with reduced eutrophication

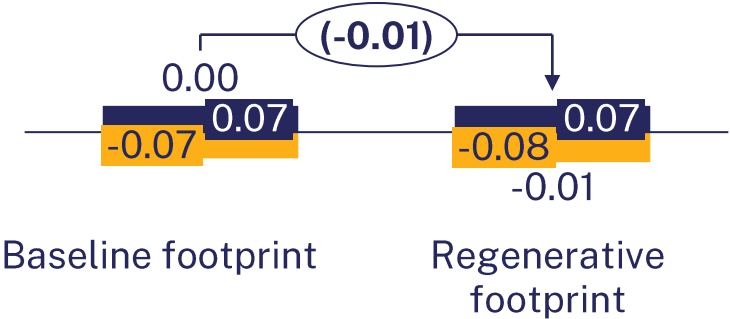
Approx. level of impact: ● Very high ● High ● Medium ● Low ○ Very low

Other regen. pillars (3, 5 on previous slide) can also contribute significantly to soil health, water conservation and quality, and biodiversity and land use. See appendix 1 for further details

D Given Ethiopia’s farmers are “organic by default”, proposed regenerative practices expand production while maintaining a near-zero GHG footprint

GHG footprint under regenerative adoption¹
Kg CO₂e/Kg GBE

■ Fertilizer
■ Agroforestry



- Though the change is small, emissions reduction is mostly driven by a **~30% increase in shade tree density**, which enhances carbon sequestration
- Also driven by a **near doubling of yields** by year six from 458 to 848 kg GBE / ha, largely due to adoption of stumping and routine rejuvenation practices
- **Additional production comes with no increase in absolute GHG emissions**

¹Variance in GHG emissions for coffee produced on farms that adopt selected regenerative practices. Figures obtained by manually uploading data into Cool Farm Platform GHG module. Emissions sources and sinks (a) included in all analysis: crop details, crop residues, pesticide, fertilizers, non-crop estimates; (b) included only if relevant to production system: wastewater, fuel and energy, irrigation energy; (c) excluded from all analyses: transport, re/deforestation, soil carbon changes, machinery operations.
For Ethiopia: crop residue emissions excluded due to negligible amount of coffee crop residue produced on-farm;
Sources: TechnoServe analysis & expert interviews
See appendix for calculation inputs and assumptions

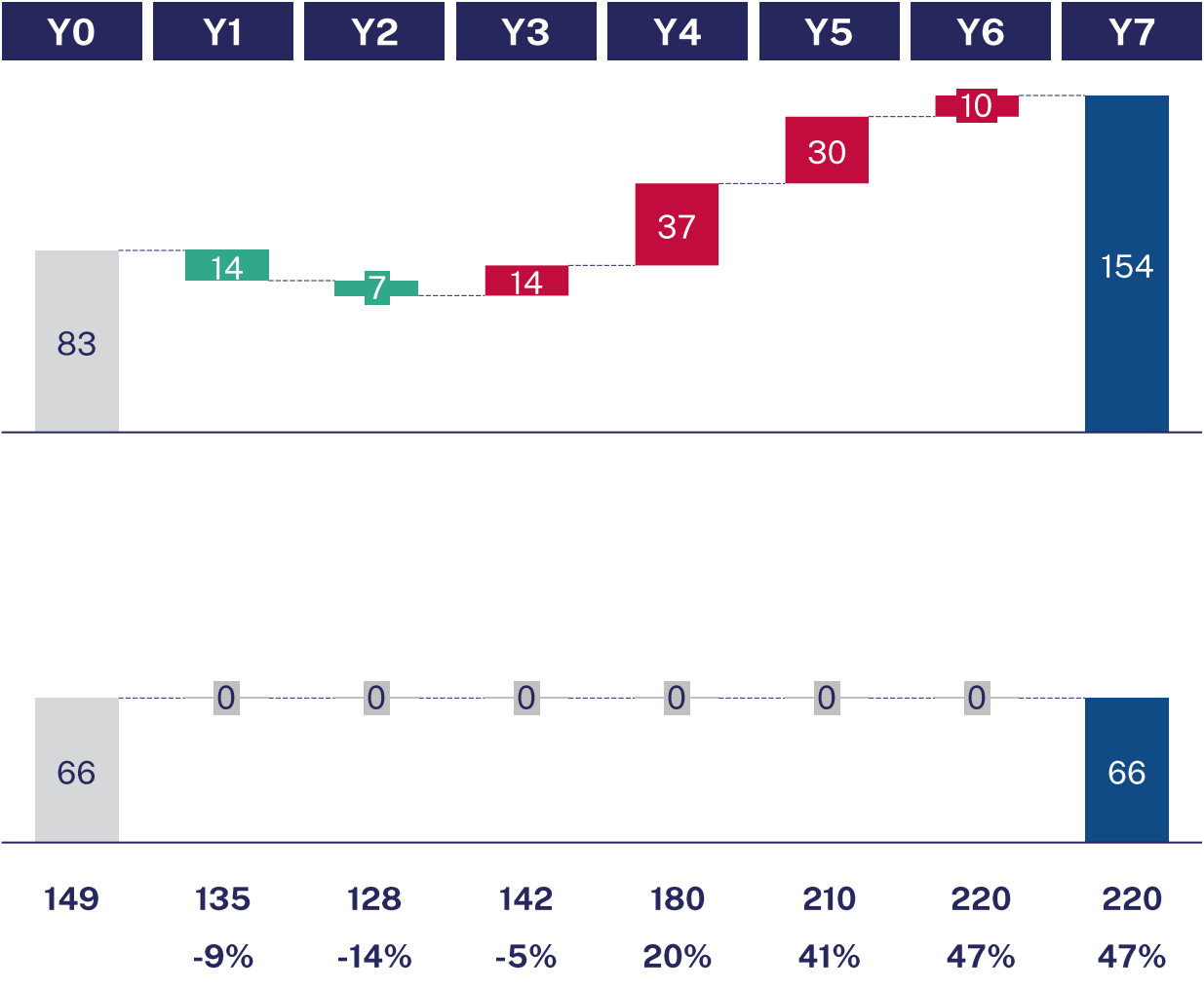
E While operating costs are projected to increase due to additional harvest labor demands resulting from increased production...

YoY Change (\$/ha)

Harvest labor

Crop mgmt. labor

Total costs
% change vs. baseline



Interpretation

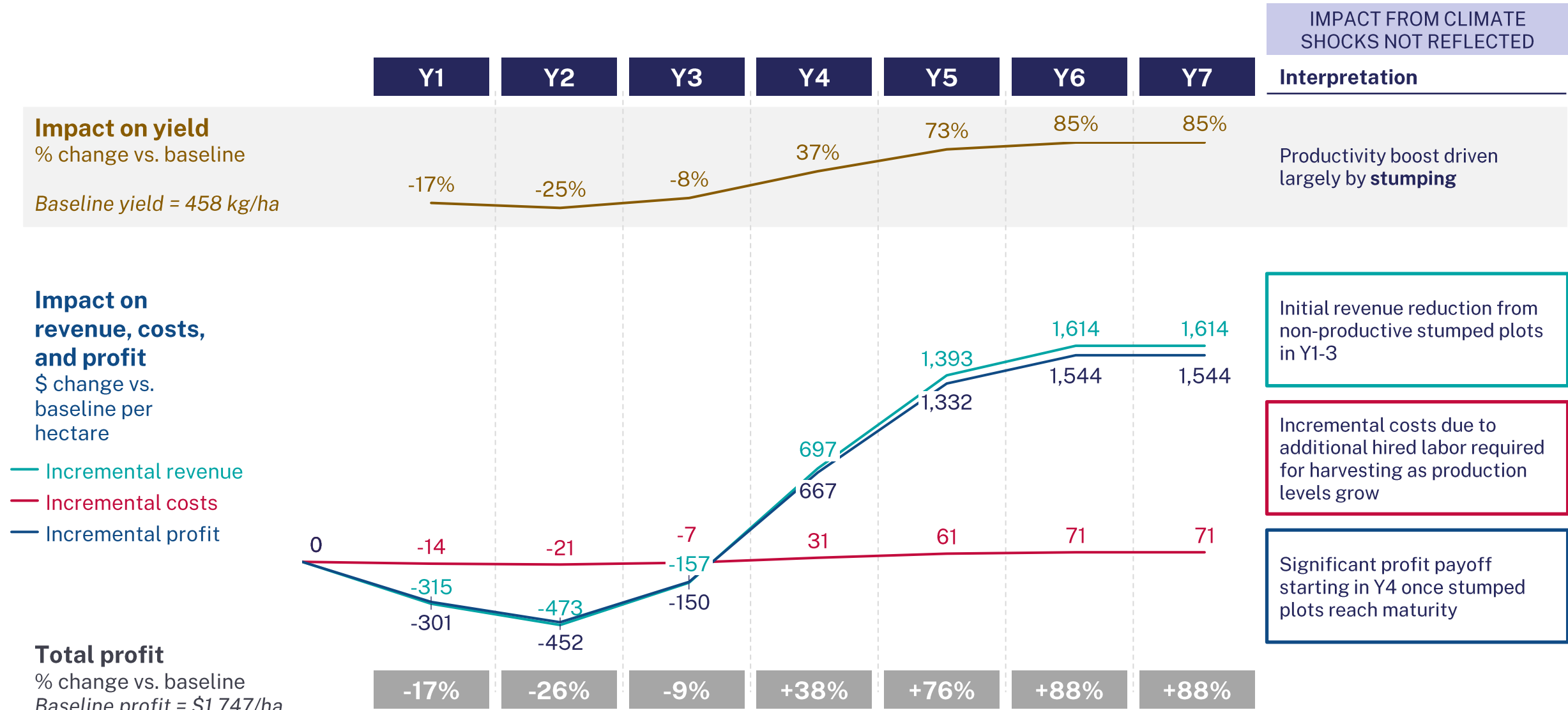
Additional harvest labor likely required with increases to production volume –
Paid labor expected to meet the additional harvest demands resulting from increased production starting in Y3 as stumped plots reach maturity

No additional hired labor required for crop management activities –
Family labor likely used for additional crop management labor required with implementation of prioritized practices (incl. stumping, managing shade trees, weeding, making compost)



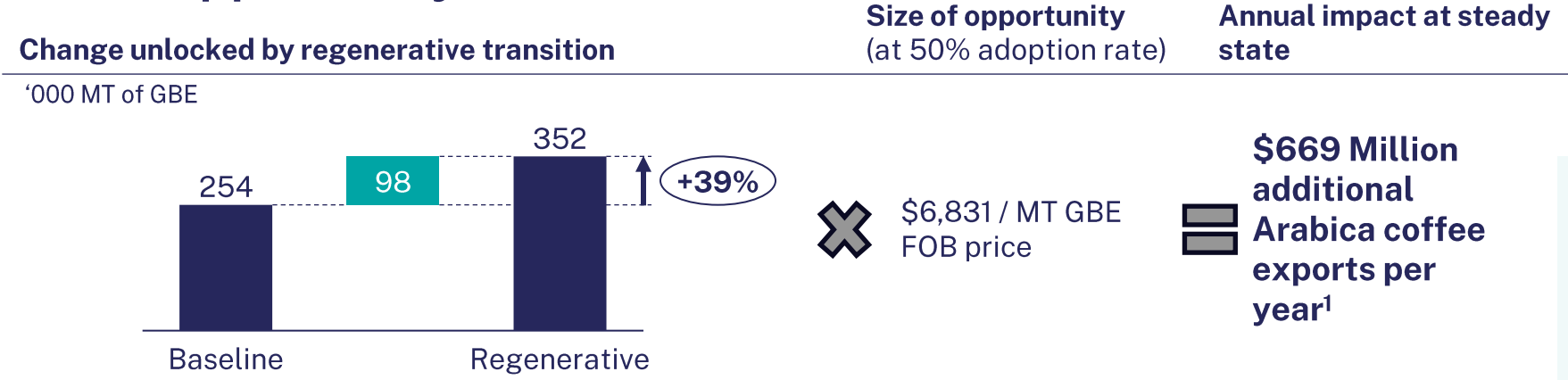
Assumptions: Stumping of 15% farm area per year for Y1-Y3 in line with recommended 7-year cyclical stumping practices to mitigate initial production/income losses; Agroforestry seedlings provided free of cost by government programs; Constant prices, constant input costs, constant exchange rate; and no inflation
Sources: TechnoServe analysis & expert interviews

E ...yield benefits from stumped plots can almost double farm profit after six years



DE Scaling these farm-level impacts to all small-scale Arabica farms underscores the magnitude of the opportunity at stake

ECONOMY
Exports



PEOPLE
Farmer Income



NATURE
GHG Emissions



To build a perspective on scale potential, farm-level transition model for small farmers in Sidama and SERS regions is scaled to all small Arabica farms in Ethiopia.

Similar gains are expected, even if some variation in practices is needed (e.g. shade tree planting)

¹Assumes all incremental production from farms that adopt selected regenerative practices is absorbed by export markets ²Assumes 50% of archetype adopts regenerative practices
See appendix for all calculation inputs and assumptions

F Since farmers incur losses in the initial years of the transition, investment is needed to both offset lost income and provide hands-on training and demo plots

	Purpose of investments	Investment needed over 7-year transition ¹		
		Per Farm	Total for archetype	Share of total
Upfront transition investment	None needed given lack of upfront investment costs incurred by farmers during regen transition (agroforestry seedlings provided free of cost by government programs, no composting nor stumping equipment needed)	n.a.	n.a.	0%
Transition operating expenses	None needed given lack of transition operating expenses incurred by farmers during regen transition (compost produced free of cost using on-farm organic materials, no synthetic inputs needed)	n.a.	n.a.	0%
Foregone net income due to initial yield drop	Covering foregone net income during years 1-3 where yield is lower than baseline from non-productive stumped plots	\$343 / farm	\$ 378M	73%
Technical assistance	Technical support to educate and guide farmers on renovation/rehabilitation, agroforestry, IWM and INM adoption, including on-farm demonstration plots	\$129 / farm	\$ 142M	27%
TOTAL INVESTMENT		\$472 / farm	\$ 520M	

Existing finance or technical assistance provided by industry, civil society or public sector entities could be directed towards these efforts

¹Sum of investments needed over a 7-year transition period. Assumes 50% of archetype adopts regenerative practices. See appendix for all calculation inputs and assumptions

Elevating Ethiopia from “organic by default” to a beacon of regenerative coffee requires relatively modest investment and delivers massive benefits

Farm archetype focus of study:

- ~2,200K small Arabica farms (<2ha); 100% of Ethiopia’s coffee farms, ~85% of national production
- Low mechanization; low input use; shade grown, based on farm profile from Sidama and SERS regions

Regenerative opportunities:

- Productivity levels below potential due to minimal adoption of GAP and increasingly extreme, variable weather, forecasted to potentially lead to an 85% reduction of localities where Arabica is growing naturally by 2080¹. Key practices to impact farm income and GHG footprint are:
 - **Renovation, rehabilitation, and coffee varieties:** Implement staggered stumping with appropriate timing, regrowth mgmt.
 - **Agroforestry systems and shade:** In areas with lower shade (e.g. Sidamo), plant additional shade trees, prioritizing indigenous trees and those with opportunity to use produce on farm
 - **Integrated weed mgmt. (IWM):** Adopt mulching and targeted manual weeding practices
 - **Integrated nutrient mgmt. (INM):** Adopt optimal compost production and application practices

Environmental benefits:

- Given Ethiopia’s farmers are largely “organic by default”, proposed regenerative practices offer negligible GHG reduction from ~0 to -0.01 kg CO₂e / kg GBE, primarily through an increase in shade tree density and near doubling of yields
- Further benefits include increased biodiversity through environments created by agroforestry and added organic matter applied to soil

Economic benefits:

- In addition to strengthening resilience to weather shocks, regenerative practices can improve **farm profitability** from ~\$1,747/ha to ~\$3,291/ha by year six, largely through 85% increase in productivity

Investment required:

- **Farmer capital investment** of \$343/ farm is needed to cover foregone net farmer income during initial years of regenerative transition when yields are below baseline due to non-productive stumped plots
- **Technical assistance investment** of \$129/ farm is needed to educate and guide farmers on renovation/rehabilitation, agroforestry, IWM, and INM practices, including on-farm demonstration plots



EXPECTED BENEFITS



1,100k
farms



440k
hectares

ECONOMY

39% increase in Arabica exports²
\$669M additional exports p.a.

PEOPLE

88% increase in farm income³
\$679M additional farm income p.a.

NATURE

n.a. reduction in kg CO₂e/kg GBE⁴
3K MT CO₂e abated p.a.

\$74 Million investment p.a. over 7 years¹

¹Sum of investments needed over a 7-year transition period; ²Assumes all incremental production is absorbed by export markets; ³Farmer net income at steady state versus baseline for farms that adopt selected regenerative practices, assumed as 50% of all farms in the archetype ⁴Variance in GHG emissions for coffee produced by adopting farms, based on Cool Farm Platform. Given baseline 0.0 Kg CO₂e/Kg GBE, any minor change delivers a disproportionate % change
See appendix for all calculation inputs and assumptions

Appendix 1

REGENERATIVE COFFEE FARMING FRAMEWORK



Rito Girón Hernández (right) learns techniques to improve his coffee production in the department of Intibucá, Honduras. (TechnoServe / Olivia Sakai)

Ten Pillars of Regenerative Agriculture for Coffee Farming



1 Renovation, Rehabilitation, and Coffee Varieties

Rejuvenating aging and replacing diseased/ poorly managed coffee trees with new trees or improved coffee varieties capable of producing higher yields and/or better qualities

- Pruning
- Rejuvenation, including stumping
- Grafting (in nurseries or topworking for adult plants)
- Replanting old/diseased coffee trees
- Use of improved varieties
- Variety diversification



2 Agroforestry Systems and Shade

Growing trees, coffee plants, and other crops within the same plot (intercropped and around edges), creating multiple vegetation layers similar to a natural forest

- Shade management
- Shade tree species diversity



3 Soil Conservation and Cover Cropping

Activities that protect topsoil against water and wind erosion, as well as improve soil health and water retention

- Cover cropping¹
- Intercropping²
- Physical structures (such as live and dead barriers, terraces, living fences, windbreaks)
- Contour planting
- Minimizing soil disturbance



4 Integrated Weed Management (IWM)

Preventative and corrective measures that limit weed introduction and spread, help coffee outcompete undesirable weeds, and prevent weeds from adapting to management measures

- Mulching with organic residue
- Physical control of weeds (such as trimming, mowing, slashing, uprooting)
- Spot chemical applications on aggressive weeds



5 Integrated Pest & Disease Management (IPDM)

A pest and disease management strategy based on regular monitoring and the timely application of nature-based prevention and control measures

- P&D identification and monitoring
- Field hygiene practices (such as removal of diseased parts, sanitation of farm tools, timely harvesting and disposal of fallen cherries)
- Biological control (such as biocontrol agents, biopesticides, insects)
- Traps
- Precision applications of selective pesticides

¹ Focus on service crops.

² Focus on ground crops grown for income or consumption purposes.

Ten Pillars of Regenerative Agriculture for Coffee Farming (2/2)



6 Integrated Nutrient Management (INM)

The efficient and balanced use of mineral fertilizers, along with the management of organic resources to ensure optimal crop nutrition, sustain soil health, and minimize negative environmental impacts

- Soil analysis and field observation
- Soil amendments (e.g., lime)
- Composting and vermi-composting
- Optimal fertilizer³ management (4R strategy)
- Application of biofertilizers and/or beneficial microorganisms



7 Efficient Water Use

Minimizing production and post-harvest water footprint by reducing use and loss of water, promoting water recycling, and avoiding contamination of water sources

- Rainwater harvesting (such as reservoirs or collection basins)
- Improved irrigation management (efficient systems, water quality, maintenance)
- Efficient water use in postharvest processing (such as water recycling/recirculation systems, dry fermentation tanks, special milling machines, honeys/naturals)



8 Wastewater Management

Actions to limit or eliminate the negative effects of residual water from postharvest processing on natural resources and human health, and reduce the carbon footprint of coffee production

- Wastewater treatment (such as lime, biodigesters, oxidation tanks, ecomills, vetiver grass)



9 Waterbody Protection¹

Actions to limit or eliminate the contamination waterbodies that are on or near coffee farms

- Riparian buffers of natural vegetation



10 Waste Valorization and Production of Organic Inputs²

Recycling and converting organic waste and crop residues into products that can be used on the coffee farm, thereby reducing the need for external inputs

- Biochar production
- Anaerobic digestion of wastewater

¹ CIAT's Landscape Action practice includes waterbody protection with riparian barriers among other practices that are beyond an individual farmer's control. Protecting waterbodies on or near coffee farms with buffer zones is a feasible practice for most archetypes and is included in other regenerative agriculture assessment frameworks.

² Other waste valorization sub-practices mentioned by CIAT include animal feed that includes coffee pulp, compressed husk pellet production, mushroom production, and insect cultivation. These sub-practices have been removed from the Framework because they are not common strategies and not relevant across most archetypes

³ Includes both organic and synthetic fertilizers

Beyond GHG, these 10 regenerative pillars deliver significant environmental benefits across soil health, water conservation and quality, and biodiversity and land use

		Impact area(s)		
Pillars		 Soil Health	 Water Conservation and Quality	 Biodiversity and Land Use
1	 Renovation, Rehabilitation, and Coffee Varieties	 Cover soil and prevent erosion with pruned materials	 Minimize risk of water pollution with reduced fungicide and insecticide use²	 Allow for more efficient use of available land, reducing pressure on remaining forest
2	 Agroforestry	 - Protect soil against water and wind erosion - Enhance soil life, fertility, and nutrient cycling	 Improve water regulation and retention (“hydraulic lift” and “nutrient pump” effects)	 Provide habitats for insects, plants, birds, soil fauna, and microbes with tree canopies and litter
3	 Soil Conservation and Cover Cropping	 - Reduce loss of fertile topsoil - Improve soil temperature, aeration, porosity	 Improve water infiltration and retention	 Provide habitats for functional biodiversity with cover crops
4	 Integrated Weed Management (IWM)	 Help control soil erosion and runoff with mulching cover	 - Minimize risk of contamination of water bodies with reduced use of herbicides¹ - Improve water infiltration with mulching cover	 Support functional biodiversity (pollinators and natural enemies of pests) with reduced use of herbicides¹
5	 Integrated Pest & Disease Management (IPDM)	 Increase soil biodiversity with reduced use of harmful insecticides and fungicides¹	 Minimize risk of contamination of surface and groundwater with reduced use of insecticides and fungicides¹	 Support functional biodiversity (pollinators and natural enemies of pests) with reduced use of insecticides and fungicides¹
Approx. level of impact:		 Very high  High  Medium  Low		

¹ Impact level vary per archetype depending on level of synthetic input use; ² Impact area only relevant for archetypes with irrigation and/or wet milling
Sources: CIAT (2023), TechnoServe analysis & expert interviews

Beyond GHG, these 10 regenerative pillars deliver significant environmental benefits across soil health, water conservation and quality, and biodiversity and land use (2/2)

		Impact area(s)		
Pillars		 Soil Health	 Water Conservation and Quality	 Biodiversity and Land Use
6	 Integrated Nutrient Management (INM)	 • Stimulate nutrient cycling and retention with combined use of mineral fertilizers, organic resources and soil amendments¹ • Strengthen soil carbon stocks with organic inputs	 • Reduce nutrient losses from volatilization and leaching, thus reducing contamination of water bodies with excess nutrients • Enhance soil water retention with improvements in organic resource management	 • Support soil microbial diversity with a balanced and nutrient-rich soil environment • Help to protect wild biodiversity on farm and in the surrounding landscape with reduced eutrophication and chemical dependency¹
7	 Efficient Water Use	 • Help limit GHG emissions from postharvest wastewater with reduced water consumption²	 • Prevent aquifer depletion and secure water availability in watersheds	 • Help protect and restore wild biodiversity with conservation of water sources
8	 Wastewater Management	 • Improve soil health with reuse of byproducts from coffee processing as compost²	 • Protect water resources from overuse and contamination	 • Help conserve aquatic life
9	 Waterbody Protection	 • Support control of soil erosion and landslides	 • Decrease sedimentation and contamination of water bodies	 • Enhance biodiversity with improved aquatic habitats
10	 Waste Valorization and Production of Organic Inputs	 • Replenish soil with essential nutrients • Enhance nutrient cycling with source of energy for soil biota	 • Help prevent watershed contamination from untreated wastewater²	 • Help protect and restore wild biodiversity with reduced negative effects of unprocessed coffee waste disposal

Approx. level of impact: ● Very high ● High ● Medium ● Low

¹Impact level vary per archetype depending on level of synthetic input use.

²Impact area only relevant for archetypes with irrigation and/or wet milling.

Sources: CIAT (2023), TechnoServe analysis & expert interviews

Appendix 2

ADDITIONAL DETAILS ON METHODOLOGY

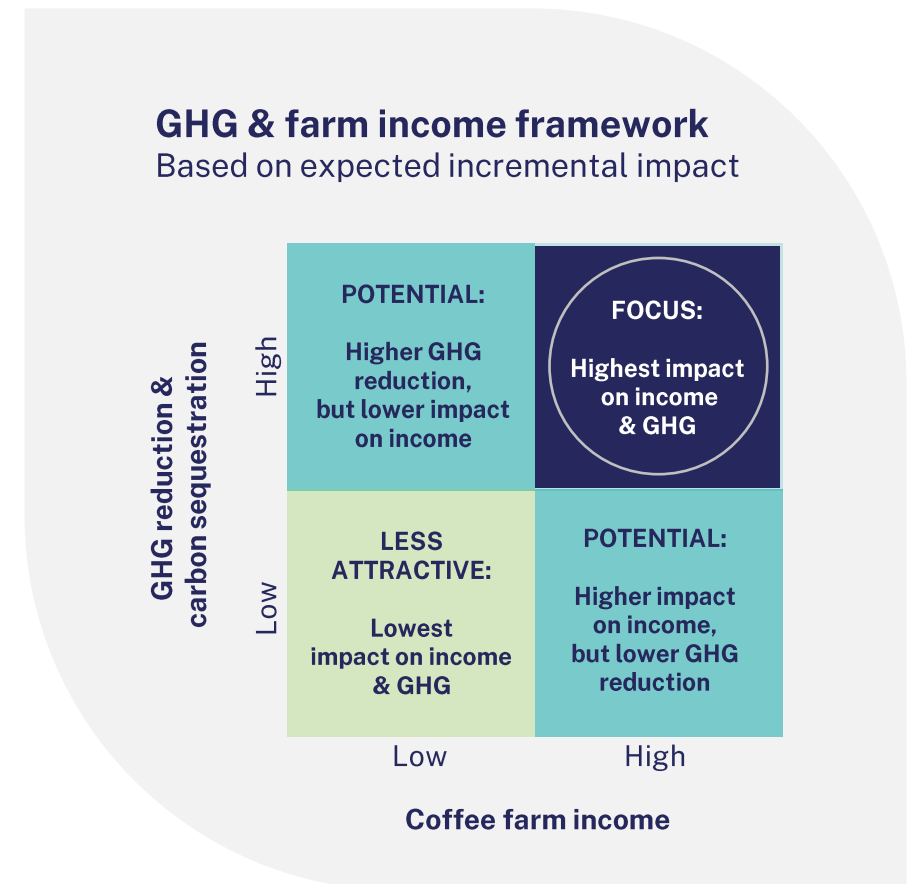


From right: Vicky Tarime and Gadi Swai prepare coffee beans for drying in the foothills of Mt Kilimanjaro, Tanzania. (TechnoServe / Naashon Zalk)

Roadmaps for each country identify proven practices relevant to the local context, that benefit both farmer incomes and nature

APPROACH TO DESIGN THE REGENERATIVE TRANSITION

- The ambitious outcomes described in the roadmaps are generated by envisaging a world where farmers in major coffee growing countries adopt a subset of practices from the Regenerative Coffee Farming Framework.
- Practices are selected for each coffee origin based on assessment of relative impact on the environment and coffee farm income. To shortlist practices that can immediately attract investment at scale, GHG mitigation is used as the primary environmental screen and income from coffee and agroforestry are used as the primary source of farm revenue.
- However, these practices also offer substantial benefits for soil health, water use, and biodiversity, which the report describes qualitatively. A future phase of this study would incorporate the costs and benefits of the full transition to regenerative coffee farming, including potential farm income from ecosystem services.
- Additionally, the study focuses on practices that are already being employed and have an evidence base for impact. While additional innovation may be required, scaling existing technologies already offers huge potential, as demonstrated in the quantified impact figures.

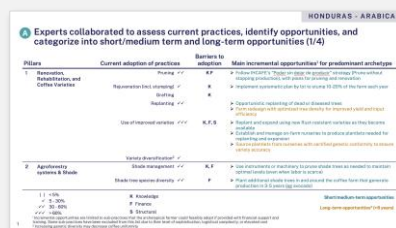


Farm-level economic and GHG modeling supports each country roadmap.

Resilience, soil, water, and biodiversity impacts are captured qualitatively

GHG EMISSIONS AND FARM INCOME EVALUATION METHODOLOGY

A Establish base practices and identify opportunities



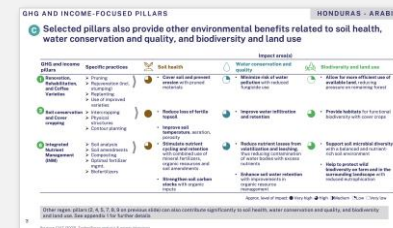
- Document evidence of climate change impact on coffee
- Identify dominant coffee farm archetypes based on size, mechanization
- Assess existing farming practices
- Identify and categorize regenerative opportunities across short vs long term

B Shortlist practices for GHG and farm income



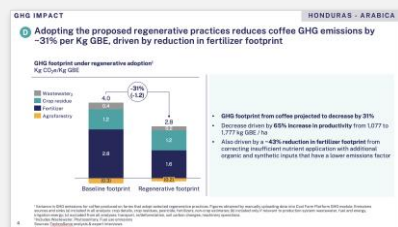
- Evaluate regenerative practices based on feasibility, economic viability, and adoption potential
- Rank practices by impact on GHG reduction, carbon sequestration, farm income

C Assess impact on soil, water, and biodiversity



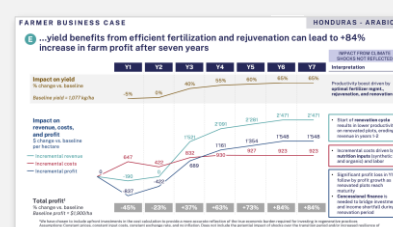
- Qualitatively analyze impact on soil health from increased organic matter
- Evaluate water conservation benefits in retention, runoff, and quality changes
- Assess impacts on efficiency of land use, species diversity and habitat restoration

D Quantify impact on GHG emissions



- Collect farm-level data on synthetic fertilizer use, organic inputs, and emissions
- Model emissions reductions using Cool Farm Platform

E Quantify change in farmer income



- Gather farm data on yields, input and labor costs, and selling prices
- Calculate year by year impact on revenues and costs from new practices
- Forecast long-term profitability shifts

F Estimate investment and incremental costs



- Calculate farmer capital to cover incremental costs, and foregone net income during each transition year
- Estimate costs of technical support to farmers
- Define types of capital required to meet needs

See appendix for additional details on methodology. Individual country reports available with detailed analysis and commentary.

- **Data collection:** Aggregate and anonymize data from TechnoServe farm surveys, partners' farm-level data (i.e., Nestle, JDE Peet's), public research, and expert interviews.
- **Data analysis:** Filter raw datasets received to include only those farms that fit the selected archetype dimensions (e.g., farm size, mechanization, input use, irrigation).
- **Key assumptions:** Constant prices, constant input costs, constant exchange rate, and no inflation. Does not include the cost of inaction, or the potential impact of shocks over the transition period and/or increased resilience of regenerative farms in the face of those shocks. Projections are based on adequate adoption of recommended practices and represent an optimal scenario.
- **Interpretation and recommendations:** Consult with coffee agronomists, practitioners and subject matter experts to validate insights from data analysis, align on selection of practices for GHG and income modeling, provide quantitative inputs to project change in drivers of GHG emissions, yields and costs, and provide qualitative perspectives on impact on soil, water and biodiversity.

GHG emissions were obtained for each country archetype, using the online-based calculating tool Cool Farm Platform

Methodology

- **Data collection:** Data was collected from TNS farm field surveys, partners' farmer data, public research, and expert interviews. All data has been anonymized for confidentiality purposes
 - **Data analysis technique:** Raw datasets received were aggregated and filtered to include only those farms that fit the selected archetype dimensions.
 - **Calculating tool (and methodology):** GHG emissions were obtained by manually uploading data into Cool Farm Platform's (CFP) GHG module, version Methods 2.2.0 - CFP 2.XX. The pathway used was "perennials", and the typology selected was "Coffee – shaded" for all archetypes except for Brazil Arabica and Brazil Robusta, for which "Coffee – monocrop" was selected
 - **Global Warming Potential (GWP):** IPCC AR6
 - **Operational boundary:** GHG emissions assessment limited to on-farm emissions from activities that farmers have direct control over and could be mitigated with implementation of regenerative practices. Explanations of emissions sources/sinks excluded are found in upcoming slides. This study assesses the potential variance in GHG emissions from adopting certain regenerative practices, rather than coffee's carbon footprint. A complete carbon footprint would require a life-cycle assessment, either cradle-to-gate or cradle-to-grave, which exceeds the purposes of this study
- | Emissions sources/sinks considered: | |
|-------------------------------------|---|
| Included in all analyses: | <ul style="list-style-type: none">• Crop details• Crop residues• Pesticide• Fertilizers• Non-crop estimates |
| Included in some analyses: | <ul style="list-style-type: none">• Wastewater¹• Fuel and energy²• Irrigation energy³ |
| Excluded from all analyses: | <ul style="list-style-type: none">• Transport• Re/deforestation• Soil carbon changes• Machinery operations |

¹Only included if farmer archetype irrigates and/or wet process on-farm; ²Only included if farmer archetype is highly mechanized; ³Only included if farmer archetype irrigates

Certain emission sources and sinks were excluded from the study as they were out-of-scope, not applicable to the farmer archetype, or redundant

Emission sources/sinks excluded

Source/Sink	Archetype	Reason for exclusion
Inbound transportation	All archetypes	Assessment focuses only on on-farm emissions that could be mitigated with implementation of regenerative practices. All upstream emissions, except for fertilizer and phytosanitary input manufacturing, are out-of-scope
Outbound transportation	All archetypes	Assessment focuses only on on-farm emissions that could be mitigated with implementation of regenerative practices.. All downstream emissions beyond the farm-gate are out-of-scope
Land-use change (LUC)	All archetypes	Assessment focuses only on on-farm emissions that could be mitigated with implementation of regenerative practices.. Emissions from any land use change that may have occurred prior to intervention cannot be changed with regenerative transition and are therefore out-of-scope
Soil organic carbon (SOC)	All archetypes	Land management practices such as carbon inputs or tillage are considered irrelevant in the tier 1 SOC model for perennial systems, as indicated by IPCC [2019] (Volume 4, Figure 5.1). Consequently, only LUC impacts the SOC model at present
De/Reforestation	All archetypes	Assessment focuses only on on-farm emissions that could be mitigated with implementation of regenerative practices. Emissions from any deforestation that may have occurred prior to intervention cannot be changed with regenerative transition and are therefore out-of-scope
Machinery operations	All archetypes	Fallback for when accurate energy usage is not available. Given availability of primary energy usage data, machinery operations excluded.
Wastewater	Only if archetype doesn't wash coffee on farm	Not applicable for farmer archetypes that do not wash coffee on-farm
Energy for irrigation	Only if archetype doesn't use artificial irrigation	Not applicable for farmer archetypes that do not artificially irrigate their fields
Fuel and energy use	Only if archetype isn't highly mechanized	Not applicable for farmer archetypes that are not mechanized, and heavily rely on manual labor

Workarounds were implemented to address current limitations within the Cool Farm Platform, which is still in development

Tool & methodology limitations

Source/Sink affected	Limitation	Analysis workaround
Organic fertilizers	Only a few options are available for organic fertilizers. Although CFP allows to enter a fertilizer's NPK composition to estimate manufacturing emissions of products that are not already mapped, it can only be used for synthetic inputs	Organic fertilizers included in calculations only if suitable match based on carbon sequestration potential input from CFP options available
Non-NPK fertilizers (micronutrients)	If a non-NPK fertilizers is not already mapped in CFP, it cannot be assessed through the option "compose your own NPK"	Excluded from carbon footprint analysis
Bio-pesticides	Although there are emissions associated to the manufacturing of bio-pesticides, CFP is not built to consider them	Excluded from carbon footprint analysis
Inputs' density (liters/kilograms)	Emission factors for fertilizers and pesticides are defined per kilogram of product used. There are no emission factors defined per liters of product used	In cases where quantity of input used was provided in liters, density liters/kilograms was assumed to be equal to 1. This is in line with CFP's approach
Crop residues	Emissions factors for management options are still in development (e.g., "residues left on soil" mgmt. option is not yet modelled); Refined emissions factors will be part of the LSOC-N2O model coming in 2025	Calculated using Cool Farm Tool (with 0% waste fruit included due to negligible amounts of coffee cherries left on farm and pulp residues included only for archetypes with dry hulling or wet milling)
Soil organic carbon (SOC)	Land management practices such as carbon inputs or tillage are considered irrelevant in the tier 1 SOC model for perennial systems, as indicated by IPCC [2019] (Volume 4, Figure 5.1). Consequently, these type of practices do not impact CFP's SOC model at present	Excluded from carbon footprint analysis
Intercrops, shade-trees and hedges	CFP assess carbon sequestration from these type of biomass based on the plant's specie. However, it offers a limited number of species to choose from, oftentimes, not in line with region or farmer context	- Shade trees included in calculations only if suitable match based on carbon sequestration potential input from CFP options available (incl. tropical shade tree in dry areas, tropical shade trees in wet areas – canopy trees, tropical shade trees in wet areas – understory, temperate conifers, temperate broadleaf trees, temperate shrubs) - Intercrops included in calculations only if suitable match based on carbon sequestration potential input from CFP options available (incl. avocado, cashew, jackfruit, rubber durian)

Assumptions used to scale up farm-level model to all farms in archetype, to arrive at total benefits and investment required

	Value	Commentary
Regenerative adoption rate of farms in each archetype	50%	Assumed universal adoption rate across countries based on TechnoServe estimates
Transition financing per farm	Country-specific	Assumed financing is provided to farms to maintain at least their baseline income throughout the regenerative transition Ex: If a farm's baseline income is \$100, and in year 1 of the regenerative transition income drops by \$25 to \$75 (due to a \$10 revenue loss from one practice and \$15 in additional operating expenses), the transition cost per farm is broken down as \$15 in operating expenses and \$10 in foregone revenue, making up the total needed to reach the \$100 baseline income. In year 2, if income rises to \$120, exceeding the \$100 baseline, no transition financing is provided
Technical assistance cost per farm	Country-specific	Assumed all farmers who adopt regenerative practices receive full technical assistance package, and farmers who do not adopt regenerative practices drop out in Y1, incurring only 10% of total technical assistance costs Technical assistance assumed to be greater in the first 2 years and only light touch in the following 5 years Technical assistance includes demonstration plots across 5% of farms, assuming cost per plot equal to the transition financing provided per farm plus 10% for admin. activities

Appendix 3

ETHIOPIA DETAILED ANALYSES



Coffee grows under the shade of plantain trees in Honduras. (TechnoServe / Olivia Sakai)

A This business case analysis is focused on low input use, shade grown Arabica coffee farms in Sidama and SERS regions under 2 ha; representing 750k farms

	Dimension	Options	Ethiopia – Arabica	
Farmer Archetype	Coffee species	Arabica Robusta	Arabica	
	Coffee farm size	Small (<2ha) Medium (2-10ha) Large (>10ha)	Small (<2ha)	
	Predominance of archetype	Number of farms (as % of total)	100% ¹	
Relevant descriptors associated with this archetype	Mechanization	Low Medium High	Low	This small farm archetype is based on level of shade in garden-systems prevalent in Sidama and SERS regions. Small farmers in other regions present higher or lower levels of shade. Farms in this archetype represent around 750k of total 2,200k small farms in Ethiopia
	Input use (synthetic fertilizer and crop protection products)	Low Medium High	Low	
	Water source	Rain-fed Irrigation	Rain-fed	
	Shade	Full-sun Shade-grown with low species diversity Shade-grown with high species diversity	Shade-grown with high species diversity	
	Processing on farm	Wet milling Dry hulling Drying (no hulling) None	None	

A Experts collaborated to assess current practices, identify opportunities, and categorize into short/medium term and long-term opportunities (1/3)

Areas	Current adoption of practices	Barriers to adoption	Main incremental opportunities ¹ for predominant archetype
1 Renovation, Rehabilitation, and Coffee Varieties	Pruning	S	
	Rejuvenation (incl stumping)	K	➤ Implement staggered stumping with appropriate timing and regrowth management
	Grafting	S	
	Replanting ✓✓		➤ Replant trees only with disease issues and stump others
	Use of improved varieties ✓	K, S	➤ Incorporate varieties with greater pest and disease resistance
	Variety diversification ² ✓✓✓		
2 Agroforestry systems & Shade	Shade management ✓✓	K	➤ Plant additional shade trees (esp. in lower altitude garden coffee farms found in Sidama), prioritizing indigenous trees & those w/ opportunity to use produce on farm (e.g., banana, ensete trees)
	Shade tree species diversity ✓✓✓		
3 Soil conservation and Cover cropping	Cover cropping ³	S	
	Intercropping ⁴ ✓	K	➤ Introduce intercrops in stumped or newly planted areas, prioritizing nitrogen-fixing leguminous crops
	Physical structures ✓	K	➤ Plant vetiver grass that anchors soil to its strong root system
	Contour planting	S	
	Minimizing soil disturbance ✓	K	➤ Reduce extent of digging for weed management with use of hand tools (see practice 4)

() < 5%
✓ 5 - 30%
✓✓ 30 - 60%
✓✓✓ > 60%

K Knowledge
F Finance
S Structural

Short/medium-term opportunities

Long-term opportunities⁵ (>8 years)

¹Incremental opportunities are limited to sub-practices that the archetypal farmer could feasibly adopt if provided with financial support and training. Some sub-practices have been excluded from this list due to their level of sophistication, logistical complexity, or elevated cost

²Increasing genetic diversity may decrease coffee uniformity

³Focus on service crops

⁴Focus on ground crops grown for income or consumption purposes

⁵Long-term opportunities excluded from the GHG and income evaluation framework

A Experts collaborated to assess current practices, identify opportunities, and categorize into short/medium term and long-term opportunities (2/3)

Areas	Current adoption of practices	Barriers to adoption	Main incremental opportunities for predominant archetype
4 Integrated Weed Management (IWM)	Mulching w/ organic residue ✓	K	➤ Ensure optimal layer of organic mulch is present around root base of trees (especially for stumped or new areas) by leaving leaf litter from coffee and shade trees
	Physical control of weeds ✓✓✓	K, S	➤ Implement consistent targeted manual weeding practices using hand tools rather than digging
	Spot chemical applications	S	
5 Integrated Pest & Disease Management (IPDM)	P&D identification & monitoring	K	➤ Implement routine monitoring to track infestation and inform IPDM techniques used
	Field hygiene practices ✓	K	➤ Implement consistent field hygiene practices to remove diseased parts and decrease disease spread
	Biological control ✓✓✓		
	Traps	S	
6 Integrated Nutrient Management (INM)	Precision application of selective pesticides	S	
	Soil analysis	S	➤ Implement routine field observation practices to detect nutritional deficiencies
	Soil amendments	S	
	Optimal fertilizer mgmt. (4R strategy)	S	➤ Optimize organic fertilizer application with right rates and placement (e.g., under tree canopy) according to nutritional deficiencies detected through visual observation
	Composting & vermi-composting ✓✓	K	➤ Optimize composting mgt practices (e.g., produce in heaps, proper aeration) and facilitate access to organic inputs (e.g., pulp and husk residue from wet mills)
	Microorganisms / Biofertilizers	S	

() < 5%
 ✓ 5 - 30%
 ✓✓ 30 - 60%
 ✓✓✓ > 60%

K Knowledge
F Finance
S Structural

Short/medium-term opportunities

Long-term opportunities¹ (>8 years)

A Experts collaborated to assess current practices, identify opportunities, and categorize into short/medium term and long-term opportunities (3/3)

Areas		Current adoption of practices		Barriers to adoption	Main incremental opportunities for predominant archetype
7	Efficient Water Use	Rainwater harvesting	✓✓	K	No opportunities included due to minimal feasibility and potential for GHG reduction or income impact
		Improved irrigation management	N/A		Not applicable to farmer archetype (relies on rain-fed system for water source)
		Efficient water use in post-harvest processing	N/A		Not applicable to farmer archetype (does not engage in on-farm processing)
8	Wastewater Management	Wastewater treatment	N/A		Not applicable to farmer archetype (does not engage in on-farm processing)
9	Waterbody Protection	Riparian buffers	✓	S	No opportunities included due to minimal feasibility and potential for GHG reduction or income impact (farms' proximity to water bodies is limited)
10	Waste valorization & Production of organic inputs	Biochar production		S	No opportunities included due to minimal feasibility and potential for GHG reduction or income impact (farms' access to biochar inputs is limited)
		Anaerobic digestion of wastewater	N/A		Not applicable to farmer archetype

() < 5%
✓ 5 - 30%
✓✓ 30 - 60%
✓✓✓ > 60%

K Knowledge
F Finance
S Structural

Short/medium-term opportunities

Long-term opportunities¹ (>8 years)

¹Long-term opportunities excluded from the GHG and income evaluation framework

B Short & medium-term incremental opportunities were prioritized for quantitative analysis based on expected impact on GHG mitigation and farmer income (1/2)

Areas	Short & medium-term incremental opportunities	GHG impact areas	Income impact areas
1 Renovation, Rehabilitation, and Coffee Varieties	➤ Implement staggered stumping with appropriate timing and regrowth management ➤ Replant trees only with disease issues and stump others ➤ Incorporate varieties with greater pest and disease resistance	• Optimize yield – High impact	• Increase coffee production – High impact • Improve farm resilience to shocks
2 Agroforestry systems and Shade	➤ Plant additional shade trees (esp. in lower altitude garden coffee farms found in Sidama), prioritizing indigenous trees & those w/ opportunity to use produce on farm (e.g., banana, ensete trees)	• Optimize yield – Medium impact • Increase tree biomass	• Increase coffee production volume – Medium impact • Diversify income • Improve farm resilience to shocks
3 Soil conservation and Cover cropping	➤ Introduce intercrops in stumped or newly planted areas, prioritizing nitrogen-fixing leguminous crops ➤ Plant vetiver grass that anchors soil to its strong root system ➤ Reduce extent of digging for weed management with use of hand tools (see practice 4)	• Optimize yield – Low impact	• Increase coffee production – Low impact • Improve farm resilience to shocks
4 Integrated Weed Management (IWM)	➤ Ensure optimal layer of organic mulch is present around root base of trees (especially for stumped coffee or new planting) by leaving leaf litter from coffee and shade trees ➤ Implement consistent targeted manual weeding practices using hand tools rather than digging	• Optimize yield – Medium impact • Improve crop residue & waste mgmt.	• Increase coffee production – Medium impact • Improve farm resilience to shocks

☐ GHG & Income-focused practice pillars included in GHG and farmer business case analysis

B Short & medium-term incremental opportunities were prioritized for quantitative analysis based on expected impact on GHG mitigation and farmer income (2/2)

Areas	Short & medium-term incremental opportunities	GHG impact areas	Income impact areas
5 Integrated Pest & Disease Management (IPDM)	➤ Implement routine monitoring to track infestation and inform integrated pest and disease management techniques used ➤ Implement consistent field hygiene practices to remove diseased parts and decrease disease spread	• Optimize yield – Low impact	• Increase coffee production – Low impact • Improve farm resilience to shocks
6 Integrated Nutrient Management (INM)	➤ Implement routine field observation practices to detect nutritional deficiencies ➤ Optimize organic fertilizer application with right rates and placement (e.g., under tree canopy) according to nutritional deficiencies detected through visual observation ➤ Optimize composting mgt practices (e.g., produce in heaps, proper aeration) and facilitate access to organic inputs (e.g., pulp and husk residue from wet mills)	• Optimize yield – Medium impact • Improve crop residue & waste mgmt.	• Increase coffee production – Medium impact • Improve farm resilience to shocks
7 Efficient Water Use	No opportunities identified	—	—
8 Wastewater Management	Not applicable to farmer archetype	—	—
9 Waterbody Protection	No opportunities identified	—	—
10 Waste valorization & Production of organic inputs	No opportunities identified	—	—

☐ GHG & Income-focused practice pillars included in GHG and farmer business case analysis

D Assumptions entered into Cool Farm Platform to estimate change in GHG emissions for selected farmer archetype

		Value	
Data point	Unit	Baseline	Endline
Farmer data			
Latitude / longitude	°	6.583, 38.5690	
Climate zone based on IPCC classification		Cool temperate moist	
Annual average temperature	°C	20	
Soil characteristic based on IPCC classification		High activity clay	
Crop details (per year)			
Soil type		Sandy (coarse)	
Coffee tree density	#/Ha	2500	
Total fresh cherry yield	Kg	1375	2544
Fertilizer use (per year)			
Fertilizer type #1 / production region		Compost (zero emissions) – 1% N / Africa 2014	
Application rate	Kg/Ha	600	1200

		Value	
Data point	Unit	Baseline	Endline
<u>Crop residues</u>			
Management selection(s)		Marked N/A due to negligible coffee residue produced on-farm	
% of the field pruned per year	%	0	0
<u>Carbon sequestration</u>			
Shade tree type #1		Tropical shade trees in wet area – canopy trees ¹	
% of the field occupied	%	20	30
Intercrop density	#/Ha	100	150
Shade tree type #2		Tropical shade trees in wet area – understory ²	
% of the field occupied	%	20	30
Planting density	#/Ha	100	150

¹Closest alternative to indigenous shade trees (Cordia Africana, Albizia sp., Ficus sp.), which were not available in CFP's list of options

²Closest alternative to banana and ensete shade trees, which were not available in CFP's list of options

Source: TechnoServe field data , Cool Farm Platform

E P&L assumptions applied to estimate change in farmer income for selected archetype

		Value	
Data point	Unit	Baseline	Endline
<u>Farmer data</u>			
Average coffee farm size	Ha	0.4	
<u>Market data</u>			
Farm-gate price (GBE)	ETB	500.11	
Exchange rate	ETB to \$	0.0083	
<u>Yield</u>			
Average coffee yield (GBE)	Kg/ha	458	848
<u>Operating costs</u>			
Inputs		N/A	
Labor	\$/ha	149	220
Processing		N/A	
Other production costs		N/A	
<u>Upfront investments</u>			
Equipment		N/A	
Other upfront investments		N/A	

		Value	
Data point	Unit	Baseline	Endline
Outputs			
Total coffee farm revenue	\$/ha	1,896	3,510
Total operating costs	\$/ha	149	220
Total upfront investments	\$/ha	N/A	
Total operating profit	\$/ha	1,747	3,291
Profit margin	%	92	94

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- TechnoServe field data
- Partner data

Experts consulted

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*Burhalike Shamavu pruning his coffee trees in Kashanaja, Kabare Territory, South Kivu, DRC.
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