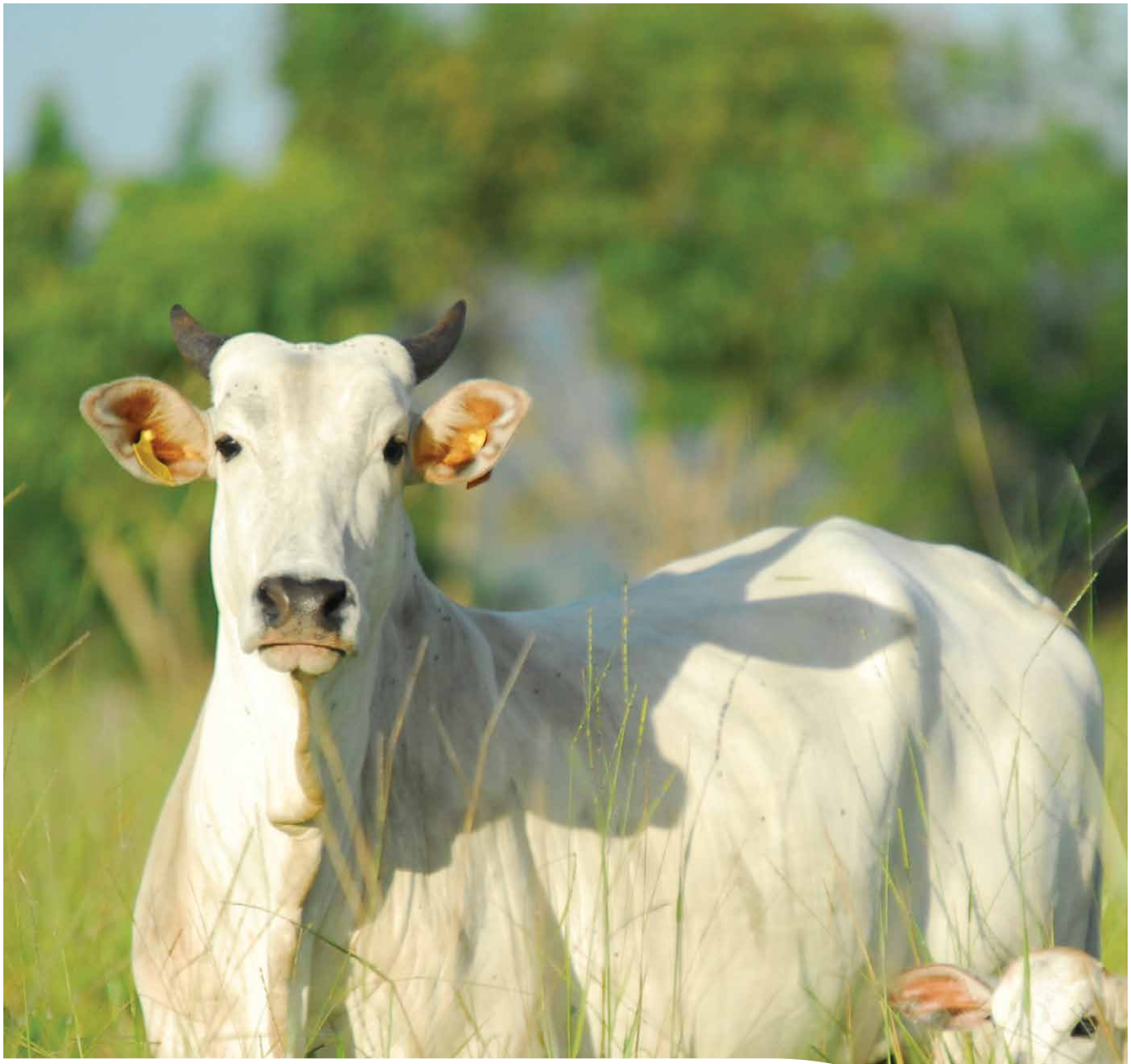

Unlocking Investment for Landscape Restoration at Scale in the Amazon

The Business Case and Investment Opportunities for the Public and Private Sectors to Restore Degraded Ranching Lands

January 2016

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Key Messages

In Ecuador, Colombia, Brazil, and across the Amazon, there is a growing trend to restore degraded lands to productive uses as part of the agendas for national economic development and climate change mitigation.

- Ecuador, for example, pledged to restore 500,000 additional hectares (ha) annually through 2017, and to increase this by 100,000 ha per year through 2025 as part of its Intended Nationally Determined Contribution (INDC)[1,2], committed to restoring 500,000 ha under Initiative 20x20[3]; and enacted a law in 2014 committing the country to reforest 30,000 ha per year through 2030.

There are opportunities in Ecuador to advance these commitments, and the broader economic and climate change mitigation and deforestation objectives, by customizing ranching and productive diversification practices to the specific needs of the region's most prevalent ranching systems.

Through a comprehensive analysis of cattle ranching systems in the Napo region in Ecuador, five common typologies for ranching systems were identified. For each, customized transformation models were developed that restore degraded ranching lands.

- Models for productive transformation combine:
  1) Intensification of ranching activities
  2) Implementation of best management practices (BMPs) to transition ranching farms to more sustainable low-emissions management systems
  3) Diversification of land freed from ranching activities to alternative land uses
- BMPs were identified based on a comprehensive analysis of their technical and sociocultural appropriateness, and an evaluation of climate mitigation impacts. These include: a) rehabilitation of silvopasture; b) optimization of grazing systems; c) improvements in cattle productivity; d) improvements in cattle reproduction techniques; and e) implementation of waste-management systems (see Table 3 on page 3 for more details).
- Alternative land uses were considered based on priorities laid out by the government of Ecuador in its Agenda for Productive Transformation in the Amazon (ATPA, using its Spanish acronym)[4]. These include the production of cocoa *Fino de Aroma*, Robusta and Arabica coffees, guayusa[5], and naranjilla[6] in agroforestry and "chakra" systems; timber production through commercial reforestation; and natural restoration.

The intensification of ranching activities and adoption of BMPs can translate into significant increases in annual income from cattle production across ranching systems:

- There are wide discrepancies in annual incomes and profitability levels across ranching systems, reflecting the diversified nature of ranching systems in the Amazon.

[1] http://www4.unfccc.int/submissions/INDC/Published%20Documents/Ecuador/1/Ecuador%20INDC%2001-10-2015%20-%20english%20unofficial%20translation.pdf

[2] Under INDC, Ecuador also pledged to advance climate-smart agriculture by promoting agroforestry and silvopastoral practices, the use of technology and data, and capacity building and knowledge-sharing to improve the resilience of farmers and agricultural systems.

[3] Initiative 20x20 brings together national and regional commitments plus $365 million in private financing to restore forests and ecosystems, reduce poverty, and improve agricultural productivity.

[4] http://www.agricultura.gob.ec/agenda-de-transformacion-productiva-amazonica-reconversion-agroproductiva-sostenible-en-la-amazonia-ecuatoriana/

[5] Guayusa is a native plant of the Ecuadorian Amazon whose leaves are dried and brewed to make a tea known for its stimulative effects. In the US market, it is increasingly sold as a tea and in ready-to-drink beverages.

[6] Naranjilla is a subtropical perennial plant from northwestern South America that produces citrus-flavored fruit, which the food industry hasturned to as a new flavor.

giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

Universidad Estatal Amazónica – Vita et Sapientia

Rainforest Alliance

- Under business-as-usual (BAU) scenarios, most ranching systems exhibit low to negative profitability. Low to medium elevation meat and dairy farms have the lowest profitability levels—with estimated annual incomes ranging from negative $228 USD[7] to positive $2,498—mainly because of low productivity and relatively high costs. Only high elevation, small- and medium-sized dairy farms are profitable enough to generate annual income above poverty line[8], with an estimated annual income of $16,904.
- Ranching systems that exhibit low to negative profitability under business-as-usual scenarios (typologies 1, 2, 3 and 4) could see their annual income reach between $2,388 and $18,445 under BMP scenarios—a significant gain compared to BAU scenarios—but, in some cases, still barely enough income to support a family that has no other way to generate revenue.

To achieve expected economic benefits, however, significant investments in transforming cattle production systems are needed, including annual investments in livestock productivity improvement and an upfront investment into the restoration of pastureland.

- Annual production costs are expected to reach from $3,451 to $20,661 per ranching system—depending on the size of the system considered, the size of the herd under management, and the type of BMPs implemented. These costs may represent up to 80 percent of annual revenues (ranging from 30 percent to 80 percent).
- Two cost items represent 71 percent and 91 percent of all annual production costs across ranching systems, highlighting the need for ranchers to invest in productivity improvement: 1) improved sanitation costs, including costs for sanitary analysis, livestock vaccines, and medicines; 2) improved animal diets, including costs for minerals and dietary supplements.
- Upfront investments to transform cattle production systems are estimated between $6,631 and $15,883 per ranching system. These investments can occur over a single- or multi-year period.
- To deliver both direct environmental benefits and productivity gains, two upfront investments are required across ranching systems: 1) investments to transform deforested and degraded grazing areas into silvopasture systems by planting new trees in pasture lands and establishing "live fences"; 2) investments in the enhancement of natural water management in pasturelands using improved natural drainage systems.

Further economic and environmental benefits can be achieved by adopting productive transformation models tailored to ranching systems in the Amazon:

- At peak production, one hectare of pasture land that's been converted to alternative production systems can yield an additional net income of $1,574 to $24,956 per year depending on the crop and the density of the production system elected.
- Because income from cattle production remains relatively low, our analysis shows that diversification into other crops can be highly beneficial to ranchers, assuming current market prices and that markets exist or are strengthened for these crops.
- In the long term, ranchers who adopt productive transformation models can expect to see a significant improvement in their farm's profitability. Our analysis of 103 possible diversification models across ranching systems showed that dedicating between 10 percent and 40 percent of degraded pastureland to alternative production systems could increase average net income up to tenfold over ten years—an order of magnitude increase.

Many opportunities exist for public- and private-sector investors and funders to finance landscape restoration in the Amazon:

- Two types of asset investments are needed to achieve the restoration of degraded cattle landscapes in the Amazon: 1) productivity investments in cattle that primarily yield economic benefits to individual ranchers, and 2) land-transformation investments that yield both economic benefits to ranchers (through income diversification) and environmental benefits at the landscape level.

[7] All amounts are in USD.

[8] The estimated poverty line is calculated on the basis of $2/day: $2,190/year for a three-person household, $2,920 for a four-person household, and $3,650 for a five-person household.

- Productivity investments (e.g., improved animal diets and sanitation, etc.) are critical to improving farm productivity and can, over time, pay for themselves once they translate into higher revenues for ranchers. In the meantime, ranchers need financial support to access the inputs and services (i.e., dietary supplements, vaccines, and veterinary services) that can help them to implement productivity-improvement practices.
- Three mechanisms can be deployed to support investments in productivity improvements:
  1) **Financial incentives,** whereby financial support or subsidies are tied to the adoption of practices
  2) **Debt financing** in the form of short-term (e.g., input loans, etc.) or longer-term (e.g., investment loans, etc.) loans, whereby financing is provided by value-chain stakeholders (out-takers or input providers), investors, and/or financial institutions
  3) **Capacity building and technical assistance** to facilitate the adoption of practices and the deployment of capital
- In Ecuador, several national programs are currently providing technical assistance and financial incentives to support the adoption of productivity-improvement practices, and the restoration and diversification of degraded ranching lands—for instance, the "Sustainable Livestock Programme"[9] or the "Conservation Incentives Programme[10]" under Socio Bosque[11] , two large scale programs promoted by the Ecuadorian government.
- These incentive programs are not always easily accessible for ranchers and ranching communities in the Amazon without technical assistance from third parties to do things such as conduct boundary delineation, develop investment plans, submit required documentation to government authorities, and carry out periodic monitoring of compliance.
- Private-sector stakeholders also play a critical role in unlocking financing for productivity improvements and land restoration. In particular, there are tremendous opportunities for financial institutions and impact investors to participate, by developing impactful investing programs and lending products that are adapted to ranchers' needs.

Such findings provide critical information—for local governments, as they develop their national restoration agendas; for impact investors, and bilateral and multilateral funders, as they design their investment programs and financing instruments; and for local financial institutions, as they develop financial products that are adapted to restoration needs.

- In order to further build on study findings, the following recommendations are advanced:
  1) Explore opportunities for the coordinated delivery of existing national financial-incentive programs
  2) Review opportunities for adapting existing debt-financing mechanisms or developing new ones;
  3) Structure public-private partnerships;
  4) Identify the role of REDD+ financing can play in enabling investment that can strengthen the technical capacities of local actors
  5) Facilitate discussions between impact investment funds[12] and/or bilateral and multilateral funders that are committed to supporting landscape restoration under Initiative 20x20

Outside of Ecuador, the methodological approach taken in this study could be applied in other Amazon countries, such as Colombia and Brazil, to assess the nature and scope of investments that are needed to restore degraded ranching lands at scale, and promote knowledge sharing across the Amazon.

[9] http://www.agricultura.gob.ec/ganaderia-sostenible/

[10] http://sib.ambiente.gob.ec/file/CGF/4.-Max%20Lascano-Plan%20Nacional%20Incentivos-MAE.pdf

[11] http://sociobosque.ambiente.gob.ec/

[12] Althelia Climate Fund, The Moringa Fund, Premian Global, Terra Bella, and Rare have jointly indicated the intention to invest a total of $365 million USD to support Initiative 20X20.

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I. Introduction

While the international community agrees on the need to invest in the restoration of degraded ranching lands in the Amazon, it has not yet assessed the size of the investments needed by ranchers to adopt sustainable ranching practices locally, nor has it defined a clear pathway for the public and the private sectors to support the adoption of these practices.

In 2015, the Rainforest Alliance undertook field research in Ecuador, with financing from Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) and in partnership with Amazon State University (or UEA, its Spanish acronym)[13]. The objective of this research was to develop productive transformation models—tailored to the needs of Amazon ranchers—that would, over time, achieve the following:

1) Reverse deforestation associated with the expansion of the ranching frontier
2) Contribute to reducing greenhouse gas (GHG) emissions
3) Improve producer incomes

This research included an economic analysis of the costs and benefits to Amazonian ranchers of adopting such models and implementing sustainable land-use and low-emission ranching practices. This publication presents the results of the analysis.

The purpose of this publication is to contribute to the discussion of landscape-restoration financing in the Amazon by:

1) Informing the size and scope of the financing required and sharing field results

2) Supporting landscape-restoration activities by highlighting investment opportunities for the public and private sectors.

II. Economic Analysis: Methodology

The economic analysis, which focused on the farm-level costs and benefits of adopting tailored productive transformation models, was developed through a partnership between the Rainforest Alliance and UEA.

Objective

The objective of the economic analysis was three-fold:

1. **Identify the size and nature of the farm-level investments required to adopt tailored productive transformation models;**
2. **Assess the short- and long-term economic benefits for ranchers from implementing these models;**
3. **Highlight landscape investment opportunities for the public and private sectors that allow them to participate and support the implementation of these models across the Amazonian Basin**.

Landscape Selection

Ecuador's Napo region was selected for field research and data collection because of its diverse altitudinal, climatic, and ecological patterns, and its unique representation of all types of ranching systems that are present in the Amazon. These characteristics make it possible to extrapolate results from Napo to other regions of the Amazon Basin—in Ecuador and beyond.

Figure 1: Napo Region in Ecuador

Classification of Ranching Systems

In total, 464 ranching farms were surveyed[14] across three municipalities in different altitudinal ranges: San Francisco de Borja, Cotundo, and Arosemena Tola. The data collected allowed to classify ranching farms into

[13] http://www.uea.edu.ec/

[14] Data collected included data relative to farmer-household structures, ranching practices, and farm-level costs and revenues.

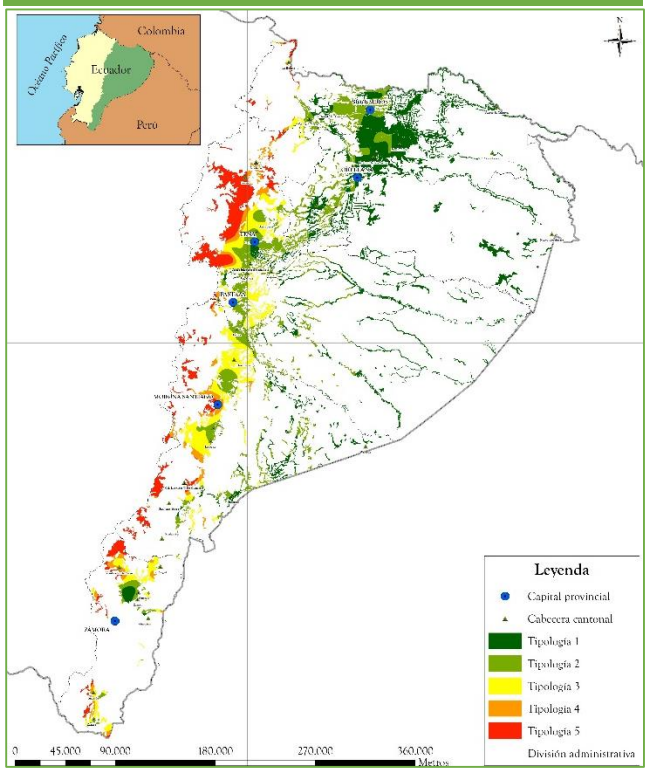
five typologies that reflect different production systems and ranching practices (see Table 1 below).

Table 1: Classification of Ranching Farms by Typology
Typology 1 (T1) **Lowland, meat, small/medium**
Small and medium-sized farms (up to 100 ha)[15] (avg. 47.7 ha) Low slope (<30%) Low to medium altitude (<800 m.a.s.l.[16]) Meat production
Typology 2 (T2) **Lowland, meat, large**
Large farms (>150 ha) (avg. 194 ha) Medium slope (<40%) Low to medium altitude (<1,000 m.a.s.l.) Meat production
Typology 3 (T3) **Mid-elevation, meat & dairy, small/medium-**
Small and medium-sized farms (avg. 54.3 ha) Medium slope (<40%) Medium altitude (<1,200 m.a.s.l.) Meat & dairy production
Typology 4 (T4) **Mid/high-elevation, meat & dairy, small/medium**
Small- and medium-sized farms (avg. 29.1 ha) Low slope (<30%) Medium to high altitude (<1,800 m.a.s.l.) Meat & dairy production
Typology 5 (T5) **High elevation, dairy, small/medium**
Small- and medium-sized farms (avg. 53.7 ha) Low slope (<30%) High altitude (>1,500 m.a.s.l.) Dairy production

Extrapolating the classifications that were developed in the Napo region allowed to map the entire Ecuadorian Amazon landscape and estimate land coverage by typology.

The topographic analysis showed that 56 percent of the landscape in the Ecuadorian Amazon—or 624,348 ha—corresponds to ranching systems classified as typologies 1 or 2 (i.e. ranching farms of all sizes that are mainly focused on meat production and located in low to medium altitude zones (<1,000 m.a.s.l.) and on medium slopes (<40 percent).

Figure 2: Typology Distribution Across the Ecuadorian Amazon



Development of Sustainable Ranching Practices

For each one of the five common ranching typologies identified, a set of ranching BMPs[17] was developed based on the characteristics and needs of each system.

Each set of BMPs was based on a comprehensive analysis of their technical and sociocultural appropriateness, their relevance to climate change mitigation, and with the objective of:

1) Intensifying cattle production
2) Diminishing GHG emissions from cattle production
3) Restoring degraded ranching landscapes

Table 2 below exhibits the recommended set of BMPs that was developed for each one of the five ranching systems identified.

[15] Farm size varies widely in the Amazon. Small- to medium-sized farms range from a few hectares up to 100.

[16] Meters above sea level

[17] Detailed information on BMPs can be obtained from the Rainforest Alliance (contact information is included at the end of this document).

Table 2: Recommended Sets of BMPs per Ranching System						
BMP	Description	T1 Lowland Meat & dairy Small/medium	T2 Lowland Meat Large	T3 Mid-elevation Meat & dairy Small/medium	T4 Mid/high-elevation Meat & dairy Small/medium	T5 High elevation Dairy Small/medium
Rehabilitation of silvopasture	Planting of new trees in degraded pasturelands	X	X	X	X	X
	Establishment of live fences around grazing areas	X			X	X
Optimization of grazing system	Improvement in forage and establishment of feed banks	X	X	X	X	X
	Improvement in natural drainage to enhance pastureland water management	X	X	X	X	X
	Enhancement of rotational grazing with portable electric fences	X	X	X	X	X
	Enhancement of rotational grazing with traditional tethering systems[18]	X				
Improvement in cattle productivity	Improvement of animal diet with salt minerals and dietary supplements	X	X	X	X	X
	Improvement of animal sanitation through access to adequate analysis, vaccination, and medicines	X	X	X	X	X
Improvement in cattle reproduction techniques	Improvement of traditional breeding system and selection	X	X	X		
	Utilization of artificial insemination				X	X
Implementation of waste-management systems	Establishment of artisanal lombriculture				X	X
	Establishment of compost area	X	X	X	X	X
	Establishment of semi-Artisanal biodigesters				X	X

[18] In the Andes, a peculiar characteristic of cattle-raising systems is the prevalence of "sogueo," a form of tethering whereby individual cattle are tied to pegs in the paddocks with a long rope and are moved at least once per day.
Source: http://www.fao.org/ag/agp/agpc/doc/counprof/ecuador/ecuador.ht

Intensification of Cattle Production

Along with the implementation of BMPs, the intensification of cattle production is recommended in order to achieve greater productivity while minimizing the total land area dedicated to cattle production in the Amazon.

For each ranching system, diversification is recommended through the:

1) The reduction of land area dedicated to cattle production[19]
2) Increases in herd size

Figures 3 and 4 below show recommended changes in the amount of pastureland and the impact of this intensification on Adult Cattle Units ("ACU") per ha of pasture in each ranching system.

Significant changes in pasturelands are expected on farms classified as typology 2 (lowland, meat, large), which currently feature the largest grazing area per head of cattle. Similarly, significant changes in ACU are expected in typology 4 farms (mid/high elevation, meat & dairy, small/medium) whose characteristics allow for a significant increase in herd size while maintaining small- to medium-sized grazing areas.

Figure 3: Farmland dedicated to cattle is reduced

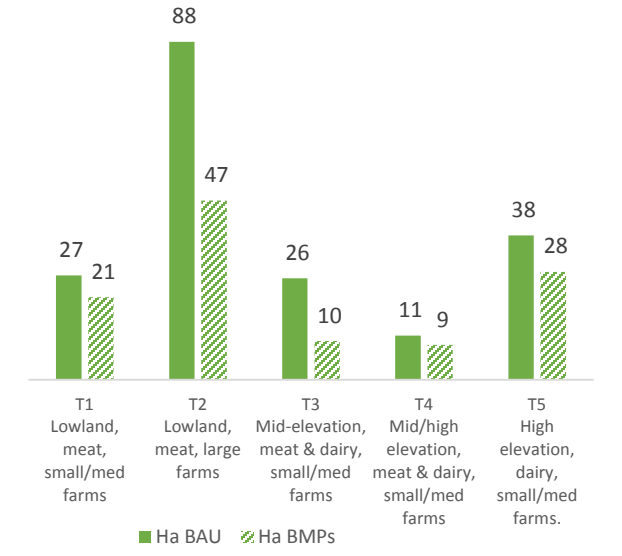
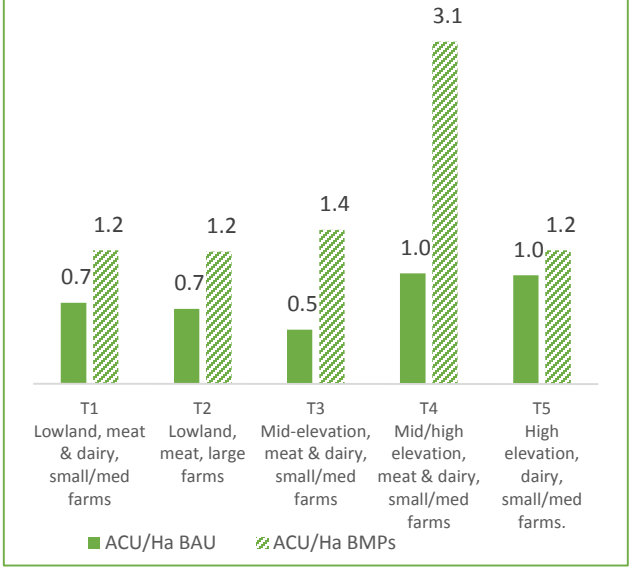


Figure 4: Adult Cattle Unit /Ha is Increased



Reconversion of pasture lands freed from cattle production

As cattle production is intensified, some farmlands previously dedicated to cattle activities can be freed up for conversion to alternative land uses that foster ecosystem resiliency while offering ranchers different but complementary sources of revenues.

For the purpose of this work, the following land uses were considered, based on priorities laid out by the government of Ecuador in its APTA:

1) <u>Land use for productive transformation</u>
   - Cash crop production including cocoa "*Fino de Aroma*"; Robusta coffee; Arabica coffee; naranjilla and guayusa
   - Timber production through commercial reforestation
2) <u>Land use for ecosystem restoration</u>
   - Natural restoration

Two production systems were considered for cash crops:

1) **Agroforestry systems (AFS)** that combine tree crops and timber trees

[19] This assumes that there is no cultural disincentives to reducing the amount of land area that's dedicated to cattle production.

2) **Chakra[20] systems** that combine commercial tree crops and subsistence crops, such as fruit trees or medicinal plants for household consumption[21]

Table 3 below highlights the tree densities used in our analysis.

Table 3: Tree Density (tree/ha)	Agroforestry System	Chakra System
Cocoa "*Fino de Aroma*"	833	625
Arabica coffee	1600	N/A
Robusta coffee	1200	625
Naranjilla	2500	N/A
Guayusa	833	625
Commercial reforestation	1111	N/A

For each alternative land use, we conducted local consultations and expert interviews to gather costs and revenue data for implementing and maintaining one hectare of land under both AFS and chakra systems.

Development of Integrated Models for Productive Transformation in the Amazon

For each ranching typology, we developed productive transformation models that combine:

1) **Sustainable ranching in reduced pasturelands**
2) **Alternative land uses in productive transformation areas**
3) **Natural restoration areas for ecosystem conservation**

These models were developed based on a comprehensive analysis of their technical and sociocultural appropriateness, an evaluation of their climate mitigation impacts, and an analysis of their long-term farm-level costs and benefits.

Examples of productive transformation models are presented for each of the five ranching systems in figures 5 and 6 below (page 6). Figure 5 presents the allocation of lands freed from cattle production to alternative land uses for each model—namely, productive transformation areas and restoration areas. Figure 6 presents several ways that one could allocate an area dedicated to productive transformation (i.e., various cash crops and timber production).

These models were selected according to an analysis of a set of 103 possible models, and a ranking of these models according to their ten-year net present value[22].

BAU and BMP Scenarios

For each model, two cost and revenue structures were developed—one under the BAU scenario and the other under the BMP scenario. Both the BAU and BMP cost and revenue structures were developed for combinations of farm and herd sizes in various locations.

For the purpose of this paper, the BAU scenario is the scenario under which ranchers keep implementing current ranching practices, with no major interventions or paradigm shifts in the production system. The BMP scenario is the "optimal" scenario under which ranchers are adopting the sets of BMPs presented in Table 3, and converting part of their land to the recommended alternative land uses.

Assumptions

The data presented in this report are the results of the economic analysis we conducted, which is based on the following fundamental assumptions:

Labor costs: The analysis only accounts for costs of hiring external labor, and does not account for the cost of labor provided by ranchers and their family.

It is assumed that the majority of cattle-ranching activities is conducted by members of the household living on the farm. The baseline survey we conducted showed that an average of 1.5 persons are available per household to conduct ranching and farming activities.

It is assumed that external labor is only contracted when the scope of the work requires more labor than an average household can provide. For example, it is assumed that labor is contracted to help with the maintenance of paddocks, and to implement labor-intensive land-transformation practices, such as the establishment of silvopastures

[20] "Chakra" is a Kichwa word that roughly translates to the practice of sustainable agroforestry wherein subsistence crops are grown alongside tree crops and medicinal plants.

[21] Detailed information on the cost-benefit analysis conducted for each alternative land use can be found by contacting the Rainforest Alliance (see contact information at the end of this document).

[22] Please see "Assumptions" section for criteria selection.

Figure 5: Recommended Models for Productive Transformation in the Amazon

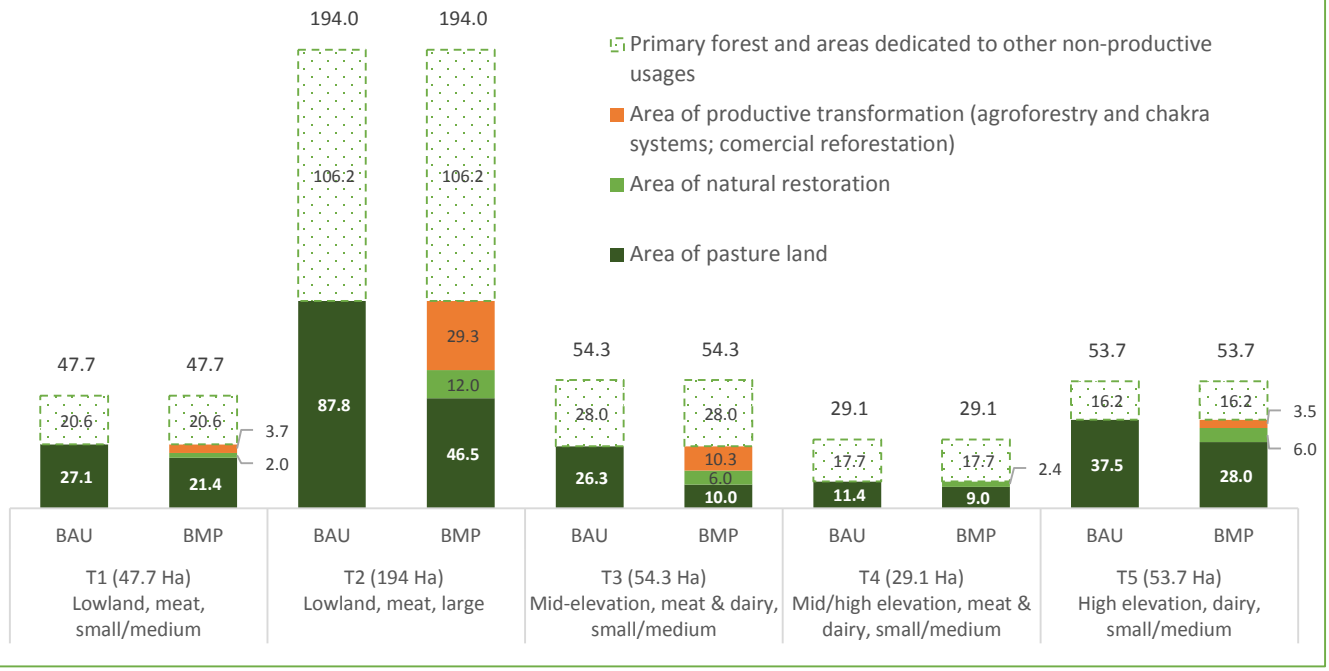
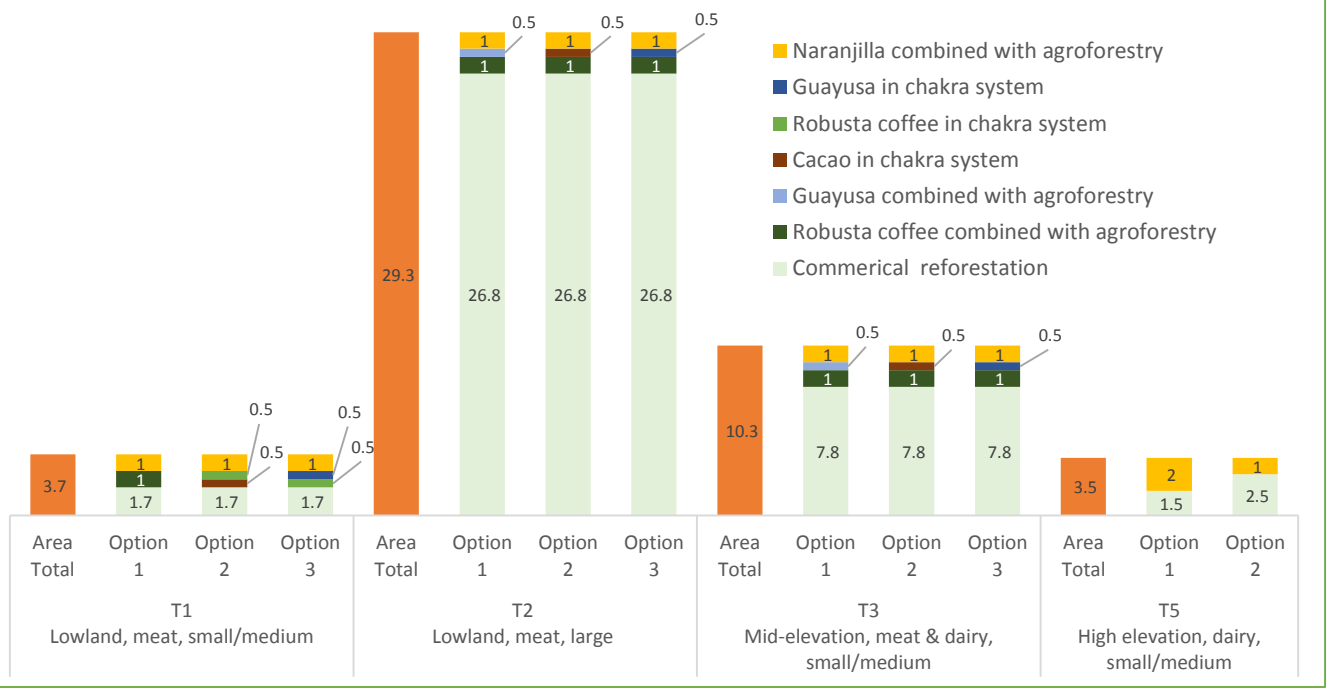


Figure 6: Examples of Recommended Productive Transformation Options



It is assumed that ranchers do 75 percent of the work required for the implementation and maintenance of alternative land uses. Thus, our economic analysis only accounts for 25 percent of the total labor costs estimated for the implementation and maintenance of alternative land uses.

Input costs and output prices: It is assumed that present input costs and output prices will remain stable, and that no significant shift in market conditions will occur[23].

Net Present Value (NPV) and discount rate: The productive transformation models presented in this report are the models that present the highest ten-year NPVs, calculated with a discount rate of 5 percent, 10 percent, and 15 percent.

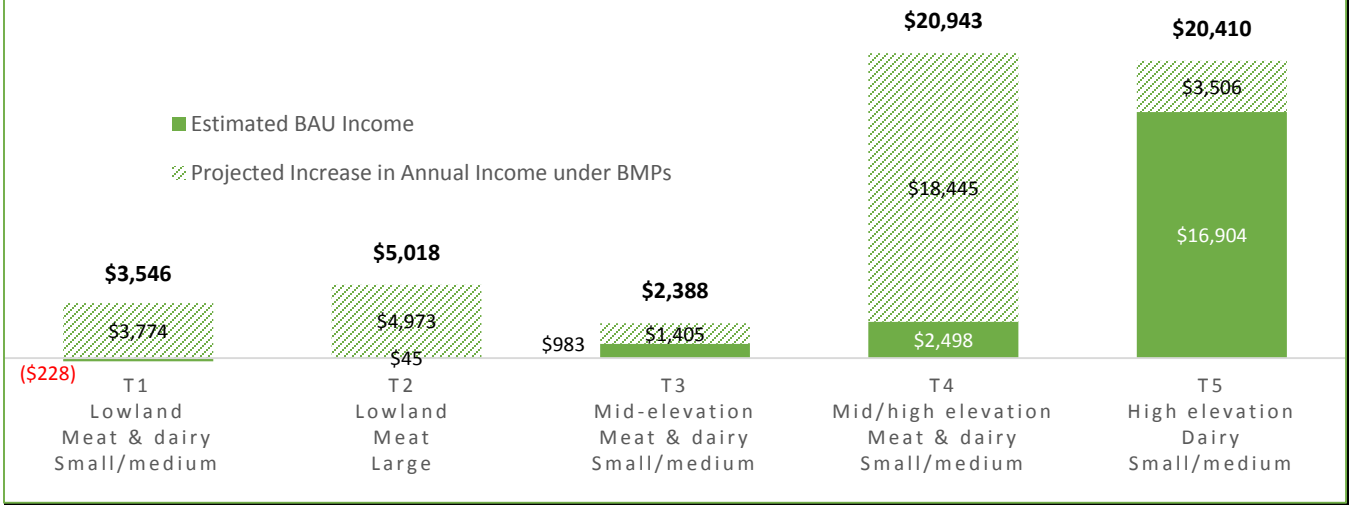
III. Economic Analysis: Key Findings

The intensification of ranching activities and adoption of BMPs can translate into significant increases in annual income from cattle production across ranching systems.

For each ranching system, we modeled annual production costs, revenues[24] and incomes[25] from cattle production in the BAU and BMP scenarios.

As shown in Figure 7 below, **there are wide discrepancies in annual incomes and profitability levels across ranching systems** in both the BAU and BMP scenarios. Small- and medium-sized dairy farms classified as typology 5 consistently outperform farms of other typologies.

Figure 7: Estimated Increase in Annual Income from Cattle Production per Typology in BMP Scenarios



In BAU scenarios, most ranching systems exhibit low to negative profitability.

Low to medium elevation farms demonstrated the lowest profitability levels, ranging from an estimated annual loss of $228 for farms of typology 1 (lowland, meat, small/medium) to a low estimated annual gain of $2,498 for farms of typology 4 (mid/high elevation, meat/dairy, small/medium).

Assuming a $2/day poverty line, only farms of typology 5 (high elevation, dairy, small/medium) showed a profitability level sufficient to support an average family of three or four, with estimated annual income of $16,904/year (compared to a poverty line of $3,285/year for a family of three)[26].

A closer look at the cost and revenue structures in BAU scenarios indicates that lowland and mid-elevation ranching farms of typologies 1, 2, and 3 present low potential for income generation, mainly because of low productivity levels and relatively high costs, with cost-to-revenue ratios that are close to or greater than one in some cases, translating into negative income (see Table 4 below).

[23] We understand that this is unlikely for some crops, but it was beyond the scope of this study to model this.

[24] Revenue is the amount of money that a producer receives from the sale of his/her production before production costs and all other expenditures have been covered.

[25] Income is the amount of money that a producer actually receives from the sale of his/her production after production costs and all other capital expenditures have been covered.

[26] This assumes that all cattle production is geared only to generate profits, and not for farm subsistence.

Table 4: Estimated Costs and Revenues in BAU scenarios		T1 Lowland Meat & dairy Small/medium	T2 Lowland Meat Large	T3 Mid-elevation Meat & dairy Small/medium	T4 Mid-/high elevation Meat & dairy Small/medium	T5 High elevation Dairy Small/medium
	Area of Production (ha)	27.1	87.8	26.32	11.43	37.5
	Herd Size (Animals)	24	70	16	13	47
Annual Estimates	Revenues from production	$2,831	$10,438	$2,935	$4,306	$24,526
	Costs of production	$3,059	$10,193	$1,952	$1,808	$7,621
	Cost-to-revenue ratio	*1.08*	*0.99*	*0.67*	*0.42*	*0.31*
	Estimated Income	$(228)	$45	$983	$2,498	$16,904

While discrepancies remain in BMP scenarios, all ranching systems are expected to see significant increases in annual income from the intensification of cattle production and the implementation of BMPs.

Our analysis indicates increases in annual income ranging from $1,405/year for farms of typology 3 (mid-elevation, meat & dairy, small-/medium) up to $18,445/year for farms of typology 4 (mid-/high elevation, meat & dairy, small-/medium) representing 7.4 times the annual income earned in the BAU scenario for that typology.

On the one hand, annual revenues from meat and dairy production increase as the result of larger herd sizes and the adoption of BMPs focused on productivity enhancements (e.g., improved diet, sanitation, etc.). Annual revenues from cattle production could increase by multipliers of 1.38 to 6.85 compared to BAU scenarios, if all recommended BMPs were fully implemented (see Table 5 below).

On the other hand, annual production costs also increase because of the implementation of BMPs—although at a lesser rate than revenues, allowing for significant annual income gains. Annual costs could grow by multiples of 1.13 to 4.73 depending on the typology, resulting in a net improvement of cost-to-revenue ratios and profitability levels across typologies.

Ranching systems that exhibit low to negative profitability in BAU scenarios (typologies 1, 2, 3, and 4) could see their annual income reach between $2,388 and $18,445 in BMP scenarios.

A noteworthy increase in annual income is expected from farms of typology 4 (mid-/high elevation, meat & dairy, small-/medium). These farms could generate an additional $18,445 in annual income in a BMP scenario when compared to a BAU scenario, mainly due to a tripling in herd size on a slightly smaller land area in the BMP scenario.

Table 5: Estimated Costs and Revenues in BMP Scenarios		T1 Lowland Meat & dairy Small/medium	T2 Lowland Meat Large	T3 Mid-elevation Meat & dairy Small/medium	T4 Mid-/high elevation Meat & dairy Small/medium	T5 High elevation Dairy Small/medium
	Area of production (ha)	21.4	46.53	10	9	28
	Herd size (Animals)	32	78	20	36	45
Annual Estimates	Revenues from production	$6,697	$25,679	$7,233	$29,497	$33,896
	Change in revenues vs. BAU	*2.47 X*	*2.46 X*	*2.46 X*	*6.85 X*	*1.38 X*
	Costs of production	$3,451	$20,661	$4,846	$8,555	$13,486
	Change in costs vs. BAU	*1.13 X*	*1.99 X*	*2.48 X*	*4.73 X*	*1.77 X*
	Cost to revenue ratio	*0.49*	*0.80*	*0.67*	*0.29*	*0.40*
	Projected income	$3,546	$5,018	$2,388	$20,943	$20,410
Projected increase in income vs. BAU		$3,774	$4,973	$1,405	$18,445	$3,506

Investments in transforming cattle production systems are needed to achieve expected economic benefits from ranching activities in BMP scenarios

Projected increases in annual revenues in BMP scenarios also come with increases in annual production costs.

The cost-structure analysis presented in Table 5 shows that annual production costs per ranching system range from $3,451/year to $20,661/year in BMP scenarios. Production costs vary widely, as they largely depend on the size of the ranching system considered, the size of the herd under management, and the set of BMPs implemented.

There are two main production costs across ranching systems (Figure 8):

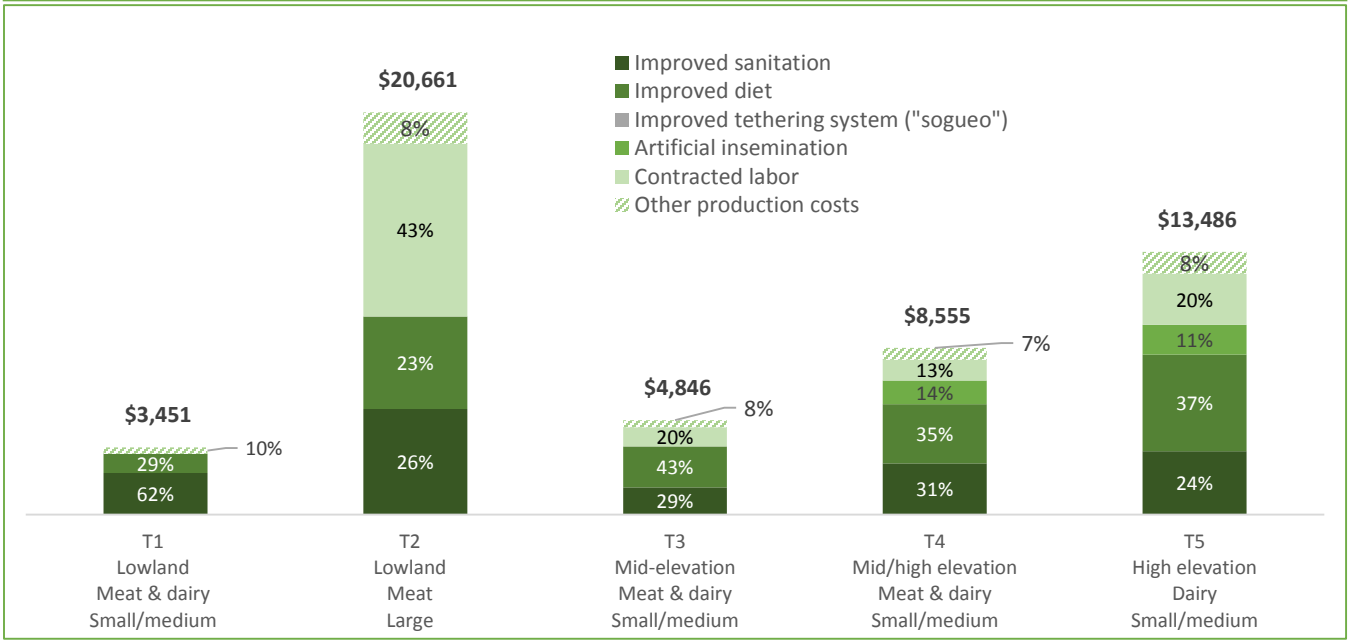
1) **Improved sanitation costs,** including costs for sanitary analysis, livestock vaccines, and medicines
2) **Improved animal diet costs,** including costs for minerals and dietary supplements

Together, these two cost items represent between 49 percent and 91 percent of all annual production costs across ranching systems**. This finding shows that ranchers need to invest in productivity improvements to increase their bottom line.**

Another noteworthy production cost is the cost of artificial insemination on dairy farms of typologies 4 and 5, a line item that is also associated with productivity improvement.

When reaching farms are large such as farms of typology 2, contracted labor may be required and weight up to 43 percent of annual production costs.

Figure 8: Estimated Annual Production Costs per Ranching System to Implement BMPs



All ranching systems require substantial upfront investments to transition from BAU to BMP scenarios, mainly to restore and transform degraded pasturelands.

Our model estimates upfront investments between $6,631 and $15,883 per ranching system, depending on the system considered, its size, and outputs (meat or dairy) (see Figure 9).

Two upfront investments are required across ranching systems:

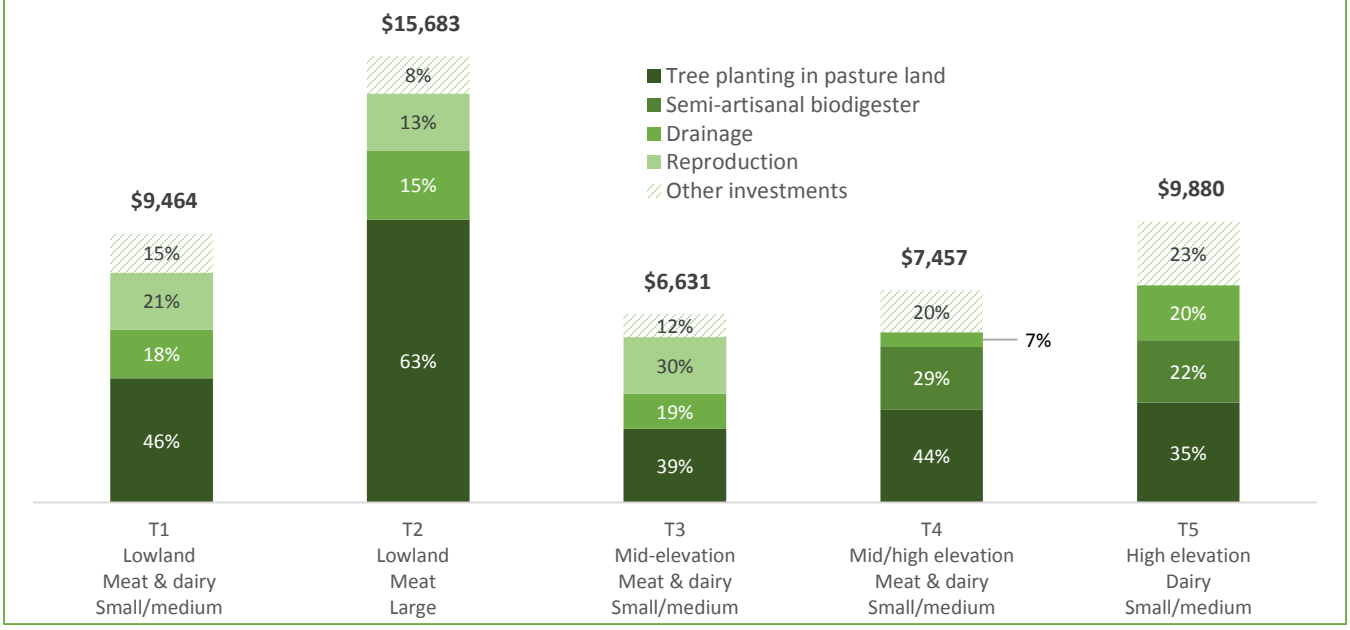
1) **Investments to transform deforested and degraded grazing areas into silvopasture systems,** by planting new trees in pasturelands and establishing live fences
2) **Investments in the enhancement of natural water management in pasturelands**, by improving natural drainage systems

Together, these two upfront investments represent between 57 percent and 78 percent of the estimated total investments needed across ranching systems.

Other representative investments identified were the acquisition of bulls for reproduction purposes in meat production systems (typologies 1, 2, and 3); and investments in organic-waste management equipment, such as biodigesters, in dairy production systems (typologies 4 and 5).

Section IV below highlights avenues for the public and private sectors to support ranchers with the costs involved in transitioning from BAU to BMP scenarios, and in maintaining sustainable cattle production in BMP scenarios.

Figure 9: Estimated Upfront Investment Required per Ranching System to Transition from BAUs to BMPs



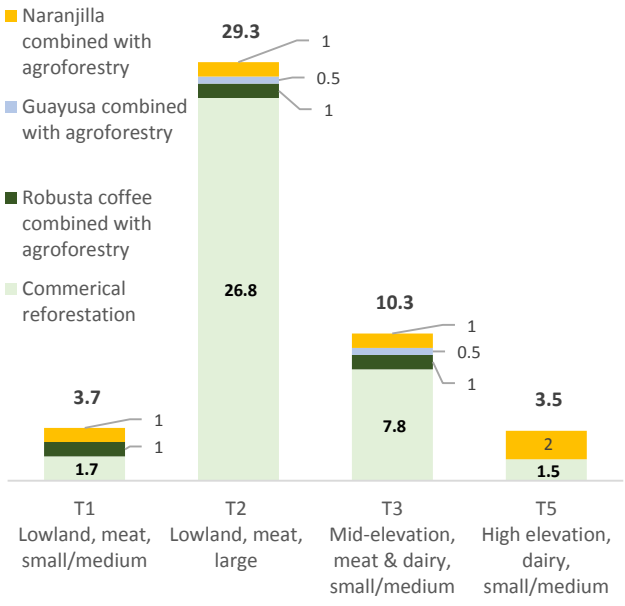
Further economic gains and economic resilience can be achieved with the adoption of integrated models for productive transformation.

Models for productive transformation do not only foster higher revenues from ranching activities, but also offer ranchers the opportunity to diversify their revenues by cultivating cash crops and growing timber trees in areas that are freed from ranching activities.

In fact, peak production of one hectare of pastureland converted to alternative production systems can yield an additional annual net income of $1,574 to $24,956 per year, depending on the crop and the density of the production system elected.

The models for productive transformation presented earlier (see Figure 5 and 6 on page 6) offer the advantage of being both "implementable" without requiring too much investment in external labor, and provide attractive sustainable income-generating opportunities.

Figure 10: Allocation for Productive Transformation



For illustration purposes, we selected one set of productive transformation options per model (Option 1, presented in Figure 6 and shown in Figure 10).[27]

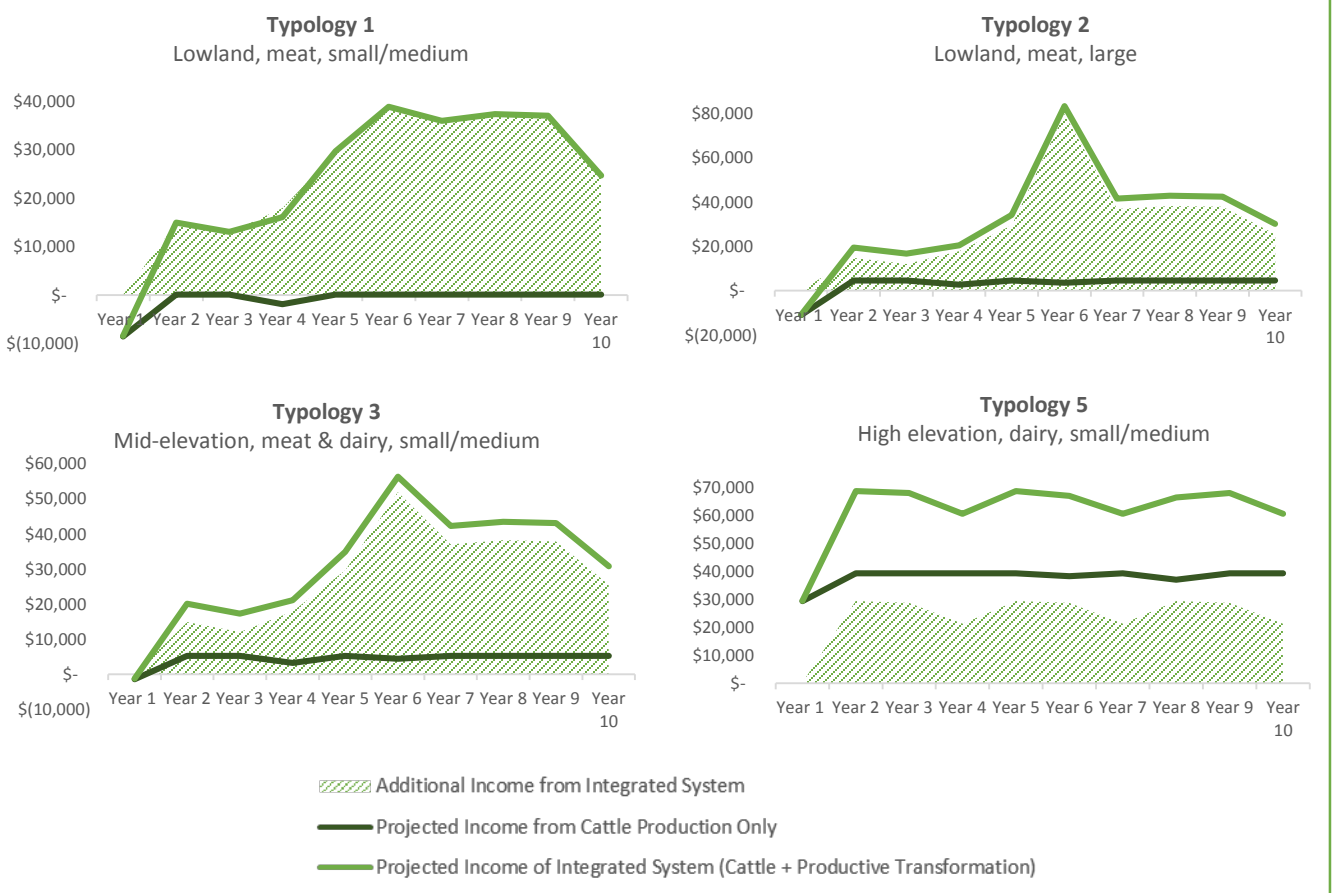
For each ranching system, we projected farm-level costs and revenues from adopting the elected productive transformation models. Models combine the implementation of BMPs into cattle production in Year 1 and the adoption of the selected alternative land uses shown in Figure 10 in Year 2.

The economic benefits of implementing these models in each ranching system are pictured in Figure 11 below.

Throughout the example, one can see that **ranchers can expect to see significant long-term improvement in their farm net income[28] when diversifying their cattle production.**

Because income from cattle production remains relatively low, diversification into cash crops can be highly beneficial to ranchers, assuming that markets are created for these crops, and that prices remains at currently levels.

Figure 11: Ten-Year Projected Income for Selected Productive Transformation models



[27] The exception is typology 4, for which the average land area does not offer productive-transformation opportunities.

[28] This assumes that net income also fluctuates according to crop cycles. In the models presented in Figure 11, a decrease in net income can be observed in Year 10 because of the nine- to ten-year crop cycle for Robusta coffee.

IV. Investment Needs and Opportunities for the Public and Private Sectors

Two types of asset investments[29] are needed to achieve the restoration of degraded ranching landscapes in the Amazon:

1) **Productivity investments** in ranching activities that yield economic benefits to individual ranchers
2) **Land-restoration and diversification investments** that yield both economic benefits to ranchers through income diversification, and environmental benefits at the landscape level

In both case, enabling investments[30] are required to shape the right environment that ultimately facilitates the provision of asset investments from both the public and the private sector.

Asset and Enabling Investments for Productivity Improvements

Productivity investments are needed in two main areas:

1) **Improved animal sanitation,** including minerals and dietary supplements for the animals
2) **Improved animal sanitation,** including sanitary analysis, and vaccines and medicines for the animals.

In both cases, ranchers need to pay for inputs (e.g., vaccines, medicines, minerals, diet supplements, etc.); and services (such as veterinary care) that they would not be paying for in BAU scenarios (see Table 6).

Table 6: Asset and Enabling Investments for Productivity Improvements
(for illustration purposes only- not comprehensive)

Investment needed	Estimated Cost	Available programs and financing mechanisms	Opportunities for the public and private sector to intervene
Improved animal diet	Establishment of food bank: ≈$26/ha Salt & dietary supplements: ≈$78/head/year		**INPUT LOAN:** Develop input-loan products by financial institutions or value-chain companies
Improved animal sanitation	Sanitary analysis & vaccines needed to acquire Agrocalidad certification: ≈$11.5/head for the first year ≈$6.5/head for subsequent years Other vaccines & medicines: ≈$62.5/head/year	Additional $0.01/liter paid under the Ministry of Agriculture (MAGAP) incentive program for sanitary improvement (assuming Agrocalidad certification) to prove that the animals are free of brucellosis, tuberculosis, and other illnesses	**FINANCIAL INCENTIVE**: Improve access to Agrocalidad certification via subsidies or direct financing to ranchers **INPUT LOAN**: Develop input-loan products by financial institutions or value-chain companies

[29] This represents the means to undertake an activity, or an investment that aims to create tangible value (LPFN, 2015).

[30] This refers to funding that generates an incentive to invest money in a particular activity. Funding helps to prepare the ground for commercial success and improve competitiveness against conventional investment alternatives, usually with no expectation of financial reward (LPFN, 2015).

These investments are critical to improving farm productivity and can, over time, pay for themselves once they translate into higher revenues for ranchers. In the meantime, ranchers need financial support to access the inputs and services they need to implement productivity-improvement practices.
Three mechanisms can be deployed to support investments in productivity improvements:

1) **Financial incentives,** whereby financial support or subsidies are tied to the adoption of productivity-improvement practices
2) **Input loans**, whereby short-term financing is provided by value-chain stakeholders (e.g., buyers, input providers, etc.) and/or financial institutions to pay for upfront input costs
3) **Enabling investments** in inputs and services for ranchers and to promote the benefits of adopting practices to improve productivity

Incentive mechanisms currently support the adoption of improved animal diet and sanitation.

As part of its Sustainable Livestock Programme[31], the Ecuador's Ministry of Agriculture, Livestock, Aquaculture, and Fisheries (or MAGAP, its Spanish acronym)) is managing an incentive program for sanitary improvement in dairy production whereby ranchers receive an additional $0.01 per liter of milk that they sell, as long as productive animals have received certification from Agrocalidad[32]- a proof that animals do not contain illnesses such as brucellosis or tuberculosis.

However, ranchers need greater access to these mechanisms, and to the inputs and services that can help them to improve productivity.

The Agrocalidad certification required to qualify for MAGAP's incentive program costs approximately $11.5 per productive animal in the first year and $6.5 in the following years (due to the cost of tuberculosis and brucellosis analysis, and brucellosis vaccines). As such, the certification is only attractive to dairy farms whose productive animals yield more than 650 to 1,150 liters of milk per year (the volume necessary to recover the annual cost of the certification). Such farms include small- and medium-sized dairy farms of typologies 3, 4, and 5. Under our BMP recommendations for "improved sanitation," we encourage dairy farms of these typologies to acquire the certification. While fairly limited, the cost of acquiring and maintaining the certification for productive animals can reach a total amount of $100 to $130 per year for dairy farms with large herd sizes.

For ranching systems that are dedicated to meat production, and have limited dairy production (typologies 1 and 2), the cost of the certification is not worth the financial benefits.

Implementation of productivity-improvement practices could benefit the development of input-financing products for ranchers—for example, short-term loans provided by dairy out-takers, financial institutions, and/or microfinance institutions that are reimbursable via milk delivery or in cash over a nine to 12 month period. Further analysis would be required to identify such mechanisms or suggest alternatives.

Finally, for such investments to be made in production systems, 1) ranchers must be educated ranchers on the benefits of investing in productivity improvements, and 2) their access to the inputs and services they need to improve cattle diet and sanitation must be facilitated.

Ranchers need to better understand the benefits of improving cattle diet and sanitation, and the resulting productivity impacts. This can be achieved through regular engagements with ranchers and rancher organizations by government extension services, meat and dairy companies[33], or other value-chain stakeholders as part of their CSR and capacity-building programs.

Beyond building the case for productivity investments, there is a need to facilitate ranchers' access to the inputs and services they need in order to implement best ranching practices. Improved access can be achieved by ensuring that the goods and services (such as dietary supplements, minerals, vaccines, and veterinary services) are actually available in the ranching communities where they are needed. In some cases, value-chain investments and capacity building

[31] http://www.agricultura.gob.ec/ganaderia-sostenible/

[32] http://www.agrocalidad.gob.ec/sanidad-animal/

[33] Meat and dairy companies operating in Napo include: Pronoca, Juris, Federer, Don Diego, Pasteurizadora Quito, El Ordeno, Parmalat, Alpina, Pasteurizadora del Carchi, Lacteos San Antonio, Nestle, Bios, Ferrero, La Universal, and Confiteca.

might be required to ensure adequate provision of inputs and productivity improvements at scale. These could include investments in the provision of veterinary services or the improvement of supply chains for dietary supplements and vaccines to ensure the best prices and input quality.

Asset and Enabling Investments in Land Transformation

Land-restoration and diversification investments take several forms (see Table 7):

1) **Investments required to intensify cattle production and regenerate degraded pastures**, including:
   - Investments in cattle intensification by increasing herd sizes and improving rotational grazing systems (e.g., using electric fences, etc.)
   - Investments in the afforestation or reforestation of pasturelands to transition from degraded pasture systems to integrated silvopasture systems
   - Investments to improve natural water- and irrigation-management systems in pasturelands
   - Investments to improve waste management on dairy farms via the acquisition of waste-management systems such as biodigesters
2) **Investments in productive-transformation systems** in areas freed from cattle production, including investments to convert land to cash-crop production (cocoa, coffee, naranjilla, and guayusa) or commercial reforestation.

Table 7: Asset and Enabling Investments for Land Transformation
(For illustration purposes only—not comprehensive)

Investment Needed	Estimated Cost	Available Programs & Financing mechanisms	Opportunities for the Public and Private Sector to Intervene
Cattle intensification, incl. increases in herd size and improved rotational-grazing systems	Mobile electric fences: ≈$612/ha Bull for reproduction purposes: ≈$2,000/head Artificial insemination: ≈$34/Head	**Banco Nacional de Fomento**: Subsidized credit lines to purchase or restock cattle and carry out genetic improvements	**DEBT FINANCING**: Develop leasing products or investment/long-term loan products for the acquisition of electric fences **DEBT FINANCING**: Develop credit lines to improve cattle reproduction and genetics **FINANCIAL INCENTIVE**: Develop incentive program to improved cattle reproduction and genetics
Afforestation or reforestation of pasturelands	Live fences: ≈$1,079/km Establishment of silvopasture land: ≈383/ha	**Socio Bosque** Passive Restoration Program: $15-$21/ha/year for active and passive restoration for individual owners with 1 to 50 ha of primary forest	**ENABLING INVESTMENT**: Improve access to land ownership and land titles **ENABLING INVESTMENT**: Technical assistance for individual landowners and communities to develop land-management plans
Improved water and irrigation management in pasturelands	Drainage permit: ≈$180/permit Drainage cost: ≈$1.1/m	N/A	**DEBT FINANCING**: Develop credit lines to pay for drainage permits and associated activities **FINANCIAL INCENTIVE**: Develop subsidies for drainage permits and associated activities **ENABLING INVESTMENT:** Simplify the permitting process to make easier for smallholder producers to prepare documentation required for permitting

Improved waste management for dairy farms	Semi-artisanal biodigester : ≈$2,197/unit Artisanal lombriculture : ≈$74.5/unit	N/A	**DEBT FINANCING:** Develop micro-leasing products and investments, and long-term loan products for the acquisition of waste-management equipment
Productivity transformation through alternative land uses (natural restoration, cash crop and timber production)	Implementation: $1,082 to $3,549/ha for cash crops in AFS and "chakra" systems Implementation: $936 to $1,157/ha for commercial reforestation	**Socio Bosque**: $15-$21/ha/year for active and passive restoration for individual owners with one to 50 ha of primary forest **MAGAP commercial reforestation incentive program**: $795 to $2,249/ha/year, for up to four years, depending on tree species and densities Tax break for afforestation and reforestation	**ENABLING INVESTMENT:** Improved access to land ownership and land titles **ENABLING INVESTMENT**: Technical assistance for individual landowners and communities to develop land-management plans **ENABLING INVESTMENT:** Target REDD+ financing flows to provide technical assistance, training, and access to the inputs required to transition degraded ranching lands into cash-crop production in areas with high-deforestation rates **DEBT FINANCING:** Capitalize a public or private fund to provide upfront financing and technical assistance to enable more smallholders and communities to access the Commercial Reforestation Incentives program—money that will later be repaid as communities receive their incentives and/or sell timber **FINANCIAL INCENTIVE:** Facilitate access to planned "mark of origin" or sustainable labels for agroforestry products, such as coffee, cocoa, and naranjilla, which are included in Ecuador's "transformation of the production matrix" agenda

Similarly, three mechanisms can be deployed to support investments in land restoration and diversification:

1) **Financial incentives,** whereby financial support or subsidies are tied to the adoption of land-transformation practices
2) **Debt financing,** whereby financing is provided by investors and/or financial institutions to pay for the costs of implementing land-transformation practices
3) **Enabling investments** in the form of capacity building and technical assistance to facilitate the deployment of capital

Several initiatives in Ecuador currently provide technical assistance and financial incentives to support the restoration and diversification of degraded landscapes.

Through its Conservation Incentives Programme, the government of Ecuador has implemented several incentive mechanisms to support the conservation and restoration of forests and the regeneration of degraded ecosystems—including the establishment of silvopastures in degraded ranching landscapes. These include its flagship initiative, Socio Bosque, and MAGAP's program for commercial reforestation.

Under Socio Bosque, individual landowners benefit from technical assistance to develop sustainable forest-management plans (a cost estimated at $46 per plan), as well as financial incentives of up to $60/ha/year for forest conservation, and up to $42/ha/year for restoration—assuming that land title can be provided[34]. Socio Bosque has proven to be a successful example of

[34] Oficina del ICCA en Ecuador, Consultoría técnica para el área de innovación para la productividad y competitividad, *Portfolio de incentivos para la conservación en la cuenca alta del rio Coca*. June 2014

an incentive-based scheme that combines environmental and socio economic benefits.

Similarly, MAGAP offers incentives for landowners to engage to reforestation activities for commercial purposes through its program for commercial reforestation[35]. The program offers incentives between $1,140/ha for one year[36] to $3,494/ha for four years[37], depending on tree species and density—again, assuming that land title can be provided.[7]

Lastly, ranchers may benefit from tax incentives for the afforestation and reforestation of lands under projects that are accredited by the MAGAP or for rural land tenure.

While these incentive programs have proven successful, they are not always easily accessible for ranchers and ranching communities in the Amazon in the absence of technical assistance and support from third parties. In order to apply and comply with the eligibility requirements of such incentive programs, ranchers and communities often need support from capacity-building providers to conduct boundary delineation, develop investment plans, submit required documentation to government authorities, and carry out periodic compliance monitoring.

Beyond existing national incentive mechanisms, financial institutions and impact investors can also play an important role—by providing debt financing for landscape restoration in the Amazon.

In fact, there is a gap in the debt financing that's available to ranchers and ranching communities so that they can invest into landscape restoration. This gap could be addressed by the development of financial products and services adapted to restoration needs on ranching farms—including long-term investment-loan products with a minimum grace period that could be repaid over several years using the additional revenue generated from intensified cattle production and diversified production systems. Our economic analysis demonstrated that well-designed productive-transformation models could yield significant increases in farm revenues if financed and adequately implemented.

Several credit lines are presently available or are being developed by public financial institutions. For example, the national development bank (Banco Nacional de Fomento) offers subsidized credit lines to ranchers for the purchase or restocking of cattle and for genetic improvements. To qualify, ranchers are required to fill out a credit application that includes demonstrating proof of land ownership. Other forms of credit are available through MAGAP or are being developed for the establishment or renovation of cocoa and coffee plantations, to cover labor costs and initial investments.

Further analysis would be necessary to inventory financial products that are available to ranchers from local financial institutions. An interesting financing mechanism worth highlighting is the development of micro-leasing financial products in the region to help farm owners with the acquisition of assets such as waste-management systems.

Last but not least, there is a growing interest from funders and investors in land-restoration programs that have the potential to yield significant environmental and socio-economic benefits in the form of carbon credits or revenue from cash-crop or timber production. Those interested include innovative financing and investment mechanisms including (for illustration purposes only): the Global Environmental Facility, the IDH Initiative for Sustainable Landscapes (ISLA), the Livelihood Fund for Family Farming, Althelia Climate Fund, the Moringa Fund, and the Land Degradation Neutrality Fund[38].

Finally, there is a need for ranchers to understand why these investments are critical and what impacts they may have on both the environment and their bottom line.

As mentioned in the productivity section, engaging with ranchers directly or through producer organizations can raise awareness of these issues. Because of the environmental benefits that such investments would generate, the government and its extension services are expected to engage with ranchers and their communities, and promote land-transformation practices. Private-sector players (from value chains that

[35] http://balcon.magap.gob.ec/mag01/magapaldia/WEB%20FORESTAL/WEB%20FORESTAL/programa%20de%20insentivos%202015/Programa%20de%20Incentivos%20para%20la%20Reforestaci%C3%B3n%20con%20Fines%20Comerciales%202015.pdf

[36] For Ochroma species (500 trees/ha)

[37] For *Hevea brasiliensis* species (500 trees/ha)

[38] "Scaling up investment and finance for integrated landscape management: Challenges and innovations" - A White Paper from the Landscapes for People, Food and Nature Initiative, 2015

benefit directly from land-reconversion activities) are also expected to play a role—facilitating ranchers' access to capacity-building services so that ranchers can transition to new production systems.

V. Recommendations

This analysis highlights the need and opportunity for public- and private-sector investments to restore degraded ranching lands in the Ecuadorian Amazon. Such findings are critical for local governments, to help inform the development of their national restoration agenda; for impact investors and bilateral and multilateral funders, to assist in the design of their investment programs and financing instruments; and for local financial institutions, to develop financial products that are adapted to restoration needs.

To further build on the study's findings, the following recommendations are advanced:

1) **Explore opportunities for the coordinated delivery of financial incentive programs** via the Ministry of Agriculture (i.e., the Sanitation Program and the Commercial Reforestation Incentives Program) and the Ministry of the Environment (i.e., Socio Bosque and REDD+) to bundle the financing that's available to producers as they work to restore degraded lands, and harmonize or streamline processes so that producers can access these programs.

2) **In conjunction with the appropriate government ministries, development banks, and financial institutions, opportunities should be reviewed for adapting existing debt-financing mechanisms or developing new ones to help** ranchers invest in productivity improvements or land transformation.

~~3)~~ **Structure public-private partnerships** whereby the government's financial incentives and private debt-financing mechanisms can be work in concert to offer financing that covers the cost of the most critical land-restoration practices~~.~~

4) **Identify the role of REDD+ financing** as an enabling investment that can strengthen the technical capacities of local actors—such as extension agencies, governments, producer associations and/or REDD+ project proponents—to support the implementation of restoration BMPs among producers.

5) **Facilitate discussions between impact investment funds[39] and/or bilateral and multilateral funders that are committed to supporting landscape restoration under Initiative 20x20**[40] . Further engagement could be achieved at the landscape level or at the national levelin the form of discussion workshops or consultations.

The methodological approach that was taken in this study in Ecuador could be applied in other Amazon countries (such as Colombia and Brazil) that are seeking to promote the productive restoration of degraded lands at a subnational or national scale.

Replication of this work would facilitate an assessment of the nature and scope of the investments that are needed to restore degraded ranching lands at scale, and would also promote learning among those Amazon countries that have commonalities in their approaches to productive restoration.

The transfer of regional knowledge could be promoted by:

- A comparative analysis of findings across different country contexts
- Sharing experiences and lessons learned among prioritized national and regional networks (including the Tropical Forest Alliance and others) on topics such as restoration, REDD+, and the production of sustainable commodities—a process that would also enhance the possibility of replication
- Establishing shared work agendas across countries, coordinating learning exchanges and site visits, and enhancing the technical capacities of key stakeholders in other Amazon countries to learn about how other countries approached financing restoration and applied these lessons to their own programs

VI. Contacts

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[39] Althelia Ecosphere, the Moringa Fund, Premian Global, Terra Bella, and Rare have jointly indicated their intention to invest a total of $365 million USD to support Initiative 20X20.

[40] Initiative 20x20 brings together national and regional commitments, and $365 million of private financing to restore forests and ecosystems, reduce poverty, and improve agricultural productivity.

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GIZ provides services worldwide in the field of international cooperation for sustainable development. GIZ has more than 50 years of experience in a wide variety of areas, including economic development and employment, energy and the environment, and peace and security. All commissioning parties trust GIZ to generate ideas for political, social, and economic change on their behalf, develop these into concrete plans, and implement the envisaged change processes. GIZ's registered offices are in Bonn and Eschborn.

UEA is an academic and scientific community of teachers and researchers that supports and promotes sustainable development in the Amazon, building on its ancestral knowledge, its unique potential, and its integrant part in the economy to forge culture and achieve national unity. Through science, technology, and the training of professionals and scientists, UEA works toward sustainable, comprehensive, and balanced human development in the Amazon region.