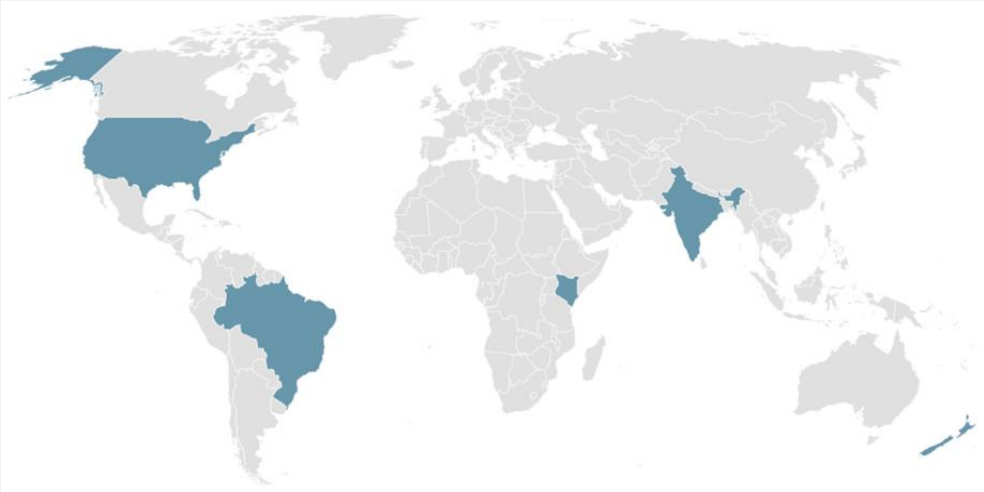
Regen10 – Landscape Transition Pathways - Overview

- **Regen10** has developed **landscape-level transition pathways** for Murang'a County in Kenya and five other significant agricultural regions.
- A **transition pathway** represents a switch from the conventional agricultural practices common in the landscape to regenerative ones, that helps **restore** and rebuild **natural systems**.
- A key element of this process is understanding the **economics of transitioning** to regenerative agricultural practices as well as the **potential environmental and social outcomes** of such transitions at landscape level.
- Regen10 recognizes that there is **more than one way to create a regenerative food system**. The proposed approaches are not prescriptive, and practices were selected after careful contextual analysis of their relevance and evidence of their intended outcomes.
- Broader evidence linking practices and outcomes is still greatly needed and highlights the importance of developing an **outcomes-based framework**, which Regen10 is currently undertaking.

Selected Landscapes



Country	Landscape	Focus Ag Product
Kenya	Murang'a County	Tea, Maize, Beans
Brazil	Querência City	Soy & Beef
India	Punjab State	Rice
United States	North Dakota	Wheat & Maize
United Kingdom	East of England	Potato
New Zealand	Waikato Region	Dairy

Source: Systemiq analysis.

Murang'a County - Kenya

Murang'a County's fertile landscape is increasingly impacted by environmental challenges, shaping the region's rural livelihoods

Agriculture and livestock farming are the backbone of the County’s economy, with 90% of livelihoods relying on small-scale subsistence farming.

Landscape information

- **Geographical Area:** 255K ha
- **Harvested Area:** 205K ha
- **Population:** 1.0M (80% rural)
- **Land holdings:** 230K
- **Typical farm size:** 1 ha

Current Challenges

Agronomic & Environmental:

- Increased landslides and droughts due to erratic weather patterns exacerbated by climate change.
- Degraded riparian areas leading to loss of natural flood barriers and increased soil erosion.
- Ongoing decline in maize yields due to deteriorating soil health.
- Reduced land productivity from prolonged droughts and pests/disease.

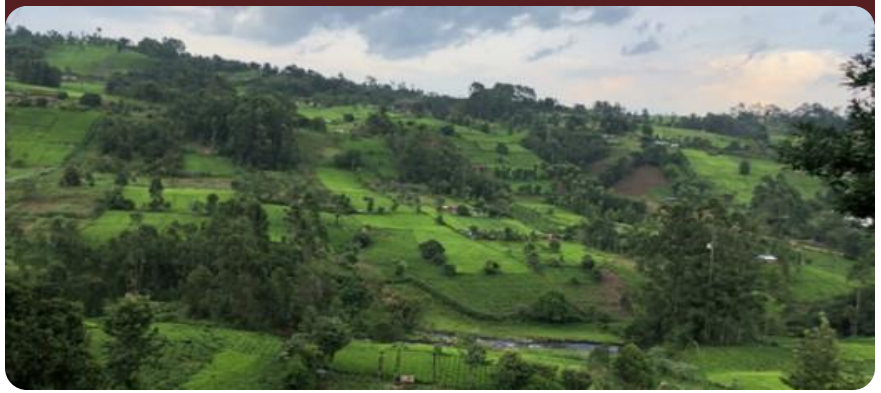
Economic:

- High dependence on a few crop varieties, increasing vulnerability to global commodity price fluctuations.
- Rising costs of agricultural inputs, elevating production costs for farmers.
- Limited value addition and agroprocessing in the predominantly subsistence-based agricultural sector.

Social:

- Concerning rates of poverty and malnutrition.
- Limited opportunities for women and young people.

Mosaic of smallholder farms in hilly areas



Source: https://youtu.be/1J_uOzz7x-w?si=m7aIy3ZhS0OmYN4u

Landslide on a tea farm

Source: kiambunewschatt.wordpress.com

Source: Systemiq analysis; Murang'a Gov; Gov of Kenya; CityPopulation; Experts' interviews

MURANG’A, KENYA

Two landscape archetypes were created to better address variations in land use and specific agricultural challenges

Key Characteristics of the landscape archetypes for Murang'a County

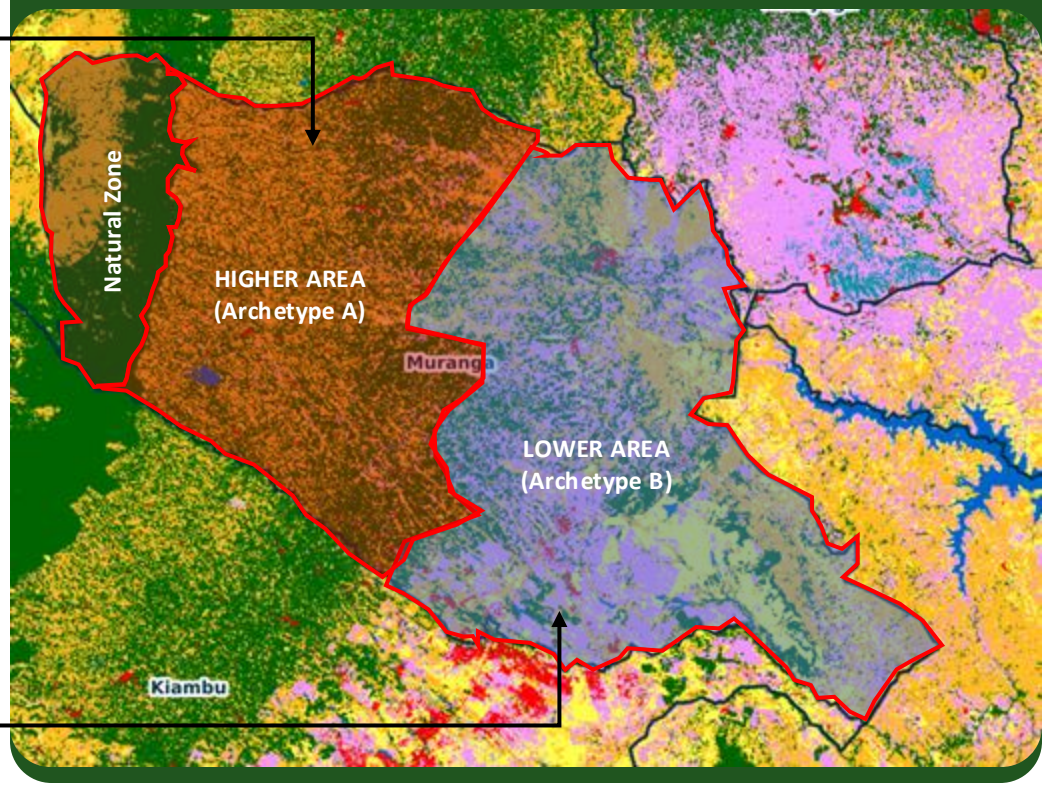
Archetype A is defined as the **Higher Area** of Murang`a County

- **Elevation:** 1,400 - 2,200m
- **Climate:** Cool and wet
- **Major Ag Products:** Tea, coffee
- **Key Environmental Challenges:** Landslides, erosion, deforestation, flooding
- **Area:** 80,000 ha

Archetype B is defined as the **Lower Area** of Murang`a County

- **Elevation:** 900 – 1,400m
- **Climate:** Warm and moderate
- **Major Ag Products:** Maize, beans, fruits, and other horticultural products
- **Key Environmental Challenges:** Degraded soil and riparian areas, water scarcity
- **Area:** 125,000 ha

Spatial View of Archetypes



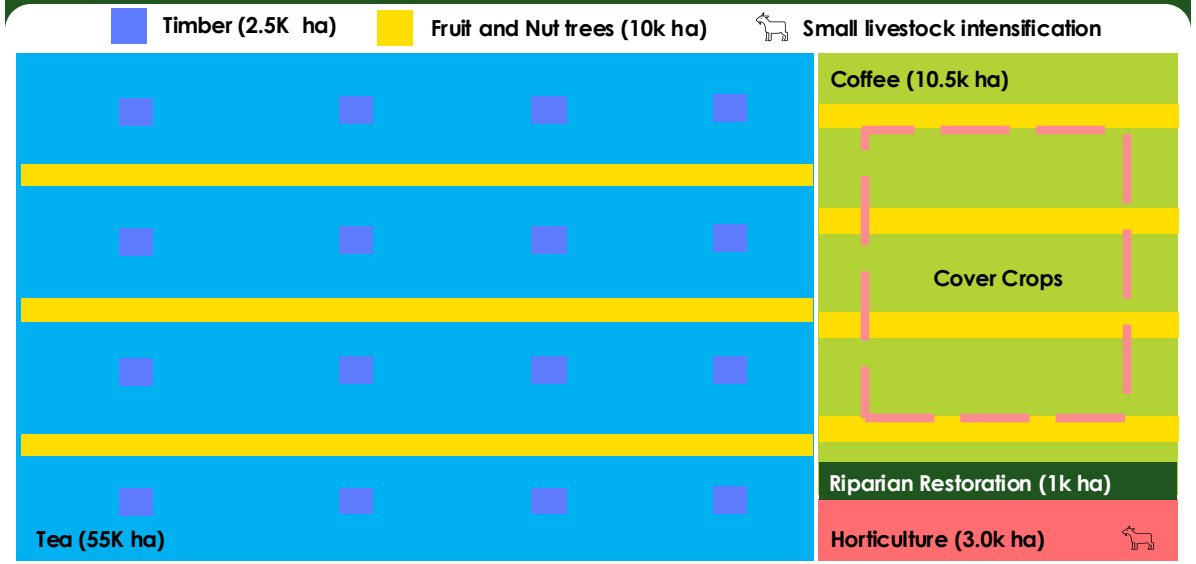
Source: ESA Wordcover 2021

Note: The delineation of landscapes is indicative and overlaps in climate and crop types are anticipated in transitional boundary areas.

An approach to Murang'a's Higher Area involves diversifying and enhancing tea and coffee cultivation with perennials

Current land use at agricultural landscape level

Alternative land use at agricultural landscape level



Transition pathway hypothesis

- **Diversify tea and improve coffee plantations** by integrating perennials – plants that last for longer cycles- to reduce landslides, serve as windbreaks, improve soil health, provide timber to alleviate forest wood demand, and expand income sources.
- **Intensification of livestock** production with small animals e.g. goats, to increase the availability of manure and provide additional income from dairy.
- **Increase in horticulture cultivation** to provide further labor opportunities for women and youth, strengthen food security, and serve as animal forage along with cover crops.
- **Restoration of riparian areas** on farms to secure clean water sources at the river catchment area, control erosion and conserve biodiversity.

Main set of changes

- **Livestock[1]:** intensification with small animals
- **Cover crops[2]:** mix of cover crops for forage and soil health on coffee plantations
- **Forestry/trees[3]:** intercrop tea and coffee with timber, fruit and nut trees
- **Edge of field[4]:** riparian restoration with vetiver grass, bamboo and native plant species

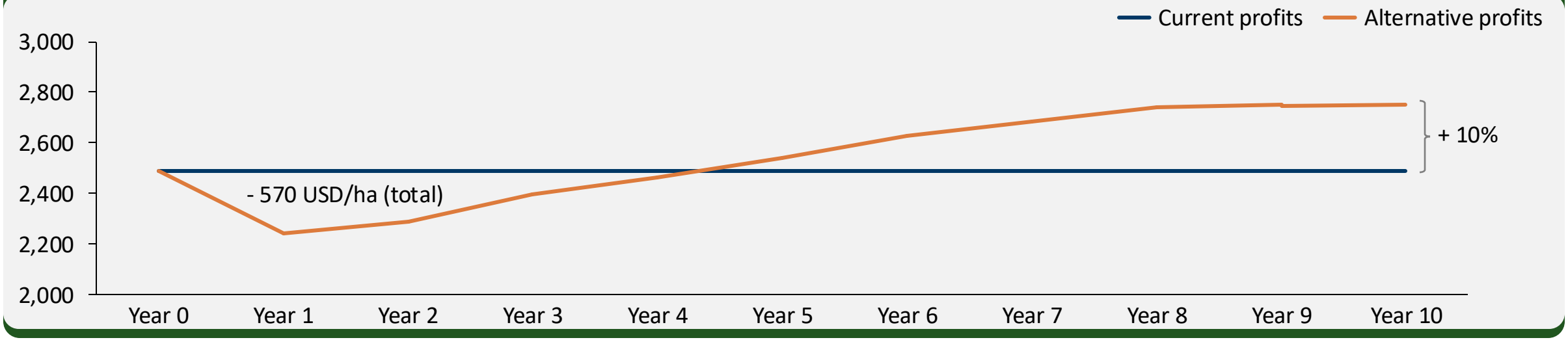
Note: [1]Mostly goats, up to two animals per farm [2]Cover crops for coffee include Canavalia ensiformis, Crotalaria, Desmodium, Dolichos, Lablab and Mucuna species. [3]Timber species include Grevillea, Leucaena, Albizia, Calliandra, Gliricidia, Croton, Eucalyptus. Fruit and nut trees include Avocado, Mango, Banana and Macadamia. [4]Vetiver grass, bamboo and native plant species amongst others.

Sources: Systemiq analysis, Experts interviews

MURANG'A, KENYA (HIGHER AREA)

Investments in the transition lead to a breakeven in year 5 and higher long-term profits

Comparison between annual net income: current vs alternative state, undiscounted cash (USD/ha)



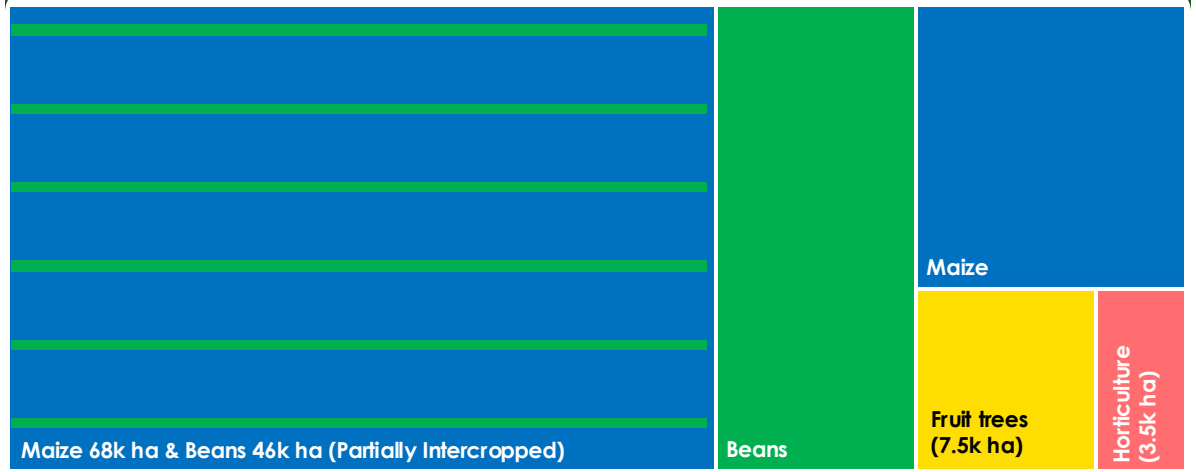
- Farms' yearly profitability decreases by up to 10% during an interim transition period and reaches **a point of equilibrium that is approximately 10% higher in the alternative state** after year 8 of the transition.[1]
- The initial drop is primarily due to the reduction in tea cultivation areas (a key cash crop) and the significant capital required for investments in perennials, horticulture setup and expansion, as well as the increase in animal stock.
- Profits are expected to surpass current levels by year 5, driven by the gradual increase in profitability per hectare from fruit and nut production, along with additional revenues from dairy.
- Farmers would forgo **570 USD/ha** in cumulative profits on average, before profitability returns to current levels (undiscounted cash).
- For a typical 1 ha farm, a short-term cost of ~$500 (profit lost in years 1-4) is offset by expected additional profits of ~$1.1K in years 5-10, resulting in **a net gain of ~$600 over the 10-year period** (undiscounted cash).[2]

Note: [1]Model focuses solely on the agricultural landscape (aggregation of farms) and does not contemplate costs for eventual new landscape-level infrastructure or market channels. It assumes no carbon revenues, green premiums, or increase in land value and a cyclic approach for earlier timber harvesting. Landscape transition happens all at once. [2] Costs and returns will vary significantly based on the farm's portfolio.
Source: Systemiq analysis

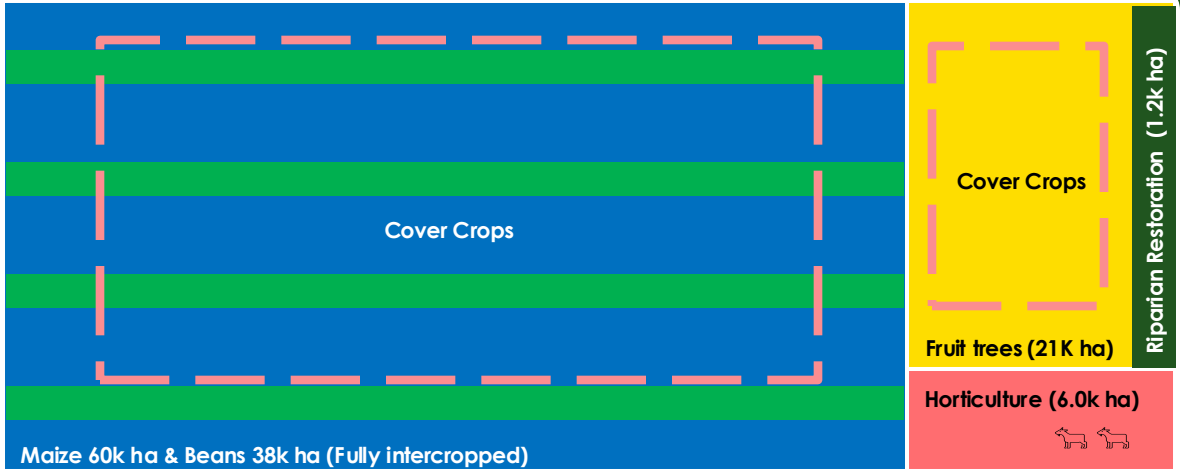
MURANG'A, KENYA (HIGHER AREA)

In Murang'a County's Lower Area, livestock and perennials can be increased, and soil health practices for maize and beans improved

Current land use at agricultural landscape level



Alternative land use at agricultural landscape level



Transition pathway hypothesis

- **Diversification of food crops** by increasing the acreage of fruit trees[1] and horticulture to improve soil health, strengthen food security, provide further labor opportunities for women and youth, and diversify income sources.
- **Intensification of livestock** with small animals e.g. goats, to increase the availability of manure that can restore maize yields and to provide additional income from dairy.
- Adoption of **cover crops** to maintain and improve soil health, provide green manure and offer grazing opportunities.
- **Restoration of riparian areas** on farms to secure clean water sources at river catchment areas, control erosion and conserve biodiversity.
- **Enhanced farm water management** by improving irrigation efficiency and expanding the reach of drip systems and rainwater harvesting to support the larger area of perennials and horticulture.

Main set of changes

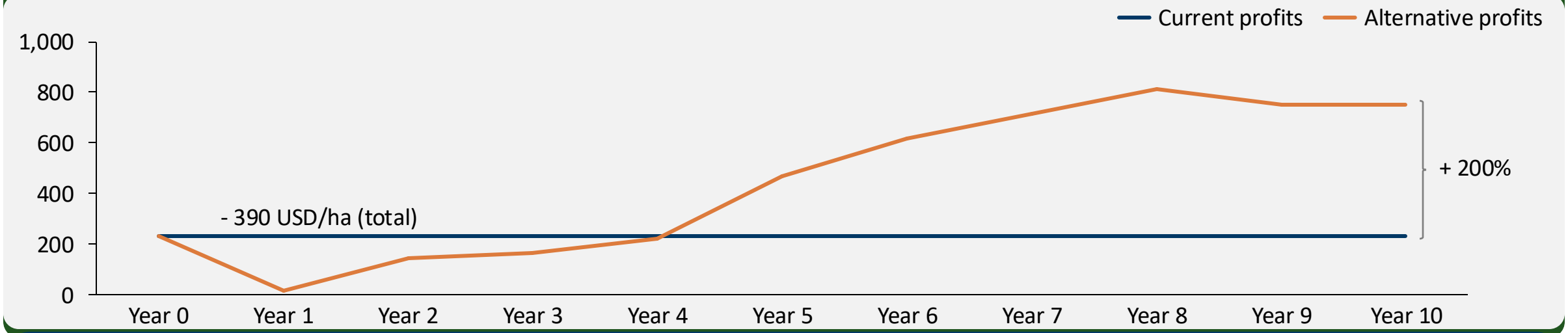
- **Crop diversification:** increase in perennials and horticulture
- **Livestock[2]:** intensification with small animals
- **Cover crops[3]:** polycultures for soil coverage, green manure and animal forage
- **Edge of fields[4]:** riparian restoration
- **Growing practices:** efficient irrigation for new perennials and horticulture via drip and rainwater harvesting systems

Note: [1]Fruit and nut trees include Avocado, Mango, Banana and Macadamia. [2]Mostly goats, up to two animals per farm. [3]Examples include Mucuna (Velvet Bean), Crotalaria (Sunn Hemp), Desmodium, Lablab (Hyacinth Bean). [4]Vetiver grass, bamboo and native plant species amongst others.
Sources: Systemiq analysis, Experts' interviews

MURANG'A, KENYA (LOWER AREA)

The transition could double long-term profits, but initial investments and short-term losses will be high

Comparison between annual net income: current vs alternative state, undiscounted cash (USD/ha)



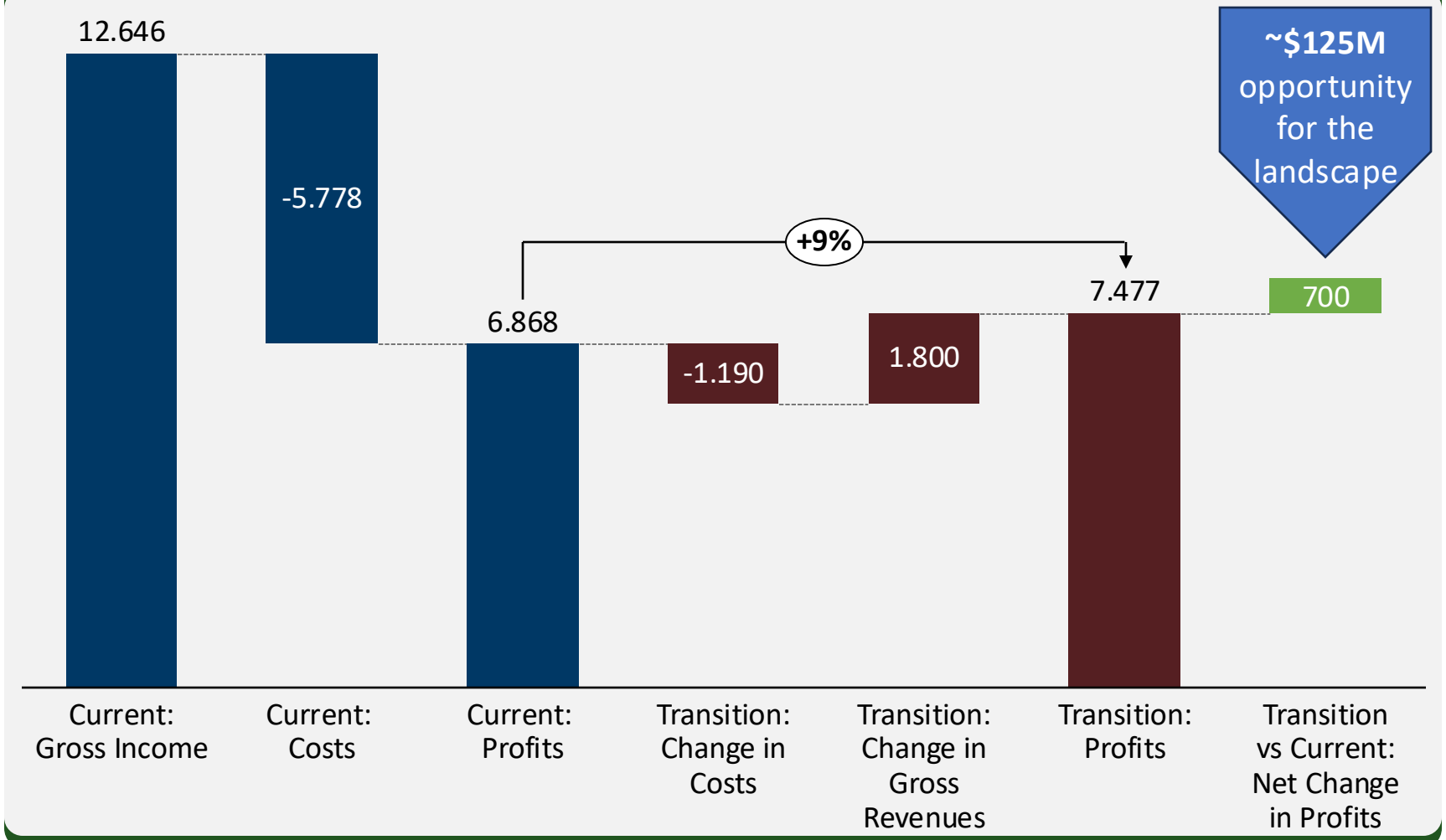
- Given the lower starting point, farms' yearly profitability in Murang'a County's lower area decreases to almost 100% in relative terms during an interim transition period but reaches **a point of equilibrium that is ~200% higher in the alternative state** after the transition.[1]
- The initial drop is primarily due to the capital required for investments in the setup of perennials and horticulture, including irrigation systems, as well as the increase in animal stocks.
- Profits are expected to surpass current levels by end of year 4, driven by the gradual increase in profitability per hectare from developing fruit and nut production, improved maize yields, and additional revenues from dairy.
- Farmers would forgo **390 USD/ha** in cumulative profits on average before profitability returns to current levels (undiscounted cash).
- For a typical 1 ha farm, a short-term cost of ~$400 (profit lost in years 1-4) is offset by expected additional profits of ~$2.7K in years 5-10, resulting in **a net gain of ~$2.3K over the 10-year period** (undiscounted cash).[2] These initial losses reiterate the need for a shared transition, involving all food system actors.

Note: [1]Model focuses solely on the agricultural landscape (aggregation of farms) and does not contemplate costs for eventual new landscape-level infrastructure or market channels.It assumes no carbon revenues, green premiums, or increase in land value and a cyclic approach for earlier timber harvesting. Landscape transition happens all at once. [2] Costs and returns will vary significantly based on the farm's portfolio.
Source: Systemiq analysis

MURANG'A, KENYA (LOWER AREA)

Regenerative interventions could generate USD ~125 Million for Murang'a County's agricultural landscape in 10 years

10-year cumulative income and expenditures – Net Present Value[1] discounted with 10% rate (USD/ ha)



- The proposed regenerative changes offer a profitable transition for Murang'a County, with **$700/ha or ~$125M** Net Present Value (NPV**) for the combined landscapes.**
- The **Lower Area benefits the most** economically, deriving the bulk of the NPV (~$120M).
- Despite the high costs associated with diversifying tea cultivation, the **Higher Area can still achieve a positive NPV** of 70 USD/ha.
- Upfront investments and reduced tea areas are profitability detractors in the short-term.
- Increased dairy income and delayed, yet substantial, perennial incomes boost transition revenues.

Notes: [1] Net Present Value
Source: Systemiq analysis

MURANG'A C, KENYA (HIGHER & LOWER AREAS)

Murang'a County can also benefit from positive environmental and social outcomes, along with economic gains

Regen10 Framework landscape level outcomes[1]	Indicative impact from transition
Economic Environmental Social	Negative Neutral Positive
Increase economic diversification and resilience	
Increase landscape value creation	
Optimize landscape biodiversity & habitat functionality	
Minimize water, soil and air pollution	
Improve water availability	
GHG emissions minimization[2]	
Optimize carbon sequestration and storage	
Enhance inclusivity and empowerment of local communities	
Enhance well-being of local communities	
Increase employment, knowledge and education	
Optimize access to safe and nutritious food	

Key implications and recommendations

- A successful transition boosts farmers' incomes, with up to a 200% rise in the Lower Area, and expands work opportunities for women and youth across the landscape.
- Economic and environmental resilience to external factors, such as market prices and climate change, is enhanced through land diversification, livestock intensification, and ecological fortification from trees and restored riparian areas.

For transition to be possible, we need to:

- Strengthen landscape partnerships and civil society organizations (CSOs) working to promote agroecological practices in Murang'a County.
- Provide farmers with publicly- and philanthropically- funded technical aid, along with tailored and sufficient financial support, to overcome the burden of transitioning to regenerative practices.
- Further develop infrastructure and increase demand for fruits, nuts, dairy, and other diversified agricultural products by public and private players.
- Safeguard land ownership for farmers to ensure the viability of longer-term investments e.g. perennials.

Notes: [1]Regen10 Outcome Framework Indicators for Landscapes from zero-draft version. [2]Livestock intensification is compensated by significant increase in perennials.[3] Net Present Value
Source: Systemiq analysis

This work is a collaborative effort with PELUM Kenya

Regen10 has partnered with PELUM Kenya to develop this Transition Pathway for the Murang'a County landscape. This initiative aims to assess and highlight the costs and benefits of transitioning a landscape selected by PELUM Kenya to regenerative and agroecological practices. Ultimately, it seeks to inform and inspire support from governments, philanthropists, financial investors and the private sector for landscape transformations nationwide, benefiting farmers, their communities, and the planet.

PELUM Kenya (Participatory Ecological Land Use Management Kenya) is a network of over 60 civil society organizations dedicated to supporting small-scale farmers. The network promotes agroecological principles and practices through advocacy, policy influence, networking, capacity development, and knowledge sharing.

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