Executive Summary - FUNDECOR: Visualizing Reforestation

WPI IQP San Jose, Costa Rica C-Term '24

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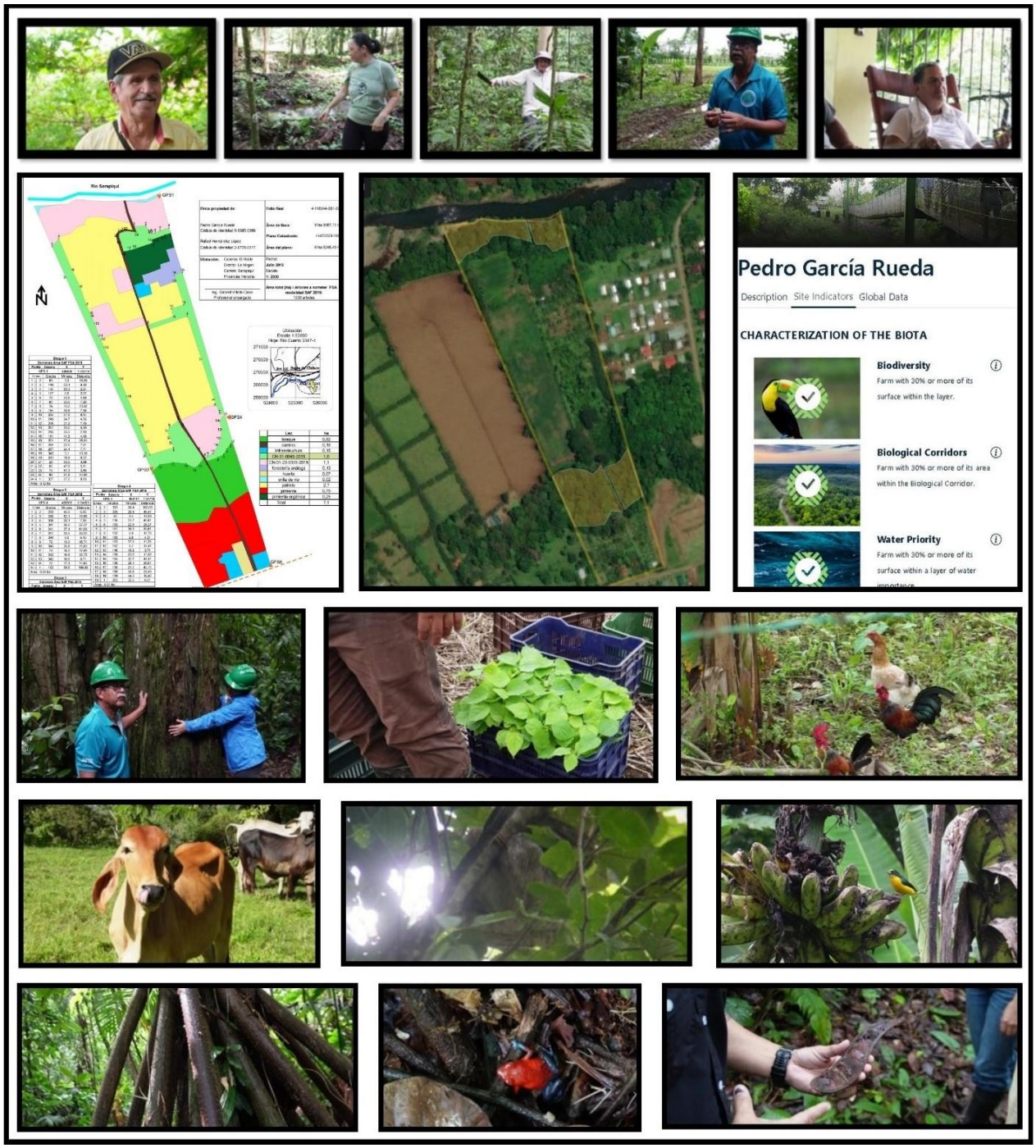
March 1, 2024



Deforestation poses significant threats to Earth's ecosystem, disrupting biodiversity and hindering natural carbon sequestration[1]. Despite its profitability for activities like mining and agriculture, the environmental consequences, such as climate change, are severe. Global reforestation initiatives, though crucial, often neglect the economic aspect for landowners, rendering these efforts less effective[2].

Proper financial resources and training on sustainable farming practices provide the foundation for successfully integrated reforestation initiatives[3]. This is especially important for families living on small farms. While larger scale projects and forestry management initiatives usually benefit from government funding, smaller scale farms are at a disadvantage due to not qualifying for this assistance. Ensuring the sustainability of small farms adds up to big environmental impact, as half of the world's habitable land is used for agriculture[4]. Sustainable farming practices, if broadly implemented, can help prevent issues like soil destruction and further forest deterioration[5].

The Foundation for the Development of the Central Volcanic Mountain Range (FUNDECOR), a Costa Rican non-profit and non-government organization, is on a mission to enhance both natural sustainability and economic development through land management. One of their slogans that defines this goal is “con hambre, no hay conservación,” which translates to “with hunger, there is no conservation,” communicating that without proper economic support to put food on the table, people will be less interested in choosing more sustainable, at times less profitable, farming practices. To address this, initiatives like FUNDECOR's Biodiversity Conservation Mechanism using Blockchain (BIOTA) program focus on both environmental sustainability and economic development. However, the current database lacks representation of small farms, hindering public awareness.

Our project highlights BIOTA's potential impact in Sarapiquí by creating profiles for five small farms. We focused on four objectives:

1. Assessing BIOTA's biodiversity indicators by conducting research with respect to the five farms we studied
2. Learning more about the BIOTA program by consulting with FUNDECOR's executive director
3. Researching the integration of the small farms onto the Geospatial Tools map by analyzing the land use maps of the five farms and by consulting the BIOTA website's administrator
4. Obtaining personal testimonies from the owners of small farms in Sarapiquí by touring the five farms, photographing their properties, and interviewing the landowners

The resulting farm profiles, added to the Geospatial Tools tab on the BIOTA website, illustrate the environmental and economic successes of the farms that FUNDECOR oversees. By highlighting the real-world impact on these properties, our project aims to attract funding, encourage participation, and promote BIOTA to a wider audience.

BIOTA's Biodiversity Indicators

The eight BIOTA indicators—biodiversity, biological corridor, conservation gap, loss of tree coverage, protected wilderness areas, Social Development Index (SDI), water priority, and wetlands—were developed collaboratively by FUNDECOR staff. The indicators, approved by the Costa Rican government, aim to assess environmental sustainability and agricultural practices[6]. The **biodiversity** indicator identifies farms essential for maintaining Costa Rica's biodiversity, following the UNDP methodology implemented by MINAE and PRIAS[7]. **Biological corridors**, established by SINAC, connect protected wild areas, addressing habitat fragmentation caused by industrial activities[8]. The **conservation gap** indicator identifies farms in

crucial conservation areas. The **loss of tree coverage** indicator employs machine learning to predict tree cover loss[6]. **Protected wilderness areas** include Forest Reserves, National Parks, and Wildlife Refuges[6]. The **Social Development Index (SDI)** identifies farms in districts with a very low index, reflecting limited human development[9]. The **water priority** indicator assesses farms in areas crucial for water conservation[10]. The **wetland** indicator assesses farms based on proximity to national wetlands[11]. As shown in the table below, our analysis revealed varying levels of qualification across the eight indicators, providing valuable insights into FUNDECOR's biodiversity initiative. A 1 indicates the farm receives that indicator while a 0 means they do not qualify.

The 8 Biodiversity Indicators for the 5 Farms

Farm	Protected Wilderness Areas	Biological Corridor	Water Priority	Wetlands	Low SDI	Biodiversity	Prediction of Tree Loss	Conservation Gaps
Elicinio Flores Porras	0	0	1	0	0	0	1	0
Isaías Arguedas Arce	1	0	1	0	0	1	0	0
Juan José Umaña Molina (Ingrid Mabel Quirós Vargas)	0	1	1	0	0	0	0	0
Pedro García Rueda	0	1	1	0	0	1	0	0
Proyectos Oasis Reforestación S.A.	0	0	1	0	0	0	0	0

The BIOTA Program

Changing lifestyles and eco-friendly practices demand alternative funding methods for land preservation. The BIOTA program addresses this gap, valuing public goods provided by forests. RAMSAR assessed forest land, assigning a value 25 times higher than the Payment for Environmental Services (PES) amount[12]. BIOTA aims to provide landowners with fairer compensation through a biodiversity credit system. Piedra emphasized BIOTA's unique funding approach, targeting large corporations through blockchain-based biodiversity credits. These smart contracts, purchased online, represent land in hectares, providing companies with certificates and detailed land information. The program aligns with corporate incentives such as philanthropy, ESG investing, and carbon offsetting. The growing trend of ESG investments globally supports the program's potential success[13]. Though currently in the proof-of-concept phase, ongoing marketing efforts aim to attract investors by creating personalized farm profiles. BIOTA's win-win model benefits investors, recipients, and the environment, offering a more sustainable alternative to the PES system's insufficient 65 USD per hectare annual funding for landowners.

Analysis of Land Use Maps

Analyzing sustainable land use, each property showcases unique commitments to environmental preservation. Porras's 9.6-hectare farm prioritizes forest conservation and is surrounded by rivers, addressing the tree cover loss indicator and water priority indicator. Vargas's 10.5-hectare farm blends forest conservation with agriculture, fostering biodiversity, and earning the biological corridor and water priority indicators. Reuland's Finca Oasis, an 11-hectare property, emphasizes rainforest regeneration over 20+ years, supporting over 350 native species, and qualifies for the water priority indicator. Rueda's 7.1-hectare farm, like Vargas's, integrates forest preservation with agriculture, earning the biodiversity, biological corridor, and

water priority indicators. Arce's 8.5-hectare property dedicates a significant portion to forest conservation and reforestation, and its steep left side facing the freeway and rivers qualify it for protected wildlife areas, biodiversity, and water priority indicators.

The Landowner's Personal Perspectives

The farms displayed commonalities and distinctions. All integrated conserved forest areas with crops or livestock farming. Common crops include yuca, heart of palm, bananas, potatoes, corn, pineapples, beans, tiquisque, and coconuts. Livestock varied, with some solely for personal use. Forests harbored diverse species, with observations of climate-induced changes. Economic challenges were a recurring theme, addressed partly through PES payments. Clean water, health services, and education were accessible to all landowners. Despite challenges, a shared commitment to environmental protection emerged. Landowners engaged in sustainable practices, supported by FUNDECOR. Economic concerns were evident, and increased income would be directed towards their children's education, infrastructure, or farming improvements. While facing distinct challenges, these landowners collectively represent a diverse group committed to sustainable practices and environmental conservation in Sarapiquí.

Descriptions for each farm, enriched with multimedia content, were integrated into a new section of the BIOTA website. These comprehensive profiles offer detailed insights into sustainable agricultural practices in Sarapiquí, showcasing FUNDECOR's impact. The website mirrors the mockup. Each farm profile includes personal testimonies, highlighting social and economic aspects, with data layers indicating tree cover loss, carbon removal, and bird occurrences.

The 8 indicators in FUNDECOR's BIOTA program assess biodiversity, conservation, tree coverage, and more across 300+ farms. Addressing the gap in PES funding, BIOTA's credit system values vital public goods from Costa Rican forest land, offering a potential income

solution for landowners committed to sustainability. Despite diverse land goals, FUNDECOR and Sarapiquí landowners, united in environmental conservation, are spotlighted on the BIOTA website's Geospatial Tool tab, showcasing their unique relationship and contributions to forest protection.

Based on our findings, we recommend that FUNDECOR:

1. Go beyond these five farms and keep developing in-depth profiles for all the farms tracked by FUNDECOR
2. Expand the storytelling toolkit to include videos and interactive online platforms, such as social media
3. Establish mechanisms for receiving feedback from the farmers, the FUNDECOR team, and the broader community on the BIOTA website where the profiles and testimonies are published
4. Monitor the impact of the farm profiles over time

List of acronyms:

UNDP - United Nations Development Program

MINAE - Ministry of Environment and Energy

PRIAS - Laboratory Programa de Investigaciones Aerotransportadas y Sensores Remotos

SINAC - National System of Conservation Areas

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