EVALUATION FEASIBILITY ASSESSMENT FOR EXPANDED LAND FOR PROSPERITY ACTIVITIES IN SOUTHERN META AND VICINITY OF CHIRIBIQUETE NATIONAL PARK: FINAL REPORT

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ACRONYMS

CEL	Communications, Evidence, and Learning
CNP	Chiribiquete National Park
DDI	Bureau for Development, Democracy, and Innovation (USAID)
EEI	Environment, Energy and Infrastructure (USAID)
FA	Feasibility Assessment
FARC	Revolutionary Armed Forces of Colombia
GFW	Global Forest Watch
GoC	Government of Colombia
IE	Impact Evaluation
IP	Implementing Partner
ITS	Interrupted Time Series
LfP	Land for Prosperity Activity
LRDP	Land and Rural Development Program
PES	Payments for Environmental Services
PPP	Public Private Partnership Public Private Partnership
SMVC	Southern Meta and Vicinity Around Chiribiquete National Park
SOW	Scope of Work
SRD	Spatial Regression Discontinuity
TOC	Theory of Change
UNESCO	United Nations Educational, Scientific, and Cultural Organization
USAID	United States Agency for International Development

I. INTRODUCTION

The Communications, Evidence, and Learning (CEL) project is conducting a desk-based evaluation feasibility assessment (FA) to help inform on design options for a mixed methods evaluation focused on selected interventions that USAID's Land for Prosperity (LfP) activity will conduct in an expanded geographic region in Southern Meta and the vicinity of Chiribiquete National Park (SMVC). The objective of the evaluation FA is to identify and develop a set of illustrative evaluation design options that meet USAID learning interests and are considered feasible for a credible assessment of the impacts of LfP's work in the expanded geographic region in SMVC, should USAID decide to conduct an evaluation of the activity. This FA is conducted by NORC at the University of Chicago and is related to an ongoing impact evaluation (IE) of LfP core interventions also conducted by NORC.[1]

The report includes a draft logic models depicting the theory of change for the LfP activity in the expanded geographic region of SMVC that were developed through a series of consultations with USAID and LfP, a summary of USAID learning interests and illustrative evaluation questions, and illustrative evaluation design options that are feasible for meeting USAID's priority learning interests from the LfP activity in the expanded geographic region of SMVC, given the current knowledge on how the activity may be implemented. Section V of the report presents a broad outline of viable mixed method evaluation options, and summarizes general strengths, limitations, and key caveats with respect to LfP implementation and context. The report concludes with cost considerations and recommendations for an evaluation of LfP activities in SMVC.

LAND FOR PROSPERITY ACTIVITY BACKGROUND

The LfP activity builds on prior USAID investments in the land sector in Colombia, such as the Land and Rural Development Program (LRDP), and is envisioned to improve the conditions of conflict-affected rural households in a sustainable manner. LfP is being implemented across seven micro-regions of Colombia. The activity comprises three main intervention components involving (1) massive land titling, (2) strengthening local government capacity, and (3) promoting public private partnerships (PPPs). A total of ten municipalities across the seven micro-regions were selected as pilot municipalities, which will receive all three LfP components. In total, these components will provide access to land titles while supporting land restitution as part of a broader land title policy support, strengthening local government capacity, and integrating citizens to licit socio-economic opportunities in target areas. The initial LfP activity began implementation in 2020 in a total of seven regions, including Southern Tolima, Montes de Maria, Meta, Catatumbo, Tumaco, Northern Cauca, and Bajo Cauca.

In late 2020, LfP responded to a request from the Government of Colombia (GoC) to implement massive cadaster and land property rights pilots in additional municipalities related to deforestation, illicit crop production, and unclear land rights linked to environmentally sustainable economic development opportunities. Ultimately, LfP and GoC agreed to expand the LfP activity to an additional geographic region of implementation covering selected deforestation hotspots in SMVC. The goal of this implementation in the additional geographies is to explore methods that focus on the integration of three thematic areas—licit, sustainable livelihood promotion, land formalization, and environmental

[1] See: Protik, A., G. Haugan, R. Wendt, L. Persha, and J.C. Muñoz Mora. (2020) *Evaluation of the 'Land for Prosperity' Activity in Colombia: Evaluation Design Report.* Washington, DC: USAID Communications, Evidence and Learning (CEL) Project; Protik, A., Haugan, G., and Persha, L. (2021) *Evaluation of the Land for Prosperity (LfP) Activity in Colombia: DRAFT Baseline Report.* Washington, DC: USAID Communications, Evidence and Learning (CEL) Project.

conservation, with a particular focus on changing behaviors associated with deforestation and biodiversity conservation.

From an evaluation standpoint, particularly strong learning interests for USAID center on the linkages between the LfP interventions in the additional geographies and (1) the promotion of licit, sustainable livelihoods; (2) reduced deforestation; as well as a resulting reduction in corruption; (3) wildlife and biodiversity conservation; and (4) climate change mitigation. These outcomes are not the sole responsibility of LfP's interventions in the additional geographies. Rather, LfP's interventions are meant to contribute to these outcomes along with complementary interventions from other USAID activities, activities funded by other international donors, and activities implemented directly by the GoC. Among LfP's core contributions to these outcomes will be evidence-based policy inputs for the GoC to implement large-scale land formalization efforts that could impact deforestation at a landscape scale.

FEASIBILITY ASSESSMENT PURPOSE, AUDIENCES AND INTENDED USES

The outputs of the evaluation FA will help to inform USAID on design options and methods for an evaluation of the intervention activities implemented in SMVC, which explores the linkages between land formalization, licit, sustainable livelihood promotion, and environmental conservation (and related learning interests regarding corruption, wildlife and biodiversity conservation, climate change mitigation). The feasibility assessment will also inform on the types of outcomes that could be measured under such designs, the additional information that would be required to proceed with the full evaluation design, and an illustrative indication of associated budgetary costs.

The primary audiences for the IE feasibility assessment are USAID/Colombia and USAID/DDI/EEI. Secondary audiences consist of LfP implementing partners, GoC and other stakeholders involved in a range of development sectors including land, biodiversity conservation, forest governance and natural resource management, climate change, and anti-corruption.

II. ADDITIONAL GEOGRAPHIES: PROBLEM DIAGNOSTIC AND LFP'S INTERVENTIONS

LfP's pilot activities in additional geographies of SMVC aim to demonstrate how formalization and improved land governance can support halting rampant deforestation in one of the most critical natural areas of Colombia for biodiversity conservation and climate change mitigation. SMVC is also characterized by sub-standard livelihoods for residents and low capacity of the Colombian government to provide critical services for land tenure and property rights and enforce environmental land use restrictions.

SMVC, which includes four national parks (Serranía de Chiribiquete, Tinigua, Picachos, and Sierra de La Macarena), one national nature reserve (Nukak), and the surrounding Amazon Forest Reserve Zone, is an immense environmental, cultural, and social resource for Colombia.[2] SMVC is a global biodiversity hotspot due to its function as a corridor between three distinct biogeographic provinces (Orinoquia, Guyana, and Amazonia) and its inclusion of unique habitats that promote a high degree of species diversity and endemism. The Chiribiquete National Park (CNP) is the largest tropical rainforest national park in the

[2] SMVC also contains 52 indigenous territories and two large (175,000 hectares) Campesino Reserve Zones (ZRCs): Calamar and El Pato. These ZRCs are authorized by the ANT and provide significant protection for land within the territory to be used for small-scale farming by campesinos, ensuring the land cannot be used for extractive industry or industrial farming, while controlling the expansion of the agricultural frontier and protecting against the inequitable concentration of land holdings within the ZRC. (source: LfP BSLP)

world, and the United Nations Educational, Scientific, and Cultural Organization (UNESCO) declared it a World Heritage Site due to its biodiversity and the presence of exceptional cultural testimony in the form of ancient rock art sites and uncontacted indigenous peoples within the park.[3] In 2018, the GoC expanded the park by approximately 3.7 million acres, representing an expansion of approximately 50 percent.

In addition to providing habitat for the diverse wildlife of this geography, the mature forests of Amazonia have demonstrated significant climate change mitigation over decades as net carbon sinks, thus providing a critical global ecosystem service.[4] While the Western Amazon, including the forests of SMVC, still serve as a net carbon sink, trajectories of land use change in the Southeast Amazon have demonstrated that deforestation and climate change can turn the Amazon rainforest into a net emitter of carbon.[5]

Despite its national and global significance, SMVC has been historically characterized by a lack of state territorial control and the presence of armed groups, who at times went so far as to intervene in "social, political, and economic activities, and [regulate] many types of conducts."[6] The Revolutionary Armed Forces of Colombia (FARC) had forms of social and territorial control over parts of SMVC starting in the 1980s and consolidating in the 1990s, leading to conflict with the state and other guerilla and paramilitary groups that terrorized and often displaced the local population. [7] Non-state territorial control peaked during a period from 1998-2002 where parts of SMVC were included in a de-militarized zone, which was meant to provide a venue for peace negotiations but reportedly served as a safe haven and military staging area for the FARC.[8] The presence of the FARC continued through the group's disarmament in 2017, and residents report that dissident groups splintered from the FARC maintain a strong presence in remote parts of the territory.[9]

While the presence of the Colombian state has since increased, the absence of an updated cadaster "means that information of who owns or has use rights to which land is not available."[10] Several factors compound to exacerbate this situation, including the massive displacement of the local population during the historic conflict, the overlaying areas of restricted use rights for social or environmental purposes, the CNP's 2018 expansion, the limited capacity of state institutions responsible for land tenure and property rights, and elite capture of notaries, land registry, and cadastral offices. The result has been formalization of irregular or illegal land purchases, invigoration of informal land markets, and the expansion of the agricultural frontier for cattle ranching and illicit crop cultivation through land grabbing and deforestation.[11]

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[3] At least 2,939 species of plant and animals have been recorded in the CNP alone, 21 of which are endemic to the park. Many more species are likely, given the little scientific research that has taken place in this area.
UNESCO World Heritage Centre. "Chiribiquete National Park – 'The Maloca of the Jaguar.'" https://whc.unesco.org/en/list/1174/.

[4] Phillips, Oliver L., and Roel J. Brienen. "Carbon Uptake by Mature Amazon Forests Has Mitigated Amazon Nations' Carbon Emissions." *Carbon Balance and Management*, vol. 12, no. 1, 2017, https://doi.org/10.1186/s13021-016-0069-2.

[5] Gatti, L.V., Basso, L.S., Miller, J.B. *et al.* Amazonia as a carbon source linked to deforestation and climate change. *Nature* **595,** 388–393 (2021). https://doi.org/10.1038/s41586-021-03629-6

[6] Provost, Rene. "FARC Justice: Rebel Rule of Law." SSRN Electronic Journal, 2017, https://doi.org/10.2139/ssrn.2925278.

[7] Sánchez, Gonzalo. "Caquetá: Conflicto y Memoria" Centro Nacional de Memoria Histórica. 2013
http://www.centrodememoriahistorica.gov.co/descargas/informes2014/cartillaCaqueta/cartilla-caqueta-completa.pdf

[8] Wilson, Scott. "Colombia Extends DMZ for 2 Months." The Washington Post, 8 Dec. 2000,
https://www.washingtonpost.com/archive/politics/2000/12/08/colombia-extends-dmz-for-2-months/b1b8e155-e06a-4a16-97c1-f650218cb130/.

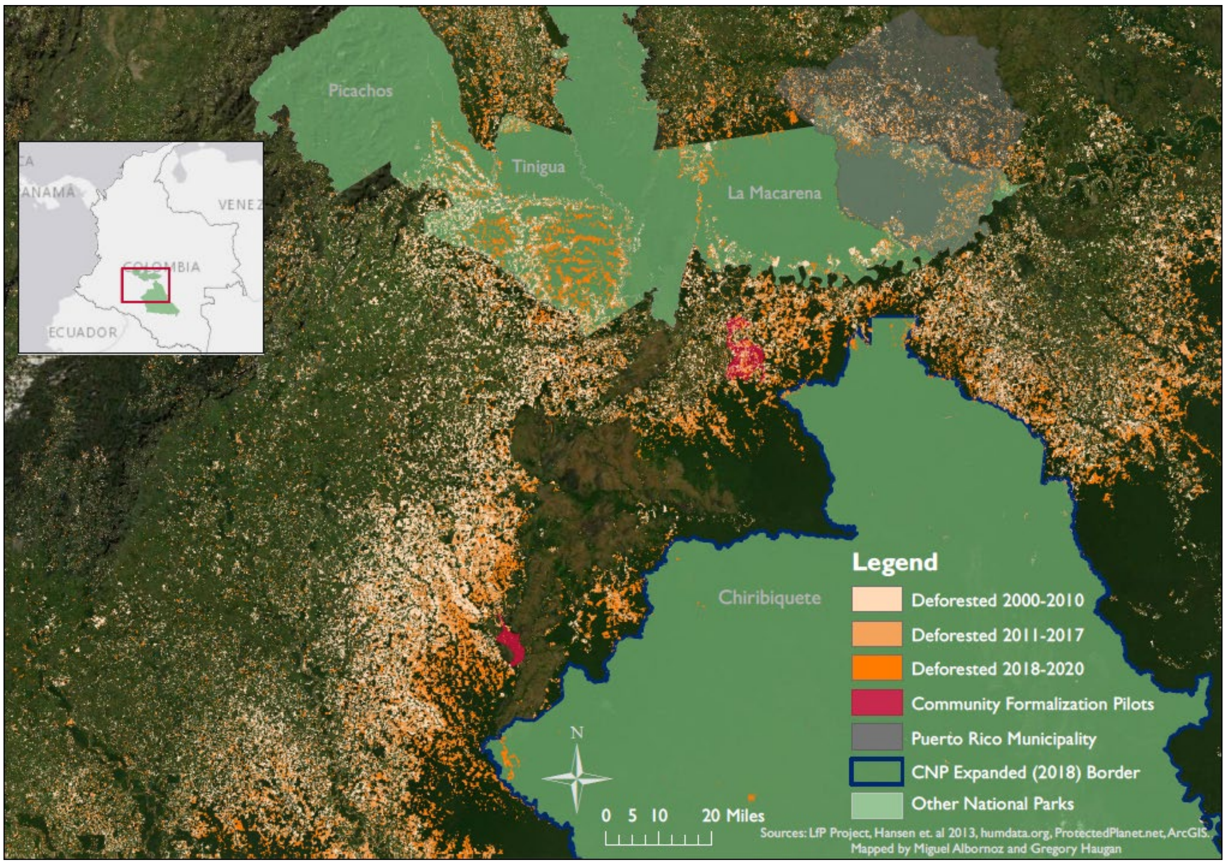
[9] Volckhausen, Taran. "Land Grabbing, Cattle Ranching Ravage Colombian Amazon after FARC Demobilization." Mongabay Environmental News, 30 May 2019, https://news.mongabay.com/2019/05/land-grabbing-cattle-ranching-ravage-colombian-amazon-after-farc-demobilization/.

[10] Biodiversity and Sustainable Landscapes Plan (BSLP): Activity in and around Chiribiquete National Park and the Municipality of Puerto Rico, Southern Meta. USAID/Colombia Land for Prosperity Activity. April 12, 2021

[11] Ibid

The years since 2017 have been the worst for forest loss in Colombia's history, according to Global Forest Watch (GFW), with 115,000 – 177,000 hectares of primary forest lost per year.[12] Shifting agriculture is cited as the main driver of this loss, though commodity-driven deforestation is also a contributing factor. Deforestation in SMVC has been a key contributor to this loss, as the Colombian Institute of Hydrology, Meteorology, and Environmental Studies (IDEAM) reported close to 43,000 hectares of rainforest lost between Caquetá, Guaviare, and Meta between October and December 2018 alone.[13] As Figure 1 shows, much of the deforestation occurs in the buffer zones around the CNP's 2018 expansion area, where institutional weaknesses prevent the Government of Colombia from clarifying and enforcing the park boundary.[14] The figure also shows that this deforestation has mostly occurred in these areas in the past few years.

Figure 1: Deforestation Trends in SMVC



LfP personnel and local stakeholders in SMVC assess land conversion and aggregation for extensive cattle ranching to be the main impetus behind land use change and deforestation. Farmers reportedly fell trees from October through December before the start of the dry season, which enables forest clearance through burning during the subsequent dry season from January to March and seeding for pasture during the rainy season thereafter. This process, or similar processes to cultivate licit or illicit crops in previously forested areas, subsequently serves as a justification for appropriating previously forested land for permanent non-forest uses. Given low capacity for land governance and enforcement

[12] Global Forest Watch Dashboard – Colombia. Accessed January 13, 2022. https://gfw.global/3Ku3nL5
[13] Volckhausen 2019
[14] USAID/Colombia LfP BSLP

among local government institutions in the area, land grabbers ignore established conditions for environmental and/or productive land use.[15] Although the local population is at times directly responsible for clearing forest, often they do so on behalf of wealthier parties or organizations from outside the area who pay locals to engage in this activity, so that they can subsequently buy and aggregate the deforested land.[16]

III. ACTIVITY LOGIC MODEL AND KEY ASSUMPTIONS

LFP ADDITIONAL GEOGRAPHIES GENERAL THEORY OF CHANGE

LfP will pursue multiple strategies that all aim to improve tenure security and local land governance as necessary conditions for enforcing legal and environmentally sustainable land use, while also pursuing public-private partnerships (PPPs) that connect local stakeholders with opportunities to participate in income-generating activities that favor environmental conservation (i.e. "green value chain opportunities"). These outcomes provide necessary conditions for reducing drivers of deforestation, conserving biodiversity, and promoting sustainable, improved livelihoods in SMVC; though per LfP's theory of change, they are not deemed sufficient for achieving these broader objectives without complementary interventions from other stakeholders and/or implementation at a much larger scale.

In the SMVC, LfP's interventions are serving as a proof of concept, in whichthe methodologies the activity will employ to promote formalization, monitor and enforce land use restrictions, and advance licit economic opportunities are without precedent in the local context. LfP's interventions thus serve as a test of these methodologies in pilot contexts, with the aim of demonstrating evidence-based policy inputs for the GoC. Should LfP demonstrate that these methodologies succeed in achieving their short-term goals for improving tenure security and land governance in ways that favor environmental conservation, the GoC could expand these methodologies to other deforestation hotspots at a scale that is sufficient to yield desired changes in deforestation, biodiversity, and improved livelihoods at a landscape scale.[17]

According to the LfP Biodiversity and Sustainable Landscapes Plan (BSLP), the activity's theory of change in the additional geographies of SMVC is as follows:

IF "green" formalization (use rights), tenure security, and up-to-date cadaster and related imagery for priority sites are achieved through formalization pilots and local land policy capacity activities adapted to SMVC's context (environmental restrictions, illicit crops, and ethnic lands), enhanced by biodiversity and sustainable landscapes relevant guiding principle (GP) actions; **THEN** incentives for deforestation will be reduced and institutional and community capacity to monitor deforestation and enforce sustainable land uses will be improved; **AND IF** strategic partnerships expand "green" value chain opportunities for local people, **THEN** a virtuous cycle of sustainable, improved livelihoods and biodiversity conservation will gain momentum, helping to preserve buffer zones and protected areas.

The buffer zones and protected areas of SMVC cover an expansive geography. Within this geography, LfP will pursue three separate interventions at four proximate, but discrete locations: the CNP, two

[15] USAID/COLOMBIA AMAZON ACTIVITIES PERFORMANCE EVALUATION Final Report, November 2020. https://pdf.usaid.gov/pdf_docs/PA00X849.pdf
[16] Ibid
[17] The FA team presents a more detailed description of the role of evidence-based policy inputs in LfP's theory of change towards the end of this section (see *Cross-Cutting Evidence-Based Policy Inputs for Long-term Impacts*)

small communities in the vicinity of the CNP's northwest border, and the Puerto Rico Municipality, as shown in **Figure 2**. The three separate interventions are summarized in **Table 1**. Each of these interventions operationalize the general theory of change in a different way and at a different scale, as summarized below.

Figure 2: Map of LfP activities in SMVC Additional Geographies

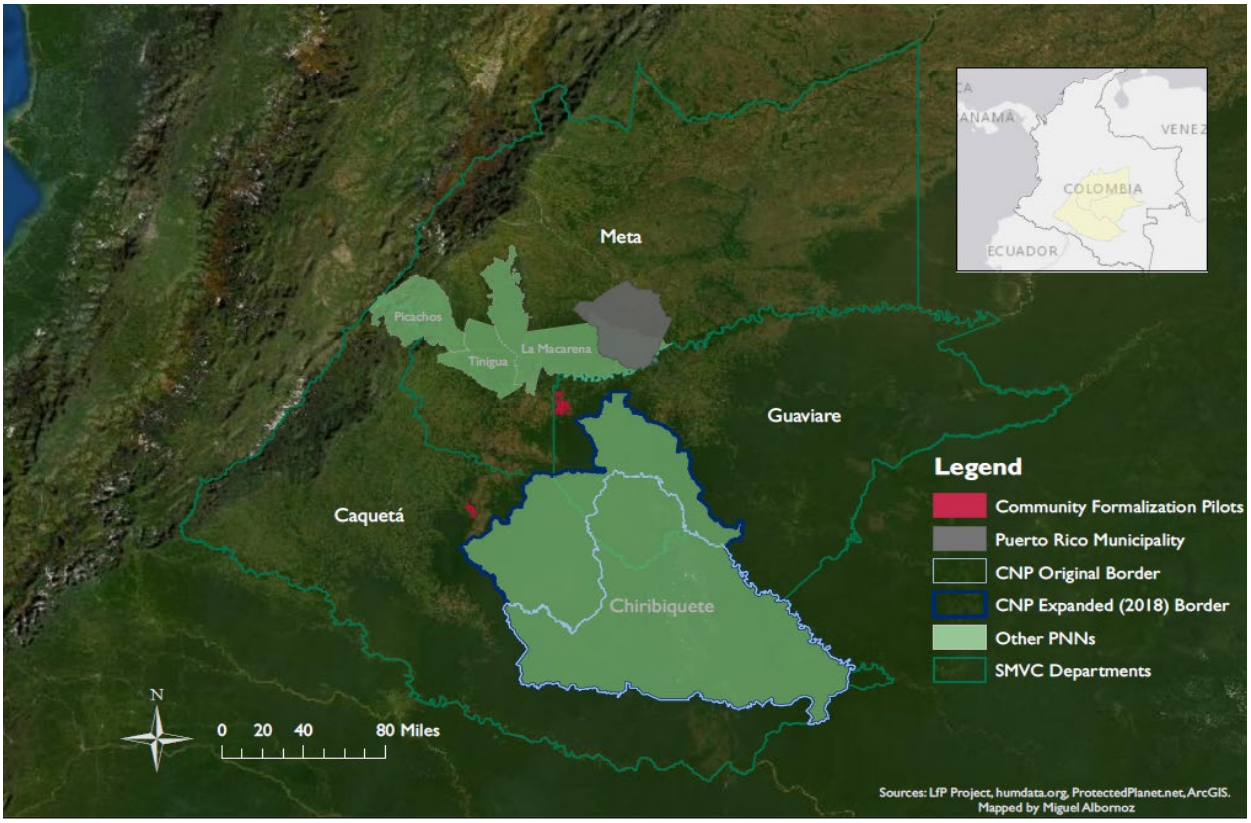


TABLE 1: SUMMARY OF KEY DIFFERENCES BETWEEN LFP INTERVENTIONS IN ADDITIONAL GEOGRAPHIES

Intervention Component	Green formalization, tenure security, cadaster, and imagery	Land Policy Capacity Activities	Green value chain opportunities
1. Delineation of CNP Border and Key Features Therein	▪ Imagery for precise border and key feature delineation ▪ Cadaster update for 4.3 million hectares of CNP land	▪ Capacity building with the National Parks authority (PNN) and the Ministry of Environment and Sustainable Development (MADS) for managing cadaster data (e.g., to open Real Estate Registration Sheets for polygons identified within) and monitoring land use ▪ Capacity building with IDEAM to monitor risks and presence of deforestation using imagery and cadaster ▪ Socialization of park boundary with local communities	▪ N/A

TABLE 1: SUMMARY OF KEY DIFFERENCES BETWEEN LFP INTERVENTIONS IN ADDITIONAL GEOGRAPHIES

Intervention Component	Green formalization, tenure security, cadaster, and imagery	Land Policy Capacity Activities	Green value chain opportunities
2. Community-level Formalization Pilots	▪ Collaborative cadaster update ▪ Demand-driven formalization via land use contracts ▪ Training and community socialization of land use contract strategy	▪ Capacity building with local authorities and CSOs for monitoring and enforcing terms of land use contracts, integrating agrarian and environmental objectives of land use	▪ PPPs tailored to local population in each community
3. Puerto Rico Parcel Sweep	▪ Parcel sweep for formalization of land titles/land use contracts, as appropriate for local use restrictions (e.g. PNN Macarena, mining/energy concessions, illicit crop restrictions, etc.) ▪ Update multipurpose municipal cadaster	▪ Municipal Land Office (MLO) establishment with environmental objectives ▪ Capacity building for local land and environmental authorities	▪ PPP tailored to local population in municipality[18] ▪ Training of/engagement with community members

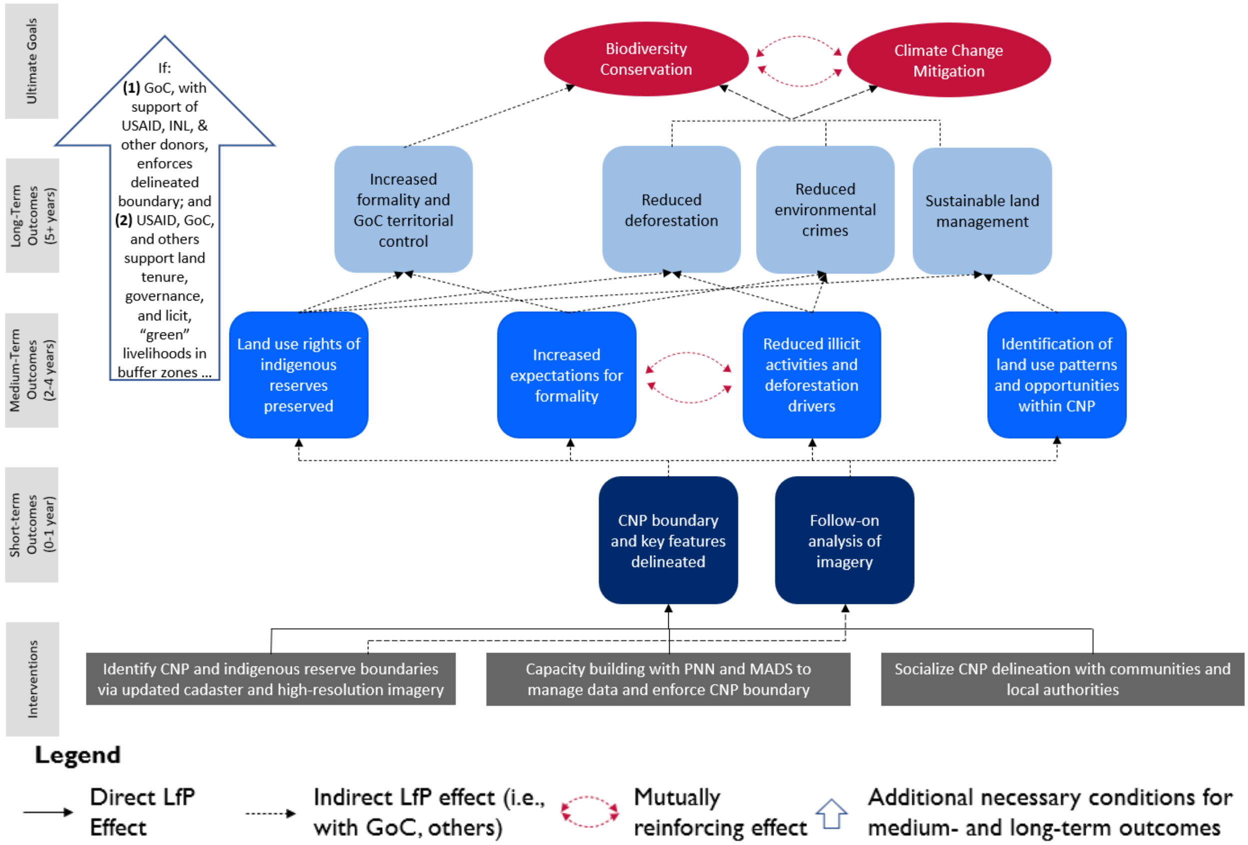
Logic models depicting the theories of change and key underlying assumptions for each of these interventions are described in the following sections.

INTERVENTION 1 THEORY OF CHANGE: IMAGERY AND CAPACITY BUILDING FOR DELINEATION OF CNP BORDER AND KEY FEATURES THEREIN

LfP's first intervention provides Colombian government authorities with the resources they need to precisely delineate the recently expanded border to the CNP so that they can effectively enforce it. It is prohibited for most individuals to even access CNP except by air, let alone to use or hold tenure over land inside it. However, a lack of precision over the location of the park's border reduces the Colombian government's ability to prosecute actors who are using land inside the park's border illegally and to support sustainable management of land within the park. The inputs provided by LfP will not only permit the delineation of the CNP's border, but also the delineation of key features within the CNP. These key features include the formally constituted indigenous reserve of Itilla in the north of the park, the areas informally occupied by indigenous communities in the Apaporis area in the park's south, and more recent informal occupation of the park's western and northern areas by campesino communities. This intervention will provide the GoC with the resources and technical assistance it needs to delineate the park boundary, prosecute individuals who use land in the park illegally, and support communities who could legitimately draw on communal land rights for legal land uses in indigenous reserves. It will further create the opportunity for the GoC to analyze the detailed imagery within the park boundary to promote sustainable management of the land therein by relevant environmental authorities.

[18] At the time of report submission, the specific details of the PPPs have yet to be determined. These might include payments for ecosystem services or similar activities that improve livelihoods in a way compatible with conservation.

Figure 3: LfP Additional Geographies Logic Model I: CNP Border Delineation and Enforcement



The core activity in this intervention is the provision of high-resolution imagery to support an updated cadaster for the CNP to permit delineation of the park boundary, indigenous reserve zones within the park, and the (likely illegal) claims of other occupied areas within the park with increased precision.[19] The imagery provided by LfP may additionally facilitate follow-up analysis of land use patterns and opportunities to further promote licit, sustainable livelihoods in legally occupied areas within the park boundary. For example, the GoC could analyze the imagery for evidence of illicit crop cultivation, and subsequently target areas with illicit crop cultivation for alternative development programming. LfP will complement the provision of high-resolution imagery with capacity building and technical assistance to the PNN and MADS that will permit them to effectively manage cadastral data, monitor land use, and do sustainable land use planning consistent with established regulations for protected areas once the imagery is in hand. USAID expects other programs to capitalize on these inputs to provide the law enforcement capacity building necessary to effectively investigate and prosecute environmental crimes within the CNP boundary or pursue alternative development strategies for communities that legally reside in the park. The final component of this intervention is a process to socialize the CNP border's delineation and its implications with communities and local land governance and environmental

[19] While LFP understands it may be possible for indigenous communities occupying land inside the park to seek recognition for community land rights as an indigenous reserve based on the cultural and spiritual importance of the land to their communities, there is no circumstance under which individual land tenure would be legal within the park boundary.

authorities who live in the CNP's buffer zones. This includes communicating the CNP's precise boundary location and consequences for illegally crossing it and committing environmental crimes.

Supposing that the border is delineated with sufficient precision to permit its enforcement by the GoC, and that communities are aware of and abide by its precise location, and that GoC and other projects capitalize on inputs to provide law enforcement capacity and replicate LfP formalization approaches to other communities in the buffer zones: USAID anticipates that activities driving deforestation and harming biodiversity (including land grabbing, cattle ranching, licit and illicit crop cultivation, timber extraction, wildlife trafficking, and others) will significantly reduce, and that deforestation and environmental crimes will reduce as a result. Reduced deforestation is expected to improve biodiversity conservation through the avoidance of habitat loss and the preservation of species population connectivity. Reduced burning of forest and clearing of forest for cattle ranching is expected to have a positive impact on climate change mitigation through reduced emissions, while forest cover retention will further support this impact through carbon storage and sequestration. As established in the USAID Biodiversity Policy, biodiversity conservation and climate change mitigation have a demonstrated mutually reinforcing effect – biodiversity has a key role in mitigating climate change through carbon storage and sequestration, while climate change can affect the distribution and abundance of vulnerable species by shifting suitable habitat.[20]

In contrast to LfP's other interventions in SMVC, this border delineation intervention does not offer any contractual instruments to support increased land tenure for individuals living in the CNP, though the clear delineation of borders, as well as precision mapping of occupied areas within the park, could clarify and preserve use rights for communities living within indigenous reserves inside the clarified park boundary. Instead, this intervention focuses on increasing the GoC's capacity to enforce land use restrictions and administer land governance in a way that closes current pockets of opportunity to cross into the park with a viable enforcement mechanism to prosecute those who continue to commit environmental crimes within the park boundary. This intervention will also occur at a much greater geographic scale than the other two interventions LfP will implement in this geography, as its reach spans the entire CNP park boundary, while the other intervention components take place at the scale of a single municipality or two communities. Given the scale and abrupt nature of this intervention, the FA team considers this to be the most feasible of the interventions discussed here to have a direct and attributable impact on desired long-term outcomes of reduced deforestation and biodiversity conservation, understanding that it requires complementary actions by others including the GoC, other USAID activities, activities by other donors, and the Department of State's Bureau of International Narcotics and Law Enforcement (INL) which are outside LfP's manageable influence. As this intervention is focused on land inside the CNP, where land use or tenure rights are illegal with very few exceptions, it does not include dedicated efforts to promote green value chain opportunities. This aspect of the LfP theory of change is more relevant to the other two interventions, which operate in the buffer zones surrounding the park and where land use and tenure rights are legally permitted.

CNP BORDER DELINEATION AND ENFORCEMENT LOGIC MODEL ASSUMPTIONS

1. The Office of the President is able to put sufficient pressure on relevant entities to coordinate, remove bottlenecks, and advance in issuing the necessary legal decree(s) to enforce the boundary. Other programs deliver law enforcement capacity building to support GoC in investigating and prosecuting environmental crimes.

[20] USAID Biodiversity Policy, 2015. https://www.usaid.gov/biodiversity/policy

2. No elite or corrupt capture of PNN, MADS, SNR or other institutions that permits ongoing violation of use restrictions in CNP and buffer zones.
3. Local and external actors who would have deforested or committed environmental crimes in the CNP and buffer zones do not relocate and conduct these activities elsewhere.
4. Effective coordination between USAID and INL programming allows the GoC to do law enforcement and prosecute those committing these environmental crimes.
5. Effective coordination with USAID Environment office improves traceability of illegal cattle ranching, which in turn can increase prosecution of illegal cattle ranching.
6. Communities in buffer zones view border delineation and increased formality as credible. Ethnic communities or other groups do not oppose and prevent the cadastral delimitation of CNP.
7. Patterns of colonization in buffer zones are stable (non-transitory) enough that knowledge of border delineation and implications from socialization efforts remains within communities for medium and long-term.
8. Nature of reduced deforestation is such that it contributes to biodiversity conservation (e.g. preserves population connectivity, key ecosystems, etc.).
9. Legal and regulatory framework continue to preserve use restrictions that favor conservation.

INTERVENTION 2 THEORY OF CHANGE: COMMUNITY-LEVEL FORMALIZATION PILOTS

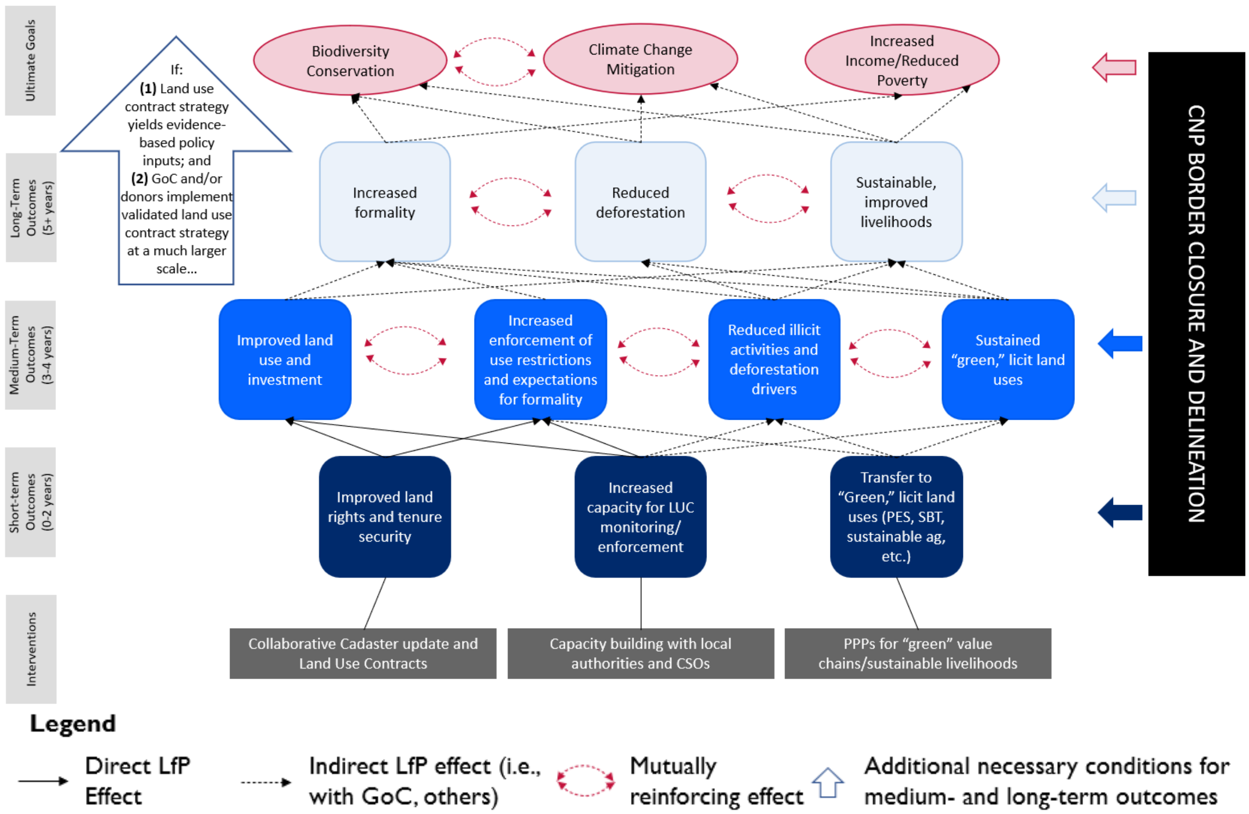
LfP's second intervention in SMVC pilots an articulated strategy to reduce incentives for deforestation and other illicit activities and promote sustainable, licit livelihoods in the buffer zones along the border of the CNP in two communities. These communities, located near San José del Guaviare in the Guaviare department and San Vicente del Caguán in the Caquetá department, are not formal administrative entities (e.g. veredas), but rather agglomerations of farms and residences that have colonized forest reserve areas near the CNP border. LfP defined these areas in conjunction with ANT and MADS by overlapping geospatial datasets including deforestation hotspots, key locations from ecological connectivity analysis, and satellite imagery to locate settlements in areas where informality in land tenure represented a significant threat to deforestation and biodiversity.

In the forest reserves where these communities are located, it is not permitted to hold formal land titles or transition contracts, and thus LfP's standard approach to multipurpose cadaster updates and to promoting increased tenure security and formalization through massive titling is not feasible. Instead, LfP will test a collaborative approach to update the cadaster and support the issuance of land use contracts, a novel contract instrument only implemented in recent years in Colombia, to increase tenure security and promote accountability for land use. These ten-year contracts give the contract holder exclusive use rights aligned with relevant regional land use restrictions that are monitored and enforced by local authorities, although they do not give the contract holder ownership over the land and are not inheritable. LfP will use a collaborative cadaster methodology to update the cadaster in each community, and subsequently offer land use contracts for parcels whose territory falls within or overlaps the community boundary. It is possible that these land use contracts could become "conservation contracts" if the GoC additionally offers "voluntary conservation agreements" to individuals who take up land use contracts, though as of this report LfP believes it is unlikely that the intervention will issue many conservation contracts given GoC's previous difficulties coordinating the administration of land use contracts and voluntary conservation agreements. [21] LfP will offer these instruments to individuals, such

[21] The term conservation contract only applies when the GoC further offers a land use contract holder a voluntary conservation agreement. The voluntary conservation agreement normally entails payments for ecosystem services, environmental restoration, or sustainable productive activities on the land.

that some parcels in the community will be subject to land use contracts and some will not, depending on who takes up the contract.

Figure 4: LfP Additional Geographies Logic Model 2: Community-level Formalization Pilots



LfP proposes to complement these land use contracts with capacity building for local land and environmental authorities to support the monitoring and enforcement of use restrictions and other contract terms and conditions. LfP will also identify PPPs for each community mapped to potential livelihood activities and/or payments for ecosystem services (PES) that will incentivize local community members to transition from illicit and/or unsustainable income generating activities to participation in green value chains. These PPPs will ensure that there remains some incentive for environmentally sustainable livelihoods in the likely event that the GoC is unable to extend voluntary conservation agreements to land use contract holders (thus converting the land use contracts to conservation contracts). This theory of change stands to be indirectly influenced by the CNP border delineation model – given that these communities are in buffer zones of the CNP, enforcement of the CNP border following its precise delineation by LfP should simultaneously reduce the availability of land for deforestation and increase the costs of deforestation in the vicinity of the park.

LfP personnel consulted in advance of this feasibility study note that, although the land use contract instrument has been issued previously in Colombia, there are significant gaps in evidence regarding the optimal process to issue these contracts. These evidence gaps include the lack of an adequate methodology to socialize this mechanism with communities, the lack of coordination of all GoC entities needed to turn land use contracts into a tool for conservation, and the lack of capacity to regulate their use for environmental conservation and monitor their enforcement. Further, in previous use cases, land use contracts have not been implemented with complementary support for alternative livelihoods, which could affect the extent to which prospective contract-holders are sufficiently incentivized to take up the contracts and abide by land use restrictions that the contracts impose.

By identifying a validated process to issue land use contracts, ensuring these contracts serve as tools for conservation, and supplementing these contracts with complementary efforts to improve land governance and green value chain opportunities, LfP's community formalization pilots are meant to serve as a "proof of concept" to provide evidence-based policy inputs for the GoC to attempt a similar strategy at a larger scale in deforestation hotspots with overlapping use restrictions where it cannot issue land titles. While the theory of change specific to LfP's two community formalization pilots thus targets changing incentives and behaviors associated with deforestation and biodiversity conservation as a direct outcome of the project, higher-order impacts on deforestation, biodiversity conservation, and sustainable livelihoods are only expected if the approach is executed at a larger scale or in conjunction with other supporting activities from donors and the GoC.

The Community Formalization Pilot theory of change presumes that an increase in landholders' tenure security through land use contracts, coupled with effective monitoring and compliance of the terms of these contracts, will lead landholders to make increased investments in the land, reduce deforestation and forest degrading land uses, and alter their land use behavior towards more sustainable, licit uses supported by PPPs. The presence of land use contracts and enforcement of associated restrictions will not only increase formality and decrease drivers of deforestation directly, but also work together with increased presence of land governance authorities and green, licit livelihood opportunities to increase community members' expectations for formality in the future. Together with increased knowledge of themes related to sustainable land use, these expectations will influence community members' decisions to choose licit, sustainable livelihoods that conserve their land and forego illicit behaviors that drive deforestation and biodiversity loss--such as land grabbing, agricultural frontier expansion, cattle ranching, timber extraction, and illicit crop cultivation.

LfP's theory of change presumes that the community formalization pilots will not affect deforestation and biodiversity conservation at the landscape scale on their own, but rather that they will yield evidence-based policy inputs regarding changes that take place at the parcel-level and that will allow the GoC to learn from and apply a similar strategy at a larger scale in future, to obtain impacts on these long-term outcomes at scale. As such, the FA team expects measurable changes in land use behaviors and indirect measures of land use changes that drive deforestation and biodiversity loss at the level of individual landholders and parcels, but we do not expect measurable changes in deforestation and biodiversity loss themselves at the landscape scale, given the small scale of the formalization pilots. Further, with only two unique pilot communities totaling an anticipated 700 land use contracts and with no known comparison community candidates nearby, it will not be possible to calculate changes in poverty attributable to the program. Indeed, any such changes may be relatively small depending on the nature of the PPPs pursued, which are the main component of the intervention that could affect income. Thus, while the FA team anticipates measurable changes in land use behavior and transitions to green licit land uses and livelihoods, the scale of these pilots is too small to detect measurable changes in deforestation, biodiversity conservation, or poverty in the long-term.

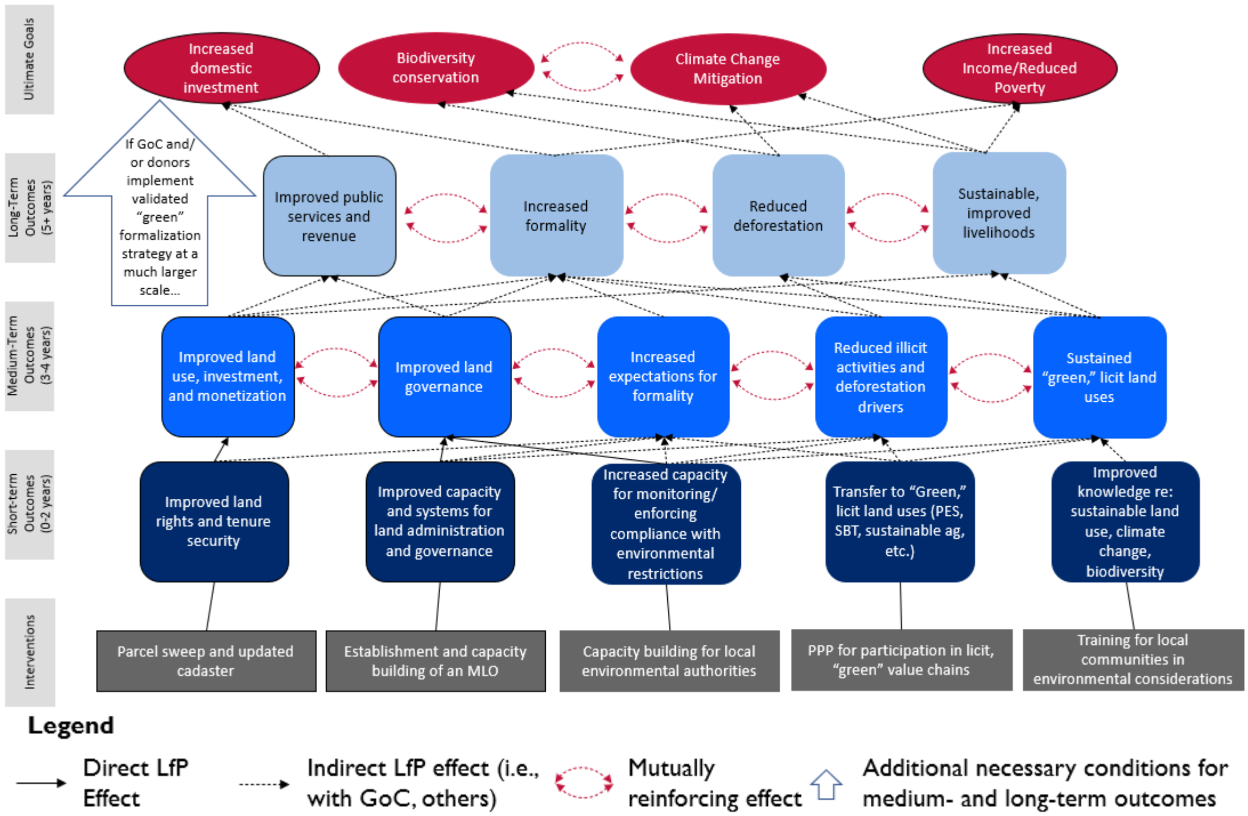
COMMUNITY-LEVEL FORMALIZATION PILOT LOGIC MODEL ASSUMPTIONS

1. No elite or corrupt capture of ANT or other local institutions that permit ongoing violation of use restrictions in pilot communities.
2. Local and external actors who would have deforested or committed environmental crimes in or around the communities do not relocate and conduct these activities elsewhere.
3. GoC increases its capacity to do law enforcement and prosecute environmental crimes, potentially with support of USAID and INL.
4. Access to green value chains and secure use rights is a sufficient incentive for communities to take up land use contracts and forego drivers of deforestation and biodiversity loss.
5. LfP can identify public and private partners who are willing to provide reliable, long-term access to green value chains and/or payment for ecosystem services for communities in environmentally restricted areas.
6. Communities in buffer zones view land use contracts and increased formality as credible.
7. Armed or other groups do not oppose and obstruct the increased presence of formal Colombian institutions. If they attempt such obstruction, GoC is capable to counter and provide adequate conditions.
8. Patterns of colonization in communities are stable (non-transitory) enough that land use contracts and knowledge from trainings and PPPs remain valid for medium and long-term.
9. Legal and regulatory framework continue to preserve use restrictions that favor conservation.
10. ANT and local institutions have capacity to meet demand for increased clarification of land rights.

INTERVENTION 3 THEORY OF CHANGE: PUERTO RICO PARCEL SWEEP

LfP's third intervention is a municipality-wide massive formalization effort in Puerto Rico municipality using the parcel sweep method. This component extends LfP's standard approach to massive land titling into a critical area of SMVC's geography, with minor modifications to account for environmental zoning and use restrictions that are uncommon in LfP's original geography. It differs from the community formalization pilot model in its focus on supporting the provisioning of formal land titles for massive formalization and its more direct intervention in local land administration through the establishment of a municipal land office (MLO). Like the community formalization pilots, it will also attempt to pursue PPPs that connect community members with opportunities to participate in "green" value chains. While the standard LfP approach also pursues PPPs that promote licit and improved livelihoods, these PPPs less often target environmentally sustainable livelihoods explicitly. Finally, while the community formalization pilots are pursuing formalization in two small, discrete communities, LfP's activities in Puerto Rico will expand upon existing formalization efforts in two adjacent municipalities such that formal land tenure and the presence and land governance capacity of the state will increase at a significant scale along a strategic corridor with critical access points to the Macarena and Chiribiquete national parks.

Figure 5: LfP Additional Geographies Logic Model 3: Puerto Rico Parcel Sweep[22]



The logic of the Puerto Rico parcel sweep is not explicitly linked with the first two interventions, however results from this intervention will provide additional learning and evidence-based policy inputs for the GoC to apply in deforestation hotspots, and perhaps particularly so in areas with a similar balance of land under restricted uses and land available for private ownership and hence eligible for titling. In the case of the parcel sweep intervention in Puerto Rico municipality, LfP's efforts will also expand upon existing formalization efforts in adjacent Fuente de Oro and Puerto Lleras municipalities, which together represents a broader effort to increase formality in the corridor of SMVC with access points to the Chiribiquete and La Macarena national parks.

The pursuit of municipal-scale mass formalization in these three contiguous municipalities is also envisioned to create a cluster of land formalization in the area that may provide an additionally important demonstration effect with respect to the role of the interventions in reducing drivers of deforestation and biodiversity loss, slowing the advancement of the agricultural frontier, and dampening the spread of illicit activity in the region.

It is also possible that this approach could help to reduce the risk of negative spillovers, whereby environmentally destructive land use activities are merely displaced to other areas, to nearby communities with weaker land tenure, governance, and sustainable livelihood opportunities. The risk of negative spillovers not only reduces directly as formalization expands, but also indirectly as increased

[22] This logic model is an extension of the existing logic model for LfP, described in detail on page 7 of the "Evaluation of the LfP Activity in Colombia: Baseline Report." The shapes with solid black outlines on the left side of the logic model above are condensed versions of the identical theory of change depicted in the baseline report, while the shapes without outlines in the rest of the logic model expand upon new elements of the theory of change that are specific to the Puerto Rico intervention in LfP's expanded geography.

formality in project areas signals to actors who might pursue environmentally destructive activities that formality is likely to increase in other access points to protected natural areas in the long-term. These increased expectations for formality could incentivize these actors to change their behavior in favor of more formal and less environmentally destructive activities. This dynamic not only applies to LfP's efforts in access points to the Macarena and Chiribiquete national parks, but also more broadly to contemporary efforts by USAID (e.g. Amazon Alive), the Government of Colombia, and other actors (e.g. UKAID, etc.) to "squeeze out" informality and promote licit, sustainable livelihoods throughout SMVC. All of these contemporary efforts constitute contextual factors that may also reduce the likelihood of negative spillovers from LfP's interventions in the SMVC into surrounding areas and provide a more favorable context for project success.

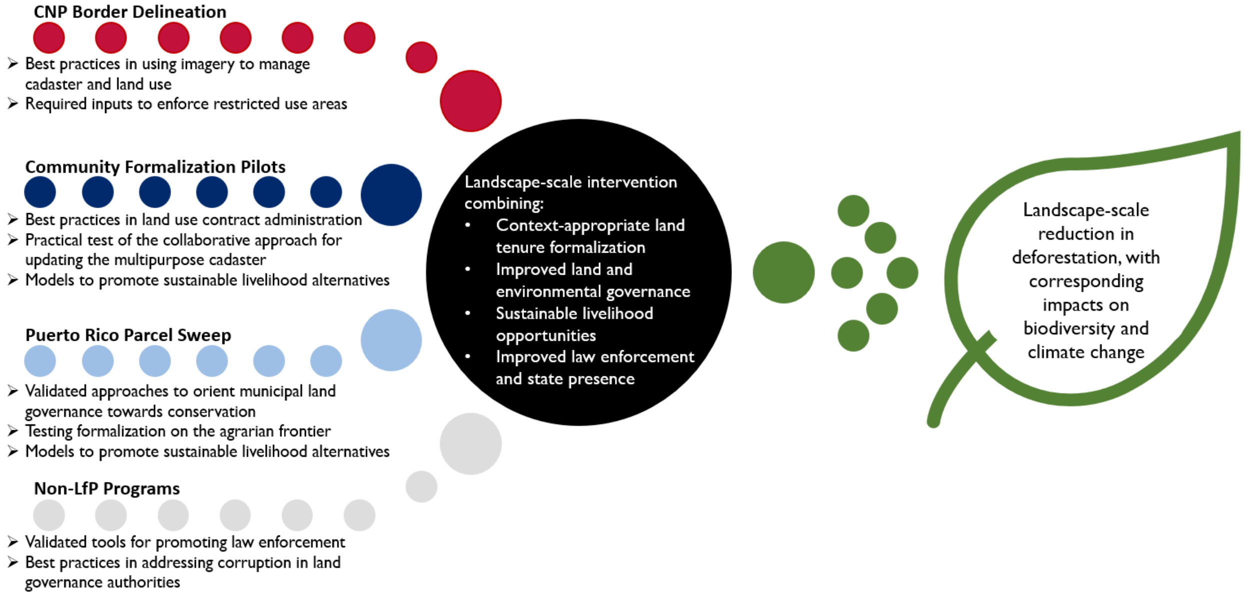
PUERTO RICO PARCEL SWEEP LOGIC MODEL ASSUMPTIONS

1. No elite or corrupt capture of ANT or other local institutions that permit ongoing violation of use restrictions in pilot communities.
2. ANT and local institutions have capacity to meet demand for increased clarification of land rights.
3. Local and external actors who would have deforested or committed environmental crimes in or around the communities do not relocate and conduct these activities elsewhere.
4. GoC increases its capacity to do law enforcement and prosecute environmental crimes, potentially with support of USAID and INL.
5. Access to green value chains and secure land tenure in the form of formal land titles is a sufficient incentive for communities to forego drivers of deforestation and biodiversity loss.
6. LfP can identify public and private partners who are willing to provide reliable, long-term access to green value chains and/or payment for ecosystem services for residents of the municipality.
7. Armed or other groups do not oppose and obstruct the increased presence of formal Colombian institutions. If they attempt such obstruction, GoC is capable to counter and provide adequate conditions.
8. Legal and regulatory framework continue to preserve use restrictions that favor conservation.
9. ANT and local institutions have capacity to meet demand for increased clarification of land rights.

CROSS-CUTTING EVIDENCE-BASED POLICY INPUTS FOR LONG-TERM IMPACTS

The three LfP interventions are envisioned to comprise different elements of a broader and coordinated effort that can provide the GoC with evidence-based policy inputs for a large-scale, articulated strategy to reduce deforestation, conserve biodiversity, and mitigate climate change through promoting formalization of land tenure and sustainable livelihoods for people living in deforestation hotspots throughout the country. It is recognized that GoC will likely need a suite of coordinated efforts to achieve these objectives, but currently there is insufficient evidence regarding the effectiveness of different interventions. There is also not a strong understanding of which interventions and methodologies may best meet this overarching purpose in specific local contexts. The three LfP interventions target increased tenure security and improved land governance in different ways and under different circumstances, and they may each contribute to GoC learning and evidence needs to implement a comprehensive, scaled up strategy that would impact deforestation at a landscape scale. Figure 6 broadly illustrates how LfP's interventions are envisioned to converge with and complement each other and other programs outside the scope of LfP to facilitate this process, and these synergies are described in further detail below.

Figure 6: Evidence-based policy inputs for GoC that facilitate landscape-scale impact



The community formalization pilots will demonstrate how best to operationalize the land use contract instrument to promote conservation, including evidence and learning regarding how to socialize the contract with communities, how to coordinate GoC services to make the contract a conservation tool, and how to monitor and enforce the terms of the contracts. To LfP's knowledge, these pilots will test a collaborative approach to updating the cadaster for the first time in Colombia, where previously only direct and indirect cadaster methods have been implemented. Results may be particularly essential for strengthening the evidence base for policy options in deforestation hotspots with similar land use restrictions as the formalization pilot communities, where formal titles and transition contracts are not feasible and where overlapping use restrictions exist.

The Puerto Rico parcel sweep will demonstrate how municipal land governance can be aligned with conservation objectives, and how massive formalization can occur at a municipal scale where some parcels are suitable for private ownership and titling, while others have overlapping use restrictions that prohibit private ownership. The parcel sweep will also test the extent to which formal land rights on the agrarian frontier can stop advancement into a park area. Both the formalization pilots and the parcel sweep will pursue public-private partnerships to promote sustainable livelihoods, demonstrating the potential for sustainable livelihoods and increased tenure security to create a virtuous cycle of sustainable, licit land use that favors conservation.

The provision of imagery to delineate the CNP boundary, when coupled with the other two activities, will demonstrate how reducing the feasibility of accessing protected lands for illicit activities can further incentivize communities to take advantage of the benefits of land tenure security and sustainable livelihoods, further fueling this virtuous cycle. Even in areas where a restricted area's boundary is delineated with sufficient precision, any changes in legal enforcement targeting environmental crimes enabled by complementary INL, UKAID, or GoC programming may yield valuable demonstration effects regarding the role of law enforcement in the GoC's ultimate articulated strategy. LfP will also yield helpful inputs for using high-resolution imagery to manage a cadaster and land use within the park boundary.

Additional evidence inputs will be required to help the GoC implement a comprehensive strategy, including methods to increase law enforcement capacity and reduce corruption that permits illegal land uses that drive deforestation. LfP anticipates these inputs will be provided by other activities that target these outcomes, such as those planned by INL and the United Kingdom's *Territorios Forestales* program. *If* all of these inputs converge, *and if* the GoC uses them to implement a landscape-scale intervention with all necessary components (perhaps with the support of other donors), *then* it is expected that deforestation will reduce in ways that favor biodiversity conservation and climate change mitigation throughout SMVC, including in LfP's implementation areas. The improved sustainable livelihoods that are part of this strategy are expected to render these changes sustainable in the long term.

IV. LEARNING INTERESTS AND ILLUSTRATIVE QUESTIONS

In discussions with the FA team, USAID personnel expressed an interest in an evaluation of LfP in SMVC that could respond to the following particular learning interests:

- Understanding drivers of deforestation and biodiversity loss in the intervention implementation areas and the impacts of the proposed LfP activities on reducing deforestation, biodiversity loss, and maintaining intact forest landscapes. USAID is particularly interested in the feasibility of incorporating design options to measure biodiversity conservation outcomes in a direct and rigorous manner.
- Understanding the linkages between increased tenure security through land titling, land use contracts, or any other means and behavioral changes that could drive conservation outcomes; and the extent to which impacts on such outcomes are sustainable given the socio-political context of the additional geographies.
- Learning interests related to cadaster update work, including the process and decision-making around resolving conflicts around overlapping or multi-use land areas.
- Effectiveness of anti-corruption interventions or activities on deforestation, biodiversity loss, and maintaining intact forest landscapes.
- Understanding changes in land management as a whole in the SMVC coming out of the intervention, and how these interact with mitigating deforestation. Particular interest in how the GoC leverages resources and capacity building provided by LfP for improved governance, reduced deforestation, and reduced environmental crime.

In consideration of these learning interests, the underlying logic of LfP's three interventions in the additional geographies of SMVC, and the feasibility of various evaluation approaches to assess these interventions, NORC proposes the following Illustrative Questions (IQs) to guide a mixed-methods evaluation including direct beneficiaries of all three LfP interventions in SMVC (households in formalization pilot communities, households in the Puerto Rico municipality, and land near the CNP border and buffer zones):

IQ1: What changes in (i) land use and behaviors driving deforestation and biodiversity loss and (ii) participation in sustainable, improved livelihoods occurred among households in the formalization pilot communities and Puerto Rico Municipality following LfP's articulated interventions[23] to improve land tenure security, improve land and environmental governance capacity, and increase opportunities to participate in green value chains in SMVC? What evidence is there that these changes may have been caused directly or indirectly by LfP, and through what mechanisms?

a. How did changes differ based on the specific contract instruments (e.g. land titles, land use contracts, etc.), cadaster update methodologies, and land and environmental governance capacity building activities employed? How do the different instruments, methodologies, and activities employed affect the perceived sustainability of changes?
b. What, if any, important contextual influences on LfP's ability to update cadasters and formalize land tenure arrangements result from the presence of different types of overlapping areas with defined use restrictions (e.g. forest reserve zones, campesino reserve zones, indigenous reserves, national parks, etc.)? How does the presence of these areas affect LfP's outcomes and sustainability?
c. Is there any evidence that LfP's activities caused spillover of deforestation drivers and illicit activities into surrounding areas? Are there any other possible unintended outcomes of LfP's activities, whether positive or negative?

IQ2: What changes occurred in local land governance, environmental governance, and the reduction of environmental crime and corruption within the CNP and its buffer zones following the provision of high-resolution imagery of the CNP, the updated cadaster within the CNP, capacity building with relevant GoC authorities, and socialization of the CNP border with local communities? What evidence is there that LfP's activities contributed directly to these changes, and through what mechanisms? To what extent were results bolstered by complementary measures from other programs or the GoC?

IQ3: What impact does the delineation and enforcement of the CNP border have on deforestation, habitat connectivity, and biodiversity conservation within the CNP and in portions of the buffer zones where LfP conducted complementary activities to decrease activities driving deforestation? What are the reasons for observed impacts? Is there evidence of any effect on deforestation or biodiversity conservation elsewhere in SMVC geography to which LfP may have contributed?

Table 2 maps the illustrative questions to the USAID learning interests, and broadly shows the data sources and methods proposed to answer each question. The only learning interest not captured in this table regards the effectiveness of law enforcement and anti-corruption activities. This is because LfP considers these activities to be the responsibility of other GoC or donor-funded initiatives that leverage resources provided by LfP. However, corruption can be analyzed as a contextual and potential explanatory factor for observed outcomes. The following sections outline measurement and evaluation design strategies that respond to these learning priorities and illustrative questions.

[23] The FA team uses "articulated interventions" to refer to the two interventions which include synergistic representation from all three main components of LfP's theory of change: improved land tenure security, governance capacity, and opportunities for green value chains. The CNP intervention does not fit this definition.

TABLE 2: EVALUATION MATRIX FOR ILLUSTRATIVE EVALUATION QUESTIONS			
Illustrative Evaluation Questions	**Key USAID Learning Interests**	**Key Data Sources**	**Broad Evaluation Approach**
IQ1: What changes occurred among households in the formalization pilot communities and Puerto Rico Municipality, following LfP's articulated interventions, regarding: (i) Land use and behaviors driving deforestation and biodiversity loss (ii) participation in sustainable, improved livelihoods. What evidence is there that these changes may have been caused directly or indirectly by LfP, and through what mechanisms?	Understanding drivers of deforestation and biodiversity loss in the intervention implementation areas and the impacts of the proposed LfP activities on reducing deforestation, biodiversity loss, and maintaining intact forest landscapes.	• Household survey • Land use raster data • Qualitative interviews and FGDs • Administrative data	• Mixed-Methods PE: Descriptive summary statistics, content analysis of qualitative data; econometric analysis
IQ1a: How did changes differ based on the specific contract instruments (e.g. land titles, land use contracts, etc.), cadaster update methodologies, and land and environmental governance capacity building activities employed? How do the different instruments, methodologies, and activities employed affect the perceived sustainability of changes?	Understanding the linkages between increased tenure security through land titling, land use contracts, or any other means and behavioral changes that could drive conservation outcomes; and the extent to which impacts on such outcomes are sustainable given the socio-political context of the additional geographies.	• Household survey • Qualitative interviews and FGDs • Administrative data	• Mixed-Methods PE: Descriptive summary statistics, content analysis of qualitative data; econometric analysis; supplemental analysis of raster data where indicated
IQ1b: What, if any, important contextual influences on LfP's ability to update cadasters and formalize land tenure arrangements result from the presence of different types of overlapping areas with defined use restrictions (e.g. forest reserve zones, campesino reserve zones, indigenous reserves, national parks, etc.)? How does the presence of these areas affect LfP's outcomes and sustainability?	As above, and: Learning interests related to cadaster update work, including the process and decision-making around resolving conflicts around overlapping or multi-use land areas.	• Qualitative interviews and FGDs • Land use raster data	
IQ1c: Is there any evidence that LfP's activities caused spillover of deforestation drivers and illicit activities into surrounding areas? Are there any other possible unintended outcomes of LfP's activities, whether positive or negative?	Understanding changes in land management as a whole in SMVC coming out of the intervention, and how these interact with mitigating deforestation. Particular interest in how the GoC leverages resources and capacity building provided by LfP for improved governance, reduced deforestation, and reduced environmental crime.	• Deforestation and land use raster data • Qualitative interviews	

TABLE 2: EVALUATION MATRIX FOR ILLUSTRATIVE EVALUATION QUESTIONS			
Illustrative Evaluation Questions	**Key USAID Learning Interests**	**Key Data Sources**	**Broad Evaluation Approach**
IQ2: What changes occurred in land governance, environmental governance, and the reduction of environmental crime and corruption within the CNP and its buffer zones following the provision of high-resolution imagery of the CNP, the updated cadaster within the CNP, capacity building with relevant GoC authorities, and socialization of the CNP border with local communities? What evidence is there that LfP's activities contributed directly to these changes, and through what mechanisms? To what extent were results bolstered by complementary measures from other programs or the GoC?	Understanding changes in land management as a whole in SMVC coming out of the intervention, and how these interact with mitigating deforestation. Particular interest in how the GoC leverages resources and capacity building provided by LfP for improved governance, reduced deforestation, and reduced environmental crime.	• Qualitative interviews • Administrative data	Mixed-Methods PE: Descriptive summary statistics, content analysis of qualitative data; econometric analysis
IQ3: What impact does the delineation and enforcement of the CNP border have on deforestation, habitat connectivity, and biodiversity conservation within the CNP and in portions of the buffer zones where LfP conducted complementary activities to decrease activities driving deforestation? What are the reasons for observed impacts? Is there evidence of any effect on deforestation or biodiversity conservation elsewhere in SMVC geography to which LfP may have contributed?	Understanding drivers of deforestation and biodiversity loss in the intervention implementation areas and the impacts of the proposed LfP activities on reducing deforestation, biodiversity loss, and maintaining intact forest landscapes.	• Deforestation and land use raster data • Qualitative interviews • Biodiversity measurement • Administrative data	• IE (deforestation and habitat connectivity) coupled with pre/post inferential analysis (biodiversity) • Deforestation: Interrupted Time Series and/or Spatial Regression Discontinuity Analysis • Biodiversity: Pre/post with inferential analysis

V. OUTCOME INDICATORS AND DATA REQUIREMENTS

To answer the evaluation questions, the evaluation will focus on measuring a variety of outcomes through both quantitative and qualitative data. **Table 3** below lists illustrative outcomes in different domains. This list is intended to be further added to, refined and finalized by an evaluation team during evaluation design phase.

TABLE 3: ILLUSTRATIVE EVALUATION INDICATORS AND OUTCOMES MEASURES[24]

ANTICIPATED TIME FRAME TO ACHIEVE CHANGE AT SCALE	INCREASED FORMALITY	REDUCED DEFORESTATION, ILLICIT ACTIVITY; BIODIVERSITY CONSERVATION AND CLIMATE CHANGE MITIGATION	IMPROVED LIVELIHOODS
SHORT-TERM (0-2 years)	*IQ1b: What changes occurred among households, and what, if any, important contextual influences on LfP's ability to update cadasters and formalize land tenure arrangements result from the presence of different types of overlapping areas with defined use restrictions (e.g. forest reserve zones, campesino reserve zones, indigenous reserves, national parks, etc.)? How does the presence of these areas affect LfP's outcomes and sustainability?* • Number of households in pilot communities with formalized land documentation (+)[HHS] • Establishment of municipal land offices (+)[QI] • Area of land under formalized documentation (+)[HHS] • Kilometers of park border defined with high-resolution imagery (+)[QI,AD]	*IQ1a: What changes occurred among households, and how did changes differ based on the specific contract instruments (e.g. land titles, land use contracts, etc.), cadaster update methodologies, and land and environmental governance capacity building activities employed? How do these affect the perceived sustainability of changes?* • Household understanding of permitted land uses in pilot communities (+) [HHS] • Household understanding of topics covered in environmental community trainings (+) [HHS,QI] • Household deforesting and other land use behavior (+) [HHS,QI] *IQ2: What changes occurred in land governance, environmental governance, and the reduction of environmental crime and corruption within the CNP and its buffer zones following the provision of high-resolution imagery of the CNP, the updated cadaster within the CNP, capacity building with relevant GoC authorities, and socialization of the CNP border with local communities?* • Kilometers of park border delineated (+)[QI,AD] • Household understanding of CNP border location and regulations (+) [HHS,QI] • Perceived capacity within GoC for land use monitoring and enforcement (+)[QI,AD] • GoC prosecution of illegal land grabbing and deforestation (+)[QI,AD] • Household perceptions of CNP border enforcement (+) [HHS,QI]	*IQ1: What changes (i) land use and behaviors driving deforestation and biodiversity loss and (ii) participation in sustainable, improved livelihoods occurred among households in the community formalization pilots and Puerto Rico Municipality, following LfP's articulated interventions? What evidence is there that these changes may have been caused directly or indirectly by LfP, and through what mechanisms?* • Establishment of PPPs (+)[HHS,QI] • Seeking and access to formal and informal sources of credit in pilot communities (+)[HHS] • Amount of credit obtained in pilot communities (+)[HHS]

[24] Indicators in this table are illustrative at this FA stage and would be further developed and finalized by an evaluation team during evaluation design phase. All indicators would be measured and analyzed at each data collection round, irrespective of the time frame at which one might anticipate obtaining change at scale for any given indicator.

TABLE 3: ILLUSTRATIVE EVALUATION INDICATORS AND OUTCOMES MEASURES[24]

ANTICIPATED TIME FRAME TO ACHIEVE CHANGE AT SCALE	INCREASED FORMALITY	REDUCED DEFORESTATION, ILLICIT ACTIVITY; BIODIVERSITY CONSERVATION AND CLIMATE CHANGE MITIGATION	IMPROVED LIVELIHOODS
MEDIUM-TERM (3-4 years)	*IQ1: As above, and:* • Perceived tenure security in pilot communities (+)[HHS, QI] • Recent land disputes in pilot communities (-)[HHS, QI] • Household expectations of the benefits of formality in pilot communities (+)[HHS, QI] • Satisfaction with and confidence in land administration and governance (+) [HHS, QI] • Trust in neighbors and local community (+)[HHS, QI] • Trust in government (+)[HHS, QI]	*IQ2: As above, and:* • Household expectations of the consequences of illicit activity in pilot communities (+)[HHS] • New incidents of illegal land grabbing (-)[QI, AD] *IQ3: What impact does the delineation and enforcement of the CNP border have on deforestation and biodiversity conservation within the CNP and in portions of the buffer zones where LfP conducted complementary activities to decrease drivers of deforestation, and what are the reasons for observed impacts?* • New incidents of deforestation/burning (-)[RSD] • Land use alignment with permitted uses along PNN Chiribiquete border (+)[RSD] *IQ1;1c: Is there any evidence that LfP's activities caused spillover of deforestation drivers and illicit activities into surrounding areas? Are there any other possible unintended outcomes of LfP's activities, whether positive or negative?* • New incidents of deforestation/burning (-)[RSD] • Land use alignment with permitted uses along PNN Chiribiquete border (+)[RSD] Area under coca production (-)[HHS]	*IQ1: As Above, and:* • Investment and participation in off-farm and non-farm income generating activities in pilot communities (+)[HHS, QI] • Participation in PPPs in pilot communities (+)[HHS, QI] • Satisfaction with PPPs in pilot communities (+)[HHS, QI]
LONGER-TERM (5-10 years)	As above.	*IQ3: As above, and:* • Forest recovery and connectivity in previously deforested areas located near the main forest (+)[RSD, QI]	As above.
VERY LONG-TERM (10+ years)	As above.	*IQ3: As above, and:* • Forest recovery and connectivity in previously deforested areas located further from the main forest (+)[RSD, QI] • Total forested area (+)[RSD, QI] • Biodiversity – Species Richness (+)[RSD, BMS] • Net carbon emissions (-)[RSD]	As above.

HHS: Outcome to be measured through a household survey in land use contract pilot communities. Evaluation approach uses pre/post quantitative analysis.
RSD: Outcome to be measured through remote sensing data from satellite imagery. Evaluation approach uses spatial regression discontinuity impact evaluation design.
QI: Outcome to be measured through qualitative interviews. Evaluation approach uses qualitative analysis.
AD: Outcome to be measured through administrative data. Evaluation approach uses pre/post quantitative analysis and/or summary statistics.
BMS: Outcome to be measured through biodiversity measurement strategies. Evaluation approach uses pre/post quantitative analysis.

VI. ILLUSTRATIVE EVALUATION DESIGN OPTIONS

Our approach to proposing potential evaluation design options is to balance the scientific rigor of the designs with the cost and feasibility of implementing them. This is done with the goal of understanding the effects and/or contributions of LfP's additional geographies activity in areas that are USAID's learning interest, given our current knowledge on how LfP implementation is envisioned to take place. Table 4 summarizes the FA team's recommended evaluation options for each LfP program component. Our proposed design options are based on our assessment of the LfP project documents, available data, and inputs from USAID, LfP and other related stakeholders. In the remainder of this section, we take a systematic approach in first assessing the evaluability of LfP's interventions in the additional geographies in general, and then discuss in detail the evaluation design options summarized in Table 4. Finally, we also discuss the different measurement approaches for outcomes that we propose to evaluate and that are aligned with USAID learning interests, and the pros and cons of each.

TABLE 4: SUMMARY OF EVALUATION OPTIONS, BY PROGRAM COMPONENT

LfP Program Component	Proposed Evaluation Design Options
Community Formalization Pilots	• Mixed Methods Performance Evaluation ○ Household survey to measure tenure security, behavior, and wellbeing, conducted as a census of all households in the two pilot communities. ○ Qualitative data collection – KIIs with LfP staff, participating local authorities, LfP beneficiaries, and other community- and municipality-level stakeholders. FGDs with community members. ○ Administrative data on local capacity for land administration and monitoring and enforcing land use contracts, along with satellite data on deforestation.
Puerto Rico Parcel Sweep	• Mixed Methods Performance Evaluation ○ Household survey to measure tenure security, behavior, and wellbeing, conducted as a census of all households in the two pilot communities. ○ Qualitative data collection – KIIs with LfP staff, participating local authorities, LfP beneficiaries, and other community- and municipality-level stakeholders. FGDs with community members. ○ Administrative data on local capacity for land administration and monitoring and enforcing land use contracts, along with satellite data on deforestation.
CNP Border Delimitation and Enforcement	• Interrupted time-series for measuring deforestation (IE) • Inferential design for measuring biodiversity (PE) • Pre-post design for measuring biodiversity (PE) • Spatial regression discontinuity design for measuring deforestation and biodiversity (IE)

FEASIBILITY OF AN EVALUATION

To assess the extent to which an evaluation of LfP's additional geographies activity is feasible, we first summarize the discussions related to LfP's three interventions, including their nature and the geographic areas in which they are implemented, the direct beneficiaries as per the activity theories of change we described, and the indirect beneficiaries that are critical for achieving the ultimate goal of biodiversity conservation and climate change mitigation. The overall point of this summary is to highlight that the implementation areas and direct beneficiaries for each intervention are distinct and will require separate evaluation components to speak to the different illustrative evaluation questions and sub-questions proposed above, and meet USAID learning interests. Findings would then be triangulated across these evaluation components to answer overarching evaluation questions and learning interests. In sum, the proposed evaluation approach is a mixed-methods performance evaluation to assess outcomes of interest stemming from the two community-level formalization pilots and the parcel sweep in Puerto

Rico, coupled with an impact evaluation approach to assess selected outcomes of the CNP border delineation intervention.

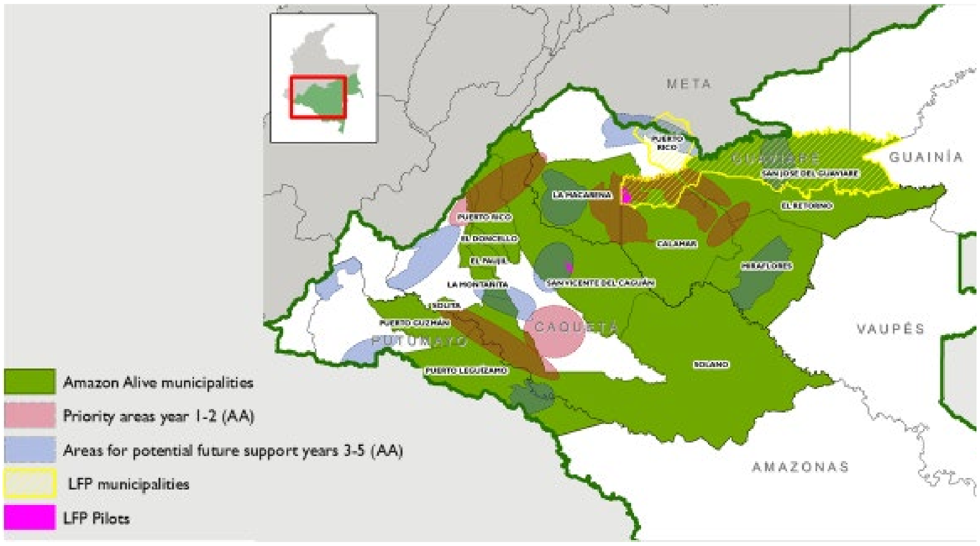
As shown in **Table 5** and discussed earlier, the areas of implementation for the three interventions are different and non-overlapping, though LfP sees these separate components working together to create a corridor of formality and protected natural habitat in the region. In addition, the direct beneficiaries of the three interventions are also different: CNP park administrators and Environmental Crimes Unit within the GoC Public Prosecutor's Office for the CNP Border Delineation and Enforcement; households in the two pilot communities for the Community-level Formalization Pilots; and households and communities in Puerto Rico for the Puerto Rico Parcel Sweep. As such, **multiple evaluation components will be required** for assessing LfP's contribution to the outcomes of interest on direct beneficiaries, given that any single evaluation component on its own will not be able to examine the impacts of all three interventions. In particular, we propose separate evaluation components for the CNP border Delineation intervention (and the assumed GOC use of the intervention outputs to enforce the border) and the other two interventions together. We discuss these evaluation components below.

TABLE 5: SUMMARY OF LFP ADDITIONAL GEOGRAPHIES INTERVENTION IMPLEMENTATION AREAS AND DIRECT AND INDIRECT BENEFICIARIES

LfP Program Component	Areas of Implementation	Direct Beneficiaries	Indirect Beneficiaries
CNP Border Delineation and Enforcement	▪ CNP	▪ IGAC, National and CNP park administration, GoC Public Prosecutor's Office Environmental Crimes Unit, and indigenous communities in CNP interior indigenous reserves	▪ MADS / GoC environmental goals for SMVC
Community-level Formalization Pilots	▪ Two communities in Guaviare and Caquetá	▪ ANT, IGAC, and Households in the two formalization pilot communities	▪ MADS / GoC environmental goals for SMVC
Puerto Rico (PR) Parcel Sweep	▪ Puerto Rico	▪ Households and communities in PR, ANT, and IGAC	▪ MADS / GoC environmental goals for SMVC

In terms of the indirect beneficiaries, households, communities, and GoC environmental goals for the land/environment within CNP and its buffer zones are all likely to be affected. In addition to LfP activities in the additional geographies, other USAID programs targeting similar outcomes, such as the Amazon Alive program, are also implemented in and around the buffer zones (see **Figure 7** below). Our discussions with USAID and LfP also suggest that other donors are funding additional programs in these areas targeting similar outcomes. As such, **it will not be possible to evaluate the contribution of LfP activities and isolate its effects in the buffer zones through a rigorous impact evaluation approach.** However, an outcome evaluation related to deforestation and biodiversity outcomes in the buffer zones to learn about the summative effects of all interventions (including LfP, other USAID programs, and other donor programs) in and around the CNP area is feasible and could be useful for future policy discussions. We discuss evaluation options for the CNP buffer zones as an add-on opportunity below.

Figure 7: Amazon Alive and LfP Implementation Areas in SMVC[25]



An important consideration in impact evaluation (IE) design to examine the expected changes as a result of an intervention(s) is the feasibility of creating a counterfactual condition—what would have happened had the intervention(s) not been implemented—so that changes in outcomes of interest can be attributed to the intervention by comparing them with the counterfactual. The most scientifically rigorous method for creating a counterfactual is an experimental design where potential implementation units of intervention are randomly assigned to two groups, one where the intervention is implemented (the treatment group) and one where the intervention is not implemented (the control). If random assignment is not feasible, then quasi-experimental designs such as a matched-comparison group design is possible, where the control group is constructed by matching key observable characteristics with that of the treatment group to mimic the counterfactual condition. Other quasi-experimental approaches may include a regression discontinuity design, where units are ranked and are selected for implementation based on a random cut-off point. For example, if all potential communities where an intervention can be implemented were ranked based on the extent of deforestation and communities above a certain cut-off were selected, then those right below the cutoff could serve as a counterfactual compared to those right above.

When constructing a counterfactual condition is not feasible, non-experimental methods such as a pre-post design (or a variation) and/or qualitative evaluation methods are used to measure contributions of an intervention. These methods are usually referred to as a performance evaluation, as opposed to the more rigorous impact evaluation approach. Note that attribution cannot be done with confidence when using performance evaluations. However, with careful assessment of the logical paths of the theories of change and examination of changes in outcomes over time, performance evaluations may provide useful information on the context in which the intervention is implemented and the complex interdependence of relevant variables necessary for change. This can still provide useful learning, for example in terms of path corrections for the current intervention or directions for future interventions.

[25] Map source: USAID/Colombia Environment Office.

EVALUATION OPTIONS FOR COMMUNITY FORMALIZATION PILOTS AND PUERTO RICO PARCEL SWEEP INTERVENTIONS

Both the community formalization pilot and the Puerto Rico parcel sweep interventions are designed to work directly on the demand side in the context of landholder's land use choices—reducing incentives for deforestation and other illicit activities and promote sustainable, licit livelihoods in the areas of intervention—by improving land tenure security of households through land-use contracts or land titles. The interventions will further incentivize households by working on PPPs that provide households opportunities to transition away from activities detrimental to the environment to activities that are part of green value chains, as well as conduct strategic work with the public sector to improve expenditure and investment in public goods and services. The elements of the interventions related to strengthening local administrative capacity building, along with the CNP border delineation and enforcement intervention, are designed to work on the supply side by reducing the availability of land for activities detrimental to the environment. As a result, we expect to observe changes in household behavioral outcomes, administrative capacity for land use monitoring and enforcement in the short and medium term, and decreased incidence of illegal activities in the medium to long term.

An impact evaluation of the two tenure security interventions (community formalization pilots and Puerto Rico parcel sweep) is not considered to be feasible by the FA team, because we cannot construct a credible counterfactual against which to compare the changes in outcomes of interests in the intervention communities to estimate impacts. A mixed methods performance evaluation is feasible and is discussed in the next section. Based on our current information on the LfP activity implementation details, we summarize in Table 6 the reasons why an impact evaluation is not feasible. Instead, we recommend a comprehensive mixed-method performance evaluation for the two tenure security interventions (community formalization pilots and parcel sweep), combining quantitative and qualitative data. We describe this option in detail in the section below.

TABLE 6: CHALLENGES TO IMPACT EVALUATION APPROACH FOR COMMUNITY FORMALIZATION PILOTS AND PUERTO RICO PARCEL SWEEP

Challenge	Details
Limitations related to treatment assignment	• Intervention communities have already been selected, so it is not possible to conduct a randomized assignment at the community level. • All eligible households that desire a land-use contract or title are expected to receive one. This limits the ability to use households that do not receive these documents as a comparison group, because they are likely different from those who receive the documents in ways that cannot be observed or controlled for. • Household-level assignment also has a high risk of spillover, given that communities (especially the two formalization pilot communities) have very small populations. • Within communities, it may be feasible to randomize the sequence in which households receive their documents, and exploit that variation to examine household-level impacts. An evaluation team will be able to make this determination with greater certainty during a design phase. Such a design would still need to consider the risk of spillovers.
Limitations related to small sample size	• A matched-comparison group design is not feasible because of the low number of units of implementation against which we can match other communities where LfP interventions are not implemented to construct a comparison group. • The low number of intervention units has implications on two fronts: (1) the match quality is very likely to be poor and (2) the statistical power of the design will be very low.[26]

[26] Note that the LfP original geographies impact evaluation uses a matched-comparison group design that involves 200 communities split equally between the treatment and the comparison group.

TABLE 6: CHALLENGES TO IMPACT EVALUATION APPROACH FOR COMMUNITY FORMALIZATION PILOTS AND PUERTO RICO PARCEL SWEEP

Challenge	Details
Limitations related to access to comparison areas	• For the evaluation of the community formalization pilots, access to potential comparison communities is likely to be limited by security conditions. • NORC has consulted with a local data collection firm, and understands that at present, security conditions in the area around the formalization pilot communities are extremely poor. LfP's relationships in the intervention communities should allow data collection for an evaluation to occur there, provided LfP can facilitate contacts with community leaders to establish trust between the enumerator teams and the communities. The absence of such relationships in potential comparison communities is likely to make data collection there extremely risky and infeasible under the current security situation in the area.

COMPREHENSIVE MIXED-METHODS PERFORMANCE EVALUATION

We propose a mixed-method pre-post performance evaluation that would combine quantitative and qualitative data to compare outcomes before and after the implementation of the two community-level interventions. This evaluation option is particularly well suited for evaluating the short- (0-2 years) and medium-term (3-4 years) outcomes at the household and the community level. As presented in the logic models in Figure 4 and Figure 5 and listed in **Table 1**, the short- and medium-term outcomes are primarily household and community level behavioral outcomes that drive deforestation/biodiversity and are related to sustainable livelihoods. In addition, we also expect changes in outcomes related to administrative capacity in monitoring and enforcing protected land areas. The performance evaluation will use data from primary household surveys, qualitative key informant interviews (KIIs) and focus-group discussions (FGDs), and administrative data, to the extent available.

Household Survey. Outcomes related to household tenure security, behavior, and wellbeing will best be measured through quantitative data from household surveys in the land use contracts pilot communities and Puerto Rico. The FA team understands that the two pilot communities are small, and together comprise only a few hundred individuals. As such, the FA team recommends conducting the survey as a census, including all households in each community, including both those that receive land use contracts, and those that do not. For Puerto Rico, we recommend a household survey with a sample of the community inhabitants. Despite the remoteness of the region, a household survey should be feasible if the reach of the survey is limited to the two pilot communities and Puerto Rico, and especially if LfP can facilitate contact with community leaders to obtain permission for data collection.

Qualitative Data Collection. The qualitative component for the evaluation will be structured to complement and expand on the quantitative results, particularly by generating plausible explanations of reasons for observed outcomes, identifying potential mechanisms, the role and importance of different LfP activities, and reasons for any variations observed across the three communities (especially between the two formalization pilot communities and Puerto Rico). The qualitative data collection will also seek to identify any potential unintended broader consequences (positive or negative) of the activities in implementation communities, beyond program objectives. It will therefore include a focus on understanding activity implementation processes and approaches, and challenges and reasons associated with transferring to "green value chain" activities. KIIs will consist of semi-structured questions administered to LfP activity staff and participating local authorities, LfP beneficiaries, other community- and municipality-level stakeholders. In addition, FGDs with members of pilot communities and Puerto Rico will help us drill down further into the community dynamics related to land-use contracts, land tenure, and sustainable livelihood activities.

Administrative Data. An evaluation team should complement the primary household survey and qualitative data with secondary administrative data on local administrative capacity for land administration and monitoring/enforcing land-use contracts (in the two pilot communities), to the extent data is available. In addition, satellite imagery can be used as administrative data on deforestation. While we do not expect changes in deforestation in the short- and medium-term, especially in the two small pilot communities, we note that this as an option especially if the evaluation is gathering satellite imagery data as part of the evaluation for CNP Border Delineation and Enforcement intervention. We discuss this data in more detail in the next section.

The mixed-method performance evaluation is not as rigorous as an impact evaluation in the sense that attribution of changes in outcomes of interest to the LfP interventions cannot be done with confidence. However, an evaluation team can use a systematic analytical approach to measure the possible contributions of LfP interventions to the short- and medium-term outcomes as hypothesized by the program theories of change. Assessment of the logical pathways and the direction of change of different outcomes will provide valuable information on the potential effects LfP interventions may have in the longer term and will also uncover household and community dynamics in the context of SMVC that will help understand what implementation components may need adjustments before scaling up the intervention.

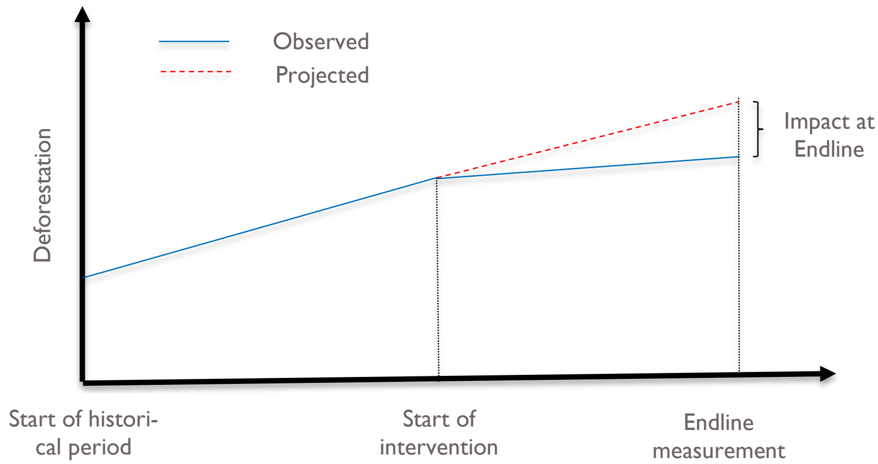
EVALUATION OPTIONS FOR CNP BORDER DELINEATION AND ENFORCEMENT INTERVENTION

The CNP Border delineation and enforcement intervention will directly affect the areas inside the park border. Because the park is uninhabited except for community members in indigenous reserve zones, evaluation options for this intervention focus on outcomes related to deforestation and biodiversity, rather than household- and community-level behavior change and land use outcomes. Unlike for the other two LfP interventions discussed above, the nature of this intervention is amenable to an IE design to measure some of the outcomes of interest (deforestation and habitat connectivity), although not others (biodiversity).

IE DESIGN OPTION: INTERRUPTED TIME-SERIES DESIGN FOR MEASURING DEFORESTATION

The first impact evaluation design option is a quasi-experimental interrupted time-series (ITS) design. An ITS design is feasible when data on outcomes of interest are available with frequent intervals allowing for the construction of time series data. The basic idea behind the ITS design is illustrated in **Figure 8**: we first use pre-intervention historical data to forecast the trajectory of outcomes (red dashed line) and then compare the forecasts to the actual realizations observed over the treatment period (solid blue line). The difference between the forecasted value and the observed value at endline (5-10 years) is the impact of the intervention.

Figure 8: Illustration of Impact Measurement Under ITS Design



In an ITS design, the forecasted trajectory serves as the counterfactual against which actual observed value of deforestation is compared. The trajectory is forecasted based on statistical models using pre-intervention time-series data on deforestation, and other time-varying variables that may affect the trend in deforestation such as precipitation, temperature, distance from roads and/or rivers etc. ITS analysis identifies the intervention effect by detecting a temporal break in the period following the introduction of the intervention. In the example above in **Figure 8,** there is an increasing trend in deforestation before the start of the intervention. The hypothesis is that there will be a spatial and temporal break in the deforestation trend after the CNP border delineation and enforcement intervention is implemented, where deforestation rate within the park will be slower (indicated by the flatter blue line after the intervention's start). A similar analysis of deforestation rates outside the park border could find evidence of spillover effects, with deforestation rates slowing down (positive spillover) or speeding up (negative spillover), depending on local dynamics.

To operationalize the ITS design, an evaluation team will first need to acquire GIS data in the form of a Shapefile with polygons corresponding to the updated and finalized park border and the boundaries of the indigenous reserve zones within. The FA team assumes that LfP will be able to provide such georeferenced data. In the next step, an evaluation team will define areas within the park border that will be part of the impact evaluation. While LfP will help the GoC delineate the border for the entire CNP, for the purpose of the evaluation an evaluation team will likely consider land grids (square units of land dividing the area into unique observations with quantifiable measurements) along the northern park border in the departments of Caquetá, Guaviare, and Southern Meta, which have been at risk of deforestation in recent years (southern areas of the park are much more remote, and available data suggests little to no deforestation has occurred there). Finally, an evaluation team will gather data on deforestation for each land grids for pre-intervention forecast and for impact analysis. We discuss the availability of deforestation data next.

Administrative Data for ITS. An evaluation team can assess the availability of administrative data related to the prosecution of environmental crimes in the region, such as prosecutions and convictions of illegal land grabbing and deforestation. The evaluation team would need to examine the spatial resolution (e.g., municipality-level, community-level, etc.) and frequency of the data, in order to determine how to best use it in an ITS. The idea is that the data should allow the evaluation team to identify events that occurred within LfP's area of impact, distinguishing between the pre- and post-intervention periods.

Remote Sensing Deforestation Data. An evaluation team can most reliably measure deforestation using remote sensing data in the form of raster satellite imagery or publicly available spatial data products derived from this. These data are high quality, available at acceptable spatial and temporal resolutions for the envisioned time period, and consistently used as part of gold-standard studies of deforestation trends in the tropics (including in Colombia and elsewhere in the Amazon). As examples, the following datasets are freely available to the public from reputable organizations and could be utilized by an evaluation team for this purpose.

- NASA/MODIS land cover and related data products: NASA's MODIS is a satellite-based sensor providing data on a variety of outcomes. The FA team proposes using MODIS data on Land Cover Type, Normalized Difference Vegetation Index (NDVI), and Burned Area. Annual data is available from 2001 at 250- or 500-meter resolution.
- Global Forest Watch Radar for Detecting Deforestation (RADD): Global Forest Watch's RADD system uses data from the European Space Agency to issue deforestation alerts in tropical forests. Data is available in raster format from January 2020 at 10-meter resolution, and is regularly updated, providing data in near real-time.
- University of Maryland Global Forest Change Data: This dataset, published by Hansen et al., is available at annual frequency since 2000, at 30-meter resolution. The data identifies spatial units where forest loss was detected over the period.

Limitations of the ITS Design. The remote sensing data sources cited above have validated uses for detecting near-real time change in deforestation, as well as large-scale drivers of deforestation such as fires, major infrastructure projects, conversion to tree monoculture, and large-scale extractive industries. However, biodiversity conservation and climate change mitigation outcomes are also likely to be affected by changes in forest degradation, which these data are not suited to measure. Reliable measurement of forest degradation requires a combination of field-based and remote sensing measurement strategies.[27] Historically, satellite data has not been suitable on its own to detect critical degradation events such as small-scale infrastructure projects, harvesting of non-timber plant products, selective logging, and understory thinning and clear cutting.[28] As such, while an ITS design is suitable for measuring changes in canopy forest cover that can be attributed to LfP, it is not suitable to detect other critical changes in forest degradation that might be impacted by the delineation of the CNP border and which may contribute to biodiversity conservation and climate change mitigation.

PE OPTION: INFERENTIAL DESIGN FOR MEASURING BIODIVERSITY

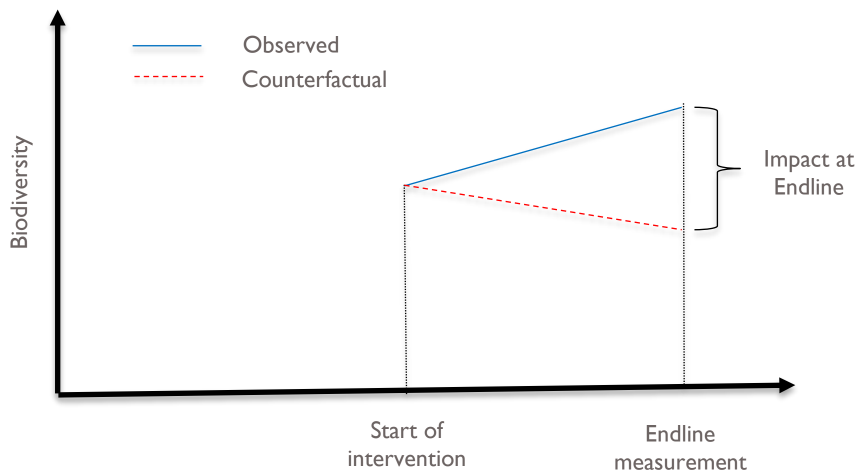
Because pre-intervention, time series historical data on biodiversity is not available, it is not feasible to use the ITS design to measure impacts on biodiversity directly. However, a similar approach to creating a counterfactual scenario has been discussed in detail by the International Union for Conservation of

[27] Mitchell, A.L., Rosenqvist, A. & Mora, B. Current remote sensing approaches to monitoring forest degradation in support of countries measurement, reporting and verification (MRV) systems for REDD+. Carbon Balance Manage 12, 9 (2017). https://doi.org/10.1186/s13021-017-0078-9

[28] Herold, M., Román-Cuesta, R.M., Mollicone, D. et al. Options for monitoring and estimating historical carbon emissions from forest degradation in the context of REDD+. Carbon Balance Manage 6, 13 (2011). https://doi.org/10.1186/1750-0680-6-13

Nature (IUCN)[29] and has been applied by several studies to estimate whether past conservation efforts made any difference in certain species status. It is called the inferential design, where a group of experts project the state of different species in each spatial unit under consideration based on a range of ecological, environmental, and social factors before the start of the intervention. This counterfactual scenario, depicted as the red dashed line in **Figure 9**, is then compared with the observed status (solid blue line) 5-10 years after the start of the intervention. To our knowledge, the inferential design has not been used to measure impacts of future conservation efforts, nor has it been used to measure impacts on biodiversity (as opposed to measuring impacts on individual species). As such, an evaluation team will need to carefully assess the details of this approach in an evaluation design phase if USAID decides to move forward with the evaluation. Alternatively, an evaluation team can consider measurement of deforestation impacts through the above IE approach to provide an acceptable proxy for biodiversity impacts, given that the biggest driver of biodiversity loss in the area is deforestation.[30]

Figure 9: Illustration of Impact Measurement Under Inferential Design



PE OPTION: PRE-POST DESIGN FOR MEASURING BIODIVERSITY

If the construction of a counterfactual scenario under the inferential approach is not possible, then another design option is the non-experimental pre-post design, where an evaluation team compares biodiversity measures 5-10 years after the start of the intervention against biodiversity measures before the start of the intervention to assess impacts. Pre-post design is usually problematic because there is no counterfactual scenario against which changes can be compared. Any unobserved variables affecting biodiversity (other than the intervention) can potentially confound the ability to attribute the observed impacts (calculated as post minus pre) to the intervention. Pre-post designs must be complemented with desk reviews and expert interviews to understand the nature and the extent of confounding factors to contextualize the observed impacts. The feasibility of this approach, and for measures of biodiversity more generally that are discussed as part of this evaluation, would require a more coordinated timing for the start of evaluation activities relative to LfP implementation activities, because an evaluation team would need to establish a credible biodiversity baseline before major intervention activities are underway and this work could take some time. This constraint does not apply to the intended

[29] IUCN (2021). IUCN Green Status of Species: A global standard for measuring species recovery and assessing conservation impact. Version 2.0. Gland, Switzerland: IUCN.
[30] USAID also agreed with this approach during discussions on an earlier draft of this FA.

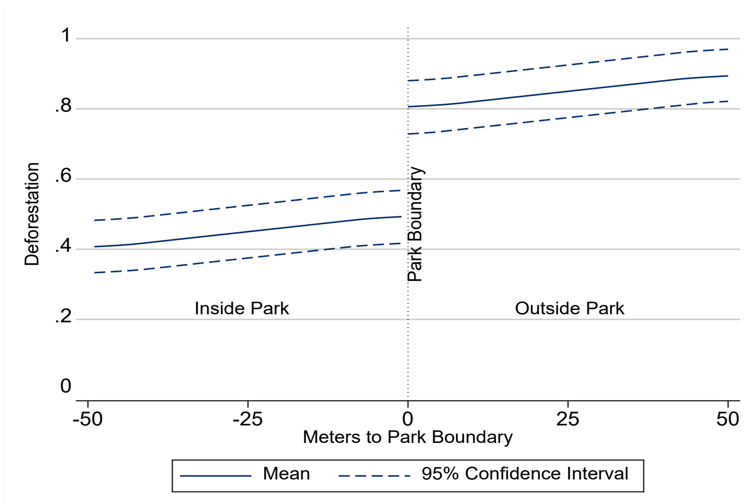
deforestation measures, because they are derived from remotely sensed data which are already available at the required time intervals.

Another important consideration in assessing impacts on biodiversity is the actual measurements or indicators of biodiversity that are used to assess change. We provide a detailed description of measurement options in the next chapter.

IE OPTION: SPATIAL REGRESSION DISCONTINUITY DESIGN FOR MEASURING DEFORESTATION AND BIODIVERSITY

A more rigorous IE design option is the spatial regression discontinuity (SRD) design, where causal impacts of a policy or intervention is identified based on a sharp change in spatial coverage of the policy/intervention. In the case of CNP, LfP's intervention will provide a detailed mapping of the park border and cadaster, which will be used by GoC to enforce and protect areas within the border, while areas right outside the park border will not be protected. The assumption is that within small spatial scales around the park border , the land context inside or outside of the park border is sufficiently comparable such that the assignment of the border closely resembles a randomized design. In other words, the close proximity of the spatial units on both sides of the park border would mean that the units are, on average, similar in terms of topography, climate, markets, proximity to human settlements, proximity to roads/rivers, and other related drivers of deforestation. Thus the spatial units right outside the newly-delineated border would serve as the counterfactual and would allow us to attribute any differences in deforestation and biodiversity outcomes between units just inside and just outside of the park to the intervention.[31] The basic idea behind the SRD design is presented in **Figure 10**.

Figure 10: Illustration of Spatial Regression Discontinuity Design



The units of analysis under the SRD design are the spatial units (e.g., raster pixels) that are aligned with spatial grids for which data on various deforestation measures are available from satellite imagery (as discussed before). We propose that an evaluation team sample pixels along the park border within the SMVC area on both sides of the newly-delineated park border. Because the resolution of the available remotely sensed data ranges from 10 to 200 meters squared, there will be plenty of analysis units available and the FA team is not concerned about power of the IE for identifying impacts. As part of the

[31] Kondylis, Florence and John Loeser. "Spatial Jumps." Published on Development Impact Blog by The World Bank (https://blogs.worldbank.org/impactevaluations/spatial-jumps).

park mapping, LfP expects to map the precise boundaries of indigenous reserves inside the park, other indigenous communities within the park who may have valid claims but are not currently in formal reserves, and other communities with no legal standing to be inside the park. The FA team anticipates that this work will generate polygons that can be provided to the evaluation team, and can be included as part of the SRD design. The exact nature of how this could be incorporated would need to be defined once the polygons are provided, and would depend on how close these communities are to the park border. If the communities are very near the border or on land that intersects the border, an evaluation team could evaluate the effects of the intervention in these areas by using the SRD model already described, but conducting a sub-group analysis that limits the scope to the communities of interest.

Although the SRD design option is more rigorous than the previous options—ITS design for deforestation and inferential and pre-post designs for biodiversity—, there are several challenges for implementing the SRD design:

Challenge 1: Maintaining Randomness Assumption of New Park Border. The SRD design's identification strategy rests on the assumption that the sharp spatial change in intervention coverage is "nearly random" and is not correlated with variables that may affect outcomes of interests, deforestation and biodiversity. In other words, looking at the characteristics of land just inside and just outside the park border (e.g., 50 meters on either side), the characteristics of the land are sufficiently similar, on average, that the border replicates a random assignment of treatment. However, as we have shown in **Figure** 1, it seems that the park border delineated in 2018 has already affected deforestation differently inside the park and outside in the buffer zones. If this is indeed true and the newly-delineated park border is not much different from what was delineated in 2018 then the SRD design will be unlikely to detect any impacts. An evaluation team will need to do a careful investigation of the "near random" assumption before moving forward with this design. Particularly, pre-intervention outcome levels should be balanced, on average, between spatial units just inside and those just outside of the park border. If pre-intervention outcome levels, such as deforestation levels and/or trends, are not balanced, then it will indicate that households and communities are largely aware of the park boundaries and that the CNP border delineation under LfP's activity in SMVC is not a random event.

Challenge 2: Geographic Spillover. Another challenge for the SRD design is the possibility of deforestation spillovers to neighboring forests when a previously accessible area is protected by law.[32] In the case of the CNP border delineation and enforcement intervention, once the park border is defined and enforced, it is likely that illegal activities such as cattle ranching and logging that affect deforestation will shift to areas right outside the park border. If this were to happen then the impact estimates comparing areas right inside the park with those right outside will overestimate the impacts of the intervention (picking up the combined effects of the intervention and the spillover). Statistical methods to control for this spillover are limited in an SRD design because the counterfactual is not based on a comparison group per se.

Challenge 3: Forest Degradation May Not be Measured. As an SRD would rely on the same data sources as the ITS design, it is prone to the same issues in detecting changes in forest degradation. Namely, while large-scale forest-degrading events like fires, shifts to tree monoculture, and large-scale

[32] Andam, K.S., Ferraro, P.J., Pfaff, A., Sanchez-Azofeifa, G.A., Robalino, J.A., 2008. "Measuring the effectiveness of protected area networks in reducing deforestation." PNAS 105 (42), 16089–16094.

infrastructure and extractive industries may be detected, other smaller-scale forest degrading activities are not likely to be detected using remote sensing data alone.

There is ample precedent in the academic literature for using counterfactual approaches to measure the impacts of protected lands on deforestation using raster data. Early examples of such geospatial impact evaluations used deforestation raster data with spatial units as coarse as 3 ha sq (Andam et al., 2008), suggesting the datasets currently available at resolutions of 250, 30, or even 10 meters sq will be more than adequate for measuring deforestation. The datasets we propose are used in more recent work, such as Blackman et al., 2017[33], Baehr et al., 2021[34], and BenYishay et al., 2017[35]. These data have also been employed in Colombia using spatial regression discontinuity (Bonilla-Mejia and Higuera-Mendieta, 2019)[36].

These studies suggest possible solutions for the challenges described above. Challenge 1 could be treated by adding an additional matching step to the regression discontinuity to reduce imbalance on observable characteristics, for example by sampling spatial units just inside the park border and matching them based on observable spatial traits (e.g., forest cover trends, distance to nearest settlement, altitude, slope, etc.) with spatial units just outside the park border. Challenge 2 could be measured using the methods for spatial spillover employed by Andam et al., which use statistical matching to match untreated areas just outside the intervention zone to untreated areas further away, and compare the trends between these two groups over time. Field-based qualitative work, including discussions with the IP, local communities and authorities, and national government officials, could also help resolve Challenge 2 and identify whether spillover effects are likely driving SRD results.

ADD-ON INTERESTS FOR EVALUATION

This section considers the possibility for add-on components to the evaluation designs described above. These include: (1) possibilities for an evaluation of the program's effects on indigenous communities, (2) evaluation of deforestation and biodiversity in CNP buffer zones; and (3) an SRD design for La Macarena National Park.

Evaluation of Program Effects on Indigenous Communities. USAID has an additional learning interest focused on the effects of the LfP interventions on indigenous communities, which can be met through at least two options. First, the household surveys that would be conducted in the two land use contract pilot communities should include questions on the ethnic minority groups households identify as members of, if any. This would allow an evaluation team to assess the impacts of different LfP program components, including border delineation, on ethnic minorities, and whether their outcomes differ from that of other households.

However, interviewing residents of the land use contract pilot communities who happen to identify as members of indigenous groups will not allow the evaluation to speak to LfP's impacts on formally constituted indigenous communities, such as those living in indigenous reservations inside the park or on

[33] Blackman, A., Corral, L., Santos Lima, E., and Asner, G.P. 2017. "Titling indigenous communities protects forests in the Peruvian Amazon." PNAS 114 (16), 4123-4128.
[34] Baehr, C., BenYishay, A., and Parks, B. 2021. "Linking local infrastructure development and deforestation: Evidence from Satellite and Administrative Data." Journal of the Association of Environmental and Resource Economists 8 (2), 375-409.
[35] BenYishay, A., Heuser, S., Runfola, D., and Trichler, R. 2017. "Indigenous land rights and deforestation: Evidence from the Brazilian Amazon." Journal of Environmental Economics and Management 86, 29-47.
[36] Bonilla-Mejia, L. and Higuera-Mendieta, I. 2019. "Protected areas under weak institutions: Evidence from Colombia." World Development 122, 585-596.

its borders. If USAID is also interested in studying the impacts of LfP on ethnic minorities inside the park or living on communal ethnic lands or reservations in the park's buffer zone, this can be achieved through an add-on component to the evaluation.

One possibility for this add-on would be to identify specific ethnic communities of interest and conduct an additional set of qualitative interviews. The approach would be to identify one or two communities of interest, and conduct FGDs with community members and leaders. This qualitative component would be structured similarly to the qualitative discussions held in the land use contract pilot communities, but would include additional topics relevant for indigenous communities and communities living inside the park,

After consulting with a local data collection firm, the FA team believes that conducting a quantitative household survey in these communities is not likely to be feasible, given local security conditions. While LfP is working directly in the pilot communities and will have established relationships there to facilitate the access for a data collection firm to conduct household surveys, the absence of similar relationships of trust in other communities will make it difficult or impossible to do the same in other communities of interest, given current conditions. However, FGDs are a format indigenous communities are generally more familiar with, require smaller teams and significantly less time to conduct, and avoid the problems generated by asking extensive personal information about individual households. Thus, qualitative data collection in these areas may still be feasible and is deemed a preferable option. Moreover, the nature of USAID's learning interests for indigenous communities is highly amenable to a qualitative approach. Still, given a dynamic security situation in the area, the feasibility of conducting FGDs in indigenous communities should be revisited by an evaluation team during an evaluation design stage. An additional consideration at this stage is whether or not Shapefiles or other geospatial information can be obtained showing the borders of indigenous communities of interest. If so, these borders could be incorporated into the SRD design to measure the impact on indigenous communities for outcomes with remote sensing data, such as deforestation or land use.

Evaluation of CNP Buffer Zones. The ITS design for measuring changes in deforestation and both the inferential design and the pre-post design for the measuring changes in biodiversity are feasible options for studying longer-term changes in the CNP buffer zones. However, as discussed before, because of the presence of other similar programs in the CNP buffer zones that will also affect deforestation and biodiversity in the long run, this evaluation will assess the summative effects of all GoC interventions during the evaluation period. Although we cannot directly attribute changes to LfP, the results of this evaluation should be informative nonetheless for future policies related to conservation interventions.

SRD Design for La Macarena National Park. We note that the SRD design would be a feasible design option if similar delineation and enforcement is conducted for the La Macarena National Park. As can be seen from **Figure** 1, deforestation within and around the La Macarena park border has been happening in recent years, especially in the area of the park within the municipality of Puerto Rico, as opposed to CNP where deforestation has not happened on a visible scale in recent years within the park. Also, because there is no clear spatial pattern in terms of deforestation within and outside of the La Macarena park border, the "near randomness" assumption required for identification of impacts under the SRD design is more plausible if a border is delineated and enforced. However, challenges related to geographic spillover and limited ability to measure environmental degradation will still be a challenge for the evaluation, although household survey data on household land use behaviors and perceptions will help to inform on degradation to some extent.

VII. BIODIVERSITY MEASUREMENT STRATEGIES

The USAID Biodiversity Policy includes two goals: conserving biodiversity in priority places and integrating biodiversity as an essential component of human development. SMVC constitutes a high-biodiversity priority region in a priority country, and its conservation contributes to the first of the Policy's goals. The Policy operationalizes this goal, in part, through support for priority sites, species diversity, and genetic diversity.[37] We discuss measurement options for these two forms of biodiversity in this section.

As indicated in Table 7 below, based on consultations with ecologists and conservation biologists working in the CNP landscape[38] and our associated research and considerations around feasibility, our team generally recommends against a focus on directly measuring biodiversity as part of an evaluation of LfP's work in the additional geographies. This is primarily due to measurement reliability challenges, value for money considerations and also because LfP and USAID appear to be in agreement that a focus on measuring changes to deforestation, forest cover and habitat connectivity -- all of which can be measured reliably – can serve as an acceptable proxy for potential changes to biodiversity in this landscape, given that deforestation, fragmentation and loss of habitat connectivity are the major threats to biodiversity. This point was also made by the ecologists/conservation biologists we consulted for this FA, who emphasized that slowing deforestation and restoring connectivity are the most important ways to conserve biodiversity in the landscape, and reflects discussions on the issue among the FA team, USAID and LfP which evolved over the course of the feasibility assessment work.

However, if USAID should still be interested to pursue a biodiversity measurement strategy, our feasibility assessment work suggests that a focus on sentinel indicator species and taking a species diversity measurement approach is more suitable for this evaluation context than that focusing on genetic or other measures of diversity. Of three field-based options for direct measurement of species diversity (direct observation, camera trapping, and environmental DNA (eDNA)), we consider camera trapping to be the most feasible option for a biodiversity measurement component to an evaluation of LfP. However, it would still require significant resources to implement and yield very basic estimates of species diversity across a small subset of the taxa present in SMVC. Furthermore, the long periods of time typically required to see changes in species biodiversity combined with the fact that LfP's interventions only indirectly address species biodiversity (for example, by protecting habitat, but not combined with direct interventions such as species reintroduction or rehabilitation), suggest a high likelihood that an evaluation may fail to directly detect any impact of the program on biodiversity.

As such, the benefits of direct biodiversity measurement are unlikely to outweigh the costs. Regardless of whether camera trapping is pursued, modeling and/or proxy indicators for biodiversity calculated based on deforestation and other inputs will provide a minimum set of evidence an evaluation could use to characterize potential effects of LfP on biodiversity outcomes. The tradeoffs of these measurement strategies are summarized below and discussed at the end of this section.

[37] USAID Biodiversity Policy, 2015

[38] We consulted an ecologist and primatologist at University of Los Andes and an Amazon program coordinator for WWF-Colombia.

TABLE 7: SUMMARY OF FEASIBILITY FOR MAIN BIODIVERSITY MEASUREMENT STRATEGIES

Measurement Option	Feasibility Tradeoffs	Status
1. Direct Observation	✓ Least technology requirements. Established method with many practitioners. Most suitable for measuring species abundance ✗ Requires many observers with locally specialized taxonomic expertise. Invasive for wildlife. Immense labor and cost requirements at suitable scale for evaluation.	● Not recommended
2. Camera Trapping	✓ Outperforms direct observation in species detection for medium and large species. Cost similar to large-scale household survey if leveraging artificial intelligence for species identification. ✗ Only capable of species richness/inventories for certain taxa, applications for species abundance rare or controversial. Will be suitable only if pre/post species inventories of medium and large terrestrial species and/or presence/absence of indicator species in these taxa suit USAID learning priorities.	● Possibly recommended
3. eDNA	✓ Highly innovative, top performing method for detecting rare species. Minimally invasive for wildlife. ✗ Highly expensive and concerningly prone to error for species richness and abundance detection. Likely not yet established enough in geographies like SMVC, with particular concern regarding suitability of DNA sequencing databases.	● Not recommended
4. Modeling/ Proxy Indicators	✓ Marginal additional cost to standard evaluation approaches, with available secondary measures. Can easily be combined with any other measurement strategy. ✗ Not a direct measurement of biodiversity. Inherits the biases of the inputs/proxy measures selected.	● Recommended

Legend: ● Not recommended ● Possibly recommended ● Recommended

SPECIES DIVERSITY MEASUREMENT

Species diversity refers to diversity across different types of species in an ecosystem. Various measurement concepts exist to characterize species diversity, the most traditional of which include species richness (number of species within an area) and species abundance (relative abundance of species within an area).[39] In either case, areas must be defined and sampled for study, after which species must be detected, classified, and counted in each area. With this data in hand, a variety of indices can be constructed to characterize biodiversity. The most basic and traditional of these are alpha diversity (number of species within an area), beta diversity (unique species across communities), and gamma diversity (total species across areas). Other indices and measures can be calculated that correct for potential shortcomings in these more basic indices, such as weighing for importance of species with an outsize impact on the health of an ecosystem or correcting for diversity at higher taxonomic levels.

For the purposes of this feasibility study, we briefly summarize three field-based measurement strategies available for calculating basic species richness and abundance (direct observation, camera traps, and eDNA), though each has substantial limitations from the perspective of evaluation data needs (including the precision and reliability of measures obtained), cost, and logistics to implement.

However, it must be said that within the literature measuring the biodiversity outcomes of conservation interventions, biodiversity is rarely measured directly. Rather, a large portion of this literature examines the impacts of land interventions on deforestation or land use changes, and authors then assess the

[39] Gotelli, Nicholas J., and Anne Chao. "Measuring and Estimating Species Richness, Species Diversity, and Biotic Similarity from Sampling Data." Encyclopedia of Biodiversity, 2013, pp. 195–211., https://doi.org/10.1016/b978-0-12-384719-5.00424-x.

implications for biodiversity based on established literature and subject matter expertise[40,41,42] or econometric modelling to simulate changes.[43] A smaller group of studies used direct biodiversity measures across different species, but have employed methods that are likely too costly for this evaluation (e.g., large-scale efforts employing hundreds of trapping stations[44,45]); the same can be said of studies that identify species that should stand to benefit from conservation interventions and attempt to measure the abundance of specific species of interest.[46]

To the best of our knowledge, there are no previously existing studies measuring changes in alpha, beta, or gamma diversity resulting from a specific conservation intervention. In any subsequent design phase, more sophisticated strategies could be investigated or pursued, though we assume the strategies below could provide the raw data necessary for more sophisticated analytical strategies.

OPTION 1: DIRECT OBSERVATION THROUGH LIVE TRAPPING, QUADRATS, AND/OR TRANSECTS

The study area is divided into sampling strata and standard sampling techniques are used to select points, lines, or polygons for direct observation. Trained observers who are expertly familiar with the species of the area regularly walk (if a line/transect or polygon/quadrat) or routinely monitor (if a live trap) the sampled areas to classify and count the species observed. Other characteristics, such as the distance from the transect or spatial distribution of species, might be noted as relevant to the study's measurement objectives. It is often practical to restrict the focal species or taxa for the study, based on the study's defined interests, resources, and practical considerations. For example, plant species are highly suitable for monitoring via quadrats and tree species via plots, while birds may require live trapping. If using to measure abundance, additional resources and methods such as those for tagging animals and estimating abundance based on rates of recapture may be necessary.

For the CNP and corridor areas, woolly monkeys are one potential option for direct survey, because they are important for ecosystem functioning, susceptible to hunting, their populations decline rapidly when affected by negative habitat or population conditions, and they are recognized as a proxy indicator for whether habitat is in good condition. There are established survey methods for their direct observation, such as use of line transects, and the equipment required is minimal. Human observers are required to conduct the surveys, but there is precedent for these to be conducted by teams of locally trained residents working together with trained biologists, to help reduce costs. However, woolly monkey populations do not rebound quickly even if habitat improves. Moreover, while it may be relatively cost-effective to conduct such surveys over a small area, a minimum of at least 15-20 such sites may be required in the context of the LfP evaluation. In addition to the increased cost, a more salient concern is the viability of finding that number of sites which would be deemed safe to work in, given substantial security concerns in the area and particularly in areas outside of communities where

[40] Giudice, R., Borner, J., Wunder, S., and Cisneros, E. 2019. "Selection biases and spillovers from collective conservation incentives in the Peruvian Amazon." Environmental Research Letters 14: 045004.
[41] Schuster, R., Germain, R., Bennett, J.R., Reo, N., and Arcese, P. 2019. "Vertebrate biodiversity on indigenous-managed lands in Australia, Brazil, and Canada equals that in protected areas". Environmental Science and Policy (101): 1-6.
[42] Probst, B., BenYishay, A., Kontoleon, A., and dos Reis, T. 2019. "Impacts of a large-scale titling initiative on deforestation in the Brazilian Amazon". Nature Sustainability 3(12): 1019-1026.
[43] Heilmayr, R., Echeverria, C., Lambin, C. 2020. "Impacts of Chilean forest subsidies on forest cover, carbon, and biodiversity". Environmental Science 3(9): 701-709.
[44] Hua, F., Wang, X., Zheng, X., Fisher, B., Wang, L., Zhu, J., Tang, Y., Yu, D., and Wilcove, D. 2016. "Opportunities for biodiversity gains under the world's largest reforestation programme". Nature Communications 7(1): 1-11.
[45] Solar, R. et al. 2016. "Anthropogenic disturbance in tropical forests can double biodiversity loss from deforestation." Nature 535: 144-147.
[46] Campos-Silva, J., Hawes, J., Andrade, P., and Peres, C. "Unintended multispecies co-benefits of an Amazonian community-based conservation programme". Nature Sustainability: 650-656.

monitoring would need to take place, according to the experts we consulted and based on their own and colleagues' experiences conducting fieldwork in that area.

Pros: Does not require sophisticated technology for species richness, though such technology might be required to measure abundance. Established method with trained practitioners. Sentinel or indicator species are available that can serve as general proxies for habitat condition more broadly.

Cons: Requires significant and specialized human resources, especially at scale.[47] Subject to human error, especially depending on species. Invasive for many species. Some species may actively avoid human presence. Substantial security threats may pose a risk to personnel, and special permits will be required for biodiversity measurement within CNP.

OPTION 2: CAMERA TRAPS

The study area is divided into sampling strata and standard sampling techniques are used to select polygons for trap placement. A sensor (e.g. wire, pressure, laser, etc.) trips in the presence of an animal and takes a photograph. Traps are set for extended periods and monitored occasionally for maintenance and to recover photos. Photographs are analyzed and coded according to study objectives, either by humans or by artificial intelligence with the supervision of humans. Camera trapping methods have validated performance in conducting species inventories for medium and large sized mammals in settings such as SMVC. [48] Camera trapping methods for estimating species abundance exist and are most feasible for species whose markings allow for individual identification. For example, jaguars and ocelots lend themselves to abundance estimation using mark-recapture modelling methods.[49] However, use of these methods is controversial and, in some cases, not recommended.[50]

For the CNP and corridor areas, tapirs, pecuaries and jaguars are also seen as sentinel species that could be a focus for camera trap monitoring. The first two can particularly serve as indicator species for improved habitat, while monitoring jaguars may be less reliable due to their very large ranges, which would require monitoring over a very large area, and because they can move through or be attracted by human-dominated areas as well. While these approaches are feasible in theory, the overarching concern, emphasized by experts we consulted who work in the area, is the viability of conducting such monitoring in practice given the substantial security concerns in the areas where monitoring would need to take place. This is particularly so not just in the context of potentially encountering armed groups in more remote areas, but also because the installation of cameras and use of GPS in these areas can be seen as particularly sensitive and may be misconstrued as being associated with military operations.

Pros: Camera trapping has been demonstrated to outperform direct observation methods in the detection of medium and large terrestrial animal species, and further produces more rich, less biased, and more verifiable results by relying on automated technology and photographs rather than human observation. Especially if artificial intelligence such as Wildlife Insights is used for analysis, there are low

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[47] For example, cataloguing tree diversity in quadrats might require dozens or hundreds of 250-1,000m2 plots each monitored by botanists with specialized identification skills who can take cuttings, dry and press them, and identify them in an herbarium and museum.

[48] Tobler et. Al (2018) found that 1,5000 trap nights (i.e. 50 camera trap stations for 30 trap-nights each) was sufficient to detect upwards of 80% of all known medium and large terrestrial mammals in a 50km^2 site in the Peruvian Amazon. Sampling intensity (i.e. number of trap nights) was demonstrated to be the prime determinant of survey success, more so than camera spacing and grid size. Tobler, M. W., et al. "An Evaluation of Camera Traps for Inventorying Large- and Medium-Sized Terrestrial Rainforest Mammals." *Animal Conservation*, vol. 11, no. 3, 2008, pp. 169–178., https://doi.org/10.1111/j.1469-1795.2008.00169.x.

[49] Wearn, Oliver & Glover-Kapfer, Paul. (2017). Camera-trapping for conservation: a guide to best-practices. 10.13140/RG.2.2.23409.17767.

[50] Tobler et. al (2018)

human resource needs for camera trapping relative to direct observation.[51] Camera traps are significantly less invasive than direct observation methods.[52] Some sentinel species that are amenable to camera trap monitoring are available, such as tapirs, and may serve as general proxies for habitat condition more broadly.

Cons: Initial equipment costs are very high (mid-range cameras cost $300-$500 each, higher quality cameras cost more). Difficult to detect small, ectothermic, or aquatic species. Data cataloguing and storage can be laborious and expensive. Cameras can malfunction, break, or be stolen. Applications for characterizing species abundance are highly controversial and often not recommended. Substantial security threats may pose a risk to personnel, and special permits will be required for biodiversity measurement within CNP.

OPTION 3: ENVIRONMENTAL DNA (EDNA)

Rather than physically identifying and counting species, eDNA methods sample soil, sediment, water, or other material in the area of interest and passively identify genetic material (e.g. hair, feces, urine, etc.) from species present in the ecosystem. This genetic material is referenced against DNA sequence databases to identify species present in the ecosystem. eDNA methods have the potential to extend beyond presence/absence detection of species to measures of relative species biomass and taxonomic richness of an ecosystem. For example, eDNA studies in Brazil and Panama sampled owl pellets or blood-feeding arthropods to characterize the diversity of organisms which the owls or arthropods recently predated, providing superior detection of small organisms than would have been achieved through camera trapping.[53]

eDNA studies generally progress in four stages: sampling, DNA extraction, molecular processing, and sequencing of DNA. Each of these stages has a multitude of opportunities for error or bias to be introduced to final detection of species and estimation of biodiversity if careful controls are not designed and enforced. Genetic material deteriorates faster in neotropical settings, and thus requires rapid transportation of samples to laboratories, materials for preservation during transit, and/or methods for field-based DNA extraction. Even when these methods are present and risk is mitigated at the sampling phase, there are many opportunities for introducing error and bias in analysis during the subsequent stages.[54] In any case, access to a laboratory where samples can be processed and highly trained researchers are required to design and execute this methodology. This presents a particular limitation on viability in the CNP context, as experts we consulted highlighted that there are no laboratories in the area to process the samples, with the closest potential option being at least a 10 hour trip. As a result, the samples would need to be transported and protected from degradation over long distances, which experts considered to be a significant challenge, together with other challenges related to use of this approach that have been encountered in the Amazonian context (for example, lack of reference sequences). To date, eDNA methods in modern terrestrial environments have mostly been used to calculate taxonomic diversity for plants and fungi – for animal DNA, the methods have mostly been used

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[51] Ahumada JA, Fegraus E, Birch T, Flores N, Kays R, O'Brien TG, Palmer J, Schuttler S, Zhao JY, Jetz W, Kinnaird M, Kulkarni S, Lyet A, Thau D, Duong M, Oliver R, and Dancer A (2020) Wildlife Insights: A Platform to Maximize the Potential of Camera Trap and Other Passive Sensor Wildlife Data for the Planet. *Environmental Conservation* 47: 1–6. doi: 10.1017/S0376892919000298

[52] Wearn, Oliver & Glover-Kapfer, Paul. (2017)

[53] Lucie Zinger et. al, Chapter Nine – "Advances and prospects of environmental DNA in neotropical rainforests,"
Editor(s): Alex J. Dumbrell, Edgar C. Turner, Tom M. Fayle, *Advances in Ecological Research*, Academic Press, Volume 62, 2020, Pages 331-373, ISSN 0065-2504, ISBN 9780128211342, https://doi.org/10.1016/bs.aecr.2020.01.001.

[54] Ibid

for presence/absence detection of specific species with traits of interest to the study (e.g. rare, invasive, keystone, etc.).[55]

Pros: Demonstrated superior performance in the detection of species for which DNA sequencing is available relative to visual observation. Does not rely on taxonomic expertise of observers. Non-invasive for wildlife. Top-performing method if looking to detect presence/absence of rare keystone/indicator species for which DNA sequencing exists, especially if these species are small, ectothermic, or aquatic.

Cons: Only a handful of eDNA studies have been attempted in the Amazon Rainforest region to date, and these have reported challenges with ecology of eDNA in the tropical climate and finding appropriate reference sequences for species identification.[56] Unavailability of a locally based laboratory with qualified personnel over the timeframe of the study. Use of the method to calculate overall taxonomic diversity of terrestrial animal life is not widely established. Though the method is potentially promising in future as the technology, science and availability of reference sequences expand , experts we consulted consider it to be infeasible for the purposes of this evaluation, given the current state of the science and logistical limitations around sampling and processing samples.

OPTION 4: MODELING/PROXY INDICATORS

As an alternative to direct measurement, and under the assumption that reduced deforestation is the main channel through which LfP might affect changes in species biodiversity, an evaluation could design a model using deforestation and other contextual inputs to calculate expected changes in biodiversity based on measured changes in forest loss, land use patterns, and habitat connectivity. For example, this is the approach taken by Heilmayr et al. (2020), who model the biodiversity impacts of the expansion of forest plantations in Chile.

Alternatively or additionally, it could use secondary proxy measurements of species diversity that are based on forest loss. GFW maintains and reports to annually update two such measures at a $1km^2$ resolution: global biodiversity intactness and global biodiversity significance. The first measure leverages Hudson et. al.'s PREDICTS database to model the impacts of land use change and human population density on biodiversity in forested areas.[57] The second measure calculates the relative importance of each pixel in terms of its aggregate contribution to the distribution of forest-dependent species of mammals, birds, amphibians, and conifers by overlaying IUCN species range maps with maps of forest loss.[58]

Pros: Minimum cost solution with no administrative burden for access to CNP for direct measurement. No security risk to study personnel.

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[55] Philip Francis Thomsen, Eske Willerslev, "Environmental DNA – An emerging tool in conservation for monitoring past and present biodiversity," *Biological Conservation*, Volume 183, 2015, https://doi.org/10.1016/j.biocon.2014.11.019.[56]Sales, Naiara Guimarães, et al. "Assessing the Potential of Environmental DNA Metabarcoding for Monitoring Neotropical Mammals: A Case Study in the Amazon and Atlantic Forest, Brazil." Mammal Review, vol. 50, no. 3, 2020, pp. 221–225., https://doi.org/10.1111/mam.12183.

[56]Sales, Naiara Guimarães, et al. "Assessing the Potential of Environmental DNA Metabarcoding for Monitoring Neotropical Mammals: A Case Study in the Amazon and Atlantic Forest, Brazil." Mammal Review, vol. 50, no. 3, 2020, pp. 221–225., https://doi.org/10.1111/mam.12183.

[57] Hudson, Lawrence N., et al. "The Database of the Predicts (Projecting Responses of Ecological Diversity in Changing Terrestrial Systems) Project." *Ecology and Evolution*, vol. 7, no. 1, 2016, pp. 145–188., https://doi.org/10.1002/ece3.2579.

[58] https://www.globalforestwatch.org/map

Cons: Not a direct measurement of biodiversity and inherits any biases in biodiversity measurement inherent to the model/proxy measures. The two cited indicators, although reported to be updated annually, so far only published one round of analysis from 2019.

SPECIES DIVERSITY MEASUREMENT DISCUSSION

The ultimate decision in terms of which of the above strategies to use for species diversity measurement in an evaluation of the LfP activities in SMVC depends on USAID's learning priorities and the budget USAID is willing to allocate to biodiversity indicators. eDNA methods, though potentially promising and innovative, are currently too prone to error in the local context to merit discussion and are likely prohibitively expensive in any case. Our illustrative cost work, presented in section VI below, suggest that for an investment similar to that typically reserved for large scale household survey data collection in a USAID evaluation, camera trap methods leveraging artificial intelligence could potentially yield reliable estimates of medium and large mammal species richness in the study areas (but not other taxa that may be of interest), although there are also substantial security concerns to conducting this work in the CNP area that limit the practical feasibility of this approach in this LfP evaluation context, as highlighted above. Additionally, if there are particular medium and large mammal species whose persistence or expansion into new areas would serve as an indicator of conserved/expanded biodiversity in the study areas, camera trapping could focus on detecting pre/post differences in the presence of such species in specific areas of interest. For species that have individual markings, mark-recapture modelling may also be feasible as a strategy to characterize species abundance.

However, our initial consultations with experts raised substantial limitations around conducting this work in practice in the vicinity of CNP. If those concerns can be overcome, and USAID decides to pursue a field-based approach to biodiversity measurement for this evaluation, it would likely be beneficial to conduct additional due diligence consultation with experts in the local species we highlighted (e.g., tapirs, pecuaries) to determine more particular details of sampling requirements and monitoring effort that would be required for this "indicator species" strategy to be successful.[59] In any case, while the FA team views camera trapping methods as preferable to direct observation methods on technical, security, and respect for wildlife grounds and preferable to eDNA methods based on practical and cost considerations, our overarching recommendation is still to focus on measuring forest cover change and connectivity as a less costly, more reliable and safer proxy to inform on biodiversity conservation trajectories for this evaluation context.

We emphasize this even while understanding that direct measurement of biodiversity in the CNP would advance not only the USAID Biodiversity Policy, but also scientific efforts in general to catalogue the area's biodiversity. However, this would be an expensive measurement strategy that could pose substantial security risks to local researchers and would depend significantly on approvals from the GoC for access to CNP. The FA team's view is that the security risks a field team would incur, together with the costs, are unlikely to be worthwhile for what would amount to a pre/post characterization of species richness and/or presence absence of key indicator species, likely without robust evidence regarding species abundance. In making this recommendation, we are also taking into consideration the long time periods that would be required to see changes, and the fact that species biodiversity is an indirect outcome of LfP's interventions which will mean changes from LfP are more difficult to detect. In contract, modeling and/or proxy

[59] Such consultation would include asking these experts what successful biodiversity conservation would look like after a conservation intervention like LfP's, and then determining the most appropriate sampling strategy.

indicators would provide meaningful information with respect to biodiversity at a fraction of the cost. Either of these approaches could be combined with qualitative or inferential methods, if desired.

GENETIC DIVERSITY MEASUREMENT

Genetic diversity refers to the biological diversity within species which allows species to adapt to changing climate, habitats, and biotic interactions including novel disease.[60] Low genetic diversity increases the risk of species extinction. Although species and genetic diversity could theoretically co-vary (i.e. change in a correlated fashion), studies across a range of ecosystems and temporal and spatial scales have differing findings with respect to whether the two are correlated. In many cases, they find they are not correlated.[61] Given that species diversity and genetic diversity provide separate and critical information regarding the health of an ecosystem, and that one does not necessarily predict the other, it is ideal to characterize an ecosystem according to both concepts. However, genetic diversity measurement is significantly more expensive than species diversity measurement, and as such has historically been under-utilized relative to species diversity as a summary of ecosystem health.

DNA-based measures of genetic diversity require access to laboratory facilities and highly skilled labor, ideally proximal to the site where samples are taken. SMVC, to the FA team's knowledge, does not have such facilities available, and they would be prohibitively expensive to fund for the purposes of an evaluation. Further, changes in genetic diversity for plants and animals often require successive generations of reproduction to manifest.[62] Even if LfP's activities influence genetic diversity, any changes are not likely to be measurable over an evaluation timeframe.

With these complications in mind, the FA team does not recommend including measurement of genetic biodiversity in an evaluation of the LfP activities in SMVC.

VIII. ILLUSTRATIVE COST FOR RECOMMENDED EVALUATION DESIGNS

Table 8 provides illustrative cost estimates to finalize the evaluation design and conduct the baseline data collection, analyses and reporting phase for each of two evaluation design options. Both of the evaluation designs are complex, mixed-methods evaluations which combine PE and IE components targeting all three of the LfP interventions in SMVC: (1) a pre-post, mixed-methods PE of the two formalization pilot communities and the intervention in Puerto Rico municipality, focused on assessing household and community level change over the short and medium term on outcomes of interest and potential causal pathways; and (2) either an interrupted time series or spatial regression discontinuity IE design for the CNP border delineation intervention, to assess changes in deforestation, biodiversity, and related governance outcomes (see Tables 2 and 3 on learning interests and outcomes).

The key difference between options A and B is the approach to obtain measures of biodiversity outcomes. Drawing on recommendations in Table 7, Table 8 provides illustrative cost estimates for an evaluation which utilizes a camera trapping approach to obtain species richness and inventories of medium and large terrestrial species, together with presence/absence and abundance measures for key indicator species (Option A), or relies on modeling approaches and/or proxy measures to estimate biodiversity impacts based on related changes in factors such as forest loss and regrowth, land use patterns and habitat connectivity (Option B). The camera trapping option is more costly due to the higher data collection cost, including purchasing camera traps and related equipment and personnel

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[60] Hoban, Sean, et al. "Genetic Diversity Targets and Indicators in the CBD Post-2020 Global Biodiversity Framework Must Be Improved." *Biological Conservation*, vol. 248, 2020, p. 108654., https://doi.org/10.1016/j.biocon.2020.108654.

[61] Xinzeng Wei, Dachuan Bao, Hongjie Meng, Mingxi Jiang, Pattern and drivers of species-genetic diversity correlation in natural forest tree communities across a biodiversity hotspot, *Journal of Plant Ecology*, Volume 11, Issue 5, October 2018, Pages 761-770, https://doi.org/10.1093/jpe/rtx046

[62] Hoban et. Al.. 2020

costs (which are substantial even if staffed through local collaborators due to the total number of camera-trap nights required to meet minimum recommended standards for reliable measures), and associated consultant and analysis costs. Option B could be accomplished more cost-effectively. We note that as work on this FA evolved, and over the course of discussion with USAID and LfP in the months prior to finalizing the report, there appeared to be general agreement that proxy measures of biodiversity outcomes, such as obtained through option B, were deemed appropriate and sufficient for the LfP intervention context. We still include Option A in Table 8 for the purposes of cost comparison.

These cost estimates are conservative and illustrative only. Several cost-sensitive aspects of evaluation design must be determined with greater certainty during an evaluation design phase, including the cost for the data collection itself via a competitive bidding process for data firms.

TABLE 8: ILLUSTRATIVE COST ESTIMATES

Ballpark Topline Budget Estimate by Design Option – IE Design Scoping, Baseline Data Collection, Baseline Analysis and Reporting	Option A – Biodiversity measures obtained via camera trapping	Option B– Biodiversity measures obtained via modeling and/or proxy indicators
Key Informant Interview	20	20
Focus Group Discussions	12	12
Total number of households surveyed	1,250	1,250
	(25 HHs per community x 10 communities in Puerto Rico, and full census in 2 community pilots estimated at ~500 HHs per community)	
Camera trapping effort	30 cameras x 4 sites x 30 camera-trap nights (3,600 camera-trap nights)	NO
Biodiversity modeling and/or proxy indicators	NO	YES
Estimated Labor, Consultants, Travel, Other Direct Costs, G&A[b]	$ 286,000	$ 205,000
Estimated Data Collection Costs (HH survey; qualitative; camera trapping)[c]	$ 164,000	$ 92,000
Total Estimated Budget	**~ $450,000 - $500,000**	**~ $300,000 – $330,000**

Notes:
[a] HH = Household.
[b] Conservative staffing estimate using CEL labor rates. Budgets include a co-principal investigator, in-country SME, and US-based design and analysis team; 10-day scoping trip during design phase for 1 in-country SME and 1 US team member.
[c] Data collection costs are illustrative only. HH survey costs assume $65 per household (generalized average). Camera trapping costs assume camera cost of $600 / camera.

IX. RECOMMENDATIONS

The FA team makes the following recommendations regarding an evaluation of LfP's activities in the additional geographies of SMVC:

1.) **Proceed with the design of a complex, mixed-methods evaluation combining PE and IE components targeting all three LfP interventions in SMVC.** The feasibility assessment establishes that all of LfP's interventions in SMVC are evaluable to varying degrees. Though in most cases only PE methods will be possible, which cannot attribute changes in outcomes of interest to LfP, comprehensive PE strategies are available that respond to USAID's learning interests. Namely, a pre/post, mixed-methods performance evaluation of activities in the formalization pilot communities and the Puerto Rico municipality can provide credible evidence regarding (i) linkages between tenure security and conservation outcomes and (ii) how cadaster update work is affected by overlapping or multi-use land areas. Through assessing pre/post behavior change and triangulation with qualitative and secondary data, these methods can also illuminate drivers of deforestation and biodiversity loss in the intervention implementation areas. Meanwhile, IE methods leveraging the temporal and/or spatial discontinuity of the CNP border delineation can investigate changes in deforestation that will be attributable, at least in part, to LfP. Qualitative and administrative data will also characterize changes in land management as a whole in SMVC and how these interact with mitigating deforestation. Camera trapping presents intriguing possibilities for assessing pre/post changes in biodiversity in the CNP associated with reduced deforestation, but the security concerns around implementing such an approach in the CNP landscape are sufficiently large to caution against this. Modeling and/or proxy measures of biodiversity may be obtained at a fraction of the cost, while still obtaining reliable evidence on main drivers of biodiversity loss in the LfP intervention context (deforestation and habitat fragmentation),

2.) **An evaluation of LfP's work in SMVC should have two primary components:**

   a. **First, a mixed-methods PE of articulated strategies to improve conservation through tenure security and sustainable livelihoods in the formalization pilot communities and Puerto Rico.** The PE of LfP's interventions in the formalization pilot communities and the Puerto Rico municipality should focus on household- and community-level behavior and related changes in the short- and medium-term associated with reductions in behaviors driving deforestation and biodiversity loss and increased behaviors associated with sustainable improved livelihoods. The purpose of including Puerto Rico in this PE, although it will use methods that are standard to LfP's approach for improving tenure security, is to provide a comparative case for the community formalization pilot theory of change that leverages different land tenure contract instruments and support for governance at a larger, more formal scale. We recommend a comprehensive, mixed-methods performance evaluation approach that descriptively assesses changes in desired outcomes and potential causal pathways to which LfP may be contributing. For the household survey, we recommend using a census in the two pilot communities and a sample of the Puerto Rico municipality. Qualitative data collection should focus on, among others (i) tenure security, local trust and governance changes that may be attributable to LfP, (ii) causal pathways for observed pre/post changes in behaviors of interest, especially related to land use and drivers of deforestation and biodiversity loss. Deforestation outcomes can be monitored descriptively at marginal cost using remote sensing data as part of this PE, but change cannot be attributed to the intervention.

   b. **Second, an IE of the effect of CNP border delineation on deforestation loss, including measurement strategies for biodiversity conservation and changes in governance.** We recommend as ITS and/or SRD for an impact evaluation of CNP border delineation and enforcement on deforestation. We recommend assessing changes in deforestation events in the short- and medium-term and overall forest loss/retention in the long-term. An evaluation team should also use minimal qualitative and administrative data approaches to complement the impact evaluation by assessing implementation fidelity and any changes in governance.

3.) **Build methods into both evaluation components to assess causal mechanisms for detected change and implications for sustainability.** This will be essential given that USAID's learning priorities largely imply causal questions (e.g. "what impacts occurred?", "what are driving factors for outcomes of interest?", etc.) and that both of the evaluation components described above have varying threats to validity in attributing causal change to LfP. One method to accomplish this is building in measurement strategies for intermediate change that will drive outcomes of interest. This is the intent of conducting household surveys and qualitative data collection investigating behavior change in the mixed-methods PE. Another method to accomplish this is to triangulate primary, secondary, administrative, and qualitative data to illuminate perceptions regarding how change occurs and whether it is sustainable.

4.) **Given security concerns in the CNP vicinity and because deforestation and habitat fragmentation are the two main drivers of biodiversity loss in the intervention context, focus on modeling or proxy measures to assess changes in biodiversity outcomes, rather than direct measures obtained through field-based approaches.** The FA team's assessment is that direct measurements of biodiversity, such as camera trapping, have sufficiently high security concerns and are likely to be too costly, given the amount of added information they would provide, and the level of changes that could be expected to be observed from the intervention. The FA team recommends a focus on modeling or proxy measures to assess changes in biodiversity instead. However, if direct measurement of biodiversity is critical to USAID, and if pre/post measures of diversity of medium and large terrestrial species and/or presence/absence of specific medium or large terrestrial indicator species in critical geographies fulfill USAID learning priorities regarding biodiversity, a camera trap survey at baseline and long-term follow-up leveraging artificial intelligence to support data analysis would provide the most feasible way forward. Inferential approaches to constructing a counterfactual for biodiversity may be of interest regardless of whether or not direct measurement is pursued, though additional work is needed to refine species of interest for an inferential approach with direct measurement, assemble an expert panel, and determine which inputs to inform the inferential exercise. Additional consultation with experts during an evaluation design phase and prior to baseline would be essential in this case to agree on which sentinel species to focus on and determine specific details regarding sampling locations that must be physically visited and related details on logistics of data collection effort throughout the evaluation timeline. On the other hand, USAID can wait to decide on a measurement approach for deforestation or statistical modelling of biodiversity, as the required raw data is collected and made available for public use on a regular basis, irrespective of USAID's decision.

5.) **Connect the LfP implementation team with the evaluator regarding any updates in program design.** There is no need for the evaluator to influence program implementation, given that proposed methods do not require leveraging specific aspects of program implementation to design a counterfactual. However, various changes in program design leading up to implementation may affect the optimal evaluation design. These include, for example, specific strategies for promoting sustainable livelihoods (i.e. specific PPPs identified), the nature of intervention to improve land and environmental governance, the nature of training provided to community members, and any other factors that might influence specific expected changes in community behavior or governance. It will also be helpful for an evaluator to have LfP and USAID's support obtaining relevant secondary data and permissions from the GoC as relevant to the final evaluation design. This will include, at minimum, shapefiles with boundaries of areas with restricted land uses (e.g. forest reserve zones, campesino reserve zones, indigenous reserves, national parks, etc.) that overlap with LfP's implementation areas; along with information regarding permitted land uses.

6.) **Omit direct measurements of forest degradation, genetic biodiversity, and climate change mitigation from the evaluation strategy of LfP in SMVC.** Although they may be affected by the program, these outcomes are prohibitively expensive or difficult to measure in a way that is precise and attributable to LfP, and further are not required to advance USAID's more immediate learning priorities regarding deforestation and biodiversity conservation. In other words, the proposed evaluation would detect changes in household behaviors driving forest degradation/deforestation/biodiversity loss (for community formalization pilots/Puerto Rico) or in deforestation itself (for CNP) that can validate the program's theory of change and provide evidence of follow-on effects for forest degradation, genetic diversity, and climate change mitigation without measuring these outcomes directly. To the extent feasible, an evaluation should pursue low-cost options to assess descriptive changes in these outcomes by proxy measures (e.g. land use raster data, habitat connectivity, etc.).

7.) **Omit the effectiveness of anti-corruption interventions on deforestation, biodiversity loss, and maintaining forest landscapes as a learning priority for an evaluation of LfP's activities.** As LfP explicitly asserts direct changes in corruption and environmental crime to be outside the scope of its activities (i.e. within the scope of other programs and/or follow on actions by the GoC), the FA team does not recommend devoting significant resources to assessing changes in corruption, even though USAID expressed it as a learning priority. An evaluation should still use qualitative data collection to assess the contribution of corruption as a contextual factor to outcomes observed, but should not measure it as an outcome of LfP.