National Strategy for the Bioeconomy of Costa Rica

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A project submitted

in partial fulfillment of the requirements

for the degree of

Master of Science

(Environment and Sustainability)

in the University of Michigan

April 2022

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Abstract

The client for this capstone project was the United Nations Development Program's Biodiversity Finance Initiative. The team provided technical support to two Costa Rican agricultural companies (one coffee and one pineapple) as they sought to finance and implement various bioeconomy projects. The work involved applying three methodologies– an environmental life cycle analysis (eLCA), social life cycle assessment (SLCA), and associated biodiversity assessments. These methodologies involved conducting summer fieldwork to gather quantitative and qualitative data for analysis to be analyzed later. The results and analysis were different for each methodology. The biodiversity assessments showed generally positive impacts on biodiversity from both companies, but there are still opportunities for further improvement and community engagement. The eLCA showed that both companies are making progress in reducing chemical and inorganic fertilizer use, however better documentation of chemicals and amounts used is required. Moreover, the SLCA showed that both companies were having positive social impacts and striving for gender equality. Lastly, a separate deliverable of a sustainable finance roadmap was created. This document showcases how UNDP Biofin can lead agricultural companies into the sustainable finance market to increase private investment and create positive biodiversity impacts. Overall, the methodologies used provided different levels of data to the companies that will help them understand how to access the private capital market in the future. Consistent data collection on agrochemicals and periodic biodiversity training will help the companies prepare for applying for biodiversity related certifications as well.

Acknowledgements

We would like to acknowledge the farmers we interviewed and the communities we visited for welcoming us. We would especially like to thank a couple of individuals, which include:

- Laura Brenes Peralta and Mariajose Esquivel, researchers at TEC
- Don Jorge Sanchez and the office employees at Nicoverde
- The office employees at Coopetarrazu
- Our translator Eva Vargas Solis
- Our advisor Dr. Jose Alfaro
- The SEAS Masters Project Grant and Rackham Graduate Research Grant
- The Tinker Foundation, the U-M Center for Latin American and Caribbean Studies, and the U-M International Institute, for providing additional funding

Introduction

Context

“In August 2020, the Ministry of Science and Technology of Costa Rica **(**MICITT) led a cross-ministerial team that developed the National Strategy Biodiversity (NSB) framework, which seeks to capitalize on Costa Rica’s rich sustainability leadership from an innovation and entrepreneurship perspective. The framework is designed to reorient the Costa Rican economy on sustainable, resilient, decarbonized, and competitive knowledge and entrepreneurship by promoting five strategic objectives: 1) Using the bioeconomy for rural development; 2) Biodiversity and development; 3) Biomass residue refineries; 4) Advanced biotechnology; and 5) Green cities and urban bioeconomy. Last year the country declared its intent to decarbonize by 2050 and its electrical grid is more than 95% renewables. The United Nations Development Programme (UNDP) is implementing the Biodiversity Finance Initiative (BIOFIN), a global project that aims to help governments develop a strong case for increased investment and improve efficiency in investment conservation, sustainable use and equitable distribution of the benefits of ecosystems and biodiversity, with an approach aimed at determining and meeting the financing needs of the NSB and its global goals, and once the mobilization plan has been designed of financial resources, manage concrete solutions for the projects indicated as priorities by the government authorities associated with the initiative. In Costa Rica, BIOFIN works in conjunction with MICITT to support the NSB as part of a prioritized financial solution: the bio business platform.

UNDP BIOFIN and NSB partnered with the University of Michigan School for Environment and Sustainability (SEAS) to create a team of interdisciplinary students and their academic advisor for implementation and analysis for two agricultural companies, Coopetarrazu (coffee) and Nicoverde (pineapple), to provide environmental technical support of their bioeconomy projects. The goal of the project with SEAS is to provide technical support through environmental, biological, and social assessments. The partnership officially began in winter 2022, when the University of Michigan team met virtually with UNDP-BIOFIN to clarify the project scope. BIOFIN also facilitated initial meetings with both Coopetarrazu and Nicoverde to understand each client's history and needs and to set a schedule for fieldwork.

Field Work Description:

The University of Michigan team conducted field work from May 2021- July 2021 in Costa Rica with the assistance of Coopetarrazu and Nicoverde. Funds were provided from SEAS and UNDP BIOFIN to allow for extended travel.

The University of Michigan team traveled to San Marcos, Costa Rica from May 2021- June 2021 and conducted site visits and interviews with Coopetarrazu employees and farmers. The team was able to have access to a drone and flew the drone taking pictures and videos over farms for the duration of their visit due to the steep terrain of coffee plantations. The team drove to 10 farms where they were greeted by the land owner and main farmer of the coffee farm and were given guided site walks. Data was collected by hand and written down. The University of Michigan team was also accompanied by a translator who was an agricultural student from the Costan Rican Institute of Technology (Tecnológico de Costa Rica). Photos of the farm were taken by the team and uploaded to a drive with the handwritten notes.

From June 2021- July 2021, the University of Michigan team lived in La Fortuna, Costa Rica and commuted to Pital, Costa Rica to conduct field work with Nicoverde. The team was able to have access to a drone and flew the drone taking pictures and videos over the pineapple farms for the duration of their visit due to the size of the pineapple plantations. The team drove to 10 farms where they were greeted by the land owner and main farmer of the pineapple farm and were given guided site walks. Data was collected by hand and written down. The University of Michigan team also conducted interviews with Nicoverde employees and were accompanied by a cooperative representative or Nicoverde employee at

every farm. One team member, Veronica Correa, was the main Spanish speaker of the group and a heritage Spanish speaker.

Included in the report are two of the five outputs provided to the UNDP in their entirety. These outputs consist of data analysis and recommendations from the research conducted.

- A sustainable finance roadmap that details how to measure impact in biodiversity and recommended strategies for entering the sustainability finance market.
- An external-facing case study on each company and their sustainability, biodiversity and technological impact, and a summary of developed activities and final recommendations.

Abbreviations List

ADI: Association of Integral Development (a regional economic development board)

BAP: Biodiversity Action Plan

BCA: Biodiversity Check Assessment

BIOFIN: Biodiversity Finance Initiative

BPT: Biodiversity Performance Tool

CATIE: Centro Agronómico Tropical de Investigación y Enseñanza (Tropical Agricultural Research and Higher Education Center)

CBI: Climate Bond Initiative

eLCA: Environmental Life Cycle Assessment

ENB: National Biodiversity Strategy

ESG: Environmental Social Governance

FS: Financial Solution

GAP: Good Agricultural Practices

GBP: Green Bond Principles

GBS: Global Biodiversity Score

GiZ: German Society for International Cooperation

GLP: Green Loan Principles

GRI: Global Reporting Initiative

ICMA: International Capital Market Association

IFC: International Finance Corporation

KPI: Key Performance Indicator

LSTA: Loan Syndications and Trading Association

MICITT: Ministry of Science, Innovation, Technology and Telecommunications

MIDEPLAN: Ministry of National Planning and Economic Policy

MINAE: Ministry of Environment and Energy

NSB: National Strategy for the Bioeconomy

PBD: Product Biodiversity Footprint

SBP: Social Bond Principles

SLBP: Sustainability-Linked Bond Principles

SLCA: Social Life Cycle Assessment

SPT: Sustainability Performance Target

TA: Technical assistance

UNDP: United Nations Development Program

USDA: United States Department of Agriculture

WHO: World Health Organization

Sustainable Finance Roadmap for the United Nations Development Programme's Biodiversity Finance Initiative and the Costa Rican National Bioeconomy Strategy

Executive Summary

The Biodiversity Finance Initiative (BIOFIN) is a global project implemented by the United Nations Development Program (UNDP) that aims to help governments develop a strong case for increased and more efficient biodiversity investment to achieve National Biodiversity Strategy (ENB) and its global goals, and understand financial needs to later implement a financial resource mobilization plan, which in Costa Rica is comprised of six financial solutions (FSs) and an inter-institutional Program that integrates gender inclusion as a driving condition to include women and nature in a blue and green economic recovery.

The BIOFIN project in Costa Rica is led by a Steering Committee formed by the Ministry of Finance, the Ministry of Environment and Energy (MINAE), and the Ministry of National Planning and Economic Policy (MIDEPLAN), and UNDP. The financial sector and the private productive sector have also been involved in the development of the project.

The BIOFIN project has been implemented in two stages. The first consisted of applying a methodology to quantify the biodiversity deficit, understood as the existing gap between the resources that the country currently invests in the management of its biodiversity and the resources required to be able to successfully implement the ENB. The second stage of the initiative consists of implementing a resource mobilization plan to reduce this deficit through innovative FSs.

Among the FSs to be implemented, is the Bio-Business Funding Platform, which develops a project portfolio with emphasis on bioeconomy for the mobilization of impact investment funds and financing through preferential green credits, seed, and risk capital. This FS aims to promote enterprises and startups that apply sustainable use of biodiversity or whose business model seeks to mitigate, reduce, or eliminate the negative impacts of human activities on ecosystems. Special interest will be given to support development of a national bioeconomy pipeline and identify specific

financing resources for demonstrative startups and bio enterprise projects.

The objective of the consultancy is to develop a roadmap for biodiversity-linked impact measurement in bioeconomy projects, through two case studies of agricultural Costa Rican companies that are part of the National Strategy for Bioeconomy portfolio, developed by the Ministry of Science, Innovation, Technology and Telecommunications (MICITT) with the support of BIOFIN and the Inter-American Development Bank.

This sustainable finance roadmap will focus on conservation and biodiversity efforts related to agriculture. This roadmap will serve as a way for agricultural companies to navigate the sustainable finance landscape to increase biodiversity. It seeks to understand how to leverage the private sector investments in agriculture companies to meet the biodiversity goals set out by the Costa Rican National Bioeconomy Strategy. Two case studies were conducted through this Sustainable Finance Roadmap. Due to privacy and project constraints, there is no financial analysis conducted for the case studies. However, there are broad overarching recommendations for steps to follow in entering the Sustainable Finance Space.

Sustainable Finance Options

Sustainable finance is the process of taking environmental, social, and governance (ESG) considerations and requirements when making investment decisions. This leads to long-term investments in economically sustainable activities and projects which creates positive ESG impacts [1].This roadmap looks at debt financial mechanisms, specifically bonds and loans. Sustainable debt markets have been increasing in recent years with the first sustainable finance events occurring in 2012[2]. And just in the year of 2021, the issuance of sustainable debt across the world hit $825 billion.[3]

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[1] “Green Bond Principles”. Accessed on March 7, 2022. https://www.icmagroup.org/assets/documents/Sustainable-finance/2021-updates/Green-Bond-Principles-June-2021-140621.pdf

[2] CICERO Shades of Green. “Best Practices 2020.” Accessed March 7, 2022. https://static1.squarespace.com/static/5bc5b31a7788975c96763ea7/t/5f562a0858ec0849a0ea8a29/1599482405278/CICERO_Green_Best_Practices_2020.pdf.

[3] The Niche, Not-so-Niche Sustainable Debt Market | Bloomberg Professional Services.” Accessed March 7, 2022. https://www.bloomberg.com/professional/blog/the-niche-not-so-niche-sustainable-debt-market/#:~:text=In%20the%20first%20half%20of,issued%20through%20all%20of%202020.

A loan is defined as the lending of financial capital by at least one individual or organization, from banking or large financial institutions. The recipient incurs a debt and is usually liable to pay interest on that debt until it is repaid as well as to repay the principal amount borrowed. This principal and interest are likely given a timeline for repayment that is agreed upon by the borrower and lender.

A bond is a fixed income instrument or a debt instrument that is normally owned by governments or companies and can be sold and traded on bond markets to financial/public institutions. Bonds are essentially a way for organizations to raise money by selling an 'IOU' with annual interest payments. The key difference between bonds and loans is that bonds are tradeable; issuing bonds gives corporate entities more freedom to operate free from the restrictions that often accompany loans.

Sustainable debt, the market of bonds and loans where capital is raised with environmental and social purpose in mind, has reached a market size of almost $3 trillion of issuance as of June 2021.[4] This roadmap discusses sustainable bonds and loans together as their requirements are similar when aligning with sustainable/green principles and it further elaborates on green bonds/loans and social bonds/loans.

Below is a list of institutions that set guidance regarding sustainable finance:

ICMA- The International Capital Market Association (ICMA) has created the Sustainable Finance Principles which is committed to promoting resilient well-functioning international and globally coherent cross-border debt securities markets, which are essential to fund sustainable economic growth and development. They are a leader in international green finance and the most known and used around the world. ICMA is also committed to building trust in the financial market by encouraging internationally accepted standards of best practice, contributing to the development of sustainable finance through the capital markets, encouraging information flows and dialogue in the international capital markets: borrowers,

[4]"The Niche, Not-so-Niche Sustainable Debt Market | Bloomberg Professional Services." Accessed March 7, 2022. https://www.bloomberg.com/professional/blog/the-niche-not-so-niche-sustainable-debt-market/#:~:text=In%20the%20first%20half%20of,issued%20through%20all%20of%202020.

intermediaries, and investors, and engaging with international and national regulators and policy makers.[5]

London Stock Exchange - The London Stock Exchange has established a sustainable finance market and was the world's first major exchange to establish a dedicated Green Economy. The Green Economy launched in 2019, helps investors identify companies that make most of their revenues in green sectors. Its Sustainable Bond Market has helped issuers raise more than $140 billion in debt capital and it is now planning an innovative initiative to direct funding to the voluntary carbon markets.[6]

S&P Dow Jones - S&P Dow Jones is the world leading index provider. The Dow Jones has the Sustainability World Index, a market capitalization weighted indices that measures the performance of companies selected using ESG criteria. S&P Dow Jones is the largest global resource for essential index-based concepts, data and research, and home to iconic financial market indicators.[7]

World Bank Green Bond Program and International Finance Corporation - Through the International Finance Corporation (IFC), the World Bank's institution focused on the private sector, the World Bank has played a key role in launching the world's green bond market and has moved from being an issuer of green bonds to an investor. In 2008, the World Bank began distributing green bonds to developing countries. IFC's overall funding program amounts to $14 US billion a year and finances loan investments in projects and companies in emerging markets which must adhere to stringent ESG standards and the World Bank Sustainability Framework. The IFC issues green and sustainable development bonds to projects in developing countries.[8]

Table 1 (see below) shows the relative sizes of the different debt issuances as of 2021. Activity-based instruments bring together any projects or activities that have social and/or environmental benefits. Funding from this debt style can be used to finance projects or refinance old ones. In contrast, the behavior-based products tie the interest rate or

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[5] ICMA, 20222. Mission. https://www.icmagroup.org/About-ICMA/mission/. Accessed Feb 17, 2022.
[6] "Sustainable Bond Market | Sustainable Finance | LSEG." Accessed March 7, 2022. https://www2.lseg.com/sustainablefinance/sustainablebondmarket.
[7] "Dow Jones Sustainability World Index | S&P Dow Jones Indices." Accessed March 7, 2022. https://www.spglobal.com/spdji/en/indices/esg/dow-jones-sustainability-world-index/#overview.
[8] World Bank. "Green Bonds." Accessed March 7, 2022. https://treasury.worldbank.org/en/about/unit/treasury/ibrd/ibrd-green-bonds.

coupon rate to a sustainability target and the activities performed with the money itself are not what give a behavior-based debt its 'sustainable or green' label.[9]

Table 1: Sustainable Finance Debt Issuances[10]

Debt Type	Debt Style	Purpose	Market Size as of 2021	Proportion of Sustainable Debt
Green Bond	Activity-Based	Environmental Projects	$1,485 bn	45.7%
Green Loan	Activity-Based	Environmental Projects	$550 bn	17.3%
Sustainability Linked Loan	Behavior-Based	Institutional ESG targets	$532 bn	16.7%
Social Bond	Activity-Based	Social Projects	$343 bn	10.8%
Sustainability Bond	Activity-Based	Environmental & social projects	$246 bn	7.7%
Sustainability Linked Bond	Behavior-Based	Institutional ESG targets	$60 bn	1.9%

This financial roadmap looked specifically at the ICMA Sustainable Finance Principles. The Green Bond Principles (GBP), the Social Bond Principles (SBP), the Sustainability Bond Guidelines, and the Sustainability-Linked Bond Principles (SLBP) have become the leading framework globally for the issuance of sustainable bonds. Loan principles

[9] The Niche, Not-so-Niche Sustainable Debt Market | Bloomberg Professional Services." Accessed March 7, 2022. https://www.bloomberg.com/professional/blog/the-niche-not-so-niche-sustainable-debt-market/#:~:text=In%20the%20first%20half%20of,issued%20through%20all%20of%202020.

[10] The Niche, Not-so-Niche Sustainable Debt Market | Bloomberg Professional Services." Accessed March 7, 2022. https://www.bloomberg.com/professional/blog/the-niche-not-so-niche-sustainable-debt-market/#:~:text=In%20the%20first%20half%20of,issued%20through%20all%20of%202020.

were taken from the Loan Syndications and Trading Association (LSTA) which is a financial services trade group which exists to enhance the development and running of the syndicated loan market. The Green Loan Principles were developed by an 'experienced working party, consisting of representatives from leading financial institutes'[11] globally, and they build upon and refer to the Green Bond Principles by ICMA. For the roadmap, the bond and loan sustainable finance principles were combined as they have similar key criteria. All information is taken from the principles managed by LSTA and ICMA.

Green Loan/Bond

Green lending refers to a lending dependent on environmental criteria for the planned use of funds which provide clear environmental benefit. It is part of wider sustainable investing and aims to reduce the environmental impact of new lending activities.

The fundamental determinant of a green loan/bond is the utilization of the loan/bond proceeds for green projects; below see Table 2 for green project categorization. All designated Green Projects should provide clear environmental benefits, which will be assessed, and where feasible, quantified, measured, and reported by the borrower. Green loans/bonds enable capital-raising and investment for new and existing projects with environmental benefits. The Green Bond Principles (GBP) seek to support issuers in financing environmentally sound and sustainable projects that foster a net-zero emissions economy and protect the environment.[12]

The Green Loan Principles (GLP) also recommends an external review process. However, self-certification by a borrower or investor with the technical expertise to confirm alignment of the green loan with the key features of the GLP is deemed sufficient. This indicates that third party review is not required for a loan versus a bond.

Table 2: GBP Project Categories[13]

Green Bond Project Categories and Environmental Objectives

[11] LSTA.org, 2022. "Green loan principles". https://www.lsta.org/content/green-loan-principles/. Mar 7, 2022.
[12] Climate Bonds. "Explaining Green bonds." https://www.climatebonds.net/market/explaining-green-bonds. Accessed on March 7, 2022.
[13]ICMA.org, 2021. "Green Project Mapping" https://www.icmagroup.org/assets/documents/Sustainable-finance/2021-

Green Bond Categories	*Climate change mitigation*	*Climate change adaptation*	*Biodiversity*	*Natural resource conservation*	*Pollution prevention and control*
Renewable Energy	Primary				Tertiary
Energy Efficiency	Primary				Tertiary
Pollution prevention and control projects				Tertiary	Primary
Environmentally sustainable management of living natural resources and land use	Tertiary	Secondary	**Primary**	Primary	
Terrestrial and aquatic biodiversity conservation projects		Tertiary	**Primary**	Primary	
Clean transportation	Primary			Tertiary	Primary
Sustainable water and wastewater management		Secondary	**Secondary**	Secondary	Primary
Climate change adaptation projects		Primary			
Eco-efficient and/or circular economy adapted products, production technologies and processes	Secondary		**Tertiary**	Primary	Tertiary
Green buildings	Primary	Tertiary		Primary	Tertiary

updates/Green-Project-Mapping-June-2021-100621.pdff Accessed on Mar 7 2022.

The two project categories directly showing positive primary impact in biodiversity are '*Environmentally sustainable management of living natural resources and land use' and 'Terrestrial and aquatic biodiversity conservation projects*.' To ensure that green bonds have an impact on biodiversity, there must be projects focused in these categories. As will be explained later, an environmental life cycle analysis is a good method to compare projects or measure environmental management, land use, and terrestrial and aquatic impacts. Secondary and tertiary impacts display that there are accompanying positive impacts to these project categories. However, they are not direct or primary.

Social Loan/Bond

Social loans/bonds are any type of loan/bond instrument made available exclusively to finance or refinance, in whole or in part, new and/or existing eligible Social Projects. They are solely focused on social projects. The social loan market aims to facilitate and support economic activity, which mitigates social issues and challenges, and/or achieves positive social outcomes. The Social Bond Principles (SBP) intend to support integrity in the bond market through transparency, disclosure, and reporting. SBP are collaborative and consultative and are based on the work of the members and observers of the GBP. These principles are updated as needed and reflect the current social bond market.

Sustainability Loan/Bond

Sustainability bonds and loans can finance both green and social projects. Examples of specific projects that could be financed through sustainability bonds or loans include affordable housing and renewable energy. The proposed project may relate to widely used definitions of sustainability, such as the UN's Sustainable Development Goals (SDGs) or the Paris Agreement. Since there is regular overlap between green and social projects, issuers should ensure they have their own clear guidelines for green, social, and sustainability bonds/loans based on their own projects.

Sustainability Linked Loan/Bond

Sustainability linked loans and bonds aim to facilitate and support environmentally and socially sustainable economic activity and growth. Like sustainability loans and bonds, sustainability linked bonds can help borrowers finance projects with green and social aims. However, instead of determining specific uses of proceeds, sustainability linked loans look

to improve the borrower's sustainability profile by aligning loan/bond terms to the borrower's performance against the relevant predetermined sustainability performance targets.

The borrower of the loan/ bond sustainability performance is measured using predetermined sustainability performance targets, as measured by predefined KPIs, such as external ratings, and/or metrics for sustainability and/or Environmental, Social, and Governance (ESG). These measure improvements in the borrower of the loan sustainability profile. The issuer will also set Sustainability Performance Targets (SPTs) that relate to its overall sustainability strategy and establish a benchmark for the industry. The pricing of the loan is based on the borrower's ESG score or other overall sustainability achievements such as emission reductions or SDG goals. If the borrower achieves its sustainability target within the predefined timeline, it benefits from favorable interest rates on the loan. If it fails, the borrower may pay a higher rate, or the date of maturity may change.

Transition Bonds

Transition bonds are a newer class of sustainable finance bonds. The proceeds of the bonds are used to fund a firm's or organization's transition toward a reduced environmental impact or to reduce their carbon emissions. The proceeds can be used exclusively to finance new and/or existing eligible transition projects. In this roadmap there is no further discussion of transition bonds as presently they are not as relevant for biodiversity objectives.

Sustainable Finance Road to Issuance

Steps and Tasks for Green, Social and/or Sustainable Loans/Bonds

There are three key steps for green, social, and/or sustainable loans/bonds.

Step 1: Establish alignment with the ICMA Principles
The ICMA Bond Principles contains a set of four pillars. Borrowers should consider each pillar and how they will align their efforts (see Table 2). In this step, the borrower should clearly define the projects and the estimated environment/social benefits that the projects will have.

Step 1.1: The first pillar is the use of proceeds. This means that the issuer should consider the project categories that they will use and identify any subcategories they will want to include. While ICMA has a list of project categories available these are not exclusive, and issuers can propose other categories. It is important to remember that this pillar requires issuers to identify categories of projects and not specific projects themselves.

Step 1.2: The second pillar is the Project Selection Process. For this pillar, borrowers should consider and explain the process of how they will select projects within the categories chosen. This is where the use of an eLCA and or biodiversity assessments can be very important. The issuer should consider establishing a committee that will evaluate projects within the categories and use the assessment tools chosen for an appropriate cutoff for the project selection.

- A green loan/bond can showcase a positive impact into biodiversity if they fall along the category lines below:
    - For primary biodiversity impacts projects should include environmentally sustainable management of living natural resources and land use (including environmentally sustainable agriculture; environmentally sustainable animal husbandry; climate smart farm inputs such as biological crop protection or drip-irrigation; environmentally sustainable fishery and aquaculture; environmentally-sustainable forestry, including afforestation or reforestation, and preservation or restoration of natural landscapes), terrestrial and aquatic biodiversity conservation projects (including the protection of coastal, marine and watershed environments) for primary positive biodiversity impact.
    - For secondary positive biodiversity impacts the project should include sustainable water and wastewater management (including sustainable infrastructure for clean and/or drinking water, wastewater treatment, sustainable urban drainage systems and river training and other forms of flood mitigation).
    - For tertiary positive biodiversity impacts the project should include eco-efficient and/or circular economy adapted products, production technologies and processes (such as development and introduction of environmentally sustainable products, with an eco-label or environmental certification, resource-efficient packaging, and distribution).

Step 1.3: Management of the proceeds pillar should establish how the company will ensure that the proceeds from the loan/bond will be used only for the projects established. This should clearly state how the proceeds will be used for the projects and outline the appropriate accounting practices.

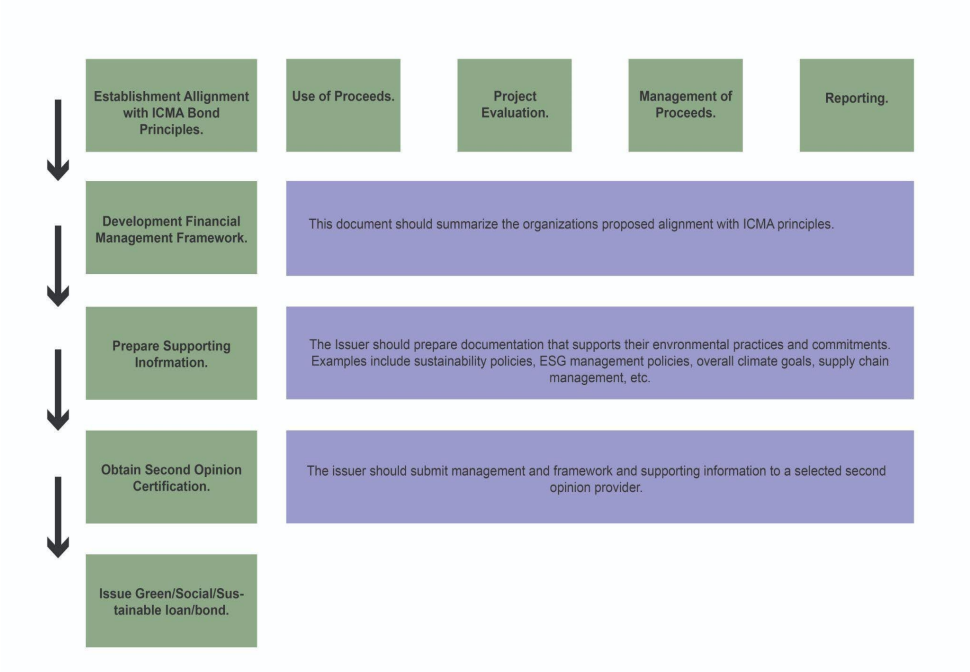
Step 1.4: The borrower should consider how it will report its activities for the loan/bond to the issuer. It should consider aligning with practices such as those recommended by the Task Force on Climate-related Financial Disclosures, etc.

Step 2: The borrower should create a document that provides a clear explanation of each of the processes determined above. This document should include the intended targets of the loan/bond. This will state the impact and metrics that the issuer is tracking whether that's climate, biodiversity, etc. This document should also include showcasing of the organization's ESG practices.

Step 3: Once the loan/bond has been issued the borrower should keep readily available and up-to-date information on the use of proceeds of the loan/bond. The bond should be renewed annually until it reaches its full allocation. This method is called reporting and should give detailed reports to the issuer of the loan/bond and how it is meeting the intended targets.
For a loan, the issuer works with the borrower to design a payment schedule for example the bank loan payments. For a bond, the company, or project, pays an interest coupon at an agreed upon interval that equals the annual interest rate for the bond. At the end of the bond period, the company pays back the principal (initial capital).

These steps are best summarized in Figure 1 below.

Figure 1: ICMA Principles Alignment and Process



Steps and Tasks for a Sustainability Linked Loan/Bonds

The Sustainability-Linked Bond Principles have five core components:
1. Selection of Key Performance Indicators (KPIs)
2. Calibration of Sustainability Performance Targets (SPTs)
3. Loan/Bond characteristics
4. Reporting
5. Verification

Step 1: Identification of KPIs. This should address the relationship of the sustainability targets to a borrower's overall corporate social responsibility strategy. A borrower's sustainability objectives should be clearly communicated to its issuers and should align with its proposed targets. Borrowers should also disclose any third-party sustainability standards or certifications they are looking to adopt for their corporate social responsibility strategy. A KPI is a broad indicator of sustainability. The KPI should be linked with the sustainability goals of the organization. KPIs should be relevant, core and material to the issuer’s overall business, and of high strategic significance to the issuer’s current and/or future operations, measurable or quantifiable on a consistent methodological basis, externally verifiable, and able to be benchmarked as much as possible.

Some examples of KPIs are increasing biodiversity, reducing plastics, reducing deforestation, and reducing greenhouse gas emissions. For a KPI to be earmarked for biodiversity it must make improvements and contributions in conservation and biodiversity.

Step 2: Establish SPTs. The SPTs are typically formulated through discussions between the borrower and the issuer on a project-by-project basis. Oftentimes, a coordinator or structuring agent is appointed to assist in the discussion process. The SPTs should be:

- ambitious and meaningful to a borrower's business,
- associated to predetermined sustainability benchmarks
- based on recent organizational and performance levels.

The SPTs may be either internal to the organizations (based on the organization’s sustainable responsibility strategy) or external (based on sustainability metrics established by an outside organization).

Step 3: Loan/ Bond Characteristics. This is the economic feature of the loan/bond which is variable and will be triggered by either reaching or missing the predefined targets. The borrower must disclose how the financial and structural characteristics are adjusted depending on if the SPTs are met.

Step 4: Reporting. Information regarding a borrower's sustainability performance must be reported to the issuers, at least on an annual basis or periodically. The borrower is required to demonstrate compliance with the SPTs that includes discussion of the methodology used. Borrowers are often required to publicly report this information, which can be found in a borrower's annual financial reports or in a dedicated sustainability report.

Step 5: Verification. This verification assessment should then be made publicly available. The verification Second Party Opinion is necessary for sustainability-linked loans/bonds.

Second Opinion Process

The second opinion process protects the integrity of the market. It builds capacity and creates a common language for municipalities, investors, scientists, and companies. There is multiple second opinion process options. The independent assessment process for second opinions and company assessments alike is a desk-based review that considers relevant principles and other standards as well as cutting-edge climate

science. Both assessment types follow a very similar science-based methodology.

Second Opinions and Green Bond Reviewers

There are many different companies that offer second opinions and green bond reviewing. Among them, Cicero and Vigeo Eiris are largely considered leaders in green bond investment frameworks. Additionally, Climate Bonds Initiative (CBI) ISS, and Sustainalytics are highly regarded second opinion providers.

Some second opinion providers and green bond reviewers use a screening process to identify green bonds and loans that are eligible. For example, CBI uses a three-step decision tree to classify a green bond as eligible. Their three steps are the following: (1) identify green-themed bonds, (2) screen the projects or assets for alignment with their climate bonds taxonomy, and (3) finally evaluate the allocation of proceeds to aligned projects or assets.[14]

Disclosure of Risk

A business's impact or dependency on nature can indicate nature-related financial risks which may not currently be reflected in financial statements. This is relevant financial information that needs to be translated to a range of stakeholders. Risks include financial loss from negative impacts on nature, through regulation, market access or non-access, and the costs stemming from the loss of species, genetic variation, and/or key ecosystem services on which the organization depends. Examples include local and regional financial losses in the agricultural sector from reduced pollination from insects. In contrast, opportunities include financial implications for a business through increased resilience of business and production process or demand. Opportunities may occur when businesses benefit financially due to changes in market preferences/demands. Businesses should follow a scientific approach to identify the opportunities and risks of nature-related financial disclosures.

The core elements of nature-related risk include governance, strategy, risk management and metrics and targets. Governance includes the business governance of nature-related risks and opportunities. Strategy is the actual and potential impacts of nature-related risks and opportunities on the organization's businesses, strategy, and financial planning. Risk

[14] ClimateBonds.net, 2018. CBI Green Bond Database Methodology. https://www.climatebonds.net/files/files/Climate-Bonds-Initiative_GreenBondMethodology_092018%281%29.pdf Accessed Mar 7, 2022.

management is the processes used by the business to identify, assess, and manage nature-related risks. Lastly, metrics and targets include to manage relevant nature-related risks and opportunities.[15]

Measuring Impact on Biodiversity related to Agriculture

Loss of biodiversity specifically impacts agricultural activities and food production. Land use changes are the main driver of biodiversity loss globally[16]. There are several ways to measure biodiversity specifically related to agriculture. Some methods have been identified such as the Biodiversity Check Assessment (BCA) developed by the German Society for International Cooperation (GiZ), Global Reporting Initiative's (GRI) biodiversity indicators, Product Biodiversity Footprint (PBF), and the EU-LIFE Biodiversity Performance Tool (BPT), among other methods. Additionally, there are several biodiversity-related certifications for agriculture that can be obtained for positive biodiversity impacts.

Biodiversity Check Assessment (BCA)

BCA is a flexible, personalized methodology to help companies see how important biodiversity is to their process. BCA starts with a dialogue on voluntarily implementing programs that integrate biodiversity. It measures the company outputs on three levels: production area, farm, and greater landscape outside of the farm. BCA can bring companies an innovative new business model, open them to international markets, increase value and reputation, save money, minimize risks, reduce pesticides, and increase conservation [17]. The BCA can serve as a biodiversity checkpoint then ultimately helps to secure other biodiversity certifications.

Global Reporting Initiative (GRI)

GRI was founded in 1997 with an “aim to create the first accountability mechanism to ensure companies adhere to responsible environmental conduct principles, which was then broadened to include social, economic and governance issues.” The first version was published in 2000 and

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[15] Task Force on Nature related Financial Disclosure, 2021. Proposed Technical Scope. https://tnfd.global/wp-content/uploads/2021/07/TNFD-%E2%80%93-Technical-Scope-3.pdf Accessed on Mar 7, 2022.

[16] “Moody’s ESG / Insights & Analysis / Integrating Biodiversity into a Risk Assessment Framework.” Accessed March 7, 2022. https://esg.moodys.io/insights-analysis-reports/integrating-biodiversity-into-a-risk-assessment-framework.

[17] Biodiversity Check Programa Biodiversidad and Negocios Biodiversity Check Agricola. (2020, February). German Agency for International Cooperation (GiZ). https://docs.google.com/document/d/1-GhchdckATU0n-bfkylSwOD6XpIYOSAa.

additional chapters and sections have been added since. The GRI biodiversity indicators show the amount of activity that a business is implementing to minimize their biodiversity impacts [18]. GRI specifically has indicators of biodiversity that are related to agriculture. GRI standards methods include management approach disclosures, topic specific disclosures, and significant impacts of activities on biodiversity[19]. Compared to the BCA, the GRI includes more quantitative analysis.

Product Biodiversity Assessment

Additionally, a company could also use the Product Biodiversity Assessment (PBF) when measuring biodiversity impacts on agriculture. The PBF uses life cycle assessment (LCA) and ecology approaches to measure impacts to biodiversity in business decisions. Its objective is to allow comparison of variants of a given product to support eco-design, addressing the five drivers identified in the Millennium Ecosystem Assessment. The methodology combines LCA and current ecology knowledge and points toward biodiversity indicators and representations for sustainable business decisions[20].

Biodiversity Performance Tool

The Biodiversity Performance Tool (BPT) assists agricultural producers to implement biodiversity action plans which contribute to sound biodiversity performance at the farm level. The BPT supports auditors and certifiers of biodiversity standards as well as product, quality, and sourcing managers of food companies to better assess the preservation and improvement of integration of biodiversity at farm level. BPT identifies the weaknesses and strengths of a farm regarding functional biodiversity and will confirm biodiversity improvement [21].

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[18] Addison, Prue F.E., P. J. Stephenson, Joseph W. Bull, Giulia Carbone, Mark Burgman, Michael J. Burgass, Leah R. Gerber, et al. “Bringing Sustainability to Life: A Framework to Guide Biodiversity Indicator Development for Business Performance Management.” *Business Strategy and the Environment* 29, no. 8 (2020): 3303–13. https://doi.org/10.1002/bse.2573.

[19] “GRI 304: Biodiversity.” Accessed March 7, 2022. https://www.globalreporting.org/standards/media/1011/gri-304-biodiversity-2016.pdf.

[20] Asselin, Anne, Suzanne Rabaud, Caroline Catalan, Benjamin Leveque, Jacques L’Haridon, Patricia Martz, and Guillaume Neveux. “Product Biodiversity Footprint – A Novel Approach to Compare the Impact of Products on Biodiversity Combining Life Cycle Assessment and Ecology.” *Journal of Cleaner Production* 248 (March 1, 2020): 119262. https://doi.org/10.1016/j.jclepro.2019.119262.

[21] Caroline Gibert, Marine Gimaret, Frédéric Coulon, Philippe Pointereau, Jordi Domingo, Vanessa Sanchez, Laura Garcia Pierna, Amanda del Rio, Tobias Lludes, Stefan Hörmann, Udo Gattenlöhner , Carlos MC Teixera, Nuno Sarmento, Kerstin Fröhle, Saskia Wolf, Marion Hammerl, Adrien Weitzmann, Martine Bernard Ollié, Heinrich Schneider, Frank Nierula. “Biodiversity

Agriculture Biodiversity Certifications:

Additionally, certifications can serve as a positive biodiversity checkpoint when assessing biodiversity at the farm level. Some certifications that can assist farms and organizations in achieving positive biodiversity impacts are:

- Rainforest Alliance
- Biodiversity Partnership MesoAmerica
- Fairtrade International
- Organic Certified

Aside from biodiversity assessments, agricultural companies can use other methods to measure environmental and social impacts which are important when considering increasing sustainable investment. These methods include environmental and social life cycle assessments.

Environmental Life Cycle Assessment (eLCA)

An Environmental Life Cycle Assessment (eLCA) is an analysis of environmental impacts of a product's life cycle, most used to understand which part of the process has the most overall environmental impact. There is consistent literature showing that quantifying these values helps in understanding effects on biodiversity at a high level since biodiversity is negatively affected by environmental damages.

Social Life Cycle Assessment (SLCA)

An SLCA usually includes six broad impact categories: human rights, working conditions, health and safety, cultural heritage, governance, and socio-economic repercussions. The SLCA framework follows a base of collected inventory data to inventory indicators, impact subcategories, impact categories and ultimately to stakeholder categories. When scoping an SLCA, the definition of relevant stakeholder categories forms the basis for inquiry. In other words, these categories inform the scope of the assessment. Linked to the stakeholder categories, are the impact subcategories that comprise socially significant themes or attributes. The impact subcategories linked to the stakeholder categories comprise socially significant themes or attributes. These subcategories are assessed using impact indicators, of which inventory indicators link directly with the inventory of the product life cycle. Product impacts are measured against subcategories using inventory indicators. Inventory

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Performance Tool: A tool to assess the functional biodiversity potential at the farm level." Accessed March 7, 2022. https://bms.biodiversity-performance.eu/storage/Biodiversity-Performance-Tool-User-Manual-Short-version-BPT1.0-VF-June2019-converti.pdf

indicators are calculated using data collected during the product life cycle inventory stage.

Positive Impacts to Biodiversity

The definition of private investment in biodiversity and ecosystems is: “for-profit investments aiming to result in a measurable positive impact on biodiversity and ecosystems”[22]. Financing for agriculture, livestock and related commodities is a well-known financial asset class. Biodiversity and functioning ecosystems have their own financial markets that allow for streamlining financial capital. Large banking and financial institutions investing, and financing sustainable agriculture have been largely disconnected from biodiversity and ecosystem management in their sustainability metrics. Many agriculture companies and organizations have started investing in collaboration with government agencies to increase investment in biodiversity. These organizations are using green and sustainable financial products, reframing their business models to be more environmentally and sustainability friendly, and are delivering projects in sectors such as agriculture to mitigate or offset negative impacts and increasingly producing positive impacts on biodiversity and ecosystems.

There are many ways in which farmers and organizations can increase biodiversity on agricultural lands. Below is a short list of methods agricultural companies can complete to increase positive impacts on biodiversity.

- Restore terrestrial ecosystems including wetlands.
- Stop the discharge of untreated wastewater and chemicals into the environment.
- Lower the risk to worldwide crop production through the loss of crop pollinators.
- Sustainably increase productivity of severely degraded land.
- Aligning with sustainable standards and certifications.
- Diversifying crop production through methods such as crop rotation and allowing the soil to rest between harvests.
- Banning extractive practices such as hunting, fishing, and deforestation on farm property.
- Increase intercropping and implement conservation buffers.

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[22] BIOFIN. “Moving Mountains - Unlocking Private Capital for Biodiversity and Ecosystems.” Accessed March 7, 2022. https://www.biofin.org/index.php/publications-carousel/moving-mountains-unlocking-private-capital-biodiversity-and-ecosystems.

- Maintaining biological corridors on the farm so that wildlife can easily travel.
- Recording plants and animals that are present on the farm, identifying any species that may be endangered or threatened.

Table 3: Bringing Sustainability to Life[23]

Table 3 was created as part of an academic publication in the journal *Business Strategy and the Environment.* The paper provides a model for businesses to evaluate their contributions to biodiversity and connect their performance to global biodiversity targets. This graphic showcases a circular framework that is intended to help businesses visualize their current biodiversity goals and take action to measure their progress.

Tracking and Managing Biodiversity Progress for Businesses	
Step 1: Define the business decision context	• How often will the assessment be? • What will the spatial scale of the assessment be? • Who will the audience be? • What business decisions will be influenced by a better understanding of biodiversity performance?
Step 2: Set biodiversity goals and targets	• Relating to business influence and impacts • Include quantifiable targets to account for business impacts and mitigation (e.g., no net loss or better) • Link to national regulation, lender standards or international biodiversity goals
Step 3: Explore and set management actions	• Consider actions that can mitigate impacts (e.g., implementation of the steps of the mitigation hierarchy)

[23]Addison, Prue F.E., P. J. Stephenson, Joseph W. Bull, Giulia Carbone, Mark Burgman, Michael J. Burgass, Leah R. Gerber, et al. “Bringing Sustainability to Life: A Framework to Guide Biodiversity Indicator Development for Business Performance Management.” *Business Strategy and the Environment* 29, no. 8 (2020): 3303–13. https://doi.org/10.1002/bse.2573.

	• Go above and beyond mitigating a business's own impacts and contributing to international biodiversity goals • Implement management actions that will help achieve goals and targets
Step 4: Develop or select indicators	• Develop indicators that take into consideration an understanding of the natural system being managed • Consider the spatial and temporal scale of evaluation • Indicators can measure biodiversity state, pressures, business actions, or ecosystem services
Step 5: Monitoring, evaluation, and reporting	• Monitoring evaluation should be targeted, cost-effective, and well-designed to generate the information to assess whether biodiversity goals are being achieved • Ensure evaluation and reporting will need to be targeted for the intended audiences
Step 6: Adapt and refine	• As new information is revealed about the system, adapt management and/or monitoring as required

Costa Rican Agricultural Sustainable Debt Market Examples

Coopetarrazu

The UNDP is concurrently implementing BIOFIN, a global project that aims to help governments develop a strong case for increased investment in biodiversity. In Costa Rica, BIOFIN works in conjunction with MICITT to support the NSB as part of a prioritized financial solution: the “bio business platform.”

As a result of this project, the University of Michigan team is conducting an independent assessment of the biodiversity and environmental impacts of the Costa Rican company Coopetarrzu, on their production processes and future project plans. The results will be shared with the BIOFIN regional group in Latin America and the Costa Rican ministerial team. The primary service of the University of Michigan team is providing an independent sustainability assessment of Coopetarrazu’s agricultural processes and additional green projects; the team is specifically using eLCA and SLCA methodologies to help the companies measure their environmental, sustainability, biodiversity, and social impacts. The team is building off previous work done by the Costa Rican Institute of Technology (TEC) to conduct an eLCA (that also incorporates a biodiversity assessment). The eLCA will measure biodiversity impacts through a methodology used by Laura Brenes Peralta and Mariajose Equivel, and methodologies developed by CATIE (2008). The team is conducting a SLCA of the company at large and the coffee agricultural process. This is looking at coffee production operations from office employees point of views, landowners, farmers, year-round employed farm workers and one regional association. Additionally, the University of Michigan team is creating a green projects portfolio summarizing sustainability projects at the cooperative. This information gathered by the

team has been used to inform a case study on the recommendations for Coopetarrazu to engage with sustainable finance mechanisms within their business model below.

Business Model

Coopetarrazu is a cooperative of coffee farmers located in the mountainous Tarrazu region in Costa Rica. They are involved with several projects across the San Carlos de Dota area such as managing and processing coffee bean plants, supermarkets, gas stations, and agricultural feed and supply stores. As of 2018 Coopetarrazu has three certifications– Fair Trade, Starbucks CAFE Practices, and Esencial Costa Rica.

As part of their various environmental efforts and certifications, Coopetarrazu is working on a variety of green projects to reduce their overall environmental impacts and diversify their revenue. Overall, these green projects are intended to transition Coopetarrazu into a circular economy model and further technological innovation and efficiency. Due to privacy implications these projects have only been summarized shortly.

Description of Coopetarrazu Bioeconomy Projects

Biodigester

Description: The most substantial project in Coopetarrazu's portfolio is a proposed biodigester that is currently in the design process. The biodigester would ideally supplement the existing composting process and further reduce the necessary emissions for separating the coffee pulp. The residual effluent would then be sold as liquid organic fertilizer to the farms.

Project Category Fit: The biodigester would likely be considered within the "eco-efficient and/or circular economy" or "pollution prevention or control" GBP categories, as it is specifically mitigating waste production and reducing CO2 emissions within a certain step of the production chain.

Data Needed: Although the biodigester has not been implemented yet, Coopetarrazu should provide as much data as possible from the mock-up and design process. This might include any estimates on waste reduction and CO2 mitigation.

Green Coffee Products

Description: Coopetarrazu has transformed coffee by-products into other market items with additional nutritional and/or economic value. These products are sold in local shops. For example, they have produced pills with the unroasted green coffee beans. These contain chlorogenic acids which are meant to improve metabolism. Other products sold include capsules with whole green coffee that are meant to serve as a natural energy-booster and antioxidant. The cáscara, or shell, is also sold and advertised as a superfood.

Project Category Fit: The green coffee products would fit under the “eco-efficient and/or circular economy” GBP category. They aim to make Coopetarrazu’s business model more circular by minimizing the amount of green coffee and pulp that goes to waste.

Data Needed: If possible, Coopetarrazu should gather data from a cradle-to-gate eLCA for each product to be able to present a holistic understanding of their environmental impacts.

Compost Facility

Description: Coopetarrazu aims to improve the infrastructure for their composting process to accommodate higher volumes. They wish to develop space for an additional 2,500 square meters of composting and buy more machinery for filtering the coffee pulp that goes into the compost. In addition, they currently package and distribute organic compost to farmers. In the future, they hope to be able to sell and develop a wider market for their compost.

Project Category Fit: The compost facility would fit under the “eco-efficient and/or circular economy” GBP category since the compost is created from the coffee pulp that is a byproduct of the processing chain.

Data Needed: Although the facility improvements are still in progress, so it may be difficult to conduct a formal assessment, Coopetarrazu can still collect data on the proposed design and predicted economic and environmental benefits.

Recommendations

Based on Coopetarrazu’s history and current business goals, our initial findings recommend that a *sustainability linked bond* would be the most useful instrument to finance their proposed environmental projects. This is

based on Coopetarrazu's clear goal to finance their proposed biodigester, compost and green coffee projects in the upcoming years tied to their overall ESG performance. Their green projects have clear environmental benefits since it aims to reduce emissions from steps of the overall coffee cultivation process.

The proposal could be considered within the "eco-efficient and/or circular economy projects" category, therefore making it eligible for a sustainability linked bond and creating a positive biodiversity impact while also meeting predetermined ESG objectives. Additionally, Coopetarrazu's proposed plan to expand its compost facilities and build a biodigester could be considered a type of pollution prevention and control if the company also wanted to seek a combined bond to finance these services. Given both the high capital cost of the biodigester and a desire to fund additional projects, Coopetarrazu likely would hope to seek a bond with a high value bond. Therefore, a sustainability linked bond would be appropriate for this larger-scale initiative. UNDP-BIOFIN may be able to provide support for Coopetarrazu to best bundle their projects for the financial market.

Nicoverde

The University of Michigan team conducted an independent assessment of the biodiversity and environmental impacts of Nicoverde's production processes and future project plans. The results will be shared with the BIOFIN regional group in Latin America and the Costa Rican ministerial team. The primary service of the University of Michigan team will be providing an independent sustainability assessment of Nicoverde's agricultural processes and additional green projects; the team will use Environmental Life Cycle Assessment (eLCA) and Social Life Cycle Assessment (SLCA) methodologies to help the companies measure their environmental, sustainability, biodiversity, and social impacts. The eLCA process and BCA methodologies are further described in the Assessment Methodologies Factsheets starting on page 7 of the report.

Conducting an eLCA provides information from the impact assessment phase that allows us to quantifiably see what parts of the production process affect the environment most strongly. There is consistent literature showing that quantifying these values helps in understanding effects on biodiversity at a high level since biodiversity is negatively affected by environmental damages. Biodiversity is known to be negatively affected using agrochemicals such as pesticides, herbicides, and fertilizers. The extent to which the local environment is affected changes based on region and type of chemical used, but overall, the addition of any unnatural chemical changes the ecosystem. This information gathered by the team has been used to inform a case study on the recommendations for Nicoverde to engage with sustainable finance mechanisms within their business model below.

Business Model

Nicoverde is a pineapple producer and distributor headquartered in Costa Rica's northern zone. It is a subsidiary of Italian corporation Nico Frutta. Nicoverde has shown dedication to biodiversity and sustainability through its fulfillment of multiple certifications, such as: Rainforest Alliance, Fair Trade, Global Gap, and Biodiversity Partnership MesoAmerica. It also has multiple organic farms in partnership with four local farming cooperatives.

Another way that Nicoverde has aimed to mitigate the biodiversity impacts of pineapple is through creating more efficient and circular economy processes. Nicoverde has an advanced laboratory based in their Nicoverde office that produces bioinsumos and cultivates fungus and bacteria to replace soil chemical inputs. Additionally, it redirects some of the biological waste from the pineapple crown into animal feed. In addition, it produces biological materials such as fungal bacteria to distribute to farmers. This is intended as a substitution for more hazardous fertilizers. Finally, it labels fruit during the packaging and distribution process based on the product's certification, informing the consumer of that product's biodiversity impact. Due to privacy implications for Nicoverde these projects have only been described briefly.

Description of Nicoverde Bioeconomy Projects

Mushroom Cultivation

Description: Nicoverde has been involved with the production of edible and medicinal mushroom cultivation from their pineapple agricultural

waste. They have cultivated mainly the oyster mushroom *(Pleurotus spp)*, a product that has potential at high gastronomic, nutritional, and functional levels. This cultivation is meant to reduce the amount of waste generated from the pineapple production process and generate revenue. They have experimented and partnered with local chefs and suppliers to use and sell the mushrooms.

Project Category Fit: This project would fit under the category “eco-efficient and/or circular economy” as it seeks to reduce and reuse agricultural waste from pineapple production.

Data Needed: Nicoverde would need to collect data on how the mushroom cultivation has reduced waste heading to the landfill and reduced CO2 emissions. This can be completed multiple ways but must be quantified in a meaningful way to display reduction in waste and CO2 emissions.

Eco-labels

Description: Nicoverde has also begun generation of bio-based materials to replace single use plastics and products. These will be used to replace paper and plastic labels in the pineapple sector. The labels have a base in biodegraded substrate and have incorporated the use of abaca fibers *(Musa textilis)*.

Project Category Fit: This project would fit under the category “eco-efficient and/or circular economy” as it seeks to reduce and reuse agricultural waste from pineapple production.

Data Needed: Nicoverde would need to collect data and conduct an analysis on the life cycle of eco-labels and its impact on the environment potentially through an eLCA. Nicoverde would need to prove that the eco-labels have less of an environmental impact than that of the standard plastic and paper labels. Additionally, Nicoverde would need to collect data that shows that the eco-labels have reduced agricultural waste from pineapple production.

Recommendations

Based on our initial findings along with Nicoverde’s history and goals, we would recommend they consider investing in a *sustainability linked loan*. Since their business operations span across multiple cooperatives, a sustainability linked loan could help them target overall emissions

reductions across their scope. In addition, Nicoverde already adheres to multiple external sustainability ratings, which would be well-suited for the criteria of a sustainability linked loan. Nicoverde has multiple projects in planning, such as their use of sustainably printed labels and mushroom cultivation from pineapple crown waste, that could be considered under the eco-efficient and/or circular economy category of the Green Bond Principles. These projects, along with Nicoverde's track record for sustainability across its farms, would be helpful for establishing SPTs as part of the loan issuing process.

Special Purpose Vehicle Alternative

Despite the advantages of the sustainable financing mechanisms outlined above, a clear disadvantage is the level of effort and economic cost for entering the market. Some companies may not have a reporting system instituted to engage directly with investors, or they may not have the inhouse capabilities to measure necessary indicators or determine KPIs. Furthermore, the cost of developing an environmental management framework and obtaining a second opinion can be high when compared to smaller capital requirements.
There is an attractive alternative that can be used to allow for small and medium enterprises to enter the sustainable finance market. We introduce it as a case study here.

Establishment of a Special Purpose Vehicle

A special purpose vehicle (SPV) is an entity that can be used to hold in trust funds and act with a specific mandate. In the case of BIOFIN, a program determined to increase the private financial flows towards biodiversity, the SPV can be established with the clear mandate to issue and manage a bond with the principles of increasing biodiversity.
The SPV can then become the issuer of the sustainability linked loan or bond setting the terms and directions while providing technical assistance (TA). It would require the establishment of committees that will manage the loan/bond and ensure it is complying with the established principles providing TA. While this may seem to increase costs, in the end the purpose is to dilute the costs of entering the sustainable finance space through more projects.
The SPV could then create a clear environmental finance framework that explicitly uses the project categories that increase biodiversity from the GBP as identified above.

Use of Proceeds

In this SPV described here the operating committee can be formed in a way that includes the expertise necessary to determine appropriate

projects and therefore enforce an appropriate use of proceeds. This committee can be guided by the GBP project categories of *Environmentally Sustainable management of living natural resources and land use, Terrestrial and aquatic biodiversity conservation, Sustainable water and wastewater management, and Circular Economy.*

Project Selection

The operating committee, having the appropriate expertise as mentioned above providing TA, can then select projects from many different companies. In our case, the biodigester project of Coopetarrazu would clearly fit in the project category of *Sustainable Water and waste-water management* or in the *Circular Economy* category. In the same way the cultivation of mushrooms from the pineapple waste project at Nicoverde could be included as a *Circular Economy* project and their present expansion of use of microorganisms for creating agricultural inputs could be considered a project in the *Environmentally Sustainable Management of Living Natural Resources*.

The committee can then take charge of determining the appropriate values of the or studies required, in cooperation with the companies. It can also consult with the company to ensure appropriate reports are provided. In our example, both Coopetarrazu and Nicoverde do not have to shoulder the costs of the expertise, but instead those costs are now spread over 3 projects and two companies.

Management of Proceeds

The SPV can have a clear separation of funds and, according to accepted guidelines, can maintain funds not allocated to projects in liquid investment instruments to ensure a return. It can also work with the companies to ensure that the money issued for projects is reliably spent on the projects that were chosen providing TA.

Reporting

A SPV as suggested here can be much more effective at reporting to its investors. Furthermore, the impacts of small projects that may not have garnered attention individually, can be aggregated across the projects in the SPV portfolio allowing investors to understand the possibilities of these projects. Again, the costs of reporting with a wide range of stakeholders would not be shouldered by one project or one company, but it is diluted across the portfolio of projects managed by the SPV.

Financial Risk

A further benefit of creating an SPV that can aggregate the projects of small and medium enterprises is that financial risk is decreased by diversification. Investing in one biodigester at one coffee company may

seem risky for investors and provides a clear set of technical and economic challenges depending on many conditions. However, having a portfolio of projects allows for a broader impact and a lower risk that the bond will not produce its return.

Coopetarrazu Final Diagnosis

Executive Summary

United Nations Development Program Biodiversity Finance Initiative (UNDP Biofin) partnered with the University of Michigan School for Environment and Sustainability (SEAS) to provide environmental technical support for bioeconomy projects within two companies - Coopetarrazu and Nicoverde. The goal of the project was to provide technical support through environmental, biological, and social assessments, as Coopetarrazu and Nicoverde implement a biorefinery / biorefinery technology in preparation for the National Strategy of Bioeconomy (NSB) and UNDP BIOFIN. This project team completed independent assessments of Coopetarrazu and Nicoverde's products or approach using an Environmental Life Cycle Assessment (eLCA), quantitative and qualitative biodiversity assessments (Centro Agronómico Tropical de Investigación y Enseñanza's measuring environmental services methodology and Biodiversity Check Agrícola, respectively), and Social Life Cycle Assessment (SLCA). The assessments generated data and indicators for Coopetarrazu and Nicoverde to quantify the biodiversity, environmental and social, of their agricultural practices and additional green biorefinery projects, as defined by the methodologies listed above. This report focuses specifically on Coopetarrazu.

The University of Michigan team visited ten coffee farms associated with Coopetarrazu in the summer of 2021 with a translator and were sometimes accompanied by Coopetarrazu employees. The team collected biodiversity information through a biodiversity questionnaire. The team additionally gathered information for Coopetarrazu's green project portfolio by meetings and tours from Coopetarrazu employees.

The environmental life cycle impact assessments showed that the highest impacts are in the terrestrial ecotoxicity and global warming categories and that the impacts were driven by fertilizer use for coffee production and energy use during the processing stage. Though conducting a full eLCA provided key insights, going through that process might be cumbersome for a company to take on. However, conducting the life cycle inventory and gathering the input data required to understand environmental impact of production is valuable and can help Coopetarrazu generate the KPIs, and data required to access the private capital market.

The biodiversity assessments both showed that all the surveyed farms had an overall positive impact on protecting biodiversity. Every landowner was generally aware of what biodiversity meant in the context of coffee farming and believed it to be an important concept. Each farm plays a role in a diverse ecosystem, especially considering the role of coffee plants in attracting local pollinators. Many farmers also had a strong knowledge of local ecology and could name a variety of plant and animal species that were present on the property. However, most of them did not implement a specific biodiversity policy or take additional actions to protect and maintain the local habitat. This is one potential avenue for improvement. Another opportunity for the farms to further their commitment to biodiversity is by maintaining written records of agrochemical use, water, and waste production for each harvest. This can be done in collaboration with Coopetarrazu and potentially allow the farmers to reduce dependence on particularly harmful agrochemicals.

A Social Life Cycle Assessment (SLCA) was conducted, which allows for the qualitative consideration of social impacts. The stakeholder levels looked at were workers and local communities. This included four targeted stakeholder groups, which were landowners, farm hands, Coopetarrazu office employees, and the Association of Integral Development (ADI). Each stakeholder group had a separate questionnaire template, which can be viewed in the appendix. There is one exception to this, the ADI did not have a questionnaire template, it was a structured conversation. Additionally, a Community Capitals

framework was used for the analysis. Overall, the results indicate that Coopetarrazu is having a positive social impact.

Project Background

The Costa Rican government is at the forefront of combating climate change and is widely recognized as one of the “greenest” countries in the world. In August 2020, the Ministry of Science and Technology of Costa Rica **(**MICITT) led a cross-ministerial team that developed the National Strategy Biodiversity (NSB) framework, which seeks to capitalize on Costa Rica’s rich sustainability leadership from an innovation and entrepreneurship perspective. The framework is designed to reorient the Costa Rican economy on sustainable, resilient, decarbonized, and competitive knowledge and entrepreneurship. Moreover, the UNDP is implementing the Biodiversity Finance Initiative (BIOFIN), a global project that aims to help governments develop a strong case for increased investment and improve efficiency in investment conservation, sustainable use, and equitable distribution of the benefits of ecosystems and biodiversity, with an approach aimed at determining and meeting the financing needs of the NSB and its global goals. In Costa Rica, BIOFIN works in conjunction with MICITT to support the NSB as part of a prioritized financial solution: the bio business platform. Also, as part of the public-private partnerships being established MICITT has identified a group of over 100 companies and startups that can engage in the NSB either through new product creation or through conversion of their existing production chains. These companies are at different stages of development but in general would benefit from environmental technical support such as determining carbon footprint reductions or creating life-cycle assessments of their projects

Coopetarrazu

Coopetarrazu is a cooperative of coffee farmers located in the mountainous Tarrazu region in Costa Rica that was established in 1960. They are involved with several projects across the San Carlos de Dota area such as managing and processing coffee bean plants, supermarkets, gas stations, auto repair, and agricultural feed and supply stores. As of 2018 Coopetarrazu has three certifications– Fair Trade, Starbucks CAFE Practices, and Esencial Costa Rica. Coopetarrazú is an organization that has more than 4,650 associates. For every 15 associates, a proprietary delegate is appointed and thus the General Assembly is formed, whose main functions are to approve the policies of the cooperative and decide the destinations of the surpluses and prizes in the economic, productive, and commercial exercise. Today Coopetarrazú

has adopted an operating model of work by management, which are specialized areas focused on the substantive activities.

The coffee from the Tarrazú region is one of the most recognized in Costa Rica and represents 40% of the Costa Rican national production. The coffee growing and production in Tarrazu is located between approximately 1,200 and 1,900 meters of altitude. Most of the plantations are under shade, with different trees from the area.

78% of the coffee production from the cooperative is exported directly, 14% is sold through local exporters and 8% is marketed nationally under Coopetarrazu's local brand Buen Día. Exports are sent mostly to markets in the United States, Europe, and Asia. The coffee is known for its high acidity, medium body, extra hard grain, and aroma.

Coffee Production Process

Coopetarrazu purchases from farms that incorporate the practices of shade grown arabica coffee (*Coffea arabica*). Shade grown coffee is coffee grown under the canopy of trees, mostly banana and a variety of other fruiting trees. Arabica coffee plants can take up to 3 years before becoming mature for the first harvest. The coffee plants can live up to 50 years with most plants being removed and transplanted after 30 years when their yields begin to decrease.

The coffee plant is hand-picked and harvested normally from the months of August to February in Costa Rica with the largest harvest amounts coming from October-February. The coffee cherry is then trucked from the farm to a Coopetarrazu drop off site. These drop off sites are installed by Coopetarrazu around the Tarrazú region where the farms are located and are typically within 5 km of the farm. This reduces the transportation costs for farmers, The coffee cherries are then taken from the drop off site by Coopetarrazu to the Beneficio (coffee processing plant). Coopetarrazu has two *beneficios* in San Marcos de Dota, Costa Rica.

At the beneficio Coopetarrazu works to clean, wash, and dry the coffee bean so it is ready for transport to coffee roaster manufacturers. The pulp (mesocarp and cáscara) is first removed from the coffee cherry using a machine. The pulp is then either sent to the compost facility or sent out as waste. Coopetarrazu has begun investigating how to use the pulp for other purposes such as the biodigester energy facility mentioned, composting, or green coffee products.

After the pulp is removed the coffee bean is then placed in a friction machine to remove the mucilage. After the mucilage is removed the coffee bean is then sent to the drying mill/ oven. After the coffee bean has dried then it is moved to an internal dryer where the parchment is taken off. It is sorted for size and stored in silos for about 1 month. Once it has fully dried then it is bagged and shipped elsewhere.

Green Project Portfolio

Coopetarrazu is looking to implement a sustainable business model where the use of the raw material is maximized and by-products or materials identified through the coffee production can be incorporated into a reduction of waste, also known as a circular economy. Below is a description of a green project's portfolio for Coopetarrazu describing their efforts toward the circular economy, which can help increase biodiversity.

Biodigestion Facility

Anaerobic digestion is a process through which bacteria break down organic matter for example animal manure, wastewater biosolids, and food wastes, without oxygen present. Anaerobic digestion for biogas production takes place in a sealed vessel called a digester, which is designed and constructed in various shapes and sizes specific to the site and conditions. Specifically, for Coopetarrazu they will be using the coffee pulp and wastewater from coffee production to produce biogas and generate electricity for the operational aspects of the cooperative.

Biogas is composed of methane (CH_4), which is the primary component of natural gas, at a high percentage of about 50 to 75%, carbon dioxide (CO_2), hydrogen sulfide (H_2S), water vapor, and trace amounts of other gasses. The energy in biogas can be used similarly to natural gas to generate electricity, and power heating and cooling systems, among other uses.

To create energy through the biodigester with coffee byproduct, the coffee berry is mechanically pressed to separate the bean from the skin and the mesocarp. These last two elements are known as pulp. It is normally discharged as a highly polluting waste either to a landfill or composting pile. Coffee pulp contains hydrogen, fiber, and protein that when heated create exchangeable energy. Coffee pulp waste and production contributes to about 80% of Coopetarrazu's emissions in the industrial process. Additionally, the biodigester also creates its own waste from its electricity production through wastewater. Coopetarrazu has

plans for this wastewater to be used for irrigation on fields with grass ("pasto estrella"). This field will work as a "biofilter."

Coopetarrazu has been working on the biodigester project for over 3 years. Coopetarrazu has plans to construct one biodigestion facility within a two-year period. The facility would have two digesters and be about 7,500 square meters in area. Estimated costs for constructing the facility would be around $5 million US dollars. Operational costs at the time of writing are unknown. The plans for the biodigester have been submitted to a review board for permitting reasons.

The goal of the biodigester is to have 45-50% of the pulp diverted from composting and used in the biodigester. This will greatly reduce Coopetarrazu emissions from coffee production. Each digester is designed to process 120k fanegas (around 5,500 tons) of byproduct per day. Furthermore, environmental analysis will need to be conducted to evaluate the actual reduction of emissions and waste.

Compost Facility

Coopetarrazu currently has a 60,000 meters squared composting facility that processes 31,000 tons of organic matter per year. It takes a 1 meter by 3-meter pile of compost 12 weeks to mature. 50/60 trucks drop off coffee pulp to the composting facility during the harvest season with around 3,000 trucks dropping off coffee pulp at the end of the season. 11,000/12,000 tons of the compost is given to farmers for free either trucked to the farmers or picked up once the compost has matured. Coopetarrazu spends about $20,000 US dollars each year to truck the matured compost to the farms. Additionally, they sell one bag of compost at supply stores for about $5 US dollars for a 35kg bag. The compost matures in August and must be returned to all farmers by the beginning of the rainy season which begins in March.

Coopetarrazu aims to improve the infrastructure for their composting process to accommodate higher volumes to process. They wish to develop space for an additional 2,500 square meters of composting and buy more machinery for filtering the coffee pulp that goes into the compost. In the future, they hope to be able to develop a wider market for their compost.

Green Coffee Products

Three years ago, Coopetarrazu began to explore expanding their products from other coffee by-products. They have transformed coffee by-products into other market items with additional nutritional and/or economic value. These include coffee flour, green coffee pills and coffee cáscara. These products are sold in local shops, and they hope to expand into international markets. For example, they have produced pills with the unroasted green coffee beans. These contain chlorogenic acids which are meant to improve metabolism. Other products sold include capsules with whole green coffee that are meant to serve as a natural energy-booster and antioxidant. The cáscara, or shell, is also sold and advertised as a superfood.

Biodiversity in the Coffee Sector

Biodiversity is crucial to both environmental wellbeing and agricultural production. Agriculture impacts not just the farm unit property itself, but the greater local ecosystem it is embedded in. Across the world, land use change loss for agricultural purposes is the greatest contributor to biodiversity loss. This is because local wildlife, particularly pollinators, play an important role in the life cycle of coffee and other flowering plants. Harmful agrochemical products, such as pesticides, threaten these biologically necessary species. Wildlife loss harms the genetic diversity of ecosystems, which is important to avoid vulnerability to climate change and pests. For this reason, it is important for agricultural areas to keep protected areas and biological corridors that allow wildlife to continue safe movement across their habitat.

Despite the risks of agrochemical use, coffee farming can also benefit local ecosystems. The presence and maintenance of native plants, particularly in buffer zones around productive areas, helps protect nearby water sources by preventing erosion.[24] Coffee plants themselves provide not only flowers for local pollinators, but ecologically valuable shade cover that offers a crucial canopy for birds and other wildlife. Moreover, there is a scientific link between a high shade percentage and increased mean species richness.[25]

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[24] EU Life Programme. “Improving biodiversity protection in coffee cultivation in South America.” Accessed April 13, 2022. https://www.business-biodiversity.eu/bausteine.net/f/9480/BiodiversityinCoffeeCultivationNov2019_mh.pdf?fd=0

[25] Perfecto, Ivette, John Vandermeer, Alex Mas, and Lorena Soto Pinto. “Biodiversity, Yield, and Shade Coffee Certification.” *Ecological Economics* 54, no. 4 (September 2005): 435–46. https://doi.org/10.1016/j.ecolecon.2004.10.009.

Certifications

Voluntary biodiversity certifications help agricultural producers show a rigorous dedication to the environment. These third-party programs can also help companies advocate for additional funding through the sustainability finance market. In addition, certifications encourage more sustainable attitudes among farmers and interactions with diverse stakeholders.[26] As of 2018, Coopetarrazu has three biodiversity certifications which are explained in greater detail below.

Fair Trade

Fair Trade is a rigorous certification process that showcases a commitment to high environmental, and social standards in production. Although agricultural producers may choose to be fair trade certified, the designation can also apply to unrelated products such as textiles and precious metals. To become Fair Trade, companies must apply for a third-party auditor to review its supply chain. Specific criteria include environmental standards to reduce human and environmental exposure to chemicals, fair labor conditions and contracts, commitment to non-discrimination (including gender discrimination), and standards for a minimum price.[27]

Starbucks C.A.F.E. Practices

The Starbucks Coffee and Farmer Equity Practices was developed with Conservation International and first launched in 2004. This made it one of the first industry standards for ethical green coffee production. The certification involves open-source, third-party monitoring that aims to promote farmer well-being and increased transparency in the supply chain. Producers are rated on over 200 indicators in the following four categories: economic transparency, social responsibility, environmental leadership, and quality. More specifically, producers are banned from

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[26] Snider, Anna, Eva Kraus, Nicole Sibelet, Aske Skovmand Bosselmann, and Guy Faure. “Influence of Voluntary Coffee Certifications on Cooperatives’ Advisory Services and Agricultural Practices of Smallholder Farmers in Costa Rica.” *The Journal of Agricultural Education and Extension* 22, no. 5 (October 19, 2016): 435–53. https://doi.org/10.1080/1389224X.2016.1227418.

[27] Fairtrade International. “Fairtrade Standard for Prepared and Preserved Fruit & Vegetables for Small Producer Organizations and Traders.” Accessed April 12, 2022. https://www.fairtradeamerica.org/app/uploads/2020/08/PreparedPreservedFruit_SPO-EN.pdf.

clear-cutting natural forest for agriculture and applying banned pesticides.[28]

Esencial Costa Rica

Esencial Costa Rica is a licensing program that allows companies to track their own sustainability progress. The organization focuses on five key values that companies must prove commitment to meet certification requirements: sustainability, excellence, Costa Rican linkage, social progress, and innovation. Agricultural products, food, tourism, and other industries can all register for the certification.[29]

Environmental Life Cycle Analysis (eLCA)

What is an ELCA and why is it important to biodiversity?

An Environmental Life Cycle Analysis (eLCA) is an analysis of environmental impacts of a product's life cycle, most used to understand which part of the process has the most overall environmental impact. There are two types of eLCA analysis: cradle-to-gate and cradle-to-grave, where the former follows the production from beginning till it leaves the ownership of the producer, and the latter follows the process till the consumption and disposal. Conducting an eLCA has four phases: goal and scope definition, life cycle inventory analysis (LCI), life cycle impact assessment (LCIA), and interpretation. During the goal and scope phase the bounds of analysis are clearly defined to ensure the results are valuable and targeted. During the LCI phase data is collected on the production process of a product over a specified period, and during the LCIA phase the data is analyzed to understand the impact of the product's production. And finally, during the interpretation phase, the LCIA data is further analyzed to glean insights as to which parts of the production process have the highest impact and what the overall impact of the product is.

The Organization for Economic Co-operation and Development has noted that "various studies have shown that excessive use of pesticides has led to biodiversity loss and ecosystem degradation (Green, et al. 2005, Kleijn, et al. 2009) and, pesticide use has contributed to reducing populations of

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[28] Starbucks Stories. "C.A.F.E. Practices: Starbucks Approach to Ethically Sourcing Coffee." Accessed April 13, 2022. https://stories.starbucks.com/press/2020/cafe-practices-starbucks-approach-to-ethically-sourcing-coffee/.

[29] Esencial Costa Rica. "Requisitos y beneficios licenciamiento, Esencial Costa Rica." Accessed April 13, 2022. https://www.esencialcostarica.com/licenciamiento/quiero-ser-esencial-costa-rica/.

birds, insects, amphibians and aquatic and soil communities, either through direct exposure or reduction in food and habitat availability[30]. Literature shows that quantifying these values helps in understanding effects on biodiversity at a high level since biodiversity is negatively affected by environmental damages. Biodiversity is known to be negatively affected by the use of agrochemicals such as pesticides, herbicides, and fertilizers.

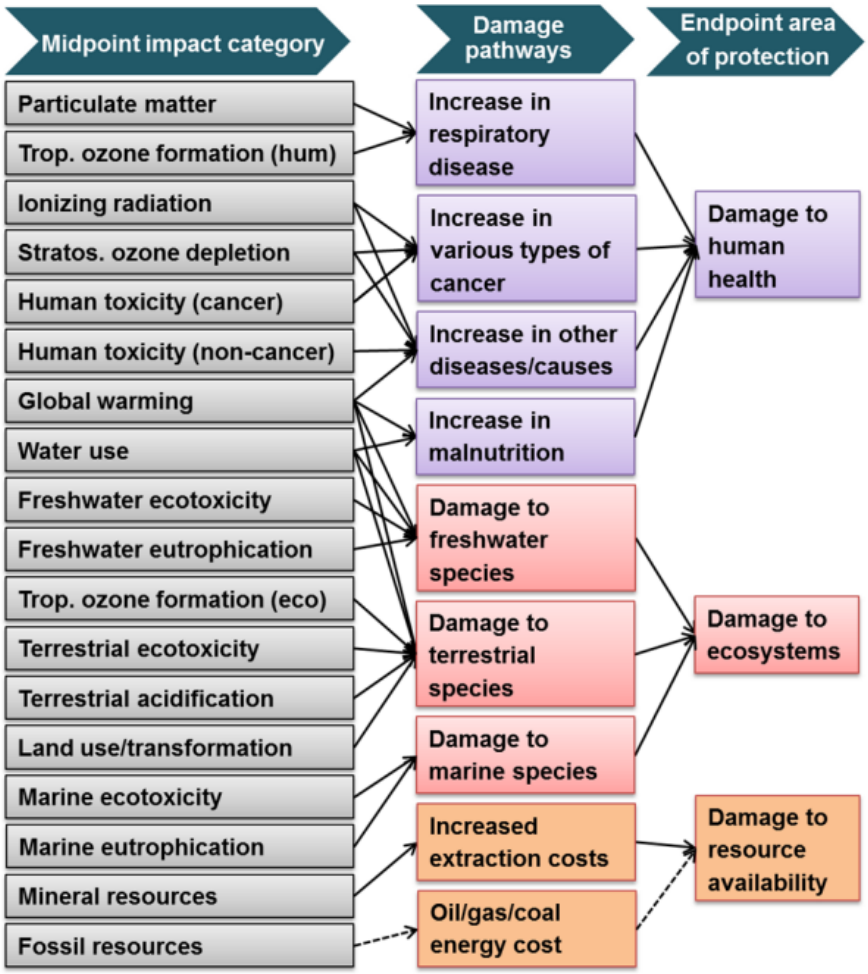
Studies exist through eLCA literature that quantify the effects of a variety of agrochemicals on land use change, ecotoxicity, eutrophication, water use, air emissions, acidification, ozone formation, etc. And these effects can be summed up based on the amounts of agrochemicals used for production, transportation, and processing of the plant.

A true measure of nitrogen impacts is best conducted through a nutrient balance of the farm which requires thorough analysis of soil nutrient level, plant nutrient uptake, and surrounding N leakage. This analysis was not within scope of the analysis. Though a common indicator on pesticide risk does not exist at the moment, the measurement of and understanding of pesticide use intensity is critical to reducing pesticide use overall and is easier to track than a nitrogen balance around the farm

These eLCAs were conducted in Simapro using the Recipe Midpoint (H) method and data was used from the Ecoinvent 3 database. The impact categories and associated damage pathways are shown in Figure 1 below. The impact categories that are of highest relevance for biodiversity are global warming, water use, freshwater ecotoxicity, freshwater eutrophication, ozone formation, terrestrial ecotoxicity, terrestrial acidification, land use, marine ecotoxicity, and marine eutrophication. Due to Coopetarrazu's operations not being directly near the Costa Rican coasts, the marine impact categories were not analyzed.

[30] Sud, Megha. "Managing the Biodiversity Impacts of Fertiliser and ... - OECD." OECD. =, 2020. https://www.oecd.org/officialdocuments/publicdisplaydocumentpdf/?cote=ENV/WKP(2020)2&docLanguage=En.

Figure 2: ReCiPe 2016 Impact Categories and associated Damage Pathways[31]

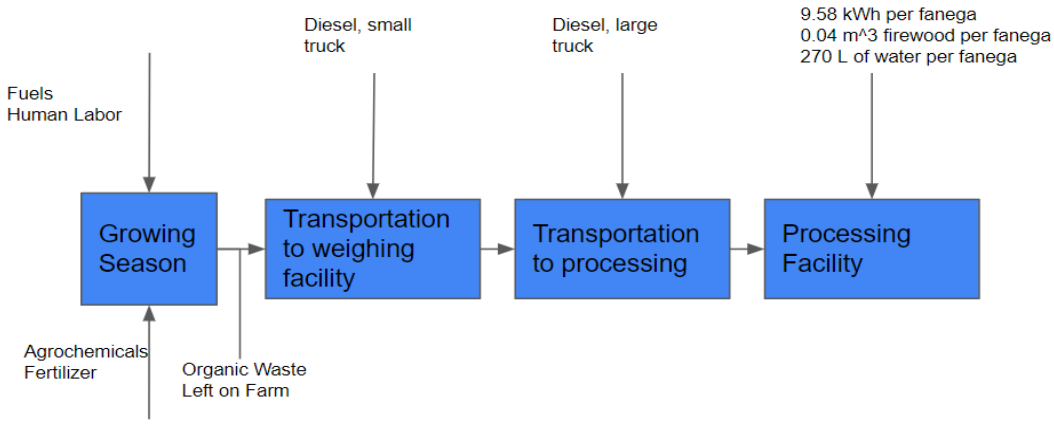


Functional Unit

Since the analysis is inclusive of the production process where the final product is green coffee, the functional unit chosen was 1kg of green coffee produced. For coffee production in Costa Rica the unit of 'fanega' is often used to provide data for amounts of coffee. 1 fanega is 44-45 kg of green coffee and 258 kg of red cherries.

[31] Huijbregts, M.A.J. "Recipe 2016 V1 - Pré Sustainability." https://www.rivm.nl/en, 2016. https://pre-sustainability.com/legacy/download/Report_ReCiPe_2017.pdf.

Figure 3: Coopetarrazu Process Flow Diagram for Coffee Production



Out of Scope

The transportation of raw material inputs (e.g., atomizers, fertilizers) were not considered in this analysis. The packaging of the inputs and outputs were not considered in the analysis and road/path maintenance is considered out of scope

Results and Recommendations

The averaged results from all 10 farms are shown below in Figure 3 and Table 1 below shows the units for each impact metric measured. As shown by the average of all farms, the two key impact categories are terrestrial ecotoxicity and global warming potential. These are further separated farm by farm below in Figure 4.

Figure 4: Average environmental impact from all 10 farms on key impact categories

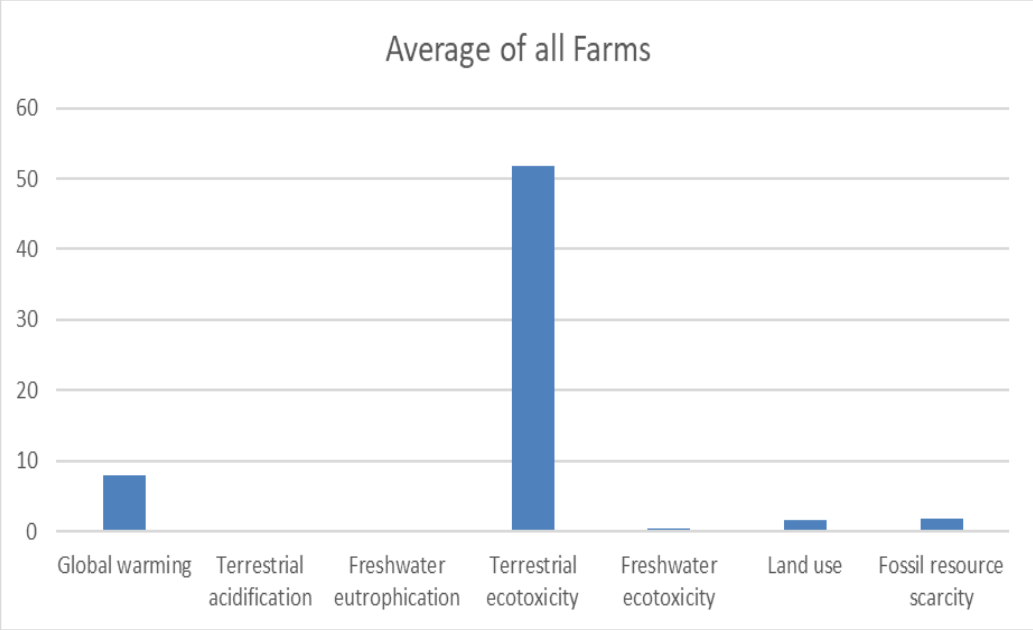


Table 4: Units for all impact metrics used in figures below

Impact Metric	**Unit**
Global warming	kg CO2 eq
Terrestrial acidification	kg SO2 eq
Freshwater eutrophication	kg P eq
Terrestrial ecotoxicity	kg 1,4-DCB
Freshwater ecotoxicity	kg 1,4-DCB
Land use	m2a crop eq
Fossil resource scarcity	kg oil eq

As seen in the two figures below, figures 5 and 6, the farm-by-farm impact on terrestrial ecotoxicity and global warming, each farm has a different level of impact for the impact metrics analyzed. This could be tied to

different altitudes or simply excess use of agrochemicals due to lack of knowledge of its impacts. Further analysis was out-of-scope for this project, however understanding these differences and creating a plan to reduce chemical and fertilizer use would positively benefit the environment and in-turn, biodiversity. The team can look at this further by understanding what parts of the process impact the two key categories, Global warming and Terrestrial ecotoxicity, the most.

Figure 5: Terrestrial ecotoxicity impact of all farms

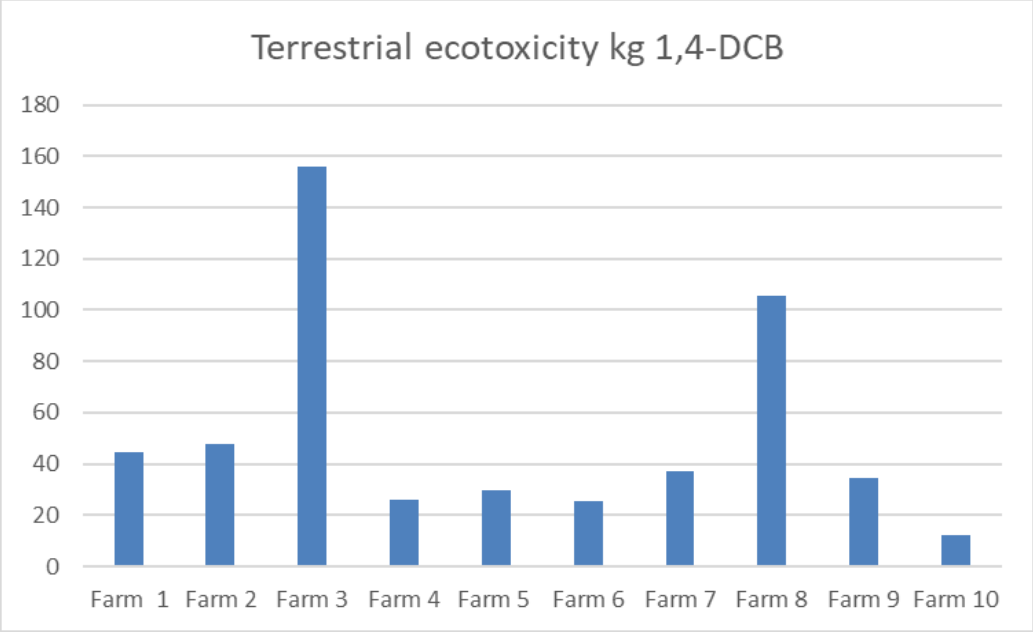
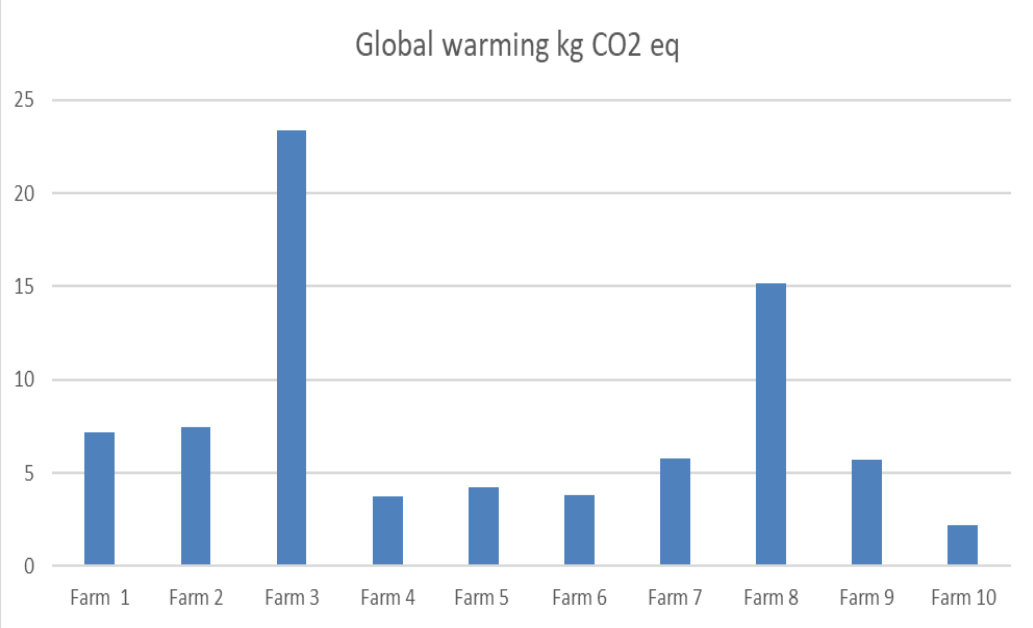


Figure 6: Global warming potential impact of all farms



Figures 7 and 8 below showcase the eLCA results from the parts of Farm 1's coffee production process. This includes fertilizer use, other agrochemical uses such as pesticides, fuels used in farm machinery, transportation of coffee cherries to processing sites, and the energy used for processing. The use of fertilizers and the processing of the coffee from red cherries to green coffee are the most environmentally intensive parts of producing 1 kg of coffee. Fertilizer use accounts for 51% of the global warming impact and processing accounts for 44%. This holds true to the analysis of each farm. Transportation of the coffee from the farm to the drop-off center, fuels used in farm equipment, and other agrochemicals do not play as large a role.

Figure 7: Farm 1 Global Warming Potential

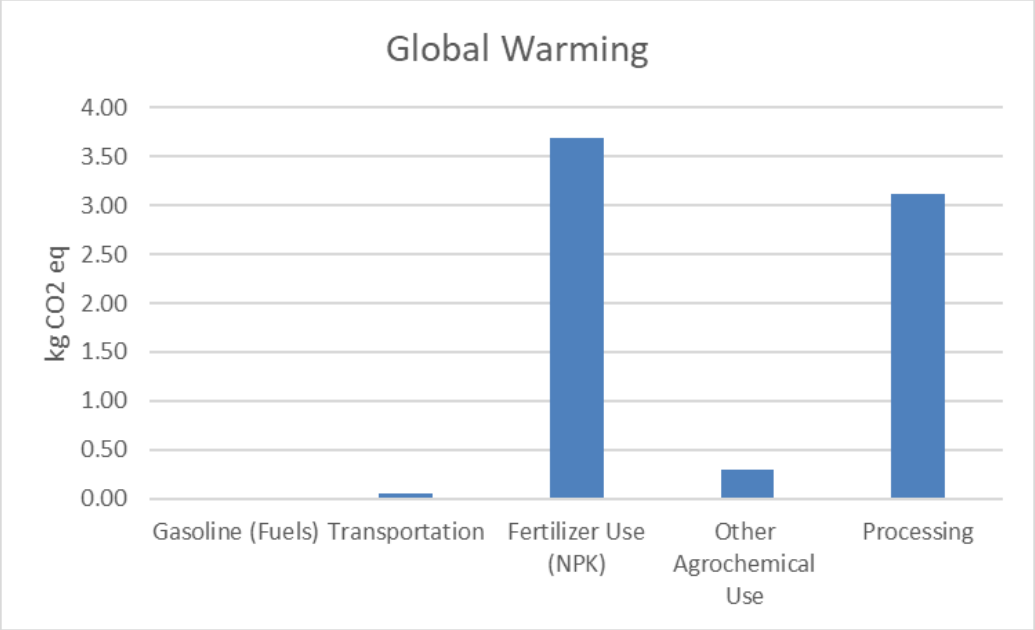
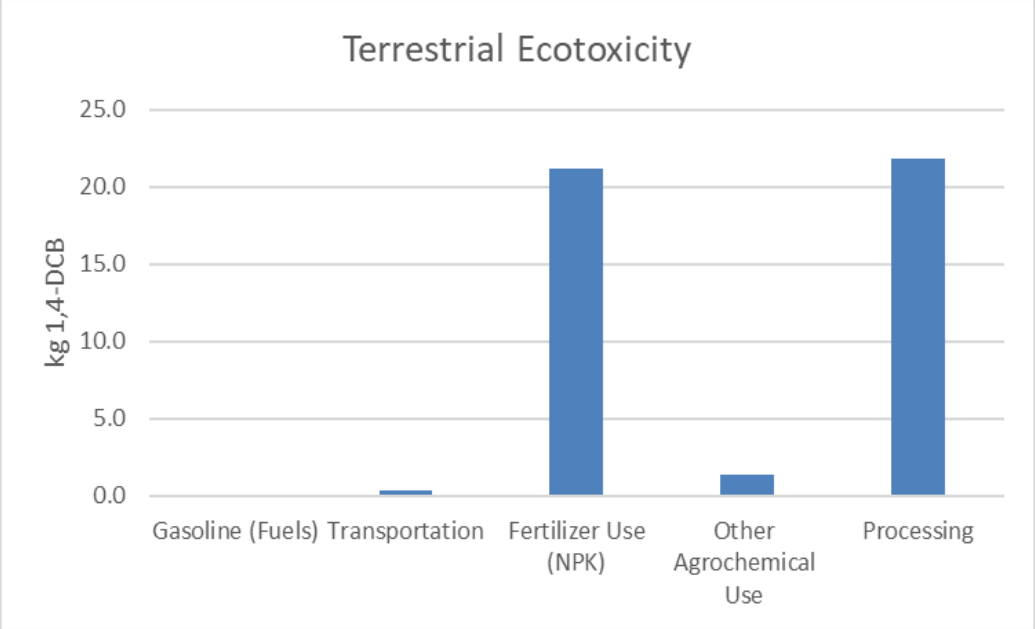


Figure 8: Farm 1 Terrestrial Ecotoxicity



Limitations

Due to limitations in Simapro and the ELCA methodology, the impact of pesticides might be understated. The Ecoinvent 3 database does not include complete data of the impacts of certain pesticides and the generic pesticide material was used in the ELCA for several of the highly hazardous pesticides. Thus, though the information from the ELCA is valuable in helping understand the overall impact of Coopetarrazu's processes on the environment, the final results may not provide valuable insight into the positive or negative biodiversity impact of specific parts of the process.

Final Conclusions

Coopetarrazu has acquired certifications that require data on labor rights and social and economic development. These certifications include Fairtrade certification, Starbucks CAFE, and Esencial Costa Rica. As shown through the study on the 'Influence of voluntary coffee certifications on cooperatives' advisory services and agricultural practices of smallholder farmers in Costa Rica, "Certifications induce cooperatives to offer new services to support farmers [that help] shape farmers' attitudes about sustainable farming practices, though farm-level changes

may be small."[32] So there are many positives to the community through acquiring certifications, however common certifications do not place focus on biodiversity.

The Rainforest Alliance is a comprehensive method of showcasing a commitment to biodiversity as a company, and UNDP Biofin can use that as an indication of an organization that has been able to build out structure to their biodiversity commitments. The data required to achieve this certification is complex and needs to pass through several third-party checks, so achieving the full certification might be costly. However, benchmarking data collection and internal processes alongside the Rainforest Alliance requirements is a beneficial way for Coopetarrazu to gather and audit the data required for accessing private capital.

Conducting a full eLCA of all growing operations provides insights into which processes generate the most environmental impact, however conducting a full eLCA might be out of scope of most company operations due to the Simapro expertise and time required. In comparison, the goal and scope and life cycle inventory stages might be accomplishable by a company and if conducted periodically, can help generate data in a consistent manner that will help a company apply for a sustainability-linked loan or bond.

Though Coopetarrazu does not have a biodiversity focused certification, they are showing improvement toward their goals of reducing fertilizer use by training their farmers on the importance of biodiversity. The eLCA results showed that the highest impact was driven by fertilizer use for coffee production and energy use during the processing stage. If an action plan is designed to reduce these impact metrics either through consistent life cycle inventories or by aligning with Rainforest Alliance templates, Coopetarrazu will be working to reduce negative biodiversity impacts. As Coopetarrazu works to sustainably capture data they will be able to generate KPIs and improvement plans to help access private capital.

Biodiversity Assessment

Since the 1992 Convention on Biological Diversity, a number of third-party mechanisms to evaluate biodiversity on different spatial scales have

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[32] Snider, Anna. "Influence of Voluntary Coffee Certifications on Cooperatives' Advisory Services and Agricultural Practices of Smallholder Farmers in Costa Rica." Taylor & Francis, 2016. https://www.tandfonline.com/doi/abs/10.1080/1389224X.2016.1227418?needAccess=true&journalCode=raee20.

been created. These are not official certifications, but they are useful for data gathering and can help a company potentially evaluate their readiness toward reaching additional certifications. The University of Michigan team selected CATIE's proposed methodology for environmental services and a shortened version of the GIZ Biodiversity Check Agrícola to measure Coopetarrazu's biodiversity impacts. These methodologies are described below. For additional context into other biodiversity methodologies that were not selected, please see Appendix.

CATIE

The Centro Agronómico Tropical de Investigación y Enseñanza (English: Tropical Agricultural Research and Higher Education Center) is an institute for agricultural science and research that is headquartered in Costa Rica. In 2008, CATIE published a paper for evaluating environmental services at the farm level. The publication breaks down environmental services into four levels: biodiversity, carbon, on-the-ground conservation, and water. Biodiversity is measured as the sum of two subcategories: habitat quality and chemical use. There is not a minimum or maximum score for the assessment.
The habitat quality indicators and methods for quantifying them are as follows:

- Arboreal strata. This was estimated visually using aerial drone images of each farm. Trees can be low (<5 meters), medium low (5-10 meters), medium high (10-15 meters) or high (>15 meters).
- Qualitative assessment of the incidence of epiphytes in trees. This was done visually by noting if there were any visible epiphytes on a property.
- Percentage of shade cover. This was measured by visually identifying a 10 x 10 grid of coffee trees. Any tree that is covered in shade was marked off to determine the total percentage out of 100.

The chemical use indicators are as follows:

- Number of herbicide applications
- Number of pesticide applications
- Number of fertilizer applications

This information was gathered by site visits to the farms and interviews with the farmer. If the farmer did not have exact records of product applications, they provided an annual estimate.
For this section, the results from the three indicators were totaled then divided by 10.
For fertilizers, a subscore of -1 was added for each independent product application. For herbicides and pesticides, the number of applications was multiplied by the product's toxicity rating. This was measured by a color

on the label according to online searches and team photos from the Coopetarrazu store. Based on the CATIE method, green products had a sub score of -1, Yellow -2, Orange -3, and Red -4. If a label color was unknown, the toxicity rating was calculated according to the active ingredient's Recommended Classification of Pesticides by Hazard according to the WHO (2019). This meant that Extremely Hazardous would receive a -4 score, Highly Hazardous was -3, Moderately Hazardous was -2, and Slightly Hazardous was -1. If a product could not be classified based on the farmer interviews, it was assigned a median score of -2 based on the available data.

GiZ BCA

The Gesellschaft für Internationale Zusammenarbeit (GiZ) (English: German Corporation for International Cooperation) is Germany's main international development agency. One of their main objectives is to help companies achieve the UN Sustainable Development Goals (SDGs), not just in Germany but internationally. GiZ began developing the Biodiversity Check Agricola (BCA) in 2018-2019 due to the perceived need to assess agricultural production through a biodiversity lens. The methodology evaluates biodiversity impacts through three spatial scales: the production area, the farm, and the greater/neighboring landscape. Its overarching goal is to facilitate a dialogue on biodiversity within the company and to develop potential biodiversity solutions. To date, it has been implemented in Costa Rica, Dominican Republic, and Guatemala. Additionally, at the beginning of the assessment there is space to provide an overall summary on management practices at the business and/or cooperative level. These subcategories are then broken down into a total of 18 overall goals that companies are evaluated on:

1. Business management
    a. Politics of biodiversity
    b. Personal capacity and sensibility
    c. Selecting providers
    d. Minimal impact on infrastructure
    e. Completion of environmental legislation
2. Productive area
    a. Ground conservation
    b. MIP and low toxicity pesticides
    c. Genetic resources and adaptive/resilient systems
    d. Efficient water use
3. Farm
    a. Conserved ecosystems
    b. Wildlife and identified protected habitats
    c. Restored areas that are not suitable for production
    d. Infrastructure for biodiversity

    e. Identified and controlled invasive species
    f. Approved and minimal impact waste
4. Landscape
    a. Identified protected areas and reduced impacts
    b. Watershed management activities
    c. Alliances with local actors

Typically, the process begins with some preliminary research on the company and property. The purpose of this step is to be fully prepared for the in-person farm visit. These results may be compiled into a “farm profile” that details the history of the company and/or associated cooperatives, land ownership, and management practices. Most of the data is collected with the in-person farm visit and interview, which generally takes between 1 to 2 hours. Sometimes other permanent workers, family members or representatives of the cooperative may also be present to provide additional information. The information from the farmer meeting is then compiled into a report with general recommendations for the company and landowners following GiZ guidelines.

Justification of chosen methodology

Based on preliminary conversations with BIOFIN and Coopetarrazu the team chose the CATIE assessment as it was the best match for the client's needs. Other existing biodiversity assessments, such as PBF and GBS (which are summarized in the appendix), rely heavily on species counts for their calculations. Because of this, the team felt that the CATIE method was more holistic than the alternatives.

In addition to the CATIE assessment, the research team felt it would be helpful to provide qualitative recommendations for farms to improve biodiversity on different spatial scales. Technically, the official BCA process is complete after the presentation of a Biodiversity Action Plan (BAP), an internationally recognized assessment that provides a strategy to improve wildlife management and biodiversity. There was not sufficient time to complete an entire BCA evaluation and Biodiversity Action Plan for each farm, so instead the team developed a slightly abbreviated evaluation based on the BCA questionnaire. This meant the team did not write a full profile for each farm and removed a couple of questions that were not applicable to coffee production. This also allowed us to focus more time on our quantitative assessments. The questions to conduct these evaluations and the detailed results are available in the appendix.

Summary of results

Successes

Overall, biodiversity and conservation are significant decision-making criteria for landowners that sell to Coopetarrazu. Every landowner who was interviewed mentioned they considered biodiversity to be important to their work in some way. Nine out of ten farmers were able to specify environmental changes they had noticed, such as changes in rainfall or pests. However, between the farms there was not a consistent answer as to what these environmental changes looked like within the Tarrazú region. Three of the farmers reported seeing fewer pests compared to the 2019-2020 growing season, although there is not a clear answer for what caused this. Two of the farmers noted they have seen more *roya,* a pest that prefers drier climates and requires more intensive atomizer use to ward off.

All of the landowners displayed knowledge of species diversity in their area, as they recalled multiple plant, invertebrate, and vertebrate species from memory. Four said they took specific actions to protect pollinators, such as maintaining flowering trees. Others who did not have a detailed plan still recognized the importance of pollinators, particularly bees. Two landowners mentioned their neighbors engaged in beekeeping or other activities to improve pollinator habitats. These results show that there is potential for neighbors to collaborate on improved biodiversity outcomes.

For the quantitative assessment, the total scores on the farms ranged from 25.3 to 59.8, with an average score of 42.2. Since all of these scores are greater than 0, this indicates all of the farms have an overall positive impact on biodiversity. Higher scores indicate a stronger positive contribution to biodiversity. However, CATIE does not provide specific ranges on what is an ideal score, or thresholds to distinguish between a slight or significant impact.

Although the number of arboreal strata is not heavily weighted in the methodology, every farm showed some species diversity with at least 2 strata. From a numerical analysis, the most significant positive contributor to biodiversity was shade cover. In the sample plots, the percentage of shade cover ranged from 27 to 57 with a mean value of 42.7.

Furthermore, none of the agrochemicals used on the farm were considered extremely hazardous according to the methodology which indicates that landowners and Coopetarrazu are generally conscious of the products they use and the potential environmental implications.

Opportunities for improvement

Although the farmers all noted that they are conscious of how agricultural practices impact the environment, there is an opportunity to implement more biodiversity practices at the farm level. As seen in the quantitative assessments, which have been compiled in a separate document to be sent to Coopetarrazu and BIOFIN, agrochemical use, especially pesticide applications, were a significant contributor to the farms' environmental impacts. The majority of agrochemicals used were considered either moderately hazardous based on the WHO classifications that were defined on page 23, which indicates some potential harmful environmental and human health impacts.

Generally, the farmers followed Coopetarrazu's overall environmental guidelines, but none of them had developed a specific biodiversity policy at the farm level. Also, none of the farms did any formal biodiversity monitoring, despite the variety of knowledge that many of them showed about biodiversity.

Another challenge that was notable on the farms was the absence of recorded data for certain farm processes, particularly agrochemical use and waste production. The team acknowledges that a high level of detailed data can be logistically difficult for a farmer to maintain on their own. A more collaborative approach could be developed where Coopetarrazu supports individual farmers' efforts to gather and maintain this data.

A completed list of the qualitative recommendations for each of the 10 farms is available in the appendix. Provided below is a general list of biodiversity recommendations that can be implemented by landowners in collaboration with Coopetarrazu.

Productive area level:

- Maintain a written record of the names and quantities of each agrochemical that is used on the farm.
- Hold seasonal conversations with Coopetarrazu about agrochemical usage to evaluate how practices can be both cost-effective and environmentally conscious.

Farm level:

- Weigh and record the amounts of inorganic and organic waste that are produced at each farm. This could be done on a timed basis, such as every two weeks, or for a certain quantity (for example, recording each time enough waste is produced to fill a 35 kg bag).
- Create and maintain a biodiversity inventory with known plant and animal species. This can be updated annually if there is the capacity for it.

- Write down a farm-specific biodiversity policy and ensure that all employees are aware of the rules. This could include regulations against hunting, fishing, littering, and deforestation.

Surrounding area level:

- Communicate seasonally with neighbors about environmental topics such as weather changes, pests, and wildlife.
- Meet with Coopetarrazu, neighbors, and other local actors (such as ADI) to evaluate which other conservation measures can feasibly be implemented. Some possibilities include monitoring local water systems for pollution, developing a biodiversity inventory, and putting up signs preventing environmental degradation.

Limitations

One limitation to both the quantitative and qualitative biodiversity methodology was incomplete information for some farms. Although there was a Spanish speaker present for every farm, there were multiple instances where the correct spelling of an agrochemical could not be identified. This made it more difficult to draw comparisons between agrochemical use on multiple farms.

Since there is no minimum, maximum or average score for the coffee industry as a whole in the CATIE method, it is difficult to compare the farms to an industry standard. Furthermore, multiple categories that existed in the original methodology for habitat use — presence of epiphytes, mean number of tree species within a hectare, and number of trees with at least a 5 cm diameter at breast height within a hectare — were excluded from our methodology. This was because in many instances it was not logistically possible to access a hectare plot given the size and steep slopes on the farms.

Social Life Cycle Assessment (SLCA)

SLCA Introduction

An SLCA has four phases: goal and scope definition, social life cycle inventory, social life cycle impact assessment, and interpretations. The methodology can be improved overtime and can go through impact assessment several times.

The SLCA framework follows a base of collected inventory data to inventory indicators, impact subcategories, impact categories and ultimately to stakeholder categories. When scoping an SLCA, the definition of relevant stakeholder categories forms the basis for inquiry. In other words, these categories inform the scope of the assessment. Linked

to the stakeholder categories, are the impact subcategories that comprise socially significant themes or attributes (Table 1). These subcategories are assessed by the use of impact indicators, of which inventory indicators link directly with the inventory of the product life cycle. Our work proposes the use of community capitals in place of the traditional impact indicators (Table 2). The community capitals framework is a ripple effect mapping system that can be used to find where capitals are being addressed, improved, and having an impact (Table 2). Product impacts (community capitals) are measured against subcategories using inventory indicators.

Table 5: Stakeholder categories and their sub-impact categories[33]

Stakeholder category	**Impact subcategories**
Workers	Freedom of association and collective bargaining, child labor, fair salary, working hours, forced labor, equal opportunities/ discrimination, health and safety, social benefits/ social security, employment relationships, sexual harassment, and smallholders including farmers.
Local community	Access to material resources, access to immaterial resources, delocalization and migration, cultural heritage, safe and healthy living conditions, respect of indigenous rights, community engagement, local employment, and secure living conditions
Society	Public commitments to sustainability issues, contribution to economic development, prevention and mitigation of armed conflicts, technology development, corruption, ethical treatment of animals, and poverty alleviation
Consumers	Health and safety, feedback mechanism, consumer privacy,

[33] "Guidelines for SOCIAL LIFE CYCLE ASSESSMENT OF PRODUCTS AND ORGANIZATIONS 2020," Life Cycle Initiative (UNEP, n.d.), Guidelines for SOCIAL LIFE CYCLE ASSESSMENT OF PRODUCTS AND ORGANIZATIONS 2020.

	transparency, and end of life responsibility.
Value chain actors (not including consumers)	Fair competition. Promotion social responsibility, supplier relationships, respect of intellectual property rights, and wealth distribution

Table 6: Seven Community Capitals[34]

Capital	**Context** (pre-existing structures)	**Process** (actions, investments, interventions)	**Outputs and Outcomes** (results of actions)
Social	trust, norms of reciprocity, network structure, cooperation, common vision and goals, leadership, depersonalization of policies, acceptance of alternative views, diverse representation	Risks taken to express differences of opinions, actions linking the company to the outside community, representation on decision-making board	Indicators: Increased networks, communication, cooperation, trust Measures: new groups formed from the processes, new leaders, and more effective leaders
Human	population, education, skills, health, creativity, youth, diverse groups	Work expertise contributed to effort	Indicators: Increased use of the skills and abilities of local people (critical thinking, innovation, problem solving); increased initiative, responsibility, and innovation Measures: new skills acquired; workforce improved
Financial	tax burden/savings, state and federal tax monies, philanthropic donations, grants, contracts, regulatory exemption, investments, reallocation, loans, poverty rates	Type of materials contributed to effort; presence and sources of both local and external financial support; mechanisms used for leveraging financial support	Indicator: Appropriately diverse and vital economies Measures: New financial instruments established, new bond issues passed; outside funding obtained to improve infrastructure and business development; poverty reduction

[34] Cornelia Butler Flora, "Community Capitals: A Tool for Evaluating Strategic Interventions and Projects," n.d., https://naaee.org/sites/default/files/204.2-handout-community-capitals.pdf.

Natural	air quality, land, water, and water quality, natural resources, biodiversity, scenery	Preserving, restoring, enhancing, conserving environmental features.	Indicator: Healthy ecosystems with multiple community benefits Measures: Landscape, scenery, outdoor recreation opportunities, soils, air quality, water quality, wildlife, vegetation preserved, conserved or restored; land development policies adopted
Political	level of community organization through the use of government, ability of government to garner resources for the community	Relationship presence and nature of relationship between company and local, county, state, federal, tribal, regional governments	Indicator: Increased ability to secure resources for the community through elected officials Measures: New community and government connections at various levels
Community	Values, heritage recognition and celebration	Sharing cultural identities (heritage, history, ethnicity, etc.) to drive effort.	Indicator: cultural consciousness Measure: new community events
Built	housing, transportation infrastructure, utilities, buildings	Infrastructure used for effort	Indicator: Appropriately diverse and vital economies

SLCA Methods

The SLCA for this project focuses on workers and the local community stakeholders. As a result, the team selected four target stakeholder groups to interview. These four levels were landowners (most of whom were also coffee farmers), farmhands, Coopetarrazu office employees and a regional council board. Each stakeholder level had a different questionnaire template (e.g., one for farmers and a different one for office employees). Each stakeholder questionnaire template had the same background information questions across the different stakeholders but differed in questions relating to specific indicators according to the stakeholder addressed. However, the Association of Integral Development (ADI) does not have a questionnaire template because it was a structured conversation with two members. The three stakeholder questionnaire templates can be viewed in the appendix.

The questionnaires focused on four of the seven community capitals-social, human, community, and built environment. The first three targeted stakeholder groups are all workers but are at different levels in the

Coopetarrazu hierarchy. For these three the team examined the social, human, community, and built environment capitals by conducting one-on-one interviews. No migrant workers were interviewed as the time of the project did not coincide with their presence.

The team aimed to conduct a focus group with a regional council board–ADI that is established in communities around the area. Members of the ADI are local community members and leaders that serve their communities. This was to provide the team with more information and a larger perspective on how one of the local communities views the company. The discussion with the two ADI members was used to inform our community and the built environment capitals.

UNDP highlights the importance of women's empowerment and gender equality; it is important to identify whether there are any gender disparities among the four stakeholder levels. Additionally, the UNDP "Gender Equality Strategy" highlights the importance of addressing the role of women and determining what is the reality for women. To achieve strategic plan goals the UNDP recommends all country projects to "include specific measures to address gender inequalities and gender (and sex) disaggregated data and indicators."[35] The templates included questions that allowed for the collection of quantitative and qualitative data that relates to gender inequalities. The gender analysis allowed the team to understand if there were gender inequalities and elaborate on the current role of women at Coopetarrazu.

The context for the questionnaire templates were based on the four capitals selected. These questions were formed as a team and reviewed by the team's advisor, Dr. Jose Alfaro, as well as by Coopetarrazu and Biofin Costa Rica before beginning the interviews. The team also received approval from the University of Michigan's Institutional Review Board (IRB) for conducting qualitative research. As a result, all sensitive information obtained has remained anonymous to protect those interviewed.

It is important to note that all interview subjects were selected by Coopetarrazu. Moreover, it is unclear how the company determined whom the University of Michigan team should interview. Additionally, while the team visited ten farms and interviewed ten landowners, this sample does not account for a statistically appropriate sample size, and it is possible that it might not demonstrate majority views of the company.

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[35] United Nations Development Programme, "How To Conduct A Gender Analysis" (United Nations Development Programme, 2016), pp. 1-19.

The SLCA will discuss Coopetarrazu's impacts as either negative, positive, or neutral by using the capital's context and analyzing the outputs within each targeted stakeholder group using the data collected.

SLCA Results

Landowners

Human and Social Capital

The team interviewed the landowners on all ten farms identified. Out of the ten farms, only one landowner was a woman, and another was a husband and wife. The average answer for ownership of the farms was 13.3 years and with an average membership in the coop of 16.3 years. Most of the landowners own more than one coffee farm and three of the ten also sell coffee to another company besides Coopetarrazu. When asked if they think if Coopetarrazu gives them a fair price for their coffee, eight said no and the remaining two felt that they did not know what a fair price for their coffee is. Many expressed that the price is too low for annual expenses to produce coffee, either from Coopetarrazu directly or other sources. Some suggested that competitors in the area provide a better price but require further distances for drop-off compared with Coopetarrazu. A repeated comment was that Coopetarrazu does not pay higher prices for higher quality coffee and that they only purchase certain varieties of coffee. Some believed that Coopetarrazu should be purchasing more varieties of coffee. Additionally, some explained that financing with Coopetarrazu is easier than with a multinational company such as Volcafe.

When asked how much cooperation there is between the landowners and the company on a scale of 1-to-5 with 5 being the highest cooperation, the average answer was 4.2.[36] This demonstrates that there is a lot of cooperation; but there is still room for improvement.

Gender

All ten landowners share the notion that women have different roles than men on a farm. Similar to the farmhands, they each expressed that it is too physically demanding for women and other machismo[37] attitudes about how women are not fit for coffee growing. Despite this, when asked if a woman wanted to be a farmer full time if it was possible that she could

[36] On a scale of 1-to-5: 1 being that they do not agree at all, 3 being sometimes, and 5 being agreement on almost everything

[37] Machismo is a strong or aggressive masculine pride. In this context typically included doubt on women being able to do manual labor.

get hired, they all answered yes. Two of the landowners stated that they know someone who employs a woman full time.

Community and the Built Environment
All ten landowners expressed that Coopetarrazu contributes to the local economy and community. The company provides jobs, loans, and other financial assistance programs. When given a hypothetical situation of the company ceasing to exist only one saw a positive, which was the potential for another company to invest in the community and give a better price. However, they explain that this could also go the other way– which would be to pay them lower prices and not offer community benefits that are currently being provided. Many feared that coffee growers would be helpless; unemployment would skyrocket; the grocery store, gas station, and hardware store would cease to exist in the community.

Farmhands

Human and Social Capital
Farmhand was defined as a worker on a coffee farm that they do not own. The team interviewed farmhands from five of the ten farms. Four of the remaining farms did not have any farmhands and the remaining farm had workers who wished to not be interviewed. The five farmhands had similarities that included: they were all men, were either related to the landowner or a good friend of, had previous farming experience, and were employed year-round on multiple coffee farms. Additionally, four of the five are members of Coopetarrazu. When asked if they have direct contact with Coopetarrazu employees on a scale of 1-to-5,[38] the average answer was 4.8.

Gender
All five men believe that women farmers have different roles than men. They elaborated that women farmers are only hired for the harvest season. They are not aware of anyone who employs a female farmhand full time. They acknowledged that women face more barriers than men in the coffee business.

Community and the Built Environment
When asked if Coopetarrazu contributes to the region's economic development, they all said yes. Yet, two expressed that they only give loans to cooperative members. Moreover, four of the five believe that Coopetarrazu contributes to the local community. When given a

[38] *1 being almost never, 3 being sometimes, and 5 being almost regularly.

hypothetical situation of the company ceasing to exist four of the five saw only negative impacts. While the remaining individual thought it could allow for more competition between the smaller coffee companies that already exist in the region and that the community does not need Coopetarrazu.

Coopetarrazu Office Employees

Human and Social Capital

The team interviewed six employees, which included four women. Coopetarrazu selected the interviewee subjects and coordinated the interview times. It is unclear how the employees were selected. Five of the six interviews were conducted over Zoom. The average amount of time that employees had been working at Coopetarrazu was 4.8 years and they each worked in a team setting. When asked if they agree with the statement that the "Company has effective leaders" on a scale of 1-to-5, the average answer was 4.3.[39] They all felt that there is room for professional development. Additionally, the average answer was 4.5 on a scale of 1-to-5 on how strong their office relationships are with their peers.[40] When asked that same question but about their direct manager/supervisor instead of peers, the average answer was 4.8. These both suggest strong relationships.

Gender

The company has women in positions of leadership. Each employee expressed that there are equal opportunities and have never witnessed any discrimination. Coopetarrazu's men to women employee ratio was not disclosed to the team. Additionally, exact numbers for how many women the company employs were not given.

Community and the Built Environment

Each employee felt that the company engages with the local community. Moreover, they all believe that the company contributes to the local economy in different ways. This largely includes producing most of the coffee in the region and providing jobs.

ADI

The University of Michigan team aimed to conduct a focus group with the Santa Marta ADI members. The goal was to gain a larger perspective on

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[39] On a scale of 1-to-5: 5 being strongly agree, 3 being neutral or don't agree or disagree, and 1 being strongly disagree.

[40] On a scale of 1-to-5: 5 being that you have strong relationships, 3 being so/so, and 1 being that you have weak relationships.

how Santa Marta views the company. However, the team was only able to arrange a meeting with two ADI members. As a result, it was not a focus group, but the structured discussion still led to valuable insights.

Both interviewees have sold coffee to Coopetarrazu in the past. They believe that the company has positive impacts on the community. Moreover, they discussed how most of the economic development taking place in Santa Marta can be tied back to the company. They claimed that 95% of people in Santa Marta deliver coffee to Coopetarrazu. When discussing what would happen to the community if Coopetarrazu ceases to exist, they expressed it would be a catastrophe. They explained: for coffee growers they would be without financial support; gasoline and service stations and the grocery store would be impacted; and other agricultural services that the company provides would no longer be available. One of the interviewees thought that it would be bankruptcy for the whole region. He expressed that the region has no tourism or any other industry; it is a monoculture of coffee production. On the positive side, they believe that it could be an opportunity for the community to find someone else who will give a higher price for coffee. They felt that the company is not currently giving the highest possible price. They expressed that coffee growing is intensive and demanding work. They expressed that Coopetarrazu is a monopoly, but it is currently the best option for coffee production. They explained that 10-15 years ago, Coopetarrazu supported the local schools much more and now that is not common. They feel there is “some community building that is missing.” They concluded that the company has left coffee growers and their families behind with their prices and the price should be increased to meet current living standards.

SLCA Conclusion

Impacts to Workers

It is apparent that the company is striving for gender equality in the office setting. Yet, there is progress to be made for coffee landowners and farmhands. However, there are not enough female landowners or farmhands, and machismo attitudes are problematic. This could be an opportunity for Coopetarrazu to lead workshops or offer other programs to get local women involved and interested in coffee production.

The issue of adequately paying coffee growers for their crops was raised. The vast majority believe that Coopetarrazu is not paying a fair price. There needs to be more transparency and discussion on the Coopetarrazu process for setting prices. The ADI, farmhands, and landowners articulated how they believe that the company does not

currently pay a fair price. Many felt that there should be an incentive or rather a premium for higher quality crops.

Impacts to Local Community
The team's assessment led to the conclusion that Coopetarrazu's impacts on the community are neutral. The company offers many programs and services. The presence of the coop in so many economic activities could create community dependence. Transparency in the company's pricing of coffee and empowering women to grow coffee are just two recommendations that could shift Coopetarrazu's impact from neutral to positive.

Coopetarrazu's Impacts on the Community Capitals at Large
While the qualitative data suggests that there are some areas for improvement. It is evident that the company is having a positive impact on the Tarrazu region, on workers and other stakeholders by increasing and supporting the community capitals. Coopetarrazu creates norms, through certification programs, that encourage farmers to follow more environmentally progressive methods. They engage deeply in the economy of the community and provide many jobs and they follow a structure where community members can participate in the governance through membership.

Conclusion

The team employed three methodologies to understand biodiversity impacts or the deployment of private investment in agriculture. The environmental life cycle impact assessments showed that the highest impacts are in the terrestrial ecotoxicity and global warming categories and that the impacts were driven by fertilizer use for coffee production and energy use during the processing stage. Though conducting a full eLCA provided key insights, going through that process might be cumbersome for a company to take on. However, conducting the life cycle inventory and gathering the input data required to understand environmental impact of production is valuable and can help Coopetarrazu generate the KPIs, and data required to access the private capital market.

The biodiversity assessments both showed that all the surveyed farms had an overall positive impact on protecting biodiversity. Every landowner was generally aware of what biodiversity meant in the context of coffee farming and believed it to be an important concept. Each farm plays a role in a diverse ecosystem, especially considering the role of coffee plants in

attracting local pollinators. Many farmers also had a strong knowledge of local ecology and could name a variety of plant and animal species that were present on the property. However, most of them did not implement a specific biodiversity policy or take additional actions to protect and maintain the local habitat. This is one potential avenue for improvement. Another opportunity for the farms to further their commitment to biodiversity is by maintaining written records of agrochemical use, water, and waste production for each harvest. This can be done in collaboration with Coopetarrazu and potentially allow the farmers to reduce dependence on particularly harmful agrochemicals.

The community capitals framework used in the SLCA led to the conclusion that Coopetarrazu is having a positive social impact. While there are room for improvement when it comes to gender, it does appear that the company is striving for gender equality.

SCHOOL FOR ENVIRONMENT AND SUSTAINABILITY
UNIVERSITY OF MICHIGAN

BIOFIN
The Biodiversity Finance Initiative

PNUD

Nicoverde Final Diagnosis

Overview

Nicoverde Introduction and Business Model

Nicoverde is a producer and marketer of pineapples in Costa Rica. Most fresh pineapples sold on the world market are produced in Latin America,

with 84% grown in Costa Rica. Most of the production is on large-scale, monoculture plantations owned by a small number of national and multinational fruit companies. The value of the international trade of fresh pineapples is around $2 billion per year, and this market is dominated by Costa Rica with two out of every three pineapples traded internationally coming from the country. There are more than 58,000 hectares dedicated to pineapple production within areas with the lowest human development index in Costa Rica, generating 32,000 direct jobs, and 120,000 indirect jobs. Net global exports have increased by 40% in the last 10 years and around 15% of total production is marketed internationally. The production of pineapple has large impacts on the environment such as deforestation, wetland destruction, agrochemical use, and loss of biodiversity.

Nicoverde is a subsidiary of the Italian company Nicofrutta founded in 2017. Nicoverde has a pineapple packing plant in Pital de San Carlos, which is in the province of Alajuela, Costa Rica. Nicoverde is supplied by around 120 small pineapple producers linked to cooperatives and associations located in Costa Rica. These are in the cities of La Cruz, Upala, Guatuso, Los Chiles, San Carlos and Sarapiquí, Costa Rica. The company provides its associated cooperatives and 120 small producers with technical assistance and training on issues related to the importance of biodiversity, quality management and compliance with international standards.

Nicoverde has shown dedication to biodiversity and sustainability through its fulfillment of multiple certifications, such as: Rainforest Alliance, Fair Trade, Global Gap, and Biodiversity Partnership MesoAmerica. It also purchases from multiple organic farms in partnership with four local farming cooperatives.

Another way that Nicoverde has aimed to mitigate the biodiversity impacts of pineapple is through creating more efficient and circular economy processes. Nicoverde has an advanced laboratory based in their Nicoverde office that produces bioinputs and cultivates fungus and bacteria to replace soil chemical inputs. Additionally, it redirects some of the biological waste from the pineapple crown into animal feed. It produces biological materials such as fungal bacteria to distribute to farmers. This is intended as a substitution for more hazardous fertilizers. Finally, it labels fruit during the packaging and distribution process based on the product’s certification, informing the consumer of that product’s biodiversity impact.

Nicoverde Bioeconomy Projects

Nicoverde has been involved with the production of edible and medicinal mushroom cultivation from their pineapple agricultural waste. They have cultivated mainly the oyster mushroom *(Pleurotus spp)*, a product that has potential at high gastronomic, nutritional, and functional levels. This cultivation is meant to reduce the amount of waste generated from the pineapple production process and generate revenue. They have experimented and partnered with local chefs and suppliers to use and sell the mushrooms.

Nicoverde has also begun generation of bio-based materials to replace single use plastics and products. These will be used to replace paper and plastic labels in the pineapple sector. The labels have a base in biodegradable substrate and have incorporated the use of abaca fibers *(Musa textilis)*.

Biodiversity in the Pineapple Sector

Biodiversity is crucial to both environmental well-being and agricultural production. Agriculture impacts not just the farm property itself, but the greater local ecosystem. Globally, land use change is the main contributor to biodiversity loss. This is specifically notable in pineapple production, which requires open plots of land with little shade. Clear-cutting forests for agricultural development results in habitat loss. In particular, forest connectivity is reduced which threatens the wellbeing of local plant and animal species. Monoculture farming has especially been linked to habitat loss and degradation in soil and water quality. Agrochemical use during conventional pineapple farming, particularly monoculture, also has major environmental implications.[41] Heavy pesticide use reduces wildlife populations, including ecologically critical species such as pollinators. Pesticide exposure contributes to runoff and pollution, which harms wildlife particularly in aquatic habitats.[42] Consistent

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[41] Shaver, Irene, Adina Chain-Guadarrama, Katherine A. Cleary, Andre Sanfiorenzo, Ricardo J. Santiago-García, Bryan Finegan, Leontina Hormel, et al. “Coupled Social and Ecological Outcomes of Agricultural Intensification in Costa Rica and the Future of Biodiversity Conservation in Tropical Agricultural Regions.” *Global Environmental Change* 32 (May 1, 2015): 74–86. https://doi.org/10.1016/j.gloenvcha.2015.02.006.

[42] Echeverría-Sáenz, S., F. Mena, M. Pinnock, C. Ruepert, K. Solano, E. de la Cruz, B. Campos, J. Sánchez-Avila, S. Lacorte, and C. Barata. “Environmental Hazards of Pesticides from Pineapple Crop Production in the Río Jiménez Watershed (Caribbean Coast, Costa Rica).” *Science of The Total Environment*, Integrated modeling and monitoring at different river basin scales under global

pesticide exposure is also harmful to human health and wellbeing.[43] For this reason, many farmworkers wear a mask when applying agrochemicals.

However, there are ways that farmers can be conscious of their impacts and not only mitigate negative concerns but build positive ones. For example, farmers can consciously maintain the local ecosystem by monitoring and preserving native species. Some specific ways they can achieve this are by mitigating pesticide use, preserving native trees, and flowering plants, and maintaining biological corridors for animals to safely move throughout their habitat.

Certifications

In recent years, a number of third-party programs have set guidelines to help producers record and improve their impacts on biodiversity. Voluntary biodiversity certifications can help landowners and companies show a rigorous commitment to the environment and social welfare. Below is a list of the biodiversity certifications that Nicoverde holds.

Rainforest Alliance

In 2018 there was a merger of the Rainforest Alliance and UTZ to 'reimagine certification' in sustainable agriculture.[44] The Rainforest Alliance provides a sustainable agriculture standard that provides strong boundaries to biodiversity impact through agriculture. It creates a continuous improvement foundation for users by having core requirements that prescribe good practices as well as improvement requirements that change as a company gains recertification. This is done through a 'smart meter' that is developed after a baseline assessment. The core requirements include a thorough list of management capacities and commitment documentation, labor documentation, and many more. The most direct tie to biodiversity is found through the 'Farming' section of the requirements where it focuses on the "outcomes of sustainable agriculture, crop productivity and profitability, and natural resources and ecosystem services." This section includes core requirements in soil fertility and conservation, integrated pest management, minimal agrochemical use, and more. The requirements focus on the use of

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change, 440 (December 1, 2012): 106–14. https://doi.org/10.1016/j.scitotenv.2012.07.092.

[43] Payán-Rentería, Rolando, Guadalupe Garibay-Chavez, Raul Rangel-Ascencio, Veronica Preciado-Martinez, Laura Munoz-Islas, Claudia Beltrán-Miranda, Salvador Mena-Munguía, Luis Jave-Suárez, Alfredo Feria-Velasco, and Ruth De Celis. "Effect of chronic pesticide exposure in farm workers of a Mexico community." *Archives of environmental & occupational health* 67, no. 1 (2012): 22-30.

[44] Rainforest Alliance. "UTZ Certification (Now Part of the Rainforest Alliance)." Accessed April 12, 2022. https://www.rainforest-alliance.org/utz/.

organic fertilizers and biological pest control methods first, the rotation of active ingredients, the banning of prohibited pesticides, and the consistent documentation of agrochemical use.[45]

Biodiversity Partnership Mesoamerica

The Biodiversity Partnership Mesoamerica was established in San José, Costa Rica in 2012[46]. Its purpose is to connect private sector actors throughout Central America and the Dominican Republic who wish to incorporate biodiversity into their business strategy. BPM offers a certification process as one of its capacity building strategies for members. However, the exact details of this certification are not publicly available.

Fair Trade

Fair Trade is a rigorous certification process that showcases a commitment to high environmental, and social standards in production. Although agricultural producers may choose to be fair trade certified, the designation can also apply to unrelated products such as textiles and precious metals. To become Fair Trade, companies must apply for a third-party auditor to review its supply chain. Specific criteria include environmental standards to reduce human and environmental exposure to chemicals, fair labor conditions and contracts, commitment to non-discrimination (including gender discrimination), and standards for a minimum price.[47]

Organic

Although Nicoverde is not exclusively organic, a few the farms that they order from are. One pineapple cooperative that they work with, Coopeproagro, is completely organic. Organic produce is grown without any fertilizers, pesticides, antibiotics, or GMOs. In many nations, including

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[45] Rainforest Alliance. “Rainforest Alliance Sustainable Agriculture Standard: Farm Requirements.” Accessed April 12, 2022. https://www.rainforest-alliance.org/wp-content/uploads/2022/01/2020-RA-Sustainable-Agriculture-Standard-Farm-Requirements.pdf

[46] Initiative 20x20. “Biodiversity Partnership Mesoamerica.” Accessed April 12, 2022. https://initiative20x20.org/partners/biodiversity-partnership-mesoamerica-bpm.

[47] Fairtrade International. “Fairtrade Standard for Prepared and Preserved Fruit & Vegetables for Small Producer Organizations and Traders.” Accessed April 12, 2022. https://www.fairtradeamerica.org/app/uploads/2020/08/PreparedPreservedFruit_SPO-EN.pdf.

the United States and Costa Rica, the department of agriculture typically oversees the standards for organic certification. Organic farming initially became popularized in Costa Rica in the 1980s due to momentum from small producers, particularly in banana and cacao farming. Organic production has a documented positive impact on the environment and reduces farmer reliance on monoculture, which may also help provide a steadier year-round form of income[48]. It is also worth noting that many organic farmers may not have an official certification due to the necessary paperwork and costs, so it is difficult to quantify exactly how much of pineapple production is organic.

University of Michigan Field Work Overview

Fieldwork was conducted with the guidance and support of the Nicoverde team. The research team visited ten farms over the course of four weeks in July 2021. At each farm, photos were taken via drone with permission from the landowner to gain an understanding of the landscape and boundaries of each farm and data was gathered via interviews for environmental and social life cycle assessments.

With the assistance of General Manager Jorge Sanchez, the University of Michigan team identified four cooperatives to complete farm tours with: Coopepiña, Probio, Agronorte, and Coopeproagro. The University of Michigan group interviewed one or two representatives from each cooperative for the SLCA. Each cooperative then took the team to two farms between June 30 and July 21.

With oversight from the German Society for International Cooperation (GiZ) and Nicoverde, the research team conducted the Biodiversity Check Agricola (BCA) at five farms. The University of Michigan team accompanied two representatives from the GiZ team to Nicoverde's Movaba and Lucialva farms and shadowed them while they conducted interviews for the updated BCA.

[48] Damiani, Octavio. "Organic Agriculture in Costa Rica: The Case of the Talamanca Small Farmers Association," 2002. https://doi.org/10.13140/RG.2.1.3899.1601.

Environmental Life Cycle Analysis (eLCA)

What is an ELCA and why is it important to biodiversity?

An Environmental Life Cycle Analysis (eLCA) is an analysis of environmental impacts of a product's life cycle, most commonly used to understand which part of the process has the most overall environmental impact. There are two types of eLCA analysis: cradle-to-gate and cradle-to-grave, where the former follows the production from beginning till it leaves the ownership of the producer, and the latter follows the process till the consumption and disposal. Conducting an eLCA has four phases: goal and scope definition, life cycle inventory analysis (LCI), life cycle impact assessment (LCIA), and interpretation. During the goal and scope phase the bounds of analysis are clearly defined to ensure the results are valuable and targeted. During the LCI phase data is collected on the production process of a product over a specified period, and during the LCIA phase the data is analyzed to understand the impact of the product's production. And finally, during the interpretation phase, the LCIA data is further analyzed to glean insights as to which parts of the production process have the highest impact and what the overall impact of the product is.

The Organization for Economic Co-operation and Development has noted that "various studies have shown that excessive use of pesticides has led to biodiversity loss and ecosystem degradation (Green, et al. 2005, Kleijn, et al. 2009) and in particular, pesticide use has contributed to reducing populations of birds, insects, amphibians and aquatic and soil communities, either through direct exposure or reduction in food and habitat availability.[49] Literature shows that quantifying these values helps in understanding effects on biodiversity at a high level since biodiversity is negatively affected by environmental damages. Biodiversity is known to be negatively affected by the use of agrochemicals such as pesticides, herbicides, and fertilizers.

Studies exist through eLCA literature that quantify the effects of a variety of agrochemicals on land use change, ecotoxicity, eutrophication, water use, air emissions, acidification, ozone formation, etc. And these effects can be summed up based on the amounts of agrochemicals used for production, transportation, and processing of the plant.

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[49] Sud, Megha. "Managing the Biodiversity Impacts of Fertiliser and ... - OECD." OECD. =, 2020. https://www.oecd.org/officialdocuments/publicdisplaydocumentpdf/?cote=ENV/WKP(2020)2&docLanguage=En.

However, a true measure of nitrogen impacts is best conducted through a nutrient balance of the farm which requires thorough analysis of soil nutrient level, plant nutrient uptake, and surrounding N leakage. This analysis was not within scope of the work presented here. Though a common indicator on pesticide risk does not exist at the moment, the measurement of and understanding of pesticide use intensity is critical to reducing pesticide use overall.

These eLCAs were conducted in Simapro using the Recipe Midpoint (H) method and data was used from the Ecoinvent 3 database. The impact categories and associated damage pathways are shown in Figure 1 below. Based on the open eLCA reference the team can see that the categories associated with acidification, ecotoxicity, climate change, and land use have a direct impact on biodiversity loss.[50] Thus the impact categories that are of highest relevance to these eLCAs and for biodiversity are global warming, water use, freshwater ecotoxicity, freshwater eutrophication, ozone formation, terrestrial ecotoxicity, terrestrial acidification, land use, marine ecotoxicity, marine eutrophication. Due to Nicoverde's operations not being directly near the Costa Rican coasts, the marine impact categories were not analyzed.

[50] Aitor P Acero, Cristina Rodriguez, and Andreas Ciroth, "LCIA Methods - Openlca," accessed April 24, 2022, https://www.openlca.org/wp-content/uploads/2015/11/LCA-METHODS-v.1.5.2.pdf.

Figure 9: ReCiPe 2016 Impact Categories and associated Damage Pathways51

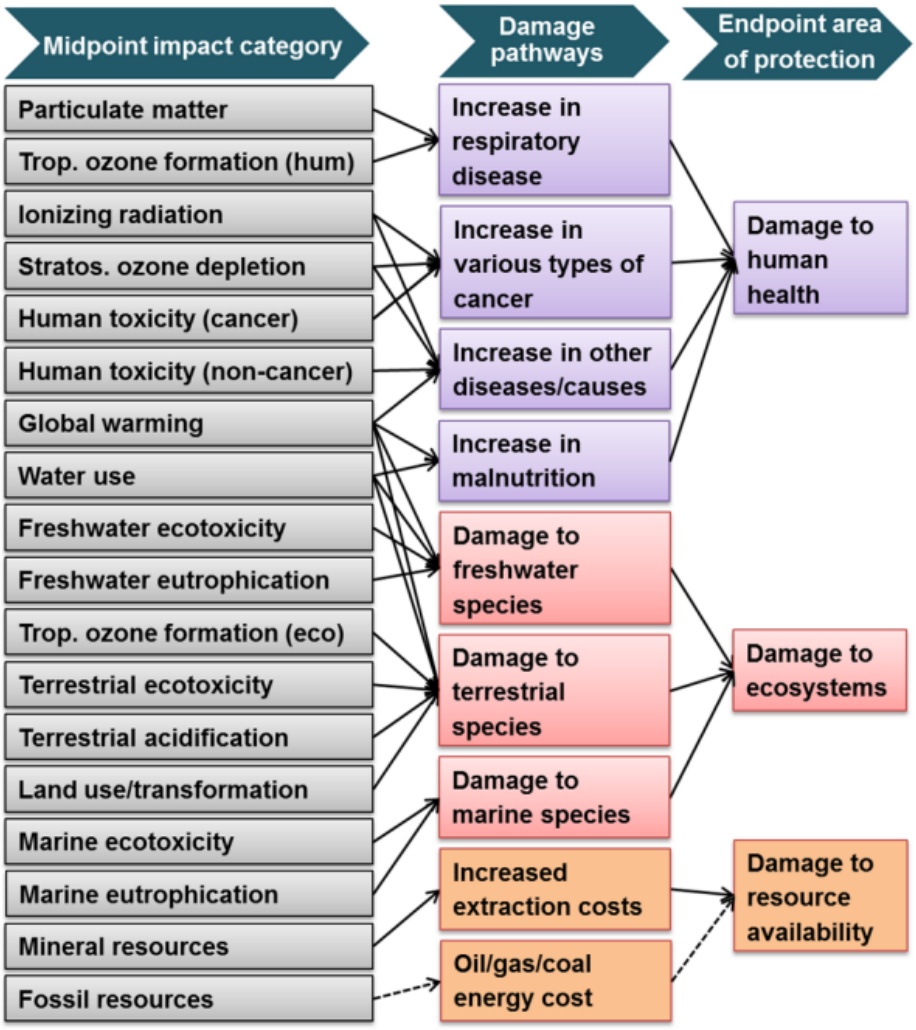


Figure 1.1. Overview of the impact categories that are covered in the ReCiPe2016 methodology and their relation to the areas of protection.

Pineapple Growth Cycle & Functional Unit

Pineapple (*Ananas comosus*) is an herbaceous perennial that grows close to the ground, typically grown in tropical regions belonging to the Bromeliaceae family. A single plant can produce over 200 flowers that

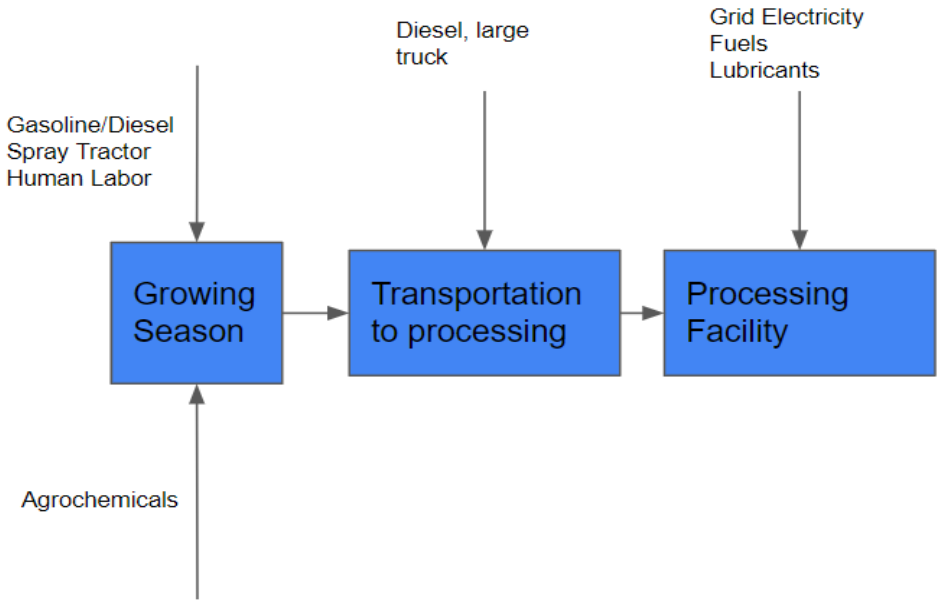
[51] Huijbregts, M.A.J. “Recipe 2016 V1 - Pré Sustainability.” https://www.rivm.nl/en, 2016. https://pre-sustainability.com/legacy/download/Report_ReCiPe_2017.pdf.

join to form one fruit at the center of the plant[52]. Pineapple pollination is a specific process that includes separately producing daughter plants that have been asexually produced from the mother plant and replanting them. Flowering begins 5 to 10 months after planting and fruiting follows over the next 6 months.

Though a single pineapple takes between 16 to 24 months to fully mature, our analysis only accounts for a year of agrochemicals and harvesting per farm. Most of the farms spoken to reseed their own plants consistently, every few weeks. Based on that understanding and through conversations with farmers the assumption is made that the farms are similar in what percent of new seeded vs mature pineapple fruit was on the land. Thus, the functional unit is 1 kg of harvested pineapple. Where a box typically contains between 6-10 pineapples and 1 plant produces roughly 1 kg of pineapple.

In order to test an assessment methodology that can show effects on biodiversity, the scope of the environmental life cycle assessment is cradle to gate, essentially the year-long growth process of a pineapple through to the harvesting and processing process.

Figure 10: Nicoverde Process Flow Diagram



[52] Undlin, Siri. “How Do Pineapples Grow?” Earth.com, June 17, 2019. https://www.earth.com/earthpedia-articles/how-do-pineapples-grow/.

Data for the production facility was taken from data gathered for Nicoverde's 2020 carbon report. This includes lubricating oils, fuels for forklifts and internal transportation, and electricity.

Out of scope

The transportation of seedlings from outside sources to the farm itself was considered out of scope, the transportation and bagging of final pineapple fruit to the customer is out of scope, and the transportation of and bagging method of the raw materials are considered out of scope. The office building and associated sanitary wastewater treatment is considered out of scope.

Many of the pesticides used at the Nicoverde farms are microbial biopesticides such as Paecilomyces lilacinus, and metarhizium anisopliae. There are not many existing eLCA studies focused on microbial biopesticides that showcase their impact on the local environment. "Biopesticides are usually inherently less toxic than conventional pesticides and biopesticides often are effective in very small quantities and decompose quickly, resulting in lower exposures and largely avoiding the pollution problems caused by conventional pesticides."[53] Due to this understanding in literature that the use of biopesticides is beneficial to organic and natural farming practices in comparison to the use of chemical pesticides, the microbiological materials are not considered in the eLCA as their impact on the environment is considered to be negligible.

Production timeline and processing plant

Pineapples are transported to the Nicoverde production facility from different farms and cooperatives during the harvest season (peak from March-August). The pineapples are unloaded from the trucks into a water tank (water is taken from the reservoir next to the processing plant) where they are washed and then loaded onto a conveyor belt. Workers are located on either side of the conveyor belt, sorting the pineapples by size, removing some of the crowns based on international market preference, and removing excessive leaves. The pineapples are sorted by size and organized by market preference. For example, pineapples shipped to Israel have the crowns removed before being boxed. Pineapples are labeled by the number of pineapples that can fit into a box. A pineapple that is identified as a 6, fits into a box with 6 pineapples. Though

[53] "What Are Biopesticides?" EPA. Environmental Protection Agency. Accessed April 24, 2022. https://www.epa.gov/ingredients-used-pesticide-products/what-are-biopesticides.

sometimes there will be 10 pineapples in a box. Organic pineapples are noticeably smaller than non-organic and thus might be packed tighter into a box. Boxes are stored in refrigerated storage rooms which can be labeled organic, fair trade, crownless, and the country that they will be shipped to. These are only stored temporarily until loaded on trucks to be shipped to their respective markets. For the eLCA, the amount of electricity, fuels, and lubricants used per kg of pineapple were used to calculate environmental impact.

Results and Recommendations

Due to incomplete data farms 5, 7, and 10 were not analyzed. The farms that were analyzed ranged from normal farming techniques, low pesticide use, and full organic production. The differences per farm are detailed in the table below. Farms 4 and 5 have full organic production and farm 3 is working to reduce inorganic pesticide use.

Table 7: Use of inorganic vs organic agrochemicals per farm

Farm #	Full Organic	Inorganic Pesticides used	Inorganic fertilizers used
1		Yes	Yes
2		Yes	Yes
3		No	Yes
4	Yes	No	No
6		Yes	Yes
8		Yes	Yes
9	Yes	No	No

Table 8 below details the units for the impact metrics shown in the graphs following.

Table 8: Units for all impact metrics used in figures below

Impact Metric	**Unit**
Global warming	kg CO2 eq
Terrestrial acidification	kg SO2 eq
Freshwater eutrophication	kg P eq
Terrestrial ecotoxicity	kg 1,4-DCB
Freshwater ecotoxicity	kg 1,4-DCB
Land use	m2a crop eq
Fossil resource scarcity	kg oil eq

Figure 11: Inorganic vs Organic Production Impact Analysis

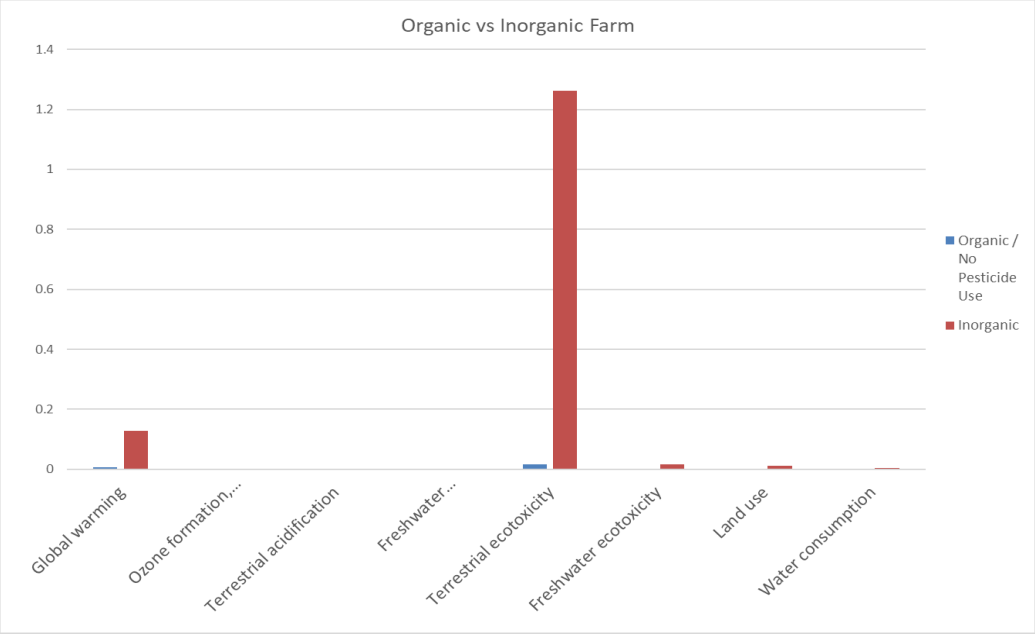


Figure 12: Average impact of Organic Production

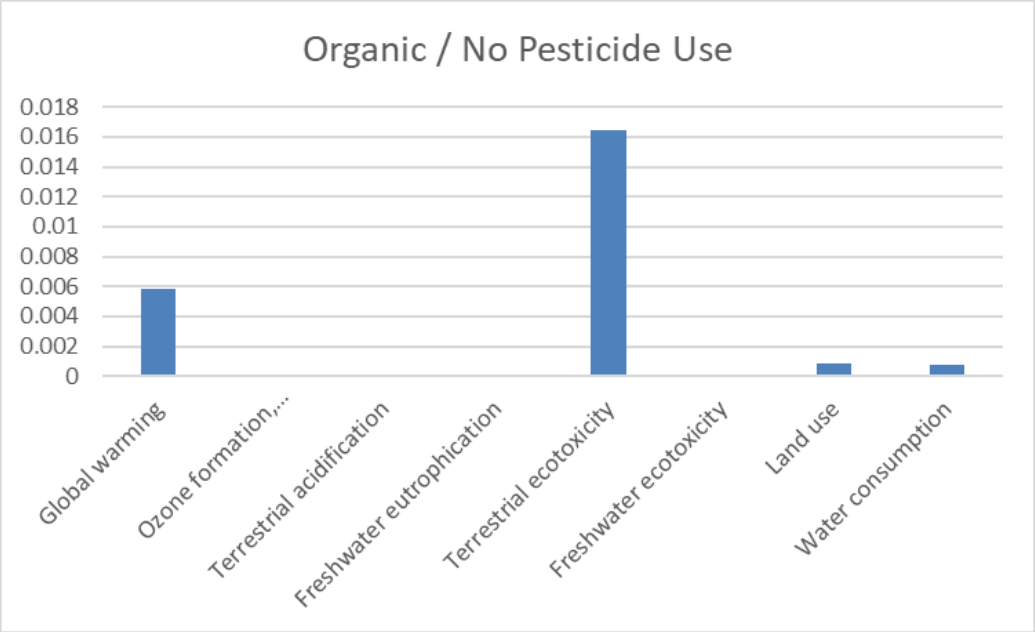


Figure 13: Average impact of Inorganic production

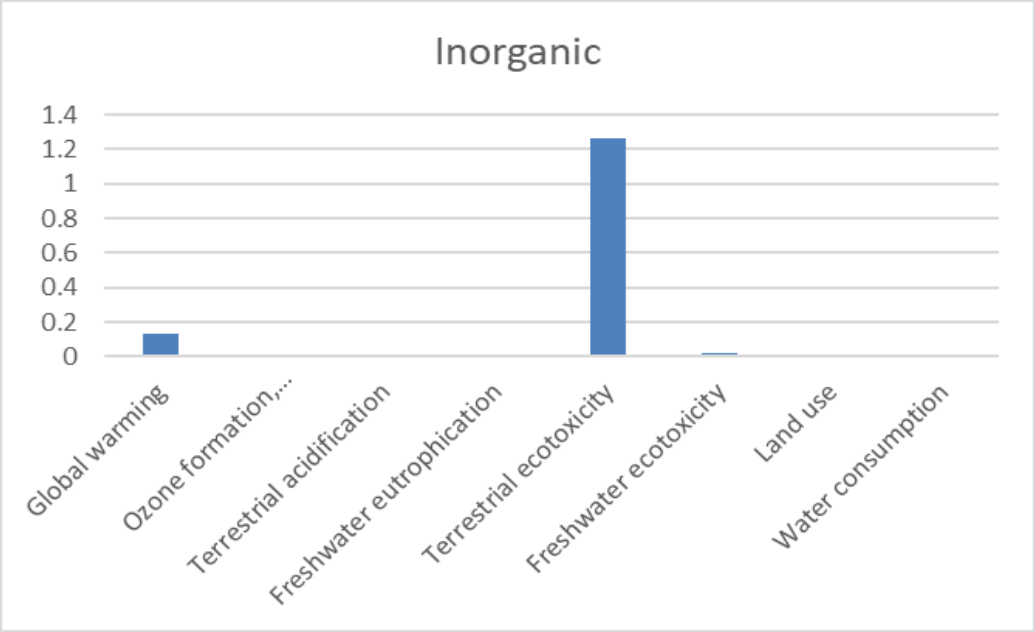


Figure 14: Farm comparisons for Terrestrial Ecotoxicity

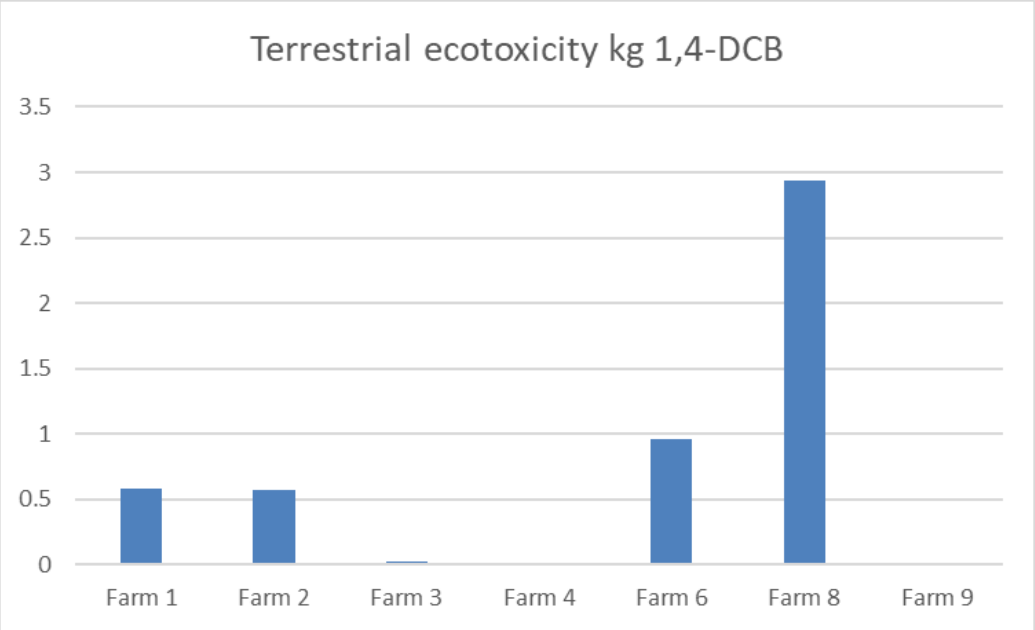
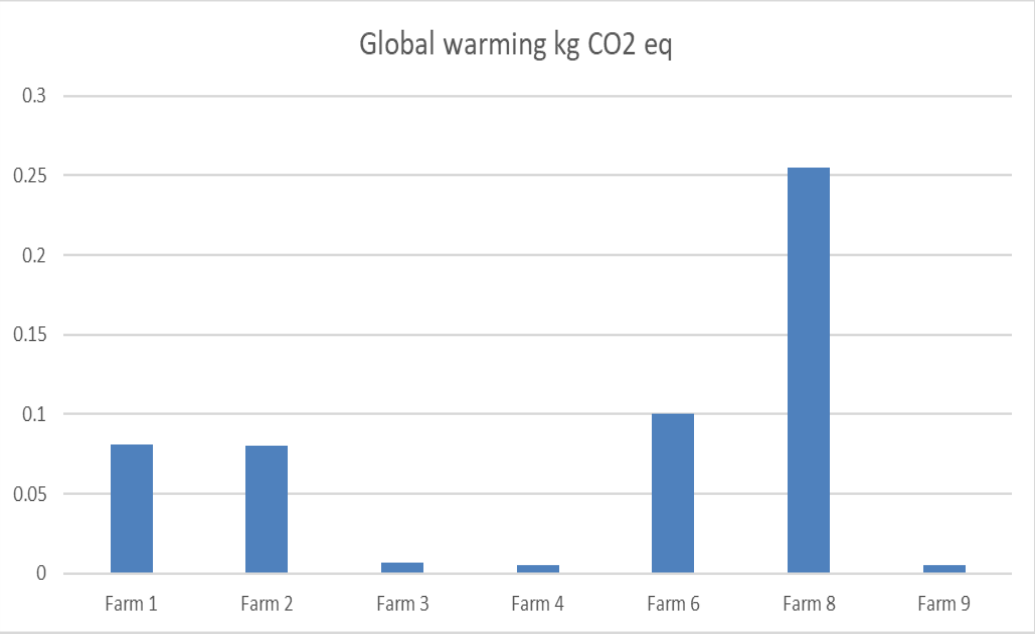


Figure 15: Farm comparisons for Global Warming potential



As seen in the image above, the organic and low pesticide use farms show minimal ecotoxicity in comparison to others. Amongst the inorganic farms, see a large difference in ecotoxicity and global warming potential. Understanding what drives this difference, (whether its land type, elevation, age, etc.) can help Nicoverde understand how to reduce agrochemical use and push towards more organic production on the inorganic farms.

Figure 16: Farm 1, Terrestrial Ecotoxicity impact of different processes

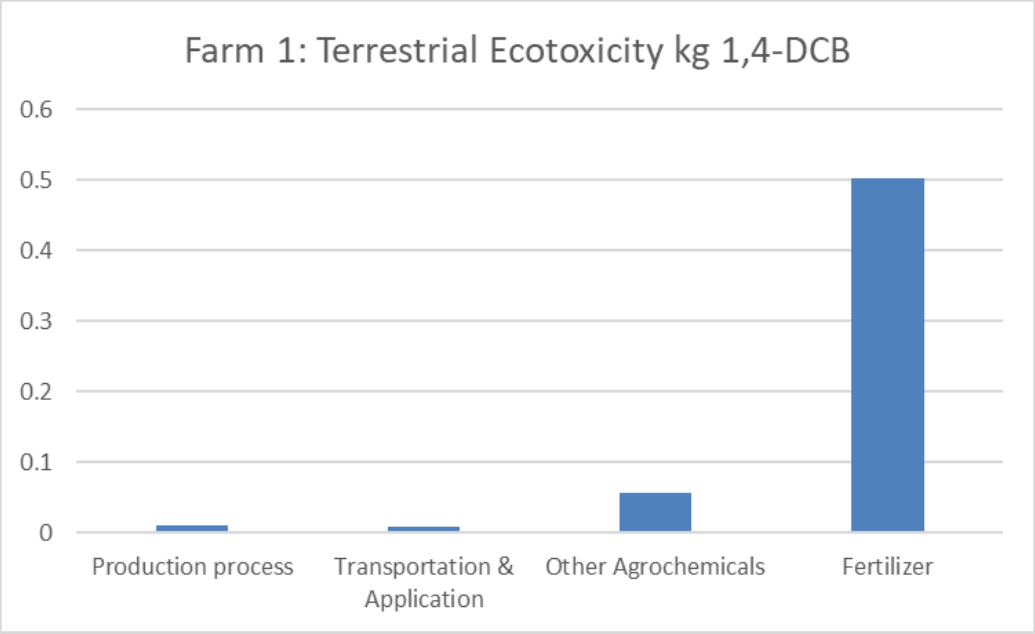
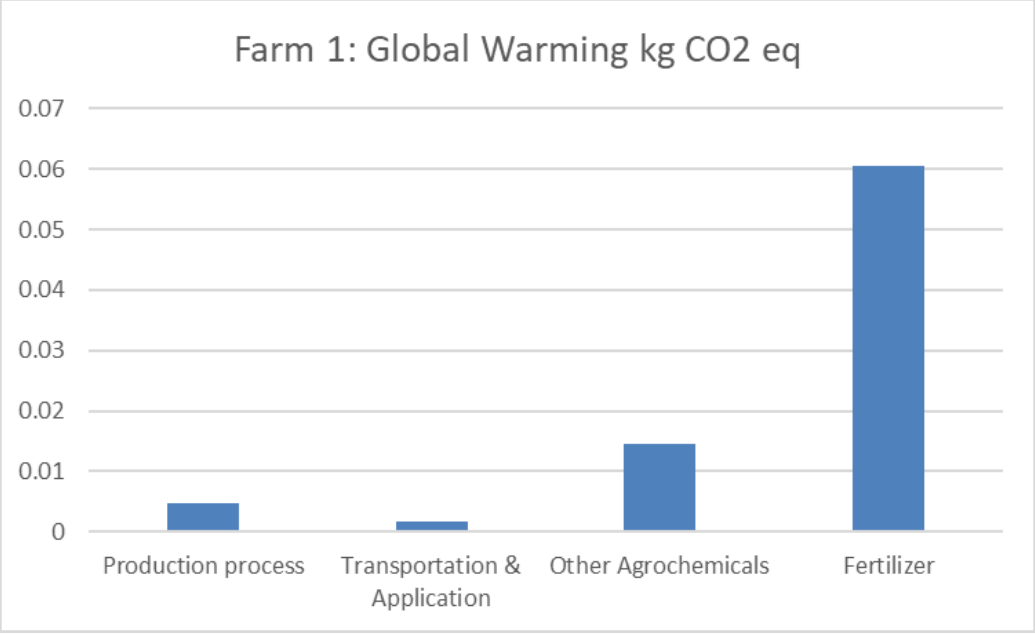


Figure 17: Farm 1, Global Warming impact of different processes



Figures 16 and 17 show the differences in impact from the parts of the pineapple process for an inorganic farm. Inorganic fertilizer and

agrochemical use clearly play a strong role in ecotoxicity and global warming impact.

Figure 18: Farm 4, Terrestrial Ecotoxicity impact of different processes

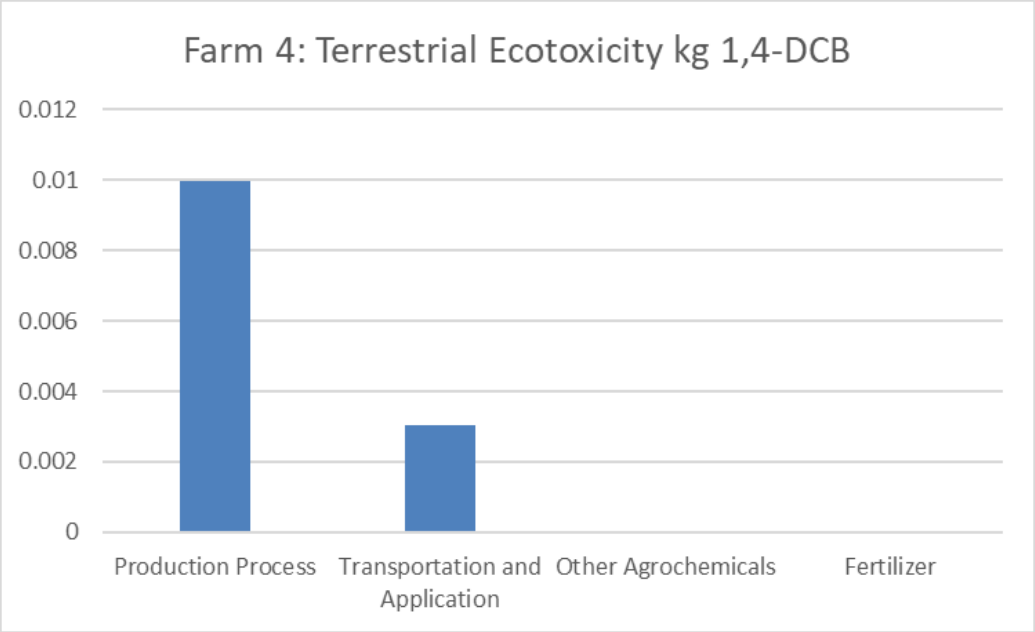
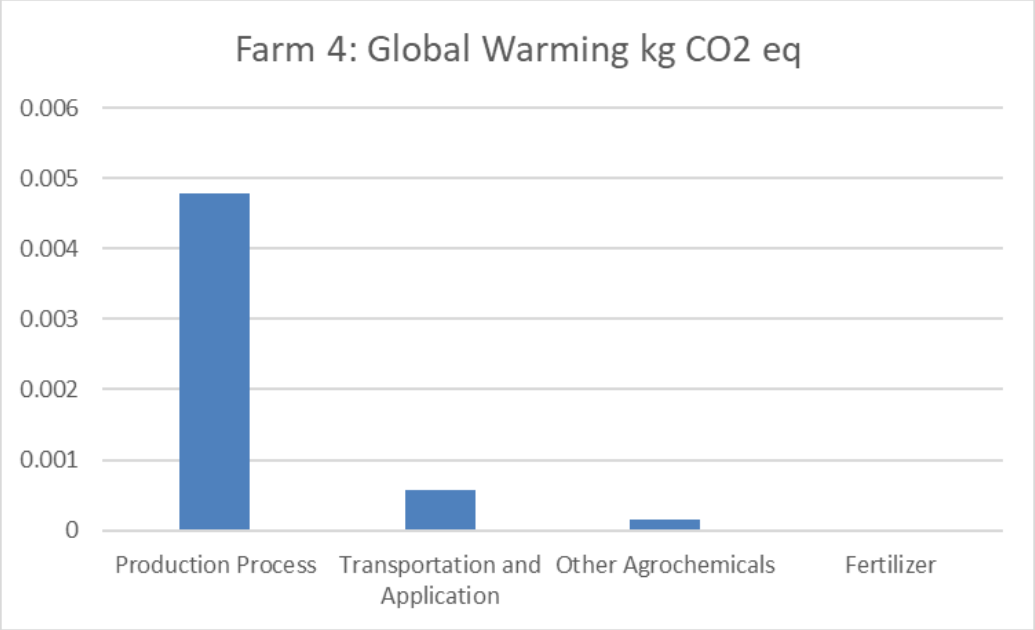


Figure 19: Farm 4, Global Warming impact of different processes



Using Farm 1 from figures 16 and 17 as an example of inorganic processes, we can see that fertilizer use and agrochemical use play the largest role in impacting biodiversity metrics. In comparison, for an organic farm of Farm 4, the production process itself plays the largest role. Overall, the use of a spray tractor to add agrochemicals and the transportation of pineapples from each coop/farm to the processing facility don't play a significant role in impacting biodiversity. This information can help Nicoverde prioritize changes at the plant level knowing that reducing inorganic chemical use will make the strongest difference first.

Limitations

Due to limitations in Simapro and the eLCA methodology, the impact of pesticides might be understated. The Ecoinvent 3 database does not include complete data of the impacts of certain pesticides and the generic pesticide material was used in the eLCA for several of the highly hazardous pesticides. Thus, though the information from the eLCA is valuable in helping understand the overall impact of Nicoverde's processes on the environment, the results may not provide valuable insight into the positive or negative biodiversity impact of specific parts of the process.

eLCA Conclusions

Though pineapple is not native to this region, Nicoverde's push for organic production shows a commitment to reducing environmental impact and maintaining biodiversity. As shown through the eLCA analysis, the reduction in agrochemical use through the use of microbial biopesticides has a significant reduction on negative environmental impact, specifically in global warming potential and terrestrial ecotoxicity.

Conducting a full eLCA of production and processing at Nicoverde farms provides insights into which processes generate the most environmental impact, however conducting a full eLCA might be out of scope of most company operations due to the simapro expertise and time required. Also, the lack of proper data for certain agrochemicals diminishes the value of the eLCA results. In comparison, the goal and scope and life cycle inventory stages might be accomplishable by a company and if conducted periodically, can help generate valuable data.

If Nicoverde were to apply to access private capital through a sustainability-linked loan or bond, understanding their overall environmental impact and a plan for how it can be reduced (these are the KPIs that can be tracked to access the bond/loan), will be necessary. Working toward lowering pesticide use and biodiversity certification is a

comprehensive way to showcase this improvement. And the data collection methods used for an eLCA, if conducted consistently, can help generate this data.

Biodiversity Assessment

In recent years, several quantitative and qualitative methods for measuring agricultural impact have been developed by international researchers. These are valuable for measuring biodiversity in multiple contexts, comparing farms to one another, and developing broader policy decisions that relate to biodiversity. The following section provides a brief description of the selected methodology. A short summary of additional biodiversity methodologies that were not selected is available in Appendix A

GiZ BCA

The Gesellschaft für Internationale Zusammenarbeit (GiZ) (English: German Corporation for International Cooperation) is Germany's main international development agency. GiZ currently partners with over 130 countries to assist with their development goals. One of their main objectives is to help companies achieve the UN Sustainable Development Goals (SDGs), not just in Germany but internationally.[54] GiZ began developing the Biodiversity Check Agrícola (BCA) in 2018-2019 due to the perceived need to assess agricultural production through a biodiversity lens. The methodology evaluates biodiversity impacts through three spatial scales: the production area, the farm, and the greater/neighboring landscape. Additionally, at the beginning of the assessment there is space to provide an overall summary on management practices at the business and/or cooperative level. These subcategories are then broken down into a total of 18 overall goals that companies are evaluated on:

1. Business management
    a. Politics of biodiversity
    b. Personal capacity and sensibility
    c. Selecting providers
    d. Minimal impact on infrastructure
    e. Completion of environmental legislation
2. Productive area
    a. Ground conservation
    b. MIP and low toxicity pesticides

[54] GiZ. "Germany." Accessed April 12, 2022. https://www.giz.de/en/worldwide/germany.html.

    c. Genetic resources and adaptive/resilient systems
    d. Efficient water use
3. Farm
    a. Conserved ecosystems
    b. Wildlife and identified protected habitats
    c. Restored areas that are not suitable for production
    d. Infrastructure for biodiversity
    e. Identified and controlled invasive species
    f. Approved and minimal impact waste
4. Landscape
    a. Identified protected areas and reduced impacts
    b. Watershed management activities
    c. Alliances with local actors [55]

Typically, the BCA process begins with some preliminary research on the company and property. The purpose of this step is to be fully prepared for the in-person farm visit. These results may be compiled into a "farm profile" that details the history of the company and/or associated cooperatives, land ownership, and management practices. Most of the data is collected with the in-person farm visit and interview, which generally takes between 1 to 2 hours. Sometimes other permanent workers, family members or representatives of the cooperative may also be present to provide additional information. The information from the farmer meeting is then compiled into a report with general recommendations for the company and landowners following GiZ guidelines. The first section of the appendix details the interview questions along with the final biodiversity recommendations for individual properties.

Justification of selected method

Nicoverde first applied the BCA in November 2019 for 3 different farms, and since then have partnered with GiZ to expand the practice. In addition to this history, the client felt that the qualitative and holistic nature of the BCA would be the most useful for their goals. The client did not feel a need for a quantitative biodiversity assessment currently. Some of the farms that required an ELCA, such as Finca Movaba, had already completed a BCA within the last 2-3 years. Fortunately, some of the data that was collected from a previous BCA could be used for the ELCA.

[55] GiZ. "Biodiversity Check: una herramienta para la gestión de la biodiversidad." Accessed April 12, 2022. https://www.giz.de/en/downloads/2019_08_27%20Fact%20sheet%20agricola_rr_esp.pdf.

Typically, the BCA includes a biodiversity action plan (BAP) for each farm. The BAP is an international framework that sets guidelines for protecting habitat biodiversity. Therefore, while setting the scope with Nicoverde the completion of the BCA was defined as the writing of a farm profile and initial report with recommendations. These reports will be visible in the appendix and are intended to be distributed to Nicoverde employees, cooperative employees, and farm owners.

Biodiversity results and recommendations

Successes

As already noted in a previous assessment conducted by a GiZ convoy for Nicoverde that the University of Michigan shadowed, the company's Finca Movaba and Finca Lucialva have shown an especially extended commitment to biodiversity.

The five farms that were surveyed for the BCA varied in size and agricultural practices. However, one of the notable similarities between these farms was a stated commitment to biodiversity. Two farms had signage on the property to enforce concrete biodiversity policies, such as bans against hunting and fishing. Formal biodiversity monitoring was not as common, although the landowners could all name various plant and animal species that they knew existed on the property. One farm had a detailed invertebrate species inventory with pictures that was developed in collaboration with a local university. Furthermore, two farms maintained detailed paper records of agrochemical use and waste production throughout the harvesting season. These documents are critical for understanding environmental impacts at the farm level and facilitate data collection for biodiversity evaluations.

In addition, two of the farms had entirely organic production. The team recognized that due to several factors, such as land size and cost-effectiveness, it is not feasible for every farm to transition to organic production. However, the fact that Nicoverde incorporates some organic farming into their supply chain highlights a deep commitment to biodiversity and an understanding of how agrochemical use impacts the environment. Even farms that were not organic utilized biological mechanisms, such as the bacteria *Bacillus,* to supplement or replace traditional fertilizers. This highlights how even producers that may not have the capacity for completely organic production still aim to mitigate the harmful impacts of agrochemical use.

Opportunities for improvement

Nicoverde has already shown commitment to the economic livelihood of the area through providing various employment opportunities, but there is still potential for greater community-level involvement between farms. Landowners could collaborate with neighbors and/or other producers within the cooperative to implement biodiversity-conscious practices that may be more challenging to complete at the farm level, such as biodiversity monitoring.

A complete list of the survey responses and recommendations for each farm is available in the appendix. Provided below are some holistic biodiversity recommendations that can be implemented by landowners in collaboration with Nicoverde and the cooperatives.

Productive area level:

- Have seasonal conversations with Nicoverde and/or the cooperative about agrochemical usage. The University of Michigan is not recommending specific changes in agrochemical products at this time, since it would be outside of our given expertise.
- Implement/continue crop rotation practices and allow soil to rest between harvests. The *mocuna* bean is one possibility that was mentioned, although landowners should consider the specific land history and any cooperative guidelines before selecting a specific crop.

Farm level:

- Create (if not completed yet)/maintain a formal biodiversity policy and ensure that all employees are aware of the regulations. Some examples include regulations against hunting, fishing, deforestation, and littering.
- Create and maintain a biodiversity inventory with known plant and animal species. This can be updated annually, if there is the capacity for it.

Surrounding area level:

- Create/update a map that identifies the farm and production area along with protected areas, water, forested areas, and other natural landmarks. This can also be used to inform farm-specific biodiversity regulations.
- Meet with Nicoverde, the cooperative, neighbors, and other local actors (such as an ADI or nearby conservation groups) to evaluate other biodiversity measures that can feasibly be implemented. Some possibilities include monitoring local water systems for pollution, developing a biodiversity inventory, and putting up signs preventing environmental degradation.

Limitations

A big constraint in implementing the BCA methodology was time. With only a month to conduct fieldwork in the area, it is difficult to draw detailed comparisons between cooperatives. In addition, the interview questions sometimes asked for a high level of detail that may not be immediately available to the farmer. For example, the farmer may not remember every agrochemical they use in the field from memory. Although some information was sent to the University of Michigan after the interview for additional details, some farms did not have complete information availability. Another limitation was the language difference. Although there was always at least one Spanish speaker during the interviews, it was a challenge to determine the correct spellings for certain agrochemicals which also contributed to some incomplete results. Although some farms and cooperatives provided detailed physical records of their data to the team, this was not possible for every farm due to varying resources and policies.

Social Life Cycle Assessment (SLCA)

SLCA Introduction

An SLCA has four phases: goal and scope definition, social life cycle inventory, social life cycle impact assessment, and interpretations. The methodology can be improved overtime and can go through impact assessment several times.

The SLCA framework follows a base of collected inventory data to inventory indicators, impact subcategories, impact categories and ultimately to stakeholder categories. When scoping an SLCA, the definition of relevant stakeholder categories forms the basis for inquiry. In other words, these categories inform the scope of the assessment. Linked to the stakeholder categories, are the impact subcategories that comprise socially significant themes or attributes (Table 1). These subcategories are assessed by the use of impact indicators, of which inventory indicators link directly with the inventory of the product life cycle. Our work proposes the use of community capitals in place of the traditional impact

indicators (Table 2). The community capitals framework is a ripple effect mapping system that can be used to find where capitals are being addressed, improved, and having an impact (Table 2). Product impacts (community capitals) are measured against subcategories using inventory indicators. Finally, interpretations are conducted through assessing the data.

Table 9: Stakeholder categories and their sub-impact categories[56]

Stakeholder category	**Impact subcategories**
Workers	Freedom of association and collective bargaining, child labor, fair salary, working hours, forced labor, equal opportunities/ discrimination, health and safety, social benefits/ social security, employment relationships, sexual harassment, and smallholders including farmers.
Local community	Access to material resources, access to immaterial resources, delocalization and migration, cultural heritage, safe and healthy living conditions, respect of indigenous rights, community engagement, local employment, and secure living conditions
Society	Public commitments to sustainability issues, contribution to economic development, prevention and mitigation of armed conflicts, technology development, corruption, ethical treatment of animals, and poverty alleviation
Consumers	Health and safety, feedback mechanism, consumer privacy,

[56] "Guidelines for SOCIAL LIFE CYCLE ASSESSMENT OF PRODUCTS AND ORGANIZATIONS 2020," Life Cycle Initiative (UNEP, n.d.), Guidelines for SOCIAL LIFE CYCLE ASSESSMENT OF PRODUCTS AND ORGANIZATIONS 2020.

	transparency, and end of life responsibility.
Value chain actors (not including consumers)	Fair competition. Promotion social responsibility, supplier relationships, respect of intellectual property rights, and wealth distribution

Table 10: Seven Community Capitals[57]

Capital	**Context** (pre-existing structures)	**Process** (actions, investments, interventions)	**Outputs and Outcomes** (results of actions)
Social	trust, norms of reciprocity, network structure, cooperation, common vision and goals, leadership, depersonalization of policies, acceptance of alternative views, diverse representation	Risks taken to express differences of opinions, actions linking the company to the outside community, representation on decision-making board	Indicators: Increased networks, communication, cooperation, trust Measures: new groups formed from the processes, new leaders, and more effective leaders
Human	population, education, skills, health, creativity, youth, diverse groups	Work expertise contributed to effort	Indicators: Increased use of the skills and abilities of local people (critical thinking, innovation, problem solving); increased initiative, responsibility, and innovation Measures: new skills acquired; workforce improved
Financial	tax burden/savings, state and federal tax monies, philanthropic donations, grants, contracts, regulatory exemption, investments, reallocation,	Type of materials contributed to effort; presence and sources of both local and external financial support; mechanisms used for leveraging financial support	Indicator: Appropriately diverse and vital economies Measures: New financial instruments established, new bond issues passed; outside funding obtained to improve infrastructure and business development; poverty reduction

[57] Cornelia Butler Flora, "Community Capitals: A Tool for Evaluating Strategic Interventions and Projects," n.d., https://naaee.org/sites/default/files/204.2-handout-community-capitals.pdf.

	loans, poverty rates		
Natural	air quality, land, water, and water quality, natural resources, biodiversity, scenery	Preserving, restoring, enhancing, conserving environmental features.	Indicator: Healthy ecosystems with multiple community benefits Measures: Landscape, scenery, outdoor recreation opportunities, soils, air quality, water quality, wildlife, vegetation preserved, conserved or restored; land development policies adopted
Political	level of community organization through the use of government, ability of government to garner resources for the community	Relationship presence and nature of relationship between company and local, county, state, federal, tribal, regional governments	Indicator: Increased ability to secure resources for the community through elected officials Measures: New community and government connections at various levels
Community	Values, heritage recognition and celebration	Sharing cultural identities (heritage, history, ethnicity, etc.) to drive effort.	Indicator: cultural consciousness Measure: new community events
Built	housing, transportation infrastructure, utilities, buildings	Infrastructure used for effort	Indicator: Appropriately diverse and vital economies

SLCA Methods

The University of Michigan team determined that the SLCA would focus on workers and the local community stakeholders. As a result, the team selected four target stakeholder groups to interview. These four groups were landowners (most of whom were also coffee farmers), farmhands, Nicoverde office and plant employees, and pineapple cooperatives. Each stakeholder level had a different questionnaire template (e.g., one for farmers and a different one for office employees). Each stakeholder questionnaire template had the same background information questions across the different stakeholders but differed in questions relating to specific indicators according to the stakeholder addressed. The stakeholder questionnaire templates can be viewed in the appendix.

Additionally, this SLCA utilized the Community Capitals Framework. The questionnaires focused on four of the seven community capitals- social, human, community, and built environment. The targeted stakeholder groups are all workers but are at different levels in the Nicoverde hierarchy and are not necessarily employed directly through the company. The team examined the social, human, community, and built environment capitals by conducting one-on-one interviews. However, there was one exception for the four pineapple cooperatives; some had two representatives and thus were not one-on-one interviews. No migrant workers were interviewed as the time of the project did not coincide with their presence. The cooperative interviews were to provide the team with more information and an outside perspective on how different communities view the company.

UNDP highlights the importance of women's empowerment and gender equality; it is important to identify whether there are any gender disparities among the four stakeholder levels. Additionally, the UNDP "Gender Equality Strategy" highlights the importance of addressing the role of women and determining what is the reality for women. To achieve strategic plan goals the UNDP recommends all country projects to "include specific measures to address gender inequalities and gender (and sex) disaggregated data and indicators."[58] As a result, gender was incorporated into the SLCA analysis. The templates included questions that allowed for the collection of quantitative and qualitative data that relates to gender inequalities. The gender analysis allowed the University of Michigan team to understand if there were gender inequalities and elaborate on the current role of women at Nicoverde.

The context for the questionnaire templates were based on the four capitals selected. These questions were formed as a team and reviewed by the team's advisor, Dr. Jose Alfaro, as well as by Nicoverde and Biofin Costa Rica before beginning the interviews. The team also received approval from the University of Michigan's Institutional Review Board (IRB) for conducting qualitative research. As a result, all sensitive information obtained has remained anonymous to protect those interviewed.

The SLCA will discuss Nicoverde's impacts as either negative, positive, or neutral by using the capital's context and analyzing the outputs within each targeted stakeholder group using the data collected.

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[58] United Nations Development Programme, "How To Conduct A Gender Analysis" (United Nations Development Programme, 2016), pp. 1-19.

SLCA Results

Landowners

Human and Social Capital

The team interviewed the landowners on all ten farms identified. Two of the landowners work directly for Nicoverde and are not part of a cooperative. The remaining eight interviewees were each a member of one of the four cooperatives. Interviews from the cooperative representatives are discussed in their respective section of this SLCA report. The team interviewed two landowners from each cooperative and the representative selected the interviewee subjects. Out of the ten farms, only one landowner was a woman. The average answer for how long landowners had been growing pineapple was 24.7 years and with a range of 4 to over 35 years in how long the landowners had owned the land. Four owned just one pineapple plot of land and the remaining six had at least one other additional plot of farmland. When asked if they think their coop sells their pineapple to Nicoverde for a fair price, seven of the eight applicable interviewees said yes. The one outlier explained that sometimes it is unfair because of supply and demand; when there are a lot of pineapples, he feels it is an unfair price.

When asked how much cooperation there is between them and their neighbors on a scale of 1-to-5 with 5 being the highest cooperation, the average answer was 3.55.[59] This demonstrates that there is some cooperation but there is room for improvement.

Gender

Three landowners have women farmers; this included family members and the women worker on Movaba that is discussed below in farmhands. The responses were mixed in terms of whether women farmers have a different role than men on the farm. The answers that responded, no there is no difference, usually followed-up by discussing how men and women perform the same roles during the harvest. As a result, these answers were inconclusive because the team wanted to know about in general and not about the harvest season specifically. However, one landowner mentioned that there is a policy where you must try to hire female farmers but that a lot of people do not do this because if the women get pregnant you have to pay them four months maternity leave. In addition, this landowner elaborated that there are a lot of machismo problems. If you hire a young woman, some of the men might harass her

[59] On a scale of 1-to-5: 1 being that they do not agree at all, 3 being sometimes, and 5 being agreement on almost everything

by making inappropriate jokes and/or try to take advantage of her. Some discussed how women are better at certain jobs like applying fertilizer and more delicate tasks. While men are better at raking and other jobs that require strength. When asked if a woman wanted to be a farmer full time, could she get hired, seven interviewees said yes. Five claimed to know someone who employs a woman farmer full time. Overall, it was clear that there is room for improvement in views about gender and farming.

Community and the Built Environment

All ten landowners expressed that Nicoverde contributes to the region's economic development by buying their pineapple crops. Some expressed that before Nicoverde, small farmers would sell to companies that would not always pay them. Nicoverde supports their cooperatives through financial services, providing their biological products for a good price, and stable payments to farmers. Many expressed liking the Bioinputs and how it is important to work with Nicoverde to reduce chemical usage in pineapple production. The benefits cascade because there are many people involved in the production and exportation of pineapple. When given a hypothetical situation of the company ceasing to exist, no one saw any potential positive impacts. Three expressed neutral sentiments such as someone else would buy the fruit so the area would survive, and another expressed how not much would happen to his community because he is one of the few that sells to Nicoverde. While others expressed how it would be a large loss of employment, especially in packaging, as well as a chain of events because other companies rely on Nicoverde and that it would be a large problem to have to find another buyer. One interviewee worried that it would be difficult to get a Fair Trade certification on his own. Essentially, it would cause economic and social problems.

Farmhands

Human and Social Capital

Farmhand was defined as a worker on a pineapple farm that they do not own. The team interviewed four farmhands from Movaba and Lucialva. It is important to note that these two farms are not part of any pineapple cooperative and only sell to Nicoverde. The relationship between the farmhands and landowner is just employees, no familial connections. All four men are from Nicaragua and ranged in age from 23 to 45 years old. Each farmhand works year-round for the landowner through an informal contract. When asked to describe their relationship with the landowner on a scale of 1-to-5, the average answer was 4.75.[60] Also, when asked if

[60] On a scale of 1-to-5: 1 being that you don't get along at all, 3 being that you get along somewhat, and 5 being that you agree on most things.

they have direct contact with Nicoverde employees on a scale of 1-to-5, the average answer was 2.5.[61] It is worth noting that the research team witnessed the farmhands on Lucialva sign a formal contract during their fieldwork, which was on July 20, 2021 along with three other men (this was after the interviews had been conducted). A formal contract will allow for stronger relationships with the landowner.

Gender

All four men believe that women farmers do not have different roles than men. When asked if they know anyone who employs a woman farmer full time, they all said no. This was interesting because the landowners of Movaba told the team that they employ one female farmer. Additionally, one of the two Movaba landowners is the sole owner of Lucialva, so it was worth noting that his farmhands did not know of a female farmhand. Each farmhand answered yes when asked if they think there are equal opportunities for women farmers at Nicoverde.

Community and the Built Environment

When asked if they think Nicoverde contributed to the local community, two farm hands discussed how the company protects green spaces and helps prevent the destruction of natural habitats and the other two said yes by providing local jobs. In terms of contributing to the region's economic development, providing jobs was mentioned again and how this makes the community better off. When given a hypothetical situation of the company ceasing to exist all four described how they would lose their jobs, people would need to find alternative sources of employment, and that would be even harder right now with the pandemic. Other negatives include that Nicoverde does a lot of knowledge building so people might know less about pineapple production and no positive impacts were listed when asked.

Nicoverde Office and Plant Employees

Human and Social Capital

The team interviewed seven employees, which included five office employees of which four were women and two pineapple plant packaging workers of which one was a woman. Jorge Sanchez selected the employees for the team to interview. It is unclear how they were selected but all were helpful, and the office is small. The office employee sample could be considered a representative sample of the office employee views on Nicoverde. The average amount of time that employees had been working at Nicoverde was 1.8 years. Some work independently and others as part of a team; the consensus was that teamwork is more

[61] 1 being almost never, 3 being sometimes, and 5 being almost regularly.

common. When asked if they agree with that statement that the "Company has effective leaders" on a scale of 1-to-5, the average answer was 4.8.[62] They all felt that there is room for professional development. Additionally, the average answer was 4.7 on a scale of 1-to-5 on how strong their office relationships are with their peers.[63] When asked that same question but about their direct manager/supervisor instead of peers, the average answer was 4.8. These both suggest strong relationships. All seven answered yes when asked if they feel there is good cooperation and communication between employees. Lastly, all seven employees answered a 5 when asked if they like working at Nicoverde.[64]

Gender

All interviewees answered yes when asked if there are equal opportunities between men and women. Moreover, when discussing if professional development opportunities are available to both men and women six said yes and one said most of the time. All interviewees said that there is equal representation in leaders, group members, and or as managers. The office employees noted that there are more women than men at the administrative level. Additionally, the plant workers noted that there is equal gender representation. One of the plant workers explained that gender is not a barrier; opportunities are available to everyone. In a separate interview, an office employee explained that if there is a job opening it will go to whoever scores highest based on their competencies. Nicoverde's men to women employee ratio was not disclosed to the team. Lastly, exact numbers for how many women the company employs were not given.

Community and the Built Environment

The office employees shared similar cultural identities. They each grew up in the area and are all Catholic. The two plant workers had similar cultural identities as well. When asked if they think there are different cultural identities (e.g., race, sex, religion, political views, etc.) present at Nicoverde they all answered yes. When presented with the question of to what extent does Nicoverde engage with the local community, the responses ranged from 3-5 with an average answer of 4.1.[65] In terms of how Nicoverde contributes to the region's local economy, it is evident that

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[62] On a scale of 1-to-5: 5 being strongly agree, 3 being neutral or don't agree or disagree, and 1 being strongly disagree.

[63] On a scale of 1-to-5: 5 being that you have strong relationships, 3 being so/so, and 1 being that you have weak relationships.

[64] On a scale of 1-to-5: 1 being you strongly don't like, 3 is you are impartial, and 5 is you strongly like.

[65] On a scale of 1-to-5: 1 being that Nicoverde is not involved at all, 3 being that Nicoverde is somewhat involved, and 5 is that Nicoverde is very much involved with the community.

the company is providing stable high-value jobs (it was noted especially during the pandemic) and creating products that farmers want, such as the Bioinputs. Since Nicoverde's start in 2017, Nicoverde has worked directly with pineapple cooperatives. Six of the seven interviewees answered yes that they are being paid a fair salary. Additionally, when asked if there is anything that the Michigan research team should know about Nicoverde there were two critical points– how important biodiversity is to the company and that it is a principle that guides a lot of the business decisions as well as the fact that interviewees mentioned how fair things are done at Nicoverde compared to other companies. Lastly, employees spoke exceptionally well of working with Don Jorge and some mentioned that work feels like a family.

Pineapple Cooperatives

The University of Michigan team wanted to meet with representatives of the four different pineapple cooperatives that Nicoverde works directly with. The goal was to gain a larger perspective on how the company interacts with the landowners as well as the farmhands, if there was any interaction at all. These ended up being unstructured conversations than the other targeted stakeholder interviews.

Human and Social Capital

The team spoke with two representatives from Coopepina, two from Probio, two from Agronorte, and one from Coopeproagro. The cooperatives ranged in size from 22 to 35 members. Some noted that not everyone has recovered from the pandemic, and some have moved away and rented their land to other producers. The coops are useful for small farms. The cooperatives aid the landowners including with the certification processes, for example Agronorte has helped their members get Fair Trade certification and or Rainforest Alliance certification. When asked if they have direct contact with Nicoverde employees on a scale of 1-to-5, the average answer was 4 with three coops saying 5 and one saying 1.[66] The coops ranged in starting to farm for Nicoverde from 2015 (when it was Nicofrutta– Nicoverde parent company) to the beginning of 2020. Coopepina and Agronorte only sell to Nicoverde. Only 20% of Probio's pineapple goes to Nicoverde and 30% of Coopeproagro's pineapple goes to Nicoverde. One interviewee explained that Nicoverde could buy more of their cooperative's pineapples if the company expanded beyond specific European markets. Different markets want specific sized pineapples. Additionally, some mentioned that only growing pineapple is not financially sustainable for farmers. Economically sustainable farmers

[66] On a scale of 1-to-5: 1 being almost never, 3 being sometimes, and 5 being almost regularly.

need around ten hectares, which is about one truckload of pineapple a week. One of the cooperative's contracts the farm hands and rotates them around the landowners' farms because the landowners cannot afford to pay for full time workers. Each cooperative answered yes when asked if they think Nicoverde pays a fair price for pineapple.

Gender

When asked if women farmers have different roles than men on the farm, all seven representatives, which included two females, said yes. Women do the harvest and help in administrative roles. It is not common to see a woman apply fertilizer or plant pineapple. The more physically demanding roles will be completed by men. Coopepina explained that they try to think about gender because it is part of the fair trade requirements. In addition, each cooperative said there are equal opportunities for women farmers at their respective cooperative. Interestingly enough, Probio explained that in Costa Rica only 8% of farms are in women's names, which makes it hard for women to get loans. They elaborated that Costa Rica has some policies, but progress is slow. Coopeproagro said that there are economic barriers to being a landowner and their coop is organic, which makes it even more expensive. Others discussed there is a cultural barrier and stigma, with farming historically being a male activity. In terms of whether they know anyone who employs a woman farmer full time, only two of the cooperatives said yes.

Community and the Built Environment

Each cooperative was asked how Nicoverde engages with the local community. One interviewee said Nicoverde has given money to educate the community about water contamination, recycling, and environmental sustainability. Nicoverde's work to make more natural chemicals (bioinputs) for pineapple production is important. Others said that they were not sure and elaborated about how their organization engages with the community. Coopepina discussed how with fair trade they must show how they use their money and give to local organizations, which includes an organization that helps homeless people and is run by a woman. In terms of how Nicoverde contributes to the region's economic development, responses included: providing employment opportunities; helping farmers improve their production and providing better equipment; and they pay a fair price and on time, which helps people keep growing pineapples. Many noted that Nicoverde has helped other organizations grow and develop better practices.

When given a hypothetical situation of the company ceasing to exist, all three cooperatives saw no potential positive impacts and the fourth said it could be an opportunity for another company to grow and become Fair

Trade certified. Potential negative impacts included social and economic impacts including loss of employment and financial security for farmers because Nicoverde has a guaranteed minimum price per pineapple. Nicoverde is unique from the other pineapple companies in the region because they support small farmers and if they no longer exist, it will be harder for smaller farmers to access resources. Lastly, since Nicoverde is focused on sustainability that ethos would be lost.

SLCA Conclusion

Nicoverde's Impact on Social Capital and Human Capital
The team's fieldwork interviews and SLCA results lead to some key takeaways. It is apparent that the company is striving for gender equality in the office and plant packaging environments. There appeared to be equal opportunities in these settings. Yet, there are not enough female landowners or farmhands. Still, it appears that progress is being made and gender norms about farming are shifting. Overall, Nicoverde's impacts on social capital and human capital are positive.

Nicoverde's Impact on Community Capital and Built Environment Capital
Ultimately, the team's assessment led to the conclusion that Nicoverde's impacts on the community and built environment capitals are positive. People share similar identities and values. The four cooperatives help Nicoverde to have a wider reach in the community and have a more vital economic impact. It is clear that people enjoy collaborating with Nicoverde as well as working for the company.

Conclusion Final Diagnosis

Nicoverde is working hard to improve their impact on biodiversity by focusing on organic production and reducing dependence on harmful agrochemicals. The company's various sustainability certifications and strong recordkeeping of agrochemical use, along with ongoing research into biological substitutes for agrochemicals, show an overall positive impact on biodiversity.

The team employed three methodologies to understand biodiversity impacts or the deployment of private investment in agriculture. The environmental life cycle impact assessments showed that the most impacted categories were terrestrial ecotoxicity and global warming and the impacts were driven by inorganic fertilizer use for pineapple production and other agrochemical use at the farm level. For the organic farms, because of the minimal use of inorganic materials and the use of biopesticides, the processing of pineapple played the largest role in

environmental impact. The use of a spray tractor for agrochemicals and the transportation to the processing facility don't play a large role in comparison. Nicoverde's push for organic production shows tangible environmental and biodiversity benefits through the eLCA. Though conducting a full eLCA provided these key insights, going through this process might be cumbersome for a company to take on.

Instead, conducting the life cycle inventory and gathering the input data required to understand environmental impact of production is valuable and can help Nicoverde generate the KPIs, and data required to access the private thematic capital markets. This can help Nicoverde on their journey to more organic production.

Overall, Nicoverde showed a highly positive commitment to biodiversity as evidenced through their completion of multiple third-party sustainability certifications. The qualitative BCA assessments showcased additional steps that the landowners, cooperatives, and Nicoverde all take to maintain and improve biodiversity. Some strengths included placing signs summarizing the importance of protecting the natural environment, banning hunting on the property, and keeping detailed annual records on agrochemical use and waste production. In general, there is still an opportunity to improve the biodiversity impact of pineapple production on the surrounding area. Although one of the surveyed farms had previously done biodiversity monitoring, this was generally not standard due to the extended time and personnel commitment that this requires. Therefore, one recommendation for Nicoverde is to facilitate further collaboration between landowners, the cooperatives, and other local stakeholders such as universities, local development organizations such as ADIs, and neighboring agricultural producers. This may help with the future creation of monitoring and protection initiatives that would benefit biodiversity not only on the farm, but throughout the Costa Rican northern zone.

The community capitals framework used in the SLCA led to the conclusion that Nicoverde is having a positive social impact. Additionally, the company is striving for gender equality.

Conclusion

The team’s project led to many valuable insights and involved learning three methodologies. Perhaps, this methodology could be replicated by a future School for Environment and Sustainability Capstone project.

The quantitative biodiversity assessment for Coopetarrazu was useful for understanding how both habitat characteristics and human inputs, such as agrochemical usage, influence biodiversity. However, the results are difficult to interpret in the context of the agricultural sector as a whole. Certain steps of the written guidelines could not be completed in the field since steep slopes on the farm prevented the team from creating plots for habitat assessment. Also, the methodology's points system was vague which made it unclear how to compare final scores between farms, or even to assess the company as a whole.

The qualitative biodiversity assessments helped showcase the extent of the clients' commitments to biodiversity in a more holistic way than the numerical evaluations. These results showed the importance of combining qualitative and quantitative methods to provide a broader picture of biodiversity. It also revealed the necessity of thinking about biodiversity not solely because of how it impacts the agricultural supply chain, but the neighboring community and ecosystems.

Conducting a full eLCA provides insights into which process generates the most environmental impact, however conducting a full eLCA might be out of scope of most company operations. The processes of goal and scope and life cycle inventory might be more in scope of a company's operations and, if conducted periodically, can help generate data in a consistent manner that will help a company apply for a sustainability-linked loan or bond.

The two companies studied had different And as shown through this study on the 'Influence of voluntary coffee certifications on cooperatives' advisory services and agricultural practices of smallholder farmers in Costa Rica, "certifications induce cooperatives to offer new services to support farmers [that help] shape farmers' attitudes about sustainable farming practices, though farm-level changes may be small"[67] So there are many positives to the community through acquiring certifications, however common certifications do not place focus on biodiversity.

The Rainforest Alliance is a comprehensive method of showcasing a commitment to biodiversity as a company, and UNDP-Biofin can use that as an indication of an organization that has been able to build out structure to their biodiversity commitments.

67

https://www.tandfonline.com/doi/abs/10.1080/1389224X.2016.1227418?needAccess=true&journalCode=raee20

Applying for a sustainability-linked loan or bond requires a company to understand their overall environmental impact and a plan for how it can be reduced (these are the KPIs that can be tracked to access the bond/loan). Working toward lowering pesticide use and biodiversity certification is a comprehensive way to showcase this improvement. And the data collection methods used for an eLCA, if conducted periodically, can help generate this data in a consistent manner.

The sustainable finance roadmap was an integral part of the project. However, it would have been better informed if it had been the last deliverable to the client. It was very broad and generally informed by current research; however, it did not include specific details about each company. Additionally, it was so broad, and it could have been expanded on and included as its own project. The project was only broadly focused on sustainable finance where if conducted as its own project would have provided more in-depth financial analysis.

Appendix A

Additional Types of Biodiversity Assessments

CATIE

The Centro Agronómico Tropical de Investigación y Enseñanza (English: Tropical Agricultural Research and Higher Education Center) is an institute for agricultural science and research that is headquartered in Costa Rica. In 2008, CATIE published a paper for evaluating environmental services at the farm level. The publication breaks down environmental services into four levels: biodiversity, carbon, on-the-ground conservation, and water. Biodiversity was measured as the sum of two subcategories: habitat and chemical usage.

PBF

The Product Biodiversity Footprint (PBF) was first proposed to incorporate the five main drivers of biodiversity loss (habitat change, pollution, climate change, invasive species, overexploitation), within an LCA methodology. It is meant to help compare different cases within the same crop or product. It has also been used to assess the biodiversity impacts of non-agricultural products, such as shampoos, throughout the supply chain. This methodology requires an extensive knowledge of local ecology, and the specific species present on that property.[68]

GBS - CDC Biodiversité

The Global Biodiversity Score was designed to assess biodiversity impacts at the business level. More specifically, it aims to align business targets with international environmental goals, such as net zero greenhouse gas emissions. Similar to PBF, the GBS methodology also addresses the five main contributors to biodiversity loss. The results are quantified through Mean Species Abundance, which indicates overall ecosystem health.[69]

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[68] Asselin, Anne, Suzanne Rabaud, Caroline Catalan, Benjamin Leveque, Jacques L'Haridon, Patricia Martz, and Guillaume Neveux. "Product Biodiversity Footprint – A Novel Approach to Compare the Impact of Products on Biodiversity Combining Life Cycle Assessment and Ecology." *Journal of Cleaner Production* 248 (March 1, 2020): 119262. https://doi.org/10.1016/j.jclepro.2019.119262.

[69] CDC Biodiversité. "Introduction to the GBS - A tool to assess the biodiversity footprint of businesses and financial assets." Accessed April 12, 2022. http://www.mission-economie-biodiversite.com/wp-

Biodiversity Performance Tool

The Biodiversity Performance Tool was developed by the EU Life Initiative to evaluate biodiversity within the food industry. It can be tailored to agricultural production in subtropical and tropical regions. It uses about 100 different indicators to assess biodiversity at the farm level. These indicators are tailored to each industry (such as cereal, fruit, or coffee) and include socio-economic conditions in addition to farm practices. Furthermore, each indicator contains a threshold value that helps the evaluator compare the farm data to a baseline industry standard. Similar to the BCA, the BPT results can also be used to develop a Biodiversity Action Plan. The BPT contains a complementary evaluation tool, the Biodiversity Monitoring System, that aggregates data at the cooperative or even regional industry level.

Appendix B

SLCA Stakeholder Questionnaire Templates

Landowner (Farmer) Questionnaire

Mi nombre es X. Soy una estudiante de posgrado en la Universidad de Michigan en los Estados Unidos. Trabajo con tres estudiantes de posgrado en nuestro proyecto final. Nosotras estamos haciendo unas evaluaciones ambientales y sociales acerca de Nicoverde. Tenemos unas preguntas para ustedes, los dueños. Sus respuestas serán confidenciales, y no lo compartimos con Nicoverde.
My name is X, I am a Master's student at the University of Michigan studying Environment and Sustainability. Our team is working on a project for the Ministry of Science and the United Nations BIOFIN. We hope you can help by answering the following questions. Your responses are confidential, we will not share them with Nicoverde.

Background:

- Nombre (Name):
- Sexo (Sex not Gender): Women, Man, other:
- Edad (Age):
- Soltero/a o casado/a (Single/married/divorced/separated):
- Tiene hijos? (Do you have kids?)

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content/uploads/2020/07/20200630-GBS-presentation-CDC-Biodiversit%C3%A9-EN.pdf.

    - Si la respuesta es sí, ¿cuántos?(If so, how many?)
    - ¿Ellos ayudan en la granja?(If so, do they help on the farm?)
- Farm name or coop it's part of:
- ¿En cual comunidad vive? (What community do you live in?)
- ¿Hasta cuando tuvo esta finca? (Since when have you owned the land?)
- How long have you been farming pineapple?
- (How long have you been farming for Nicoverde?)
- ¿Cuáles son sus actividades diarias en la finca? (What are your daily activities on the farm?)
- (Is this your only plot of land/farm?)
- ¿Cómo describiría su herencia cultural? Por ejemplo: donde creció, su religión, donde crecieron los padres. Es para decir, cuéntame la historia de su vida. (How would you describe your cultural heritage (where they grew up, religious background, where their parents are from?) In other words, tell me your life story.

Social and Human Capital Questions:

(En esta sección tenemos preguntas sobre sus conexiones profesionales. The following section asks questions about your professional relationships)

- ¿Es el único dueño de esta finca? (Are you the sole land owner?) _____
- If married, do you consider your wife an owner too? _____
- (Have you ever sold your pineapple to another business since you started farming for Nicoverde in X year?)
- ¿Piensa que vende su pina a Nicoverde por un precio justo (sí o no?)(Do you think you sell your pineapple to Nicoverde for a fair price?)
- ¿Toma usted todas las decisiones acerca de su terreno, además de las reglas de producción de Nicoverde? (In regards to your land, besides Nicoverde production regulations, do you do all of the decision-making by yourself?)
- ¿Cuántos agricultores empleas durante todo el año? (How many workers (farmers) do you employ year round?)_____
    - ¿Cuántas de esas trabajadoras son mujeres? (How many of those are women?)_____
- ¿Cuánta cooperación existe entre usted y Nicoverde? Responde con un número de 1 al 5: 1 significa que Nicoverde y usted absolutamente no están de acuerdo, 3 significa que usted y Nicoverde están de acuerdo en algunas cosas y 5 que usted y Nicoverde están de acuerdo casi todo el tiempo? (On a scale of 1 to 5, how much cooperation is there between you and Nicoverde: 1 being that Nicoverde and you do not agree at all, 3 being that

you and Nicoverde agree on some things, and 5 being that you and Nicoverde agree on almost everything?) _____

- ¿Cuánta cooperación existe entre usted y los otros agricultores de Nicoverde? Responde con un número de 1 al 5: 1 significa que no está de acuerdo con la mayoría de los otros propietarios que son parte de Nicoverde, 3 que está de acuerdo con algunos propietarios, y 5 significa que estás de acuerdo con casi todos los propietarios, Por ejemplo, si quedaría sin algo, le ayudará su vecino. (On a scale of 1 to 5 how much cooperation is there between you and your neighbors, 1 being that you barely interact with them at all, 3 being that you sometimes interact, and 5 being that you have regular communication with your neighbors and agree on somethings? For example, if you run out of something will your neighbor help you?) _____
- ¿Hay roles diferentes entre las empleadas y los empleados de la finca? (Do women farmers have different roles than men on the farm?) Si la respuesta es sí, ¿cómo? This should be yes/no→ If yes, how so?
- En su opinión, ¿hay oportunidades iguales entre las empleadas y los empleados de Nicoverde (sí o no)? (Do you think there are equal opportunities for women farmers at Nicoverde?) _____
- ¿Pagan lo mismo a los hombres y mujeres de la finca? (Do you pay male and female farmers at the same rate during the harvest?)
- In your opinion, if a woman wanted to be a farmer full time could she get hired? _____
- Do you know anyone who employs a woman full time? _____

Community and Built Environment Capital questions:

(En esta sección tenemos preguntas sobre su comunidad. The following section asks questions about your community)

- Como un dueño, ¿cómo contribuye a su comunidad? (How do you as a farmer help or contribute to your local community?)
- ¿Le parece que Nicoverde contribuye a la comunidad? Si la respuesta es sí, ¿cómo? (Do you think that Nicoverde contributes to the local community? If so, how?)

    - En su opinión, ¿Cómo contribuye Nicoverde al desarrollo financiero de la región? (Do you think Nicoverde contributes to the region's economic development?)

- ¿Qué pasaría a la comunidad si Nicoverde no existiera más? (What do you think would happen to the community if Nicoverde ceases to exist?)

    - ¿Cuáles serían los impactos positivos? (What do you think would be some positive impacts?)

    - ¿Cuáles serían los impactos negativos? (What do you think would be some negative impacts?)

Do you have any questions for us about this survey or any final thoughts?

Farm Hand (Worker) Questionnaire

Mi nombre es X. Soy una estudiante de posgrado en la Universidad de Michigan en los Estados Unidos. Trabajo con tres estudiantes de posgrado en nuestro proyecto final. Nosotras estamos haciendo unas evaluaciones ambientales y sociales acerca de Nicoverde. Tenemos unas preguntas para ustedes, los dueños. Sus respuestas serán confidenciales, y no lo compartimos con Nicoverde.
My name is X, I am a Master's student at the University of Michigan studying Environment and Sustainability. Our team is working on a project for the Ministry of Science and the United Nations BIOFIN. We hope you can help by answering the following questions. Your responses are confidential, we will not share them with Nicoverde.

Background Questions:

- Nombre (Name):
- Sexo:
- Edad (Age):
- Soltero/a o casado/a (Single/married/separated/divorced):

- Tiene hijos? (Do you have kids?)
    - Si la respuesta es sí, ¿cuántos?(If so, how many?)
    - ¿Ellos ayudan en la granja? (Do they help on the farm?)
- Relationship to landowner:
- Farm name or coop it's part of:
- ¿En qué comunidad vive usted? (What community do you live in?)
- How long have you been farming pina?
- ¿Cuándo empezó a trabajar para Nicoverde? (How long have you been farming for Nicoverde?)
- ¿Ha trabajado en otras fincas? (Have you previously farmed anywhere else?)
- Do you own your own pineapple plantation?
    - If yes, are you a member of a pineapple coop?
- ¿Trabaja todo el año? (Are you employed year round?)
    - ¿Tiene un contrato de trabajo? ¿Hasta cuando? (Do you have a work contract? How long is your work contract?)
- ¿Cómo describiría su herencia cultural? Por ejemplo: donde creció, su religión, donde crecieron los padres. Es para decir, cuéntame la historia de su vida. (How would you describe your cultural heritage (where they grew up, religious background, where their parents are from?) In other words, tell me your life story.

Social and Human Capital questions
(En esta sección tenemos preguntas sobre sus conexiones profesionales. The following section asks questions about your professional relationships)

- ¿Cómo explicaría su conexión entre usted y el dueño o dueña de la finca? Responde con un número de 1 (uno) a 5 (cinco). 1 significa que no les pasa bien, 3 (tres) significa que más o menos están de acuerdo, 5 significa que generalmente están de acuerdo. (How would you describe your relationship with the farm owner? On a 1 to 5 scale, how would you describe your relationship with the landowner, 1 being you don't get along at all, 3 being you get along somewhat, and 5 being that you agree on most things)
- ¿Si se comunica directamente con los empleados y empleadas de Nicoverde? Responde con un número de 1 (uno) a 5 (cinco). 1 significa que casi nunca, 3 (tres) significa que a veces, y 5 significa que casi siempre. (Do you have direct contact with Nicoverde staff employees? On a scale of 1 to 5, how often do you interact with someone from the Nicoverde office, 1 being almost never, 3 being sometimes, and 5 being almost regularly)

_____

- ¿Interactúa con los otros agricultores/as de otras fincas? Responde con un número de 1 a 5. 1 significa que casi nunca interactúa con otros agricultores/as, 3 significa que interactúa a

veces con otros agricultores/as, y 5 significa que interactúa con otros agricultores/as con regularidad (Do you interact or engage with other farmers?) On a scale from 1 to 5 how often do you interact with other farmers: 1 being that you very rarely interact with other farmers, 3 being sometimes, and 5 is you regularly interact with other farmers?)

- ¿Cambiará su horario entre la estación de lluvia y la estación seca? Do your working hours change depending on the season (wet vs. dry season)
    - ¿Cual es su horario? (What are your current working hours?)
- ¿Les deja tomar un descanso durante el día? (Do you get break(s)?)
- Do women farmers work here?
- ¿En general, Hay roles diferentes entre las empleadas y los empleados de la finca? (Do women farmers have different roles than men on the farm?) Si la respuesta es sí, ¿cómo? This should be yes/no→ If yes, how so?
- En su opinión, ¿hay oportunidades iguales entre las empleadas y los empleados de Nicoverde (sí o no)? (Do you think there are equal opportunities for women farmers at Nicoverde?) We want a yes or no _____
    - Cuáles son las barreras que viven las trabajadoras, recolectoras y agricultoras para tener mejores oportunidades? (If No, what are the barriers that women farmers face?)
- ¿Le parece que están pagados lo mismo a los hombres y mujeres de la finca during the harvest? (Do you think male and female farm workers receive equal pay during the harvest?)
- Do you know anyone who employs a woman farmer full time?

Community and Built Environment Capital questions:

(En esta sección tenemos preguntas sobre su comunidad. The following section asks questions about your community)

- ¿Cómo interactúa y participa en la comunidad? (How do you engage and contribute with your local community?)

- ¿Le parece que Nicoverde contribuye a la comunidad? Si la respuesta es sí, ¿cómo? (Do you think that Nicoverde contributes to the local community? If so, how?)

    - En su opinión, ¿Cómo contribuye Nicoverde al desarrollo financiero de la región? (Do you think Nicoverde contributes to the region's economic development?)

- ¿Qué pasaría a la comunidad si Nicoverde no existiera más? (What do you think would happen to the community if Nicoverde ceases to exist?)
    - ¿Cuáles serían los impactos positivos? (What do you think would be some positive impacts?)
    - ¿Cuáles serían los impactos negativos? (What do you think would be some negative impacts?)
- En su opinión, ¿paga Nicoverde un precio justo por la piña? (Do you think Nicoverde pays a fair price for pineapple?)
- Do you have any questions for us about this survey?

Nicoverde Employees Questionnaire

Hola, mi nombre es Verónica Correa. Soy una estudiante de posgrado en la Universidad de Michigan en los Estados Unidos. Trabajo con tres estudiantes de posgrado en nuestro proyecto final. Nosotras estamos haciendo unas evaluaciones ambientales y sociales acerca de Nicoverde. Tenemos que preguntar a ustedes, los empleados de la empresa, algunas cosas. Esta entrevista no tardará más de cincuenta (50) minutos. Voy a traducir para mi compañera, Annie Linden, quien escribirá sus respuestas en inglés. Sus respuestas serán confidenciales y solamente para nuestro análisis social. No las vamos a compartir con los otros empleados de Nicoverde.

Hello my name is Veronica Correa and this is Annie Linden. We are graduate students at the University of Michigan. We are working on our Master's Project along with two other students. We are conducting some environmental and social assessments on Nicoverde. We need to ask Nicoverde employees some questions. This interview should not last for more than fifty minutes. I will be conducting the interview in Spanish and then translating for Annie, which will allow her to take our notes in English. Everything you say today will be confidential. These questions strictly pertains to our project and will not be shared with anyone at Nicoverde.

- Nombre (Name):
- Sexo (Sex not Gender): Women, Man, other

- Edad (Age):
- Departamento (Department that they work in):
- Título profesional (Job title):
- Supervisor Name and/or Sexo**:**
- ¿En qué ciudad o región vive usted? (What city or region do you live in?):
- ¿Cuando empezó a trabajar con Nicoverde? (How long have you been working for Nicoverde?)

Social and Human Capital questions

En esta sección tenemos preguntas sobre el desarrollo personal y los componentes sociales acerca de las oportunidades en Nicoverde. (The following section asks questions about personal development and social aspects of opportunities at Nicoverde)

- ¿La mayoría del tiempo, trabaja solo/a o con un equipo? (Do you work independently or as part of a team?)
    - ¿Qué es más común en la empresa? (Which is more common- working independently or as part of a team at Nicoverde?)
- ¿Piensa que hay buena cooperación y comunicación entre los empleados? (Do you feel there is good cooperation and communication between employees?)
- dime si usted está de acuerdo con esa frase con un número de 1 a 5. 5: sinceramente estoy de acuerdo, 3: neutral, 1: sinceramente no estoy de acuerdo Nicoverde tiene líderes efectivos? (Nicoverde has effective leaders. On 1 to 5 scale tell me if you agree or disagree. 5 is strongly agree, 3 is neutral or don't agree or disagree, and 1 is strongly disagree)
- ¿Usted diría que los hombres y las mujeres tienen la misma representación al nivel de liderazgo, en los equipos, y al nivel de gerente: sí o no? (Would you say that men and women are equally represented as leaders, as group members, and or as managers? (We want a yes or no.)
- Por favor, responde a las siguientes dos preguntas con un número de 1 a 5. 1: tiene conexiones débiles, 3: más o menos, 5: tiene conexiones fuertes. (For the next two questions please

answer on a scale of 1 to 5- 1 being that you have weak relationships, 3 being so/so, and 5 being that you have strong relationships:)

- ¿Piensa que tiene conexiones fuertes y profesionales con sus compañeros de trabajo? Do you feel like your office relationships are strong with your peers?

- ¿Piensa que tiene conexiones fuertes y profesionales con su supervisor/a directa? (Do you feel like your office relationships are strong with your direct manager/ supervisor?)

- ¿Hay oportunidades para el desarrollo profesional en Nicoverde (sí o no?) Are there professional development and growth opportunities at Nicoverde? We want a yes or no.
  - If yes, are these opportunities accessible to both men and women?

  - En un nivel más general, ¿Tienen oportunidades iguales a los hombres y las mujeres a Nicoverde? (Are there equal opportunities between men and women?)

  - ¿Ha visto alguna instancia de discriminación en Nicoverde? (Have you witnessed any discrimination at Nicoverde?)

  - En su opinión, ¿cómo promueve Nicoverde oportunidades iguales de empleo y crecimiento profesional entre los hombres y mujeres? (How do you think Nicoverde promotes equal employment and professional opportunities between men and women?)

- ¿Le gusta trabajar en Nicoverde? Responde con un número de 1 a 5. 1: no te gusta para nada, 3: neutral, 5: le gusta muchísimo/a. (On a scale of 1 to 5, do you like working at Nicoverde? 1 being you strongly don't like it, 3 is you are impartial, and 5 is you strongly like it.)

Community and Built Environment Capital questions:
This section asks questions about Nicoverde's relationship and contributions with the community.

- ¿Cómo se involucra la empresa Nicoverde con la zona? (To what extent does Nicoverde engage with the local community?) Responde con un número de 1 a 5 (1: Nicoverde no se involucra, 3: Nicoverde se involucra un poco, y 5: Nicoverde se involucra mucho con la comunidad), (On a 1 to 5 scale, 1 being that Nicoverde is not involved at all, 3 being that Nicoverde is somewhat involved, and 5 is that Nicoverde is very much involved with the community.)

- ¿Cómo describiría su herencia cultural? Por ejemplo: donde creció, su religión, donde crecieron los padres. Es para decir, cuéntame la historia de su vida. (How would you describe your cultural heritage (where they grew up, religious background, where their parents are from?) In other words, tell me your life story.

- ¿Piensa que hay varias identidades culturales en la oficina? Por ejemplo: raza, sexo, relig´ôn, opiniones políticos, herencia. (Do you think there are different cultural identities (e.g. race, sex, religion, political views) present in the Nicoverde office?)

- ¿Interactúa frecuentemente con los productores? (Do you regularly interact with farmers?)

- ¿Cuál es su opinión acerca de cómo contribuye Nicoverde a la economía de la zona? (How do you think that Nicoverde contributes to the region 's local economy?)

Other

- ¿En su opinión, recibe un salario justo por su trabajo en Nicoverde? (In your opinion, do you think Nicoverde pays you a fair salary?)

- ¿En su opinión, reciben los hombres y las mujeres el mismo salario y beneficios por el mismo tipo de trabajo? (In your opinion,

are women and men receiving the same pay and benefits for the same kind of work?)

- ¿Reciben las empleadas las mismas oportunidades de entrenamiento? (Do female workers have the same possibilities to participate in job training?)

- ¿En su opinión, reciben los productores de Nicoverde un precio justo por su trabajo? (In your opinion, do you think that Nicoverde pays farmers a fair price for their labor and pineapple crops?)

- ¿Hay algo más que debemos saber acerca de la empresa? (Is there anything else that you think we should know about Nicoverde?)

Coop Questionnaire

Mi nombre es X. Soy una estudiante de posgrado en la Universidad de Michigan en los Estados Unidos. Trabajo con tres estudiantes de posgrado en nuestro proyecto final. Nosotras estamos haciendo unas evaluaciones ambientales y sociales acerca de Nicoverde. Tenemos unas preguntas para ustedes, los dueños. Sus respuestas serán confidenciales, y no lo compartimos con Nicoverde.
My name is X, I am a Master's student at the University of Michigan studying Environment and Sustainability. Our team is working on a project for the Ministry of Science and the United Nations BIOFIN. We hope you can help by answering the following questions. Your responses are confidential, we will not share them with Nicoverde.

Background Questions:

- Nombre (Name):
- Sexo (Sex not Gender):
- Edad (Age):
- Role at coop:
- ¿En qué comunidad vive usted? (What community do you live in?)
- How long has INSERT COOP NAME been farming for Nicoverde?

- ¿Usted es dueño de una finca propia? Do you own your own pineapple farm?
- Have you previously farmed for another coop?

- Is Nicoverde the only company that Probio sells pineapple to?

Social and Human Capital questions
(En esta sección tenemos preguntas sobre sus conexiones profesionales. The following section asks questions about your professional relationships)

- ¿Si se comunica directamente con los empleados y empleadas de Nicoverde? Responde con un número de 1 (uno) a 5 (cinco). 1 significa que casi nunca, 3 (tres) significa que a veces, y 5 significa que casi siempre. (Do you have direct contact with Nicoverde staff employees? On a scale of 1 to 5, how often do you interact with someone from the Nicoverde office, 1 being almost never, 3 being sometimes, and 5 being almost regularly)
- ¿Hay roles diferentes entre las empleadas y los empleados de la finca? (Do women farmers have different roles than men on the farm?) Si la respuesta es sí, ¿cómo? This should be yes/no→ If yes, how so? Specifically to Probio

- En su opinión, ¿hay oportunidades iguales entre las empleadas y los empleados de probio s (sí o no)? (Do you think there are equal opportunities for women farmers at probio s?) We want a yes or no _____
    - Cuáles son las barreras que viven las trabajadoras, recolectoras y agricultoras para tener mejores oportunidades? (If No, what are the barriers that women farmers face?)Do you think there are any barriers for female employees or farmers? Why are there not more female producers?

- ¿Le parece que están pagados lo mismo a los hombres y mujeres de la finca durante la cosecha? (Do you think male and female farm workers receive equal pay during the harvest?)

- ¿Conoce a alguien quien emplea a una productora? (Do you know anyone who employs a woman farmer full time?)

Community and Built Environment Capital questions:

(En esta sección tenemos preguntas sobre su comunidad. The following section asks questions about your community)

- ¿Qué pasaría a la comunidad si Nicoverde no existiria más? (What do you think would happen to the community if Nicoverde ceases to exist?)
    - ¿Cuáles serían los impactos positivos? (What do you think would be some positive impacts?)
    - ¿Cuáles serían los impactos negativos? (What do you think would be some negative impacts?)
- ¿Piensa que Nicoverde paga un precio justo por la piña? Do you think Nicoverde pays a fair price for pineapple?
- How many farmers are members of Probio?
- ¿Cómo participa Nicoverde con la comunidad? (How does Nicoverde engage with the local community?)
- En su opinión, ¿Cómo contribuye Nicoverde al desarrollo financiero de la zona? (Do you think Nicoverde contributes to the region's economic development?)
- ¿Tiene algunos pensamientos finales acerca de Nicoverde or probio s que quiere compartir? Is there anything else you think we should know about Nicoverde and/or Probio?

Coopetarrazu SLCA Questionnaire Templates

Coopetarrazu Landowner Questionnaire

Translator: Notetaker:
Farm Number:
Mi nombre es X. Soy una estudiante de posgrado en la Universidad de Michigan en los Estados Unidos. Trabajo con tres estudiantes de posgrado en nuestro proyecto final. Nosotras estamos haciendo unas evaluaciones ambientales y sociales acerca de Coopetarrazu. Tenemos unas preguntas para ustedes, los dueños. Sus respuestas serán confidenciales, y no lo compartimos con Coopetarrazu.
My name is X, I am a Master's student at the University of Michigan studying Environment and Sustainability. Our team is working on a

project for the Ministry of Science and the United Nations BIOFIN. We hope you can help by answering the following questions. Your responses are confidential, we will not share them with Coopetarrazu.

Background:

- Nombre (Name):
- Sexo (Sex not Gender): Women, Man, other:
- Soltero/a o casado/a (Single/married/divorced/separated):
- Tiene hijos? (Do you have kids?)
    - Si la respuesta es sí, ¿cuántos?(If so, how many?)
    - ¿Ellos ayudan en la granja?(If so, do they help on the farm?)
- Edad (Age):
- Direccion de la Finca (Address of Farm or Number):
- ¿En cual comunidad vive? (What community do you live in?)
- ¿Hasta cuando tuvo esta finca? (Since when have you owned the land?)
- ¿Cuando empezó con Coopetarrazu? (When did you join Coopetarrazu?)
- ¿Cuáles son sus actividades diarias en la finca? (What are your daily activities on the farm?)
- Is this your only plot of land/farm?

Social and Human Capital Questions:

(En esta sección tenemos preguntas sobre sus conexiones profesionales. The following section asks questions about your professional relationships)

- ¿Es el único dueño de esta finca? (Are you the sole land owner?) _____
- If married, do you consider your wife an owner too? _____
- ¿Ha vendido su café a otra empresa después de empezar a trabajar con Coopetarrazu en el año X? (Have you ever sold your coffee to another business since you started working with Coopetarrazu in X year?)
- ¿Piensa que vende su café a Coopetarrazu por un precio justo (sí o no?)(Do you think you sell your coffee to Coopetarrazu for a fair price?)
- ¿Toma usted todas las decisiones acerca de su terreno, además de las reglas de producción de Coopetarrazu? (In regards to your land, besides Coopetarrazu production regulations, do you do all of the decision-making by yourself?)
- ¿Cuántos agricultores empleas durante todo el año? (How many workers (farmers) do you employ year round?)_____
    - ¿Cuántas de esas trabajadoras son mujeres? (How many of those are women?)_____
- ¿Cuánta cooperación existe entre usted y Coopetarrazu? Responde con un número de 1 al 5: 1 significa que Coopetarrazu

y usted absolutamente no están de acuerdo, 3 significa que usted y Coopetarrazu están de acuerdo en algunas cosas y 5 que usted y Coopetarrazu están de acuerdo casi todo el tiempo? (On a scale of 1 to 5, how much cooperation is there between you and Coopetarrazu: 1 being that Coopetarrazu and you do not agree at all, 3 being that you and Coopetarrazu agree on some things, and 5 being that you and Coopetarrazu agree on almost everything?) _____

- ¿Cuánta cooperación existe entre usted y los otros agricultores de Coopetarrazu? Responde con un número de 1 al 5: 1 significa que no está de acuerdo con la mayoría de los otros propietarios que son parte de Coopetarrazu, 3 que está de acuerdo con algunos propietarios, y 5 significa que estás de acuerdo con casi todos los propietarios, Por ejemplo, si quedaría sin algo, le ayudará su vecino. (On a scale of 1 to 5 how much cooperation is there between you and other landowners that are part of Coopetarrazu, 1 being that you do not agree with most other landowners that are part of Coopetarrazu, 3 being that you agree with some landowners, and 5 being that you agree with almost all other landowners? For example, if you run out of something will your neighbor help you?) _____
- ¿Hay roles diferentes entre las empleadas y los empleados de la finca? (Do women farmers have different roles than men on the farm?) Si la respuesta es sí, ¿cómo? This should be yes/no→ If yes, how so?
- En su opinión, ¿hay oportunidades iguales entre las empleadas y los empleados de Coopetarrazu (sí o no)? (Do you think there are equal opportunities for women farmers at Coopetarrazu?) We want a yes or no _____
- ¿Pagan lo mismo a los hombres y mujeres de la finca? (Do you pay male and female farmers at the same rate during the harvest?)
- In your opinion, if a woman wanted to be a farmer full time could she get hired? _____
- Do you know anyone who employs a woman full time? _____

Community and Built Environment Capital questions:

(En esta sección tenemos preguntas sobre su comunidad. The following section asks questions about your community)

- Como un dueño, ¿cómo contribuye a su comunidad? (How do you as a farmer help or contribute to your local community?)
- ¿Cómo describiría su herencia cultural? Por ejemplo: donde creció, su religión, donde crecieron los padres. Es para decir, cuéntame la historia de su vida. (How would you describe your

cultural heritage (where they grew up, religious background, where their parents are from?) In other words, tell me your life story.

- ¿Le parece que Coopetarrazu contribuye a la comunidad? Si la respuesta es sí, ¿cómo? (Do you think that coopetarrazu contributes to the local Tarrazu community ? If so, how?)
    - En su opinión, ¿Cómo contribuye Coopetarrazu al desarrollo financiero de la región? (Do you think Coopetarrazu contributes to the region's economic development?)
- ¿Qué pasaría a la comunidad si Coopetarrazu no existiera más? (What do you think would happen to the community if Coopetarrazu ceases to exist?)
    - ¿Cuáles serían los impactos positivos? (What do you think would be some positive impacts?)
    - ¿Cuáles serían los impactos negativos? (What do you think would be some negative impacts?)

Do you have any questions for us about this survey?

Coopetarrazu Farm Hand (Worker) Questionnaire

Translator: Notetaker: Farm Number:

Mi nombre es X. Soy una estudiante de posgrado en la Universidad de Michigan en los Estados Unidos. Trabajo con tres estudiantes de posgrado en nuestro proyecto final. Nosotras estamos haciendo unas evaluaciones ambientales y sociales acerca de Coopetarrazu. Tenemos unas preguntas para ustedes, los dueños. Sus respuestas serán confidenciales, y no lo compartimos con Coopetarrazu.

Introduction: My name is X, I am a Master's student at the University of Michigan studying Environment and Sustainability. Our team is working on a project for the Ministry of Science and the United Nations BIOFIN. We hope you can help by answering the following questions. Your responses are confidential, we will not share them with Coopetarrazu.
Background Questions:

- Nombre (Name):
- Sexo (Sex not Gender): Women, Man, other:
- Edad (Age):
- Soltero/a o casado/a (Single/married/separated/divorced):
- Tiene hijos? (Do you have kids?)
    - Si la respuesta es sí, ¿cuántos?(If so, how many?)
    - ¿Ellos ayudan en la granja? (Do they help on the farm?)
- Relationship to landowner:
- Direccion de la Finca (Address of Farm or Number):

- ¿En qué comunidad vive usted? (What community do you live in?)
- Are you a member of Coopetarrazu?
- ¿Cuándo empezó a trabajar para Coopetarrazu? (How long have you been farming for Coopetarrazu?)
- ¿Ha trabajado en otras fincas? (Have you previously farmed anywhere else?)
- Do you own your own coffee plantation?
- ¿Trabaja todo el año? (Are you employed year round?)
    - ¿Tiene un contrato de trabajo? ¿Hasta cuando? (Do you have a work contract? How long is your work contract?)

Social and Human Capital questions

(En esta sección tenemos preguntas sobre sus conexiones profesionales. The following section asks questions about your professional relationships)

- ¿Cómo explicaría su conexión entre usted y el dueño o dueña de la finca? Responde con un número de 1 (uno) a 5 (cinco). 1 significa que no les pasa bien, 3 (tres) significa que más o menos están de acuerdo, 5 significa que generalmente están de acuerdo. (How would you describe your relationship with the farm owner? On a 1 to 5 scale, how would you describe your relationship with the landowner, 1 being you don't get along at all, 3 being you get along somewhat, and 5 being that you agree on most things)_____
- ¿Si se comunica directamente con los empleados y empleadas de Coopetarrazu? Responde con un número de 1 (uno) a 5 (cinco). 1 significa que casi nunca, 3 (tres) significa que a veces, y 5 significa que casi siempre. (Do you have direct contact with Coopetarrazu staff employees? On a scale of 1 to 5, how often do you interact with someone from the Coopetarrazu office, 1 being almost never, 3 being sometimes, and 5 being almost regularly) _____
- ¿Interactúa con los otros agricultores/as de otras fincas? Responde con un número de 1 a 5. 1 significa que casi nunca interactúa con otros agricultores/as, 3 significa que interactúa a veces con otros agricultores/as, y 5 significa que interactúa con otros agricultores/as con regularidad (Do you interact or engage with other farmers?) On a scale from 1 to 5 how often do you interact with other farmers: 1 being that you very rarely interact with other farmers, 3 being sometimes, and 5 is you regularly interact with other farmers?) _____
- ¿Cambiará su horario entre la estación de lluvia y la estación seca? Do your working hours change depending on the season (wet vs. dry season)
    - ¿Cual es su horario? (If so, what are your current working hours?)

- ¿Les deja tomar un descanso durante el día? (Do you get break(s)?)_____
- ¿Hay tareas o roles diferentes entre los agricultores/agricultoras, trabajadores/trabajadoras, y recolectores/recolectoras de la finca? (Do women farmers have different tasks/roles?
- En su opinión, ¿hay oportunidades iguales para los trabajadores/trabajadoras, agricultores/agricultoras, y recolectores/recolectoras de Coopetarrazu? (Do you think there are equal opportunities for women workers/farmers/pickers at Coopetarrazu?)
    - En su opinión, ¿cuáles son las barreras que viven las trabajadoras, recolectoras y agricultoras para tener mejores oportunidades? (If so, what are the barriers that women workers, collectors and farmers experience to have better opportunities?)
- ¿Le parece que están pagados lo mismo a los hombres y mujeres de la finca during the harvest? (Do you think male and female farm workers receive equal pay during the harvest?)
- Do you know anyone who employs a woman farmer full time?

Community and Built Environment Capital questions:

(En esta sección tenemos preguntas sobre su comunidad. The following section asks questions about your community)

- ¿Cómo interactúa y participa en la comunidad? (How do you engage and contribute with your local community?)
- ¿Cómo describiría su herencia cultural? Por ejemplo: donde creció, su religión, donde crecieron los padres. Es para decir, cuéntame la historia de tu vida. (How would you describe your cultural heritage (where they grew up, religious background, where their parents are from? In other words, tell me your life story.)
- ¿Le parece que Coopetarrazu contribuye a la comunidad? Si la respuesta es sí, ¿cómo? (Do you think that coopetarrazu contributes to the local community? If so, how?)
    - En su opinión, ¿Cómo contribuye Coopetarrazu al desarrollo financiero de la región? (Do you think Coopetarrazu contributes to the region's economic development?)
- ¿Qué pasaría a la comunidad si Coopetarrazu no existiera más? (What do you think would happen to the community if Coopetarrazu ceases to exist?)
    - ¿Cuáles serían los impactos positivos? (What do you think would be some positive impacts?)
    - ¿Cuáles serían los impactos negativos? (What do you think would be some negative impacts?)
- Do you think Coopetarrazu pays a fair price for coffee?

- Do you have any questions for us about this survey?

Coopetarrazu Office Employees Questionnaire

Hola, mi nombre es Verónica Correa. Soy una estudiante de posgrado en la Universidad de Michigan en los Estados Unidos. Trabajo con tres estudiantes de posgrado en nuestro proyecto final. Nosotras estamos haciendo unas evaluaciones ambientales y sociales acerca de Coopetarrazu. Tenemos que preguntar a ustedes, los empleados de la empresa, algunas cosas. Esta entrevista no tardará más de cuarenta (40) minutos. Hoy estoy en los E.E.U.U, entonces haremos la entrevista con Zoom. Me gustaría recordar la entrevista para que pueda traducir para las otras estudiantes y escribir notas. Sus respuestas serán confidenciales y no las vamos a compartir con los empleados de Coopetarrazu. *¿Tengo su permiso para recordar la entrevista?*
***Turn Recording on AND Don't forget to record the transcript**
Once you start the recording please get their consent again on the recording

Hello my name is Veronica Correa. I am a graduate student at the University of Michigan. I am working with three other grad students on our Master's Project. We are conducting some environmental and social assessments on Coopetarrazu. We need to ask office employees some questions. This interview should not last for more than forty minutes. I personally cannot be there today, which is why I am conducting the interview via Zoom. I would like to be able to record the interview so I can go back and take notes later. This will allow me to be more present in the conversation. The recording will not be shared with anyone else. I will delete it after I go back and write down my notes. Everything you say today will be confidential. Do you consent to being recorded?

- Nombre (Name):
- Sexo (Sex not Gender):
- Edad (Age):
- Department that they work in: recursos humanos - gerente /talento humano
- ¿En qué ciudad o región vive usted? (What city or region do you live in?): ¿Cuando empezó a trabajar con Coopetarrazu? (How long have you been working for Coopetarrazu?)

Social and Human Capital questions
En esta sección tenemos preguntas sobre el desarrollo personal y los componentes sociales acerca de las oportunidades en Coopetarrazu. (The following section asks questions about personal development and social aspects of opportunities at Coopetarrazu)

- ¿La mayoría del tiempo, trabaja solo/a o con un equipo? (Do you work independently or as part of a team?)
    - ¿Qué es más común en la empresa? (Which is more common- working independently or as part of a team?)

- ¿Piensa que hay buena cooperación y comunicación entre los empleados? (Do you feel there is good cooperation and communication between employees?)
- Coopetarrazu tiene líderes efectivos: dime si usted está de acuerdo con esa frase con un número de 1 a 5. 5: sinceramente estoy de acuerdo, 3: neutral, 1: sinceramente no estoy de acuerdo? (Coopetarrazu has effective leaders. On 1 to 5 scale tell me if you agree or disagree. 5 is strongly agree, 3 is neutral or don't agree or disagree, and 1 is strongly disagree)
- ¿Cuántas mujeres tienen una posición de liderazgo en Coopetarrazu? (How many women are positioned in leadership roles at Coopetarrazu?) [Leadership roles can be defined by the person being interviewed (upper management, project managers, people that work under them?)]
- Por favor, responde a las siguientes dos preguntas con un número de 1 a 5. 1: tiene conexiones débiles, 3: más o menos, 5: tiene conexiones fuertes. (For the next two questions please answer on a scale of 1 to 5- 1 being that you have weak relationships, 3 being so/so, and 5 being that you have strong relationships:)
    - ¿Piensa que tiene conexiones fuertes y profesionales con sus compañeros de trabajo? Do you feel like your office relationships are strong with your peers?
    - ¿Piensa que tiene conexiones fuertes y profesionales con su supervisor/a directa? (Do you feel like your office relationships are strong with your direct manager/ supervisor?)
- ¿Hay oportunidades para el desarrollo profesional? (Is there room for professional development and growth?)
    - ¿Tienen oportunidades iguales a los hombres y las mujeres a Coopetarrazu? (Are there equal opportunities between men and women?)
    - ¿Cómo promueve las oportunidades profesionales para las mujeres? (How does Coopetarrazu promote women 's opportunities in the workforce?)
    - ¿Ha visto alguna instancia de discriminación en Coopetarrazu? (Have you witnessed any discrimination at Coopetarrazu?)
    - En su opinión, ¿cómo promueve Coopetarrazu oportunidades iguales de empleo y crecimiento profesional entre los hombres y mujeres? (How do you think Coopetarrazu promotes equal employment and professional opportunities between men and women?)
- ¿Le gusta trabajar a Coopetarrazu? Responde con un número de 1 a 5. 1: no te gusta para nada, 3: neutral, 5: le gusta muchísimo/a. (On a scale of 1 to 5, do you like working at Coopetarrazu? 1 being you strongly don't like it, 3 is you are impartial, and 5 is you strongly like it.)

Community and Built Environment Capital questions:

- ¿Cómo se involucra la empresa Coopetarrazu con la comunidad de Tarrazu? (To what extent does Coopetarrazu engage with the local community?) Responde con un número de 1 a 5 (1: Coopetarrazu no se involucra, 3: Coopetarrazu se involucra un poco, y 5: Coopetarrazu se involucra mucho con la comunidad), (On a 1 to 5 scale, 1 being that Coopetarrazu is not involved at all, 3 being that Coopetarrazu is somewhat involved, and 5 is that Coopetarrazu is very much involved with the community.)
- ¿Cómo describiría su herencia cultural? (How would you describe your cultural heritage?)
- ¿Piensa que hay varias identidades culturales en la comunidad Tarrazu? Por ejemplo, raza, sexo, religión, opiniones políticos) (Do you think there are different cultural identities (e.g. race, sex, religion, political views) present in the Tarrazu community?)
- ¿Usted habla frecuentemente con los agricultores? (Do you engage with farmers on a regular basis?)
- ¿Cuál es su opinión acerca de cómo contribuye Coopetarrazu al desarrollo financiero de la región Tarrazu? (How do you think that coopetarrazu contributes to the local economy of the Tarrazu region?)

Appendix C

Coopetarrazu eLCA & Biodiversity Questionnaire

Instrumento de toma de datos
Producción primaria y biodiversidad
(Data measuring tool for primary production & biodiversity)

Finca (Farm)	
Encargado (Supervisor)	

Extensión del terreno (Land Size)	*Dedicado a Café (ha): (Coffee):*	*Total (ha):*
Especie (Species of Coffee)	*Arabica*	
Variedad (Variety of Coffee)		
Registros de producción (Production Dates): Growing season, Harvest season	*2019 – 2020:*_____	*Otros (Others):*_____
Plaga o enfermedad presentada con mayor frecuencia (Most frequent infection or plague):		

Edad promedio del cafetal (Average age of coffee plantation)	*☐<5 años (<5 years)*	*☐20/30 años (20-30 years)*
	☐5/20 años (5-20 years)	☐>30 años (>30 years)
¿Posee análisis químico de suelos? (Is there a chemical analysis of the soil?)	*☐ SÍ ☐ NO*	*Fecha o año en que realizó el último análisis: (Date of last analysis)*
¿Cuál fue su producción de granos de café verde en kilogramos del año 2019-2020? (What was your production of green coffee beans in kilograms		

from the 2019-2020 year?)		

Questions on Crop methods

Guiding Questions	Key Themes	Results and Observations
Se siembra sólo en monocultivo o se hace siembra intercalada con otro cultivo o especies forestales? ***(Is it sown only in monoculture or is it intercropped with another crop or forest species?)***	• ***Crop intercropping*** • ***Different phases of cultivation*** • ***Agroforestry system***	
¿Qué prácticas de manejo de suelo se implementan en la finca? ¿Se implementan prácticas para su conservación? ***(What soil management practices are implemented on the farm? Are conservation practices implemented?***	• ***Slopes; Erosion*** • ***No compaction*** • ***Are areas unsuitable for cultivation defined***	

Identificación General (General ID)

Atomizo (Atomizer/Pulverizer)

Fecha (Date) de aplicación (Application date)	***Producto que utilizó (Product used)***	***¿Para qué utilizó el producto? (What was this product used for?)***	***Cantidad de producto por estañón (Amount of product for tin)***	***Cantidad de estañones por manzana o por finca utiliza (Amount of tin for farm)***	***Tipo de equipo que usó (Type of equipment used)***	¿Estas actividades las realizan los hombres o las mujeres? (Is this applied by men or women?)
1st						
2nd						
3rd						
	Observaciones (Observations)					

	**Abonada (Fertilizer)**						
Fecha (Date)	***Producto que utilizó (product used: organic compost or solid soil fertilizer)***	***¿Qué tipo de abono utilizó? (What type of fertilizer was used?)***	***Fórmula o nutrientes del abono (Formula or nutrients in fertilizer)***	***Cantidad de sacos usados por manzana o finca (Number of bags used per farm)***	***¿Qué equipo utilizó? (What equipment was used?)***	¿Estas actividades las realizan los hombres o las mujeres? (Is this activity completed by men or women?)	***Observaciones (Observations)***
		☐Químico (Chemical) ☐Orgánico (Organic)			Manual		

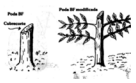
		☐Otro (Other): _____ _____					
		☐Químico (Chemical) ☐Orgánico (Organic) ☐Otro (Other): _____ _____			Manual		
		☐Químico (Chemical) ☐Orgánico (Organic) ☐Otro (Other): _____ _____			Manual		

Questions on Agrochemical use and soil management practices

Guiding Questions	Key Themes	Results and Observations
¿Cada cuánto tiempo se utilizan mecanismos de	• Minimization of chemical pesticides	

monitoreo de plagas? (How many times do you use a chemical control for pests during a season?)		

Gestión de otras labores en el cafetal (Management of other tasks on coffee plantation)

	**Poda del café (Coffee pruning)**			
Fecha (Date):				
Equipo y herramienta utilizado (Equipment and tools used):				¿Cómo realiza la poda del café (materiales, actividades, proceso, insumos, combustibles, residuos)? (How was the coffee pruned? Explain materials, activities, processes, insumos, combustibles, doses, residuals) (Is this activity completed by men or women?)¿Estas actividades las realizan los hombres o las mujeres? ***Pruning process is between march and april***
	***Poda de sombra (shade potential)***			
Fecha (Date):				
Variedades de árboles o plantas usadas en sombra (Types of trees or plants used for shade):				***Equipo utilizado (Equipment used):***
¿Cómo realiza la poda de la sombra (materiales, actividades, proceso, insumos, combustibles, residuos)?:				

(How was shade potential measured? Explain materials, activities, processes, insumos, combustibles, doses, residuals)				
	**Combate de malezas (weeding)**			
Fecha (Date):				
☐Manual (chapia) (Lawnmower)	☐Mecánica (moto guadaña) (Mechanical/motor cutter)		☐Química (Chemical)	Otra (Other): _____
Equipo utilizado (Equipment used)				¿Cómo realiza el combate de malezas (materiales, actividades, proceso, insumos, combustibles, dosis, residuos) : (How were weeds treated? Explain materials, activities, processes, insumos, combustibles, doses, residuals) (Are these activities completed by men or women?) ¿Estas actividades las realizan los hombres o las mujeres?
	**Deshija (Thinning)**			
Fecha (Date):				
Equipo utilizado si no es manual (Equipment used, if not manual)				¿Cómo realiza la deshija (materiales, actividades,

				proceso, insumos, combustibles, residuos)?: (How were the crops thinned? Explain materials, activities, processes, insumos, combustibles, residuals)
	**Resiembra o renovación (Reseeding or renovation)**			
Fecha (Date):				
Equipo utilizado (Equipment used)				¿Cómo realiza la resiembra o renovación (materiales, actividades, proceso, insumos, combustibles, residuos)?: How was reseeding or renovation achieved? Explain materials, activities, processes, insumos, combustibles, residuals)
	**Arreglo de caminos dentro de la finca (Road/path maintenance)**			
Fecha (Date):				
Equipo utilizado (Equipment used)				¿Cómo realiza el arreglo de caminos (materiales, actividades,

				proceso, insumos, combustibles, residuos)?: How were the roads maintained? Explain materials, activities, processes, insumos, combustibles, residuals)
	**Encalado (Whitewashing)**			
Fecha (Date):				
Equipo utilizado (Equipment used) None, manual addition				¿Cómo realiza el encalado (materiales, actividades, proceso, insumos, combustibles, residuos)? (How was whitewashing performed? Explain materials, activities, processes, insumos, combustibles, residuals)
	**Trampeo para control de cochinilla**			
Fecha (Date):				
Equipo utilizado (Equipment used)				¿Cómo realiza el trampeo para control de la broca (materiales, actividades, proceso, insumos, combustibles, residuos)?: (How was bit control trapping performed? Explain materials, activities, processes, insumos, combustibles, residuals)

				(Are these activities completed by men or women?) ¿Estas actividades las realizan los hombres o las mujeres?
	**Cosecha (Harvest)**			
Fecha (Date):				
Equipo utilizado - manual				¿Cómo realiza la cosecha del café (materiales, actividades, proceso, insumos, combustibles, residuos)?: (How was the coffee harvested? Explain materials, activities, processes, insumos, combustibles, residuals)
	**El Transporte (Transportation)**			
¿Cómo se transporta la fruta del café a la cooperativa? (How is the coffee fruit transported to coopetarrazu?)				
Equipo utilizado (Equipment used)				

	**Otros (Others)**			
Fecha (Date):				
Equipo utilizado (Equipment used)				¿Cómo realiza las otras actividades (materiales, actividades, proceso, combustibles, residuos)?: (Describe the other materials, activities, processes, combustibles, residuals)

Questions on Biodiversity

Guiding Questions	Key Themes	Results and Observations
(To start, we define biodiversity as the variety between living organisms. For example, plants and animals from Costa Rica, conservation of large trees from Costa Rica, and soil and water conservation. These questions will help us see the relationships between biodiversity and production on the farm.) Para empezar, se define “la biodiversidad” como la variedad	• Environmental and biodiversity awareness • Explain biodiversity: Protection of large native trees, plants that attract pollinators, plants and animals originally from Costa Rica, natural water body source on the farm, organic material on the soil, and reduction of inorganic chemical pesticides. • Knowledge of the relationship between biodiversity and production, • Knowledge about the services	

entre los organismos vivos. Por ejemplo, las matas y los animales de Costa Rica, la conservación de los árboles grandes de Costa Rica, y el mantenimiento del suelo y del agua. Estas preguntas nos ayudarían a ver las conexiones entre la biodiversidad y la producción de la finca.) ¿Cuáles diferentes especies de árboles y matas ve en la finca? (What different species of trees and plants do you see on the farm?) ¿Cuáles diferentes especies de invertebrados ve en la finca? (What different species of invertebrates do you see on the farm?) ¿Cuáles diferentes especies de vertebrados ve en la finca?	provided by ecosystems	

(What different species of vertebrates do you see on the farm?) ¿Según esta definición y sus conocimientos previos, Qué importancia tiene mantener la biodiversidad para dentro de la finca? (Based on this definition and your previous knowledge, how important is biodiversity within the farm?)		
¿Cuánta es la cantidad promedio de su producción de café en los últimos 10 años (en kilogramos)? (What is the farm's average coffee production over the last 10 years in kilograms?) ¿Ha visto menos lluvia durante la estación seca, o la estación de lluvia? (Have you noticed less rainfall in the dry or rainy season?)	Coffee plant smaller? Produces less coffee than the year before? More diseases of the soil, roots, beans, leaves? Specific hot temperatures, heavier/less rainfall, drought, flooding?	

¿Ha visto más enfermedades en sus matas de café? Por ejemplo, en las raíces, los granos, el suelo, o las hojas? (Have you noticed more diseases in your coffee plants in the roots, beans, soils, or leaves?)		
¿Ha notado cambios en los tipos o la cantidad de animales que ve? (Have you noticed changes in the types or amount of animals you see?) ¿Ha notado cambios en los tipos o la cantidad de aves que ve? (Have you noticed changes in the types or amount of birds you see?)		

¿Se ha realizado algún inventario o seguimiento de la biodiversidad? (Has any biodiversity inventory or monitoring been carried out?)	• Trees and other plants • Vertebrates/insects • Macroinvertebrates & fish diversity	
¿Se cuenta con alguna política relacionada con la biodiversidad ? Por ejemplo, un programa de reforestación o regeneración. (Is there a policy related to biodiversity?)	• Documented policy • Sustainability does not necessarily involve biodiversity	
¿Están protegidos la vegetación nativa y los hábitats de los polinizadores? (Is native vegetation and habitats for pollinators protected?)	• Habitat for pollinators (bees, wasps,beetles, flies, ants, moths, butterflies, bumble bees, honey bees, solitary bees, and wasps and beneficial organisms (eg biological controllers)	

Questions about Tree Biodiversity

Guiding Questions	Key Issues	Results and Observations
¿Se han definido especies en peligro de extinción para la explotación? Por ejemplo, las	• Endangered Species • Pest controlling vertebrates (e.g. raptors or	

especies que SINAC ha prohibido que las corten.) (Have endangered species been defined for the farm? For example, those species that are not allowed to be cut down according to SINAC.)	insectivores, snakes, toads or frogs) • Indicators of ecosystem health (eg beetles) • Aquatic species	
Con respecto a los árboles que se encuentran en su finca, ¿fueron colocados a propósito o eran nativos y preservados? (With regards to the trees that are located on your farm, were they placed on purpose or were they native and preserved?)	● Preservation of trees ● Was shade a purpose	
¿Se conservan los árboles grandes nativos? How? (Are the large native trees preserved? ¿Cómo?)	• Live or dead native trees with a height greater than 15 meters and a diameter of 60 cm or more at chest height (DBH)	
¿Hay terrenos boscosos dentro de la finca o en los bordes de la finca que estén conectados? Are there wooded patches within the	• River or stream channels • Forest fragments inside and outside the farm • Movement corridors to connect	

farm, or on the edges of the farm, that connect?	vertebrate subpopulations • Do they use live barriers as contours?	

Questions about Invasive Species

Guiding Questions	Key Issues	Results and Observations
¿Se tiene conocimiento de alguna especie invasora presente dentro de la finca? Aquí se define una especie invasora como una mata o animal que no originó en Costa Rica: por ejemplo, el pez león. (Is there knowledge of any invasive species present on the farm? Here invasive species is defined as a plant or animal that did not originate in Costa Rica, like the lionfish.)	• No intentional planting • Invasive plant residues are not deposited in ecosystems • Containment of invasive plants	

Questions about Waste

Guiding Questions	Key Issues	Results and Observations
¿Se identifican los tipos de residuos	• Organic waste: peels of fruits, vegetables, herbs, leaves and	

que genera la finca? ¿Cuáles son los desechos que se producen en mayor volumen? (Are the types of waste generated by the farm identified? What are the wastes that are produced in greater volume?)	roots; vegetables, wood, paper, cardboard and fabrics • Inorganic waste: plastics, earthenware, glass, tin, zinc, iron, cans, construction waste, Tetrapak. • Hazardous waste: batteries, asbestos, mercury lamps, electronic waste, medical equipment, radioactive material, pesticides, expired medicines, used oils, bioinfectious waste, disinfectants, corpses, ash particles, dust and pesticide drift	
¿Los residuos orgánicos se reutilizan? (Is organic waste reused?)	• Organic Fertilizer Biofuel	

Nicoverde Biodiversity Questionnaire

1. General			
1.1 Nombre de Finca (Farm Name)		1.2 Tipo de propiedad (Type of property)	
1.3 Nombre Contacto BCA (BCA Contact)		1.4 Posición (Position)	
1.5 E-mail		1.6 Teléfono	

2. Ubicación (Location)					
2.1. País (Country)	Costa Rica	2.2. Provincia/Departamento (Province)		2.3. Ciudad (City)	
2.4. Dirección física (Physical location)				2.5. Código postal (Postal code)	
2.6. Latitud:		2.7. Longitud:		2.8. Punto tomado en:	
2.9. Altitud (m.s.n.m.)		2.10. Precipitación anual (Annual precipitation)			
3. Uso de la tierra (Land use)					
3.1. Área Total (ha) (Total area)					
3.2. Área Total de producción (ha) (Production area)					
3.3. Área total dedicada a áreas protegidas o ecosistemas naturales dentro de la finca (ha) (Area dedicated to protected area/natural ecosystems)					
4. Productos y volúmenes (Product and volumes)					
4.1. Producto (Product)	**4.2 Períodos de cosecha (Harvest period)**		**4.3 Volumen de producción (año actual) (Yearly production)**		
Pineapple					
5. Fuerza laboral (Workforce)					

Todos los trabajadores empleados durante los últimos 12 meses (all workers employed in the last 12 months)	**Mujeres (Women)**	**Hombres (Men)**	**Total**
5.1. Trabajadores permanentes (Permanent employees)			
5.2. Trabajadores temporales: (Temporary employees)			
TOTAL			

Meta GE- 1: Biodiversity policy defined, disclosed, and implemented

Guiding Questions	Key Issues	Results and Observations
¿Qué tan importante es la biodiversidad entre la finca? How important is biodiversity within the farm?	• Environmental and biodiversity awareness • Knowledge of the relationship between biodiversity and production • Knowledge about the services provided by ecosystems	
¿Hay reglas acerca de la biodiversidad? Is there a policy related to biodiversity?	• Documented policy • Sustainability does not necessarily involve biodiversity	
¿Cómo han dicho estas reglas a los empleados? How has this policy been	• Methods of disclosure	

disclosed to farm staff?		
¿Hay programas específicos para desarrollar estas reglas? Are there specific programs to implement the contents of the policy?	• Programs or management systems	

Meta 1.1: Soils are conserved

Guiding Questions	Key Issues	Results and Observations
Are soil or foliar analysis carried out to define a fertilization plan for the crop?		
¿Hecha abono o componentes orgánicos al suelo? ¿Cuáles variedades, y en qué cantidad? ¿Cuándo? Are fertilizers and / or organic amendments applied?	• Compost • Processing waste • Efficient microorganisms • Legume covers	

Which ones, and how much? When?		
¿Han hecho algún análisis microbiológico del suelo? Have microbiological analyzes of the soil been carried out?	• Knowledge about the importance of soil microfauna	

Meta 1.2: Pests and diseases are controlled through the application of Integrated Pest Management (IPM) or low toxicity pesticides

Guiding Questions	Key Issues	Results and Observations
¿Cuáles son las plagas o enfermedades que se aparecen más frecuentemente? What are the main pests or diseases of the production system?	• Insects, arthropods, nematodes, bacteria, viruses, fungi.	
¿Cómo se controla a las plagas? How are these pests controlled?	• Manual, biological, chemical, resistant varieties	
¿Cuáles pesticidas o agroquímicos se usan en la finca? ¿En qué cantidades, y cuándo? What types of synthetic pesticides (or other chemicals) are used on the farm? How much,	• List of products, frequency of application and quantities per ha • Cover products to induce ripening, or concentration of degrees Brix	

and during which steps of the process?		
¿Cómo se aplican los pesticidas al suelo? How are pesticide applications made?	• Manual • Spray Boom • Aéreo, avioneta, helicóptero • Check how drift is controlled	
¿Se usa algún práctico manual o biológico para controlar las plagas? What biological or manual pest control practices are implemented?	• Biological controllers (e.g. wasps, entomopathogenic fungi)	
¿Cuáles mecanismos de monitoreo de plagas se usan? What pest monitoring mechanisms are used? Are tolerance (incidence) thresholds used to decide whether to apply chemical pesticides as a last resort?	• MIP • Minimization of chemical pesticides	
¿Cómo combate a las malezas? How is weed control done?	• Type of herbicides, time of application, amounts, burning	

Meta 1.3: Genetic resources and production systems facilitate optimal productivity, resistance to pests and reduce vulnerability to climate change.

Guiding Questions	Key Issues	Results and Observations

¿Cuáles variedades de piña se siembra aquí? ¿Están adaptadas al clima y suelo de la zona? What varieties are grown here? Are the crop varieties used adapted to the local climate and soils?	• One, two or more different varieties • Resistance to diseases, pests or droughts / high productivity; GMO	
¿Se siembra sólo en monocultivo o se hace siembra intercalada con otro cultivo o especies forestales? Is it sown only in monoculture or is it intercropped with another crop or forest species?	• Crop intercropping • Different phases of cultivation • Agroforestry system	
¿Cuándo se hace la renovación? ¿Se deja descansar al suelo? How often is renewal done? Is the ground allowed to rest?	• Fallow • Crop rotation • Planting of vegetable covers that allow the rest of the soil or the fixation of nutrients	

Meta 1.4: Efficient use of water

Guiding Questions	Key Issues	Results and Observations
¿Se almacena y usa el agua de lluvia? Is rainwater harvested, stored and used?	• Reservoirs • Collection of rainwater from roofs	
¿Se protege la humedad de suelo? Is the conservation of humidity in the soil promoted?	• Vegetable covers and organic matter	
¿Cuándo se hace la irrigación? During what times of the year is irrigation applied?	• Soil moisture measurement	
¿Qué sistema de irrigación se usa? What type of irrigation systems are used?	• Check technologies • Localized, drip, underground irrigation • Maintenance	
¿Cuándo se utiliza agua durante la producción? ¿Cuáles son las cantidades? What steps of the production process use		

water? How much?		
Do industrial processes minimize water consumption?	• Treatment • Recirculation • Efficient systems • Maintenance	

Nivel 2: Finca (Farm)

Meta 2.1: Terrestrial and aquatic ecosystems are conserved and not degraded

Guiding Questions	Key Issues	Results and Observations
¿Hay reglas acerca de cortar los árboles? Is there a no-felling policy?	• Protecting big trees, wooded areas and secondary growth	
¿Hay arboles para la sombra en el área do producción? ¿Cuáles especies? Are there any shade trees in the production area? What kinds?		
¿Cómo se manejan las regiones del bosque?	• Se vigila que no se degraden o uso sostenible • See Annex 1: terrestrial and water ecosystems	

How are forest fragments or redoubts managed or cared for?	• Degradation [70]	
¿Hay mapas de las zonas protegidas? Have areas subject to protection or restoration activities been mapped?	• Riparian buffers	
¿Hay una estrategia para restaurar las ecosistemas de la finca? Is there a plan to restore the natural ecosystems within the farm?	• Delimited zones for natural regeneration • Reforestation	

Meta 2.2: Wildlife and beneficial organisms are identified and protected.

Guiding Questions	Key Issues	Results and Observations

[70] For example: Mining or soil removal; Discharge of solid waste or untreated sewage; Intentional introduction of invasive plant species; Collection of fish, wildlife, or plants, which exceeds the regeneration capacity of said species; Cattle grazing; Construction of reservoirs, channeling of streams, fillings, or changes in the depth or direction of flow of a body of water; Drainage or drying of bodies of water or wetlands by excessive extraction of water or by other means; Pollution of bodies of water or wetlands that alters their chemical composition or species; Application of herbicides, pesticides or fire.

To start, we define biodiversity as the variety between living organisms. For example, plants and animals from Costa Rica, conservation of large trees from Costa Rica, and soil and water conservation. These questions will help us see the relationships between biodiversity and production on the farm. Para empezar, se define “la biodiversidad” como la variedad entre los organismos vivos. Por ejemplo, las matas y los animales de Costa Rica, la conservación de los árboles grandes de Costa Rica, y el mantenimiento del suelo y del agua. Estas preguntas nos ayudarían a ver las conexiones entre la biodiversidad y la producción de la finca. ¿Cuáles diferentes especies de		

árboles y matas ve en la finca? (What different species of trees and plants do you see on the farm?) ¿Cuáles diferentes especies de invertebrados ve en la finca? What different species of invertebrates do you see on the farm? ¿Cuáles diferentes especies de vertebrados ve en la finca? What different species of vertebrates do you see on the farm?		
¿Se ha realizado algún inventario o seguimiento de la biodiversidad? Has any biodiversity inventory or monitoring been carried out?	• Trees and other plants • Vertebrates/insects	
¿Es prohibido cazar en la finca? Is hunting prohibited within the properties of the farm?	• Hunting with traps, rifles, poisons	

¿Han identificado las especies de animales importantes dentro de la finca? Have flag species of importance been defined for the farm?	• Endangered Species • Pest controlling vertebrates (e.g. raptors or insectivores, snakes, toads or frogs) • Indicators of ecosystem health (eg beetles) • Aquatic species	
¿Se conservan los árboles grandes nativos? Cómo? Are the large native trees preserved? How?	• Live or dead native trees with a height greater than 15 meters and a diameter of 60 cm or more at chest height (DBH)	
¿Cómo se protege las flores y vegetación nativa? Are flower beds and other native vegetation protected?	• Habitat for pollinators and beneficial organisms (eg biological controllers)	
Con respecto a los árboles que se encuentran en su finca, ¿fueron colocados a propósito o eran nativos y preservados? With regards to the trees that are located on your farm, were they placed on purpose or were they		

native and preserved?		
¿Hay terrenos boscosos dentro de la finca o en los bordes de la finca que estén conectados? Are there wooded patches within the farm or on the edges of the farm with the possibility of connecting? What is done to manage them?	• River or stream channels • Forest fragments inside and outside the farm • Movement corridors to connect vertebrate subpopulations	

Meta 2.3: Areas not suitable for production are identified and actions are defined for their restoration

Meta 2.4: Artificial infrastructure for biodiversity is established

Guiding Questions	Key Issues	Results and Observations
¿Ha implementado alguna estructura para mantener la biodiversidad y conservar a las especies de interés? Have you thought about implementing structures to attract biodiversity and promote the conservation of animal species of interest?	• Artificial nests • Artificial racks for birds of prey or to promote natural regeneration • Living fences or barriers • Walls or accumulations of stones for reptiles	

¿Hay una especie específica que quiere proteger? Has a particular species already been identified?	• Endangered Species • Pest controlling vertebrates (eg raptors, snakes) • Pollinators • Beneficial insects	

Meta 2.5: Invasive alien species are identified, eliminated or their spread controlled

Guiding Questions	Key Issues	Results and Observations
¿Usted sabe cuales son algunos especies invasivos en Costa Rica? **Is it known which species are considered invasive in the country?**	• **100 of the World's Most Harmful Invasive Alien Species** • **http://www.iucngisd.org/gisd/pdf/100Spanish.pdf**	
¿Se tiene conocimiento de alguna especie invasora presente dentro de la finca? Aquí se define una	• **No intentional planting** • **Invasive plant residues are not deposited in ecosystems** • **Containment of invasive plants**	

especie invasora como una mata o animal que no originó en Costa Rica: por ejemplo, el pez león. **Is there knowledge of any invasive species present on the farm?**		
¿Hay una estrategia para controlar o eliminar estas especies? **Is there a strategy for its control or eradication?**	• **Cultural products or practices**	

Meta 2.6: Waste is managed with minimal environmental impact and is used

Guiding Questions	Key Issues	Results and Observations
¿Se identifican los tipos de residuos que genera la finca? ¿Cuáles son los tipos de desechos en cada	• Organic waste: peels of fruits, vegetables, herbs, leaves and roots; vegetables, wood, paper, cardboard and fabrics	

paso de la producción? ¿Usted sabe son los desechos que se producen en mayor volumen? Are the types of waste generated by the farm identified? What steps of the production process produce which kinds of waste? Do you know which are produced in greater volume?	• Inorganic waste: plastics, earthenware, glass, tin, zinc, iron, cans, construction waste, Tetrapak. • Hazardous waste: batteries, asbestos, mercury lamps, electronic waste, medical equipment, radioactive material, pesticides, expired medicines, used oils, bioinfectious waste, disinfectants, corpses, ash particles, dust and pesticide drift	
¿Qué hace la finca para reciclar, reutilizar, y disminuir los desechos sólidos? What actions are taken within the farm to reject, reduce, reuse, and recycle solid waste?		
¿Los residuos orgánicos se reutilizan? Is organic waste reused? What happens to the pineapple plants after their second harvest?	• Organic Fertilizer Biofuel	

¿Qué pasa con las matas después de la segunda cosecha?		
¿Hay una manera segura para manejar los desechos que no se pueden reciclar? Is waste not reused or recycled disposed of safely?	• Collection and deposit in landfill • Hazardous waste treatment	
¿Cómo se transportan los residuos después de la cosecha? ¿Cuántos viajes se necesitan? ¿Cómo se alimenta el equipo de transporte? How is the waste transported after harvest? How many trips does it take? How is the transportation equipment fueled?		

Other eLCA questions

¿Haces algún recorte de las plantas de piña? ¿Cómo?

Do you do any trimming of the pineapple plants? How?

Is all the planting of the crowns manual?

¿Es manual la siembra de las coronas?

¿Cómo se transporte su piña al beneficio?

How is the crop transported to Nicoverde?

¿Cuántos kilogramos de piña se transporta cada vez? ¿Sabe la distancia del viaje en kilómetros?
How much pineapple (in kg) would you usually carry per trip? Do you know how many kilometers the trip is?

¿Si usa un camión, aproximadamente cuántos colones se gasta en gasolina o diesel cada semana?
If you use a gas or truck, how much in colones do you spend on gas per week?

¿Sabe cuánta gasolina (en litros) queda en su tanque?

Do you know how much gas fits in your tank?

¿Con qué frecuencia le traen a usted (el productor) las plantas sembradas o las plantas nuevas? ¿Cómo se transportan, y de dónde? ¿Y en qué cantidades?

How often are the reseeded plants or the new plants brought to you (the farmer)? How are they transported to you? And in what amounts? From where are they transported?

¿Qué equipo se utiliza para agregar agroquímicos y para regar? ¿Con qué frecuencia riegas? ¿Cuanta agua usas? ¿Cuánto combustible usas en el equipo (registros por mes? O tal vez solo con qué frecuencia llenan el tanque).

What equipment is used for adding agrochemicals and for watering? How often do you water? How much water do you use? How much fuel do you use in the equipment (logs by month? Or maybe just how often they refill the tank)?

Appendix D

BCA Reports – Nicoverde Qualitative Biodiversity Results

REPORT
Proyecto Pora

(Coopeproagro)
Pital - Costa Rica

Date of farm visit: July 16, 2021

General facts for the evaluated company

A. Background

Costa Rica is the world's largest pineapple exporter. A lot of these exports have been overseen by the Pineapple Development Corporation (PINDECO) since the 1980s. Global demand for pineapple has been increasing since the turn of the century, with an increase by 200% from 2000 to 2013. To meet this demand, more farms have transitioned into large-scale monocropping and a high use of pesticides (Maglianesi-Sandoz 2013). Most of this production is situated in the country's North Zone.

B. Company profile

The Costa Rican company Nicoverde, founded in 2017, is a subsidiary of the Italian company Nicofrutta which was founded in 1999. The company receives pineapples from about 120 small producers from the country's north zone. It also has two farms, Lucialva and Movaba, that are co-owned between Nicoverde and the farm managers. Nicoverde's farms range from relatively small (less than 5 hectares) to over 100 hectares. It also directs an office and pineapple packing plant in Pital, San Carlos, in the Alajuela province.
Coopeproagro is a cooperative founded in 2015, and has worked with Nicoverde since 2020. Coopeproagro also collaborates with other Costa Rican fruit companies. Sells exclusively organic pineapple. He has 3 family farms in the cities of Guatuso, Pital, and Sarapiqui. Because they are family farms, many women are involved, 16 of approximately 27 farmers are women.

C. Farm profile

Proyecto Pora is one of Coopeproagro's 3 farms, located in Pital. Proyecto Pora has been part of Coopeproagro for 6 years. The land is owned by Orlando Rojas, who inherited the farm from his father and grandfather. The property was previously used for dairy until he started farming pineapple about 10 years ago. In an interview, he said he became interested in pineapple as a way to diversify the farm. Along with all of Coopeproagro's farms, it is a family endeavor and all 6 permanent employees are relatives. Orlando's two daughters and sons live in the area and assist on the farm. His wife, son-in-law and mother-in-law also work year-round. Management decisions are made as a family.

The pineapple farming is completely organic - Orlando said he is one of the only organic farmers in the area. The farm is 40 hectares, 20 of which is dedicated to pineapple farming. 4 hectares of the farm is for restoration of native tree species, including *almond (almond), guapinol, ash, cortesa, and oak*. Generally, there are not a lot of trees on the farm except for on the edges of the property.

Farm Profile - Summary

1. General Information					
1.1 Name of	Proyecto Pora		1.2 Type of property	Coopeproagro Farm	
1.3 Contact Name BCA	Orlando Rojas		1.4 Position		
1.5 E-mail			1.6 Telephone		
2. Location					
2.1. Country	Costa Rica	2.2. Province/Department	Alajuela	2.3.City	Pital
2.4. Physical address				2.5. Postal code	
2.6. Latitude:	10° 28' 34.608" N	2.7. Longitude:	84° 18' 4.572" W	2.8. Point taken at:	
2.9. Altitude (masl)	116 m	2.10. Annual rainfall	n/a		
3. Land use					
3.1. Total area (ha)					40
3.2. Total production area (ha)					20
3.3. Total area dedicated to protected areas or natural ecosystems within the farm (ha)					4
4. Products and volumes					
4.1. Product	**4.2 Harvest periods**		**4.3 Production volume (current year)**		
Pineapple			70,000 kg/ha		
5. Labor force					
All workers employed during the last 12 months			**Women**	**Men**	**Total**
5.1. Permanent workers			4	2	6
5.2. Temporary workers:			0	10	10
TOTAL			4	12	16

Results of the application of the BCA tool

Transversal Axis: Business management

Objective of the transversal axis: Establish the bases for the integration of biodiversity into business management.

Goal	Results	Recommendations
GE - 1: **Defined, disclosed and implemented biodiversity policy**	● There are rules about the use of water and organic waste, but there is no specific policy for biodiversity. All farm employees have been made aware of this policy.	● Write down a clear biodiversity policy that is integrated throughout Coopeproagro, particularly for restoration of protected areas, and disclose publicly to farm staff. ● Ensure that year-round and harvest season workers are aware of biodiversity policies.
GE - 2: Personnel trained and sensitized on biodiversity issues for decision-making at different levels	● Nicoverde provides technical support to Coopeproagro. Other than that, Coopeproagro does not have specific personal trainings for biodiversity.	● Coopeproagro should collaborate with each farm to deliver up-to-date, consistent trainings on biodiversity management for both permanent and temporary workers.
GE - 3: Suppliers of goods and services are selected considering environmental and biodiversity criteria	● Coopeproagro does not have a specific process for selecting buyers based on environmental or biodiversity criteria	● Develop a method for evaluating and comparing buyers based on commitments to biodiversity
GE - 4 : Impacts are reduced for the development and maintenance of infrastructure	● Coopeproagro uses organic products as a way to minimize negative impacts to local ecosystems.	● Prioritize the use of local, low-waste, and recyclable products in the supply chain, whenever possible.

GE - 5: The company complies with environmental legislation	● Both Nicoverde and Coopeproagro follow all legislation on environmental protections and waste disposal.	● Coopeproagro should review any updates in national environmental legislation regularly (at least annually).

Level 1: Production area

Objective of level 1: Production management is based on the optimized use of inputs and agricultural and industrial practices that are friendly to biodiversity and the environment.

Goal	Results	Recommendations
1.1: Soils are preserved	● The soil is covered with plastic wrap to preserve humidity.	● Continue regular soil analyzes to monitor any trends. Track periods of heavy rainfall to ensure rainwater is draining properly. Watch out for areas of potential erosion.
1.2: Pests and diseases are controlled through the application of IPM or low toxicity pesticides	● No herbicides are used. Pests are controlled through organic methods. Soil analyzes are carried out after each pineapple harvest to assess changes and potential vulnerabilities.	● Continue recording the dates and amounts of every product application ● Promote the use of biological products (*bioinsummos)* on the farm, in collaboration with Nicoverde.
1.3: Genetic resources and production systems facilitate optimal productivity, resistance to pests and reduce vulnerability to climate change	● The farm only sells organic pineapple - conventional varieties are sold	● Continue to evaluate the product application schedule to assess any vulnerabilities to pests or illnesses.

1.4: Water is used efficiently	● There is not an official policy for reusing rainwater. Water is used to apply biological products and fertilizer per manufacturing guidelines. There is an informal policy about conserving water use for organic product applications.	● Continue to track water use, especially for product application

Level 2: Farm

Objective of level 2: Production management is based on the optimized use of inputs and agricultural and industrial practices that are friendly to biodiversity and the environment.

Goal	Results	Recommendations
2.1: Terrestrial and aquatic ecosystems are conserved and are not degraded	● There are not many natural water sources on the property.	● Map any watershed areas and identify areas to minimize erosion
2.2: Wildlife and beneficial organisms are identified and protected	● While specific animal species have not been officially identified for conservation, hunting is prohibited on the property and the landowners do not apply products that are considered hazardous for their protection. There are some plant and animal species that have been verbally identified, but there is not an official count.	● Keep official records of plant and animal species, making note of any species that may be endangered or threatened.
2.3: Areas not suitable for production are identified and actions for their restoration are defined	● . Local vegetation in these areas is not touched or destroyed to help with restoration of native tree species.	● Record progress of restoration plans and non-intervention strategy

2.4: Artificial infrastructure for biodiversity is established	● There have not been any proposed or built artificial structures to protect biodiversity.	● After building a species inventory for the farm, identify potential species of interest for maintaining biodiversity.
2.5: Invasive alien species are identified, eliminated or their expansion is controlled.	● There is no current knowledge of invasive species on the farm	● In collaboration with Coopeproagro, develop an inventory of invasive species according to this list: http://www.iucngisd.org/gisd/pdf/100Spanish.pdf
2.6: Waste is managed with minimal environmental impact and	● Organic waste from pineapple plants is left on the soil to incorporate. Inorganic waste is collected and the manufacturers will come to the farm to pick them up and recycle them according to regulations.	● Record and weigh any inorganic waste (from cans, bottles, and other products) that is used on the farm.

Level 3: Landscape

Objective of level 3: The farm minimizes its environmental impact on its surroundings, contributes to the environmental education of the communities and collaborates with other actors in favor of biodiversity.

Goal	Results	Recommendations
3.1: The company identifies protected areas and their services and reduces the impacts of production on them.	● There are maps of the whole farms, and protected areas have been identified within those maps. There is a small restoration area for trees with declining populations, such as almonds.	● Create detailed maps of protected areas. Maintain a detailed inventory of native tree species within these areas to track local populations

3.2: The company participates in watershed management activities	● There are no specific programs in place for managing aquatic systems and basins.	● Develop an inventory of all known natural water sources
3.3: Alliances and awareness programs are established with communities and other local actors, in favor of the conservation and sustainable use of biodiversity	● As part of Coopeproagro, the farm is completely organic and has met the requirements for this certification. The landowner aims to support the biodiversity of the community through organic practices and reducing pollution.	● Collaborate with local development associations on long-term strategies for maintaining biodiversity in the area. If possible, have conversations with other local farmers about the benefits of organic farming.

Annex 1: Photos

Photo #1 Description: The division between agricultural plots: the road is accessible to vehicles. There are some big trees	
Photo #2 Description: Another example of separation between agricultural plots	

REPORT

El Encanto 2 (Probio)

Pital - Costa Rica

Date of farm visit: July 13 2021

General Facts for the Evaluated Company

A. Background

Costa Rica is the world's largest pineapple exporter. A lot of these exports have been overseen by the Pineapple Development Corporation (PINDECO) since the 1980s. Global demand for pineapple has been increasing since the turn of the century, with an increase by 200% from 2000 to 2013. To meet this demand, more farms have transitioned into large-scale monocropping and a high use of pesticides (Maglianesi-Sandoz 2013). Most of this production is situated in the country's North Zone.

B. Company profile

The Costa Rican company Nicoverde SA, founded in 2017, is a subsidiary of the Italian company Nicofrutta founded in 1999. The company receives pineapple from around 120 producers in the north of the country. He runs an office and pineapple packing plant in Pital de San Carlos, in the province of Alajuela.

Probio is a farming cooperative that was founded in 2 . They have been farming pineapple for Nicoverde since 2017. Nicoverde is the client for about 20% of their pineapple, as they work for several other distributors in the region. In recent years, Probio has expanded production to root vegetables to not be entirely reliant on pineapple production. Additionally, they have invested in drone technology to make water and product application more environmentally efficient.

C. Farm Profile

Farmowner Alexis has owned the land and farmed pineapple for 35 years. I have been working with Probio for the past 5 years. Since it is a smaller property, there are no other full-time staff. However, sometimes his 2 sons may help with decision-making.

The farm is in compliance with Global GAP and Fair Trade certifications.

Farm Profile - Summary

1. General Information					
1.1 Name of Finca	El Encanto 2		1.2 Property Type	Finca Probio	
1.3 Contact Name BCA	Alexis		1.4 Position		
1.5 E-mail			1.6 Telephone		
2. Location					
2.1. Country	Costa Rica	2.2. Province/Department	Alajuela	2.3.City	Pital
2.4. Physical address				2.5. Postal code	
2.6. Latitude:	10° 29' 13.536" N	2.7. Longitude:	84° 17' 44.946" W	2.8. Point taken at:	
2.9. Altitude (masl)	130 m	2.10. Annual rainfall	n/a		
3. Land use					
3.1. Total area (ha)					5 hectares
3.2. Total production area (ha)					4 hectares
3.3. Total area dedicated to protected areas or natural ecosystems within the farm (ha)					N/A

4. Products and volumes		
4.1. Product	**4.2 Harvest periods**	**4.3 Production volume (current year)**
Pineapple	1x a year	40,000 fruits (this year expected 60,00)
Product 2		
Product 3		

5. Workforce			
All workers employed during the last 12 months	**Women**	**Men**	**Total**
5.1. Permanent workers	0	0	0
5.2. Temporary workers:	4	6	10
TOTAL	4	6	10

Results of the application of the BCA tool

Transversal Axis: Business management

Objective of the axis transversal: Establish the basis for the integration of biodiversity into business management.

Goal	Results	Recommendations
GE - 1: Biodiversity policy defined, disclosed and implemented	● Probio is in compliance with Fair Trade, Rainforest Alliance, Global GAP, and USDA organic requirements that all have their own biodiversity standards. However, this particular farm grows conventional and not organic pineapple.	● Probio should write an updated section of their website that details how their certifications relate to biodiversity and what particular actions they have taken to fulfill these requirements.
GE - 2: Staff trained and sensitized on biodiversity issues for decision-making at different levels	● Social responsibility is part of Probio's mission statement, and they work directly with farmers to reduce environmental impacts. ● On this farm, there is not an official disclosure policy for biodiversity as there are no other full-time staff. However, the farmer is aware of the importance of biodiversity and it is seen as a priority.	● Ensure that temporary/seasonal workers are aware of the requirements for any biodiversity-related certifications.
GE - 3: Suppliers of goods and services are selected considering environmental and biodiversity criteria	● Probio has collaborated with Nicoverde for packaging and exportation due to Nicoverde's emphasis on sustainability and environmental standards. It is unknown what the environmental criteria of the other providers are.	● Continue to establish preferences for packages and distributors with a positive environmental record.
GE - 4: Impacts for infrastructure development and maintenance are reduced	● There is a general emphasis on having a minimal environmental impact, but based on interviews it is not clear how this philosophy is applied to infrastructure development on the farms.	● Use local, reusable, and/or recyclable products in infrastructure developments whenever possible.
GE - 5: The company complies with environmental legislation	● All production is in compliance with the Ministry of Environment, Energy and Telecommunications (MINAET).	● Whenever possible, Probio should review any updates in national environmental legislation regularly with landowners, at least annually.

Level 1: Production area

Objective of level 1: Production management is based on the optimized use of inputs and agricultural and industrial practices that are friendly to biodiversity and the environment.

Goal	Results	Recommendations
1.1: Soils are preserved	● There is a lot of rainfall on the farm, and a natural drainage system is in place. ● Ground renewal is done about every 2 years.	● Monitor excess water levels throughout the rainy season to ensure that the system is draining properly. Map any areas that are especially prone to flooding.
1.2: Pests and diseases are controlled through the application of IPM or low toxicity pesticides	● Generally, the use of herbicides is avoided. Weed cutting is manual to avoid the unnecessary use of products. An agronomist and inspectors from Probio visit the farm about once every 90 days to look for pests in the roots.	● Conduct an analysis of nearby water sources for any residual agrochemicals. ● Continue working with the agronomist to see if any other biological products (*bioinsumos)* can be incorporated into the production process.
1.3: Genetic resources and production systems facilitate optimal productivity, resistance to pests and reduce vulnerability to climate change	● *Trichoderma* is applied as a biological mechanism ● The agronomist maintains a detailed log of any products used.	● Collaborate with agronomists to assess what other biological products can be used, and where dependence on chemicals can be minimized.
1.4: Water is used efficiently	● Water is mostly used for the *spray boom* to apply products.	● Communicate with Probio about if their drone technology can be implemented on the property to reduce excess water consumption.

Level 2: Farm

Objective of level 2: Production management is based on the optimized use of inputs and agricultural and industrial practices that are friendly to biodiversity and the environment.

Goal	Results	Recommendations
2.1: Terrestrial and aquatic ecosystems are conserved and are not degraded	● Cutting trees is prohibited on the farm. The property is generally kept clean and organized. Any natural flower beds are left undisturbed.	● Plant quickly-growing native plants to reduce erosion and chemical drift.
2.2: Wildlife and beneficial organisms are identified and protected	● Biodiversity monitoring is carried out every year as part of the Global GAP and Fair Trade certification requirements.	● Maintain the requirements for Global GAP, Fair Trade and USDA Organic certifications.
2.3: Areas not suitable for production are identified and actions for their restoration are defined	● . There is not a specific restoration plan for the farm. Reforestation would generally minimize the available land for harvesting pineapple on an already smaller property. However, he has planted some fruit trees in non-productive areas.	● If reforestation is not possible at this time, continue to monitor native tree species on the farm. Keep an inventory of seeds from fruit trees and other native plant species.
2.4: Artificial infrastructure for biodiversity is established	● There are no artificial structures for biodiversity.	● Identify a species of interest and establish a plan for developing an artificial structure based on pre-existing biodiversity inventories.
2.5: Invasive alien species are identified, eliminated or their spread controlled	● No invasive species have been identified.	● In collaboration with Agronorte, identify any present invasive species according to this list: http://www.iucngisd.org/gisd/pdf/100Spanish.pdf
2.6: Waste is managed with minimal environmental impact and is used	● The landowner said that generally, not a lot of waste is produced on the farm. ● Organic waste is left on the soil and inorganic waste is returned to the seller based on legal regulations. The Probio office maintains records of waste production.	● Identify which steps of the growing and harvesting process produce the most waste.

Level 3: Landscape

Objective of level 3: The farm minimizes its environmental impact on its surroundings, contributes to the environmental education of the communities and collaborates with other actors in favor of biodiversity.

Goal	Results	Recommendations
3.1: The company identifies protected areas and their services and reduces the impacts of production on them	● There are no defined protected areas due to the small size of the farm.	● Search for and (if feasible) establish biological corridors to connect productive areas with the greater natural surroundings.
3.2: The company participates in watershed management activities.	● There is a biological corridor near the hilly part of the property. There is a natural watershed and some chickens that live in this area.	● Work with neighbors to regularly clean the river area. ● Include aquatic species in any biodiversity monitoring.
3.3: Alliances and awareness programs are established with communities and other local actors, in favor of the conservation and sustainable use of biodiversity	● The landowner said he has a regular working relationship with one of his neighbors.	● Leverage local connections to support local conservation projects, including but not limited to trash collection or species monitoring. ● Collaborate with Probio to identify other local actors and develop a formal sustainability alliance.

Annex 1: Photos

Photo #1 Description: An aerial view of some of the forested areas.	
Photo #2 Description: The productive area bordering some larger trees.	

REPORT

Finca Jorge Vega (Agronorte)

Katira - Costa Rica

Data of visit: July 12 2021

General facts for the evaluated company

A. Background

Costa Rica is the world's largest pineapple exporter. A lot of these exports have been overseen by the Pineapple Development Corporation (PINDECO) since the 1980s. Global demand for pineapple has been increasing since the turn of the century, with an increase by 200% from 2000 to 2013. To meet this demand, more farms have transitioned into large-scale monocropping and a high use of pesticides (Maglianesi-Sandoz 2013). Most of this production is situated in the country's North Zone.

B. Company profile

The Costa Rican company Nicoverde, founded in 2017, is a subsidiary of the Italian company Nicofrutta which was founded in 1999. The company receives pineapples from about 120 small producers from the country's north zone. It also has two farms, Lucialva and Movaba, that are co-owned between Nicoverde and the farm managers. Nicoverde's farms range from relatively small (less than 5 hectares) to over 100 hectares. It also directs an office and pineapple packing plant in Pital, San Carlos, in the Alajuela province.
Agronorte is a farm cooperative that has been near Guatuso, Alajuela province for about 20 years. They currently have 22 farmers and 6 active pineapple farms. The average size of the pineapple farms is 7 hectares and the average productive area is 1.5 hectares. Nicoverde has also helped Agronorte secure Fair Trade certifications for their farms. They are also working to get certified through Rainforest Alliance with help from GiZ.

C. Farm Profile

Jorge Vega has owned the property in Katira for 27 years. He manages the property with his wife, who also does record-keeping. He has farmed pineapple for 16 years on the property, and worked with Agronorte for 8. About 2 hectares of the land is dedicated to pineapple farming, and there are few large shade trees in the growing area. There are also buffalo on the farm.

Farm Profile - Summary

1. General Information					
1.1 Farm Name	Finca Jorge Vega		1.2 Type of property	Agronorte	
1.3 BCA Contact Name			1.4 Position		
1.5 E-mail			1.6 Telephone		
2. Location					
2.1. Country	Costa Rica	2.2. Province/Department	Alajuela	2.3.City	Katira
2.4. Physical address				2.5. Postal code	
2.6. Latitude:	10° 45' 51.018" N	2.7. Length:	84° 53' 36.168" W	2.8. Point taken at:	
2.9. Altitude (masl)	112 m	2.10. Annual rainfall	n/a		
3. Land use					
3.1. Total area (ha)					12 hectares
3.2. Total production area (ha)					2 hectares
3.3. Total area dedicated to protected areas or natural ecosystems within the farm (ha)					~1 hectares
4. Products and volumes					
4.1. Product	**4.2 Harvest periods**		**4.3 Production volume (current year)**		
Pineapple	1 time per year, but it depends		50,000 fruits		
Product 2					
Product 3					
5. Workforce					
All workers employed during the last 12 months			**Women**	**Men**	**Total**
5.1. Permanent workers			0	0	0
5.2. Temporary workers:			~6	~6	~12
TOTAL			~6	~6	~12

Results of the application of the BCA tool

Transverse Axis : Business management
Objective of the transversal axis: Establish the basis for the integration of biodiversity into business management.

Goal	Results	Recommendations
GE - 1: Biodiversity policy defined, disclosed and implemented	● Biodiversity is considered to be very important to the farm. The farmers follow biodiversity and conservation protocol as dictated by Agronorte, but the specifics of these policies are unclear.	● Biodiversity for both the individual farm and for Agronorte should be written and clearly disclosed on the farms.
SG - 2: Personnel trained and sensitized on biodiversity issues for decision-making at different levels.	● There are not specific known programs about capacity building that relate to biodiversity, either on the cooperative or individual farm level.	● Agronorte should collaborate with each farm to deliver up-to-date, consistent trainings on biodiversity management for temporary workers.
GE - 3: Suppliers of goods and services are selected considering environmental and biodiversity criteria	● Nicoverde has been Agronorte's only client for several years now. Nicoverde has had a consistent record of environmental and social practices. ● There is not a clear set of criteria for selecting providers of direct services to the farms.	● Continue to collaborate with Nicoverde and GiZ on building a plan for best environmental practices.
SG - 4: Impacts are reduced for the development and maintenance of infrastructure	● Nicoverde has collaborated with Agronorte to provide microorganisms. These biological products can be applied to the soil to minimize costs and mitigate the ecological impacts of farming.	● Whenever possible, incorporate materials that can be recycled into the farming process.

GE - 5: The company complies with environmental legislation	● There is full compliance with local environmental legislation.	● Agronorte should review any updates in national environmental legislation regularly with landowners, at least annually.

Level 1: Production area
Objective of level 1: Production management is based on the optimized use of inputs and agricultural and industrial practices that are friendly to biodiversity and the environment.

Goal	Results	Recommendations
1.1: Soils are conserved	● The soil is allowed to rest about once every 3 years	● Continue regular soil analyzes to monitor any trends. Track periods of heavy rainfall to ensure rainwater is draining properly. Watch out for areas of potential erosion.
1.2: Pests and diseases are controlled through the application of IPM or low toxicity pesticides	● Multiple (non-organic) fertilizers are applied to the soil to facilitate plant growth. *Basillus* is applied to the soil as a biological mechanism to prevent pests.	● Continue recording the dates and amounts of every product application ● Work with agronomists to identify environmental impacts of each product used and potential for mitigation
1.3: Genetic resources and production systems facilitate optimal productivity, resistance to pests and reduce vulnerability to climate change	● Agronorte helps collect soil samples approximately once a year. Fruits are monitored for pests to see if extra pesticides need to be applied. ● Chemical products are applied to the soil according to detailed agronomist recommendations.	● Continue collaboration with agronomists to assess what other biological products can be used, and where dependence on chemicals can be minimized.
1.4: Water is used efficiently	● It rains a lot on the farm, so extra humidity has to be avoided. There is not a system for collecting or storing rainwater.	● Maintain a drainage system to control for excess humidity

Level 2: Farm
Objective of level 2: Production management is based on the optimized use of inputs and agricultural and industrial practices that are friendly to biodiversity and the environment.

Goal	Results	Recommendations
2.1: Terrestrial and aquatic ecosystems are conserved and not degraded	● There are no specific rules against deforestation, but large trees are generally conserved. Hunting and mistreatment of animals is not allowed.	● Collaborate with the cooperative and possibly local environmental groups to record all known plant and animal species on the farm.
2.2: Wildlife and beneficial organisms are identified and protected	● While buffalo live on the farm (domesticated), there are no other species of importance that have been identified.	● Identify plant species that are native and beneficial to the farm and may be threatened or endangered. ● Do the same for other organisms like insects and reptiles.
2.3: Areas not suitable for production are identified and actions for their restoration are defined	● Protected areas on the farm are identified as part of the overall agronomy plan.	● Ensure that there are biological corridors in protected areas for animal species to cross throughout the property.
2.4: Artificial infrastructure for biodiversity is established	● There are no artificial structures for biodiversity.	● Identify potential species of interest based off biodiversity inventory.
2.5: Invasive alien species are identified, eliminated or their	● No invasive species have been identified.	● In collaboration with Agronorte, identify any present invasive species according to this list: http://www.iucngisd.org/gisd/pdf/100Spanish.pdf

spread controlled		
2.6: Waste is managed with minimal environmental impact and	● Most of the waste used on the farm is organic. Any organic waste is left on the farm to decompose, or to make fruit juice from defective pineapples that cannot be sold. Inorganic waste, such as fertilizer bottles or cans, are returned to the buyer. The farmer will drive himself to dispose of the inorganic waste. The farmer maintains a detailed record of wastes produced on the farm.	● Identify which steps of the growing and harvesting process produce the most waste. ● Establish improvement programs for the waste hotspots.

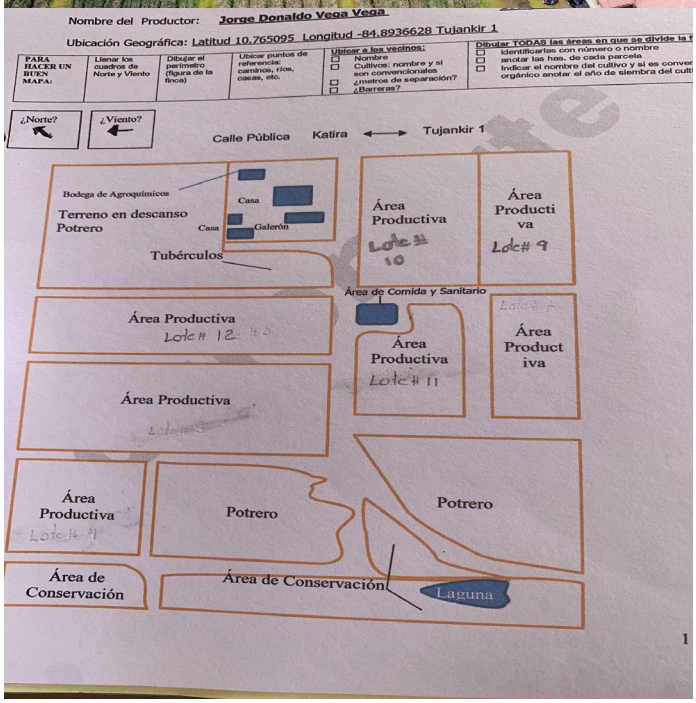
Level 3: Landscape
Objective of level 3: The farm minimizes its environmental impact on its surroundings, contributes to the environmental education of the communities and collaborates with other actors in favor of biodiversity

Goal	Results	Recommendations
3.1: The company identifies protected areas and their services and reduces the impacts of production on them	● Protected areas have been identified and mapped on the farm.	● Potentially collaborate with local environmental groups and/or neighboring farms to ensure maintenance and biodiversity of protected areas.
3.2: The company participates in watershed management activities	● The farm is not involved in any specific activities that relate to watershed improvement.	● Collaborate with neighbors to maintain local watersheds.
3.3: Alliances and awareness programs are established with communities and other local actors, in favor of the conservation and sustainable use of biodiversity.	● There is good collaboration between the farm and his neighbors. However, there are not any known documented conservation or biodiversity initiatives with other local actors.	● Leverage connections to support local conservation projects, including but not limited to trash collection or species monitoring.

Annex 1: Photos

Photo #1
Description: An aerial view of the property, including larger trees and productive areas.

Photo #2
Description: A detailed map of the farm plots including watershed and protected areas.



REPORT
Proyecto Finca La India
Sarapiquí La Virgen - Costa Rica

Date of farm visit: July 22 2021

I. General facts for the evaluated company

A. Background

Costa Rica is the world's largest pineapple exporter. A lot of these exports have been overseen by the Pineapple Development Corporation (PINDECO) since the 1980s. Global demand for pineapple has been increasing since the turn of the century, with an increase by 200% from 2000 to 2013. To meet this demand, more farms have transitioned into large-scale monocropping and a high use of pesticides (Maglianesi-Sandoz 2013). Most of this production is situated in the country's North Zone.

B. Company profile

The Costa Rican company Nicoverde, founded in 2017, is a subsidiary of the Italian company Nicofrutta which was founded in 1999. The company receives pineapples from about 120 small producers from the country's north zone. It also has two farms, Lucialva and Movaba, that are co-owned between Nicoverde and the farm managers. Nicoverde's farms range from relatively small (less than 5 hectares) to over 100 hectares. It also directs an office and pineapple packing plant in Pital, San Carlos, in the Alajuela province.
Coopeproagro is a cooperative founded in 2015, and has worked with Nicoverde since 2020. Coopeproagro also collaborates with other Costa Rican fruit companies. They sell exclusively organic pineapple and have 3 family farms in the cities of Guatuso, Pital, and Sarapiquí. Because they are family farms, many women are involved: 16 out of approximately 27 farmers are women.

C. Farm profile

Finca La India is one of three Coopeproagro farms, located in the rural area of Sarapiqui La Virgen in the Heredia province. It is 85 hectares total with 15 hectares of farming area for pineapples and 26 hectares of restoration area. The average yearly production of pineapple is approximately 500,000 fruits. As with all Coopeproagro farms, all of the pineapple farming on the property is organic. An additional 25 hectares of the property is used for raising cattle that are later sold to other farmers to sell for meat.
The questionnaire was conducted with Laura Gomez, who has owned the land for about 25 years ago. She has been farming pineapple for about 12 years at Finca La India. She has been with Coopeproagro since they started in 2015 in collaboration with the other two family farms. The land was previously used for cattle ranching and palm. She said she bought the land in Heredia to be closer to nature. The property includes a couple of rolling hills and a small creek. There is a wide diversity of biological diversity on the farm, including flora, birds, amphibians, and aquatic species. There are a number of native tree species that have been

preserved on the property for at least 15 years. These include *madero negro (Gliricidia sepium), roble coral (Terminalia amazonia),* and *cedro dulce (Cedrela tonduzii).* This year crop rotation started with velvet bean *(Mucuna puriens)* to assist with soil health and nitrogen fixation.

Farm Profile - Summary

1. General Information					
1.1 Farm Name	Finca La India		1.2 Type of property	Coopeproagro	
1.3 Contact Name BCA	Laura Gomez		1.4 Position		
1.5 E-mail			1.6 Telephone		
2. Location					
2.1. Country	Costa Rica	2.2. Province/Department	Heredia	2.3.City	Sarapiqui
2.4. Physical address				2.5. Postal code	
2.6. Latitude:	10° 30' 11.82" N	2.7. Length:	84° 5' 29.714" W	2.8. Point taken at:	
2.9. Altitude (masl)	122	2.10. Annual precipitation	N/A		
3. Land use					
3.1. Total area (ha)					85
3.2. Total production area (ha)					15
3.3. Total area dedicated to protected areas or natural ecosystems within the farm (ha)					26

4. Products and volumes		
4.1. Product	**4.2 Harvest periods**	**4.3 Production volume (current year)**
Pineapple	4 lots, harvested every 12-14 months	500,000 fruits
Livestock		

5. Labor force			
All workers employed during the last 12 months	**Women**	**Men**	**Total**
5.1. Permanent workers	5	12	17
5.2. Temporary workers:	0	4	4
TOTAL	5	16	21

Results of the application of the BCA Tool

Transversal Axis: Business management
Objective of the transversal axis: Establish the bases for the integration of biodiversity into business management.

Goal	Results	Recommendations
GE - 1: Biodiversity policy defined, disclosed and implemented	● There are rules about the use of water and organic waste, but there is no specific policy for biodiversity. All farm employees have been made aware of this policy.	● Write down a clear biodiversity policy that is integrated throughout Coopeproagro, particularly for restoration of protected areas, and disclose publicly to farm staff. ● Ensure that year-round and harvest season workers are aware of biodiversity policies.
GE - 2: Staff trained and sensitized on biodiversity issues for decision-making at different levels	● Nicoverde provides technical support to Coopeproagro. Other than that, Coopeproagro does not have specific personal trainings for biodiversity.	● Coopeproagro should collaborate with each farm to deliver up-to-date, consistent trainings on biodiversity management for both permanent and temporary workers.
GE - 3: Suppliers of goods and services are selected considering environmental and biodiversity criteria	● Coopeproagro does not have a specific process for selecting buyers based on environmental or biodiversity criteria.	● Develop a method for evaluating and comparing buyers based on commitments to biodiversity.
GE - 4 : Impacts are reduced for the development and maintenance of infrastructure	● Coopeproagro uses organic products as a way to minimize negative impacts to local ecosystems.	● Prioritize the use of local, low-waste, and recyclable products in the supply chain, whenever possible.

GE - 5: The company complies with environmental legislation	• Both Nicoverde and Coopeproagro follow all legislation on environmental protections and waste disposal.	• Coopeproagro should review any updates in national environmental legislation regularly (at least annually).

Level 1: Production area

Objective of level 1: Production management is based on the optimized use of inputs and agricultural and industrial practices that are friendly to biodiversity and the environment.

Goal	Results	Recommendations
1.1: Soils are conserved	• A soil analysis is done every year in collaboration with Nicoverde. • Plastic wrap is used to cover the soil on the pineapple to preserve humidity and prevent weed growth.	• Track periods of heavy rainfall to ensure rainwater is draining properly. Watch out for areas of potential erosion.
1.2: Pests and diseases are controlled through the application of IPM or low toxicity pesticides	• All pest management on the farm is organic. There is no pesticide or chemical pest control. An organic fertilizer with *brosa de cafe* is used to assist with crop growth.	• Continue recording the dates and amounts of every product application. Collaborate with agronomists at Coopeproagro and Nicoverde for every harvest to ensure methods are sustainable and efficiency.
1.3: Genetic resources and production systems facilitate optimal productivity, pest resistance and reduce vulnerability to climate change	• Biological methods such as *Basillus* and *Trichoderma* are applied in quantities of about 2-3 kg per hectare.	• Continue to evaluate product application schedule to assess any vulnerabilities to pests or illnesses.
1.4: Water is used efficiently	• There is a cistern on the property. However, there is not an official protocol for rainwater collection or water conservation. Water is used to apply biological products with a spray	• Continue to measure water use, especially for biological products.

	boom. The exact quantity varies between 600 - 2,000 kg per hectare.	

Level 2: Farm

Objective of level 2: Production management is based on the optimized use of inputs and agricultural and industrial practices that are friendly to biodiversity and the environment.

Goal	Results	Recommendations
2.1: Terrestrial and aquatic ecosystems are conserved and are not degraded	● There are no extractive practices such as hunting or fishing. There are no other specific policies for water conservation. ● Flower beds and other native vegetation are not cut. Trees may be removed if they are unhealthy, but they may otherwise be preserved. There is the rare cutting of trees for cattle raising.	● Identify areas that may be susceptible to erosion near the watershed.
2.2: Wildlife and beneficial organisms are identified and protected	● There is a booklet with names and photos of amphibian species on the property.	● Develop guides with photographs for tree and plant species as well as vertebrates (at least annually). ● Make note of any threatened and endangered animals present on the farm. Also, distinguish between native and non-native species.
2.3: Areas not suitable for production are identified and actions for their restoration are defined	● . There is a policy against cutting trees. There is a total of 25 hectares of land specifically set aside for restoration. There has been a visible improvement in forest health since the farm was purchased.	● Collect seeds from native tree species within the farm to help with planting and regrowth. ● Monitor annual counts of native tree species to track progress.
2.4: Artificial infrastructure for biodiversity is established	● Honey bees have been identified as a species of interest to conserve because of their role as pollinators and overall contribution to ecosystem wellness. There is a plan to build artificial bee and bat houses in the future.	● Follow up on proposed plans to develop infrastructure for pollinators.

2.5: Invasive alien species are identified, eliminated or their spread controlled	● No invasive species have been identified on the farm.	● In collaboration with Coopeproagro, identify any present invasive species according to this list: http://www.iucngisd.org/gisd/pdf/100Spanish.pdf
2.6: Waste is managed with minimal environmental impact and	● Organic and inorganic waste is separated for disposal. Organic waste is left to decompose in the soil, while inorganic waste is triple washed and recycled. A local recycling facility comes to pick the inorganic items. There is no hazardous waste on the farm.	● Record and weigh any inorganic waste (from cans, bottles, and other products) that is used on the farm.

Level 3: Landscape
Objective of level 3: The farm minimizes its environmental impact on its surroundings, contributes to the environmental education of the communities and collaborates with other actors in favor of biodiversity.

Goal	Results	Recommendations
3.1: The company identifies protected areas and their services and reduces the impacts of production on them	● All protected areas have been mapped along with the entire farm. Biological corridors are identified in the forested area.	● Annually check on biological corridors. Ensure that biological corridors continue to exist throughout the protected areas.
3.2: The company participates in basin management activities.	● There are not any specific activities on the farm for basin management.	● Conduct more detailed, annual observations of aquatic wildlife. Record names and photos of species.
3.3: Alliances and awareness programs are established with communities and other local actors, in favor of the conservation and sustainable use of biodiversity.	● The farm collaborates with local law enforcement to ensure biodiversity protection. If any illegal hunting or fishing is discovered on the property it will be reported.	● Identify local actors involved in biodiversity and environmental work. Then build a partnership with these groups to continue conservation efforts. These can focus on not just avoiding extractive practices, but on recording species.

Annex 1: Photos

Photo #1 Description: View of agricultural and biological areas.	
Photo #2 Description: A flowing river outside the productive area on the property.	

Coopetarrazu Qualitative Biodiversity Results

Farm 1

Level 1: Productive Area

Objective of level 1: Production management is based on the optimized use of inputs and agricultural and industrial practices that are friendly to biodiversity and the environment.

Goal	Results	Recommendations
1.1: The ground is conserved	• The landowner has noticed "moderate to high" soil erosion. He aims to conserve the soil by implementing terraces.	• Map areas of the farm that are especially prone to flooding.
1.2: Pests and diseases are controlled through the application of IPM or low toxicity pesticides	• A variety of fungicides, fertilizers, and herbicides are applied during the growing process. These include Opus, Cepex, Cosmo Agua, and Phagra. He has generally seen fewer pests on the farm since he started working on the property.	• Maintain a log of which products are applied and their toxicity levels. Reassess potential changes after each growing season.
1.3: Genetic resources and production systems facilitate optimal productivity, resistance to pests and reduce vulnerability to climate change	• The farmer noted that there were nutritional deficiencies in some plants, including potassium, magnesium, and zinc. He may have to apply more herbicides depending on how heavy the rainfall is that season.	• Conduct chemical and microbiological soil analyses to evaluate how the growing process can become more resistant to pests and climate.
1.4: Water is used efficiently	• There are not any specific water management activities.	• Track the amount of water that is used throughout the production process and identify the most intensive steps and/or products.

Level 2: Farm

Objective of Level 2: Production management is based on the optimized use of inputs and agricultural and industrial practices that are friendly to biodiversity and the environment.

Meta	Resultados	Recomendaciones
2.1: Land and aquatic ecosystems are conserved and not degraded	• Biodiversity is considered important to the farm, but there are not any official policies in place.	• Plant high-growth native vegetation that can mitigate erosion.
2.2: Wildlife and beneficial organisms are identified and protected	• The landowner has noticed several bird species and some pollinators such as bees on the property.	• Pay attention to specific species of trees and flowers that pollinators and birds interact with.
2.3: Areas not suitable for production are identified and actions for restoration are defined	• There are not any defined protected areas, but the farmer mentioned that additional trees were planted on the property for shade.	• Keep additional seeds from trees to potentially use for reforesting in the future.
2.4: Artificial infrastructure for biodiversity is established	• The landowner mentioned his neighbor has a bee farm, which he believes has spillover benefits for his property. Otherwise there are not any other artificial structures for wildlife.	• Collaborate with neighbors to gather more details about beekeeping. Plant additional flowers to attract pollinators.
2.5: Invasive, exotic species are identified, eliminated and expansion is controlled	• There are not any known invasive species on the farm.	• Identify any present invasive species according to this list: http://www.iucngisd.org/gisd/pdf/100Spanish.pdf

2.6: Waste is managed and used with minimal environmental impact	• The landowner reuses some bags for storage during the harvest season. He returns bottles to Coopetarrazu as part of their recycling program.	• Track the amount of waste that is returned to recycling throughout the year.

Level 3: Landscape

Objective of level 3: The farm minimizes its environmental impacts towards its surroundings, contributes to the environmental education of the communities and collaborates with other actors in favor of biodiversity.

Meta	Resultados	Recomendaciones
3.1: The business identifies protected areas and their services and reduces production impacts on them	• Coopetarrazu has not identified any particular protected areas.	• Work with neighboring farms to identify any nearby protected land if there are not any particular areas on this property.
3.2: The business participates in activities for basin management	• There are not any known activities that relate to basin or watershed management.	• Monitor watershed areas for pollution and/or littering.

3.3: Alliances and awareness programs are established with communities and other local actors, in favor of the conservation and sustainable use of biodiversity	• There are not any known alliances between this farm and other local actors that relate to conservation/biodiversity.	• Work with neighboring farmers to implement conservation and biodiversity programs. For example, a group could work together to develop a species inventory, or to identify pests.

Farm 2

Level 1: Productive Area

Objective of level 1: Production management is based on the optimized use of inputs and agricultural and industrial practices that are friendly to biodiversity and the environment.

Goal	Results	Recommendations
1.1: The ground is conserved	• The landowner builds terraces and tries to avoid pesticides when possible. He also plants shade trees and adds branches on the ground to reduce erosion.	• Discuss the results of the most recent chemical analysis with Coopetarrazu to evaluate soil health.
1.2: Pests and diseases are controlled through the application of IPM or low toxicity pesticides	• The landowner uses Opera as a fungicide 3 times a year, which controls for a wide array of crops diseases.	• Maintain a record of the names, dates, and quantities of products applied on the farm each year.

1.3: Genetic resources and production systems facilitate optimal productivity, resistance to pests and reduce vulnerability to climate change	• Coopetarrazu has given some organic fertilizer but it is not used.	• Collaborate with agronomists to figure out the barriers to using organic fertilizer and discuss an alternative.
1.4: Water is used efficiently	• A manual pump is used to apply chemical products, which requires water. There are no official records for water usage.	• Track water usage when recording chemical applications.

Level 2: Farm

Objective of Level 2: Production management is based on the optimized use of inputs and agricultural and industrial practices that are friendly to biodiversity and the environment.

Goal	Results	Recommendations
2.1: Land and aquatic ecosystems are conserved and not degraded	• The landowner follows any conservation regulations by Coopetarrazu and Volcafe, another company he sells to.	• Create signs that clearly display Coopetarrazu's environmental policies to display on the farm.
2.2: Wildlife and beneficial organisms are identified and protected	• There has not been any formal species monitoring, but the farmer identified various birds that exist on the farm and generally tries to maintain a "balance" of species.	• In collaboration with Coopetarrazu, develop a formal biodiversity inventory with names and photos of plant and animal species.

2.3: Areas not suitable for production are identified and actions for restoration are defined	• Coopetarrazu generally suggests reforestation actions and the landowner has planted trees himself. There is not a specific protected area.	• Create a map of the farm, in particular designated areas where trees have been planted or that are potential candidates for reforestation.
2.4: Artificial infrastructure for biodiversity is established	• Generally, the landowner noted that biodiversity helps regulate pests on the coffee farm but there are not any specific structures in place.	• Identify which pollinators exist on the farm to see which plants or other structures may be used to attract them.
2.5: Invasive, exotic species are identified, eliminated and expansion is controlled	• The landowner mentioned a green hornet that is not native to the area and eats other insects.	• Identify a local conservation group who can more specifically identify the species and a plan for removal. Wear thick protective clothing when going to an area with hornets.
2.6: Waste is managed and used with minimal environmental impact	• It is unknown if there are any strategies to reduce or mitigate waste.	• Maintain records of the types and quantities of inorganic waste that is produced.

Level 3: Landscape

Objective of level 3: The farm minimizes its environmental impacts towards its surroundings, contributes to the environmental education of the communities and collaborates with other actors in favor of biodiversity.

Goal	Results	Recommendations

3.1: The business identifies protected areas and their services and reduces production impacts on them	• Coopetarrazu has not identified any nearby protected areas.	• Work with neighboring farms to identify any nearby protected land if there are not any particular areas on this property.
3.2: The business participates in activities for basin management	• Large trees such as *bijarro* are preserved near the river area.	• Monitor the river itself for trash, and check in on large trees regularly to ensure their health.
3.3: Alliances and awareness programs are established with communities and other local actors, in favor of the conservation and sustainable use of biodiversity	• There are not any known alliances between this farm or other local actors that relate to conservation/biodiversity.	• Develop a network with neighbors and Coopetarrazu to see who may be able to assist with biodiversity monitoring.

Farm 3

Level 1: Productive Area

Objective of level 1: Production management is based on the optimized use of inputs and agricultural and industrial practices that are friendly to biodiversity and the environment.

Goal	Results	Recommendations

1.1: The ground is conserved	• Shade trees are planted as a soil conservation practice	• Reach out to Coopetarrazu to conduct an updated chemical analysis that can better evaluate soil health.
1.2: Pests and diseases are controlled through the application of IPM or low toxicity pesticides	• A variety of fungicides and fertilizers, such as Opera and Artemis, are applied throughout the year.	• Reassess any products that were used each year with Coopetarrazu to evaluate benefits and risks.
1.3: Genetic resources and production systems facilitate optimal productivity, resistance to pests and reduce vulnerability to climate change	• Leaves and other organic waste are used as fertilizer, instead of the company's organic fertilizer. Chemical fertilizers are also used.	• Conduct a chemical and microbiological analysis of the soil with agronomists to evaluate overall resilience and productivity.
1.4: Water is used efficiently	• Water is mainly used to apply fertilizers and other products.	• Identify the products that require the most intense water usage.

Level 2: Farm

Objective of Level 2: Production management is based on the optimized use of inputs and agricultural and industrial practices that are friendly to biodiversity and the environment.

Goal	Results	Recommendations

2.1: Land and aquatic ecosystems are conserved and not degraded	● The landowner stated that biodiversity has a positive impact and is important to the farm.	● Ensure that all workers are aware of Coopetarrazu's environmental policies. Enforce a policy against littering and cutting large trees, and put up signs about these rules.
2.2: Wildlife and beneficial organisms are identified and protected	● There is not an official wildlife list but the landowner informally identified a number of trees, such as guava, that are present on the farm. There are also a lot of vertebrates present, such as cats, raccoons and birds.	● Develop a formal biodiversity inventory with names and photos of any known plant and animal species.
2.3: Areas not suitable for production are identified and actions for restoration are defined	● A number of trees have been planted for shade.	● Monitor trees regularly for any pests or disease, and keep a collection for seeds of large fruit trees for future replanting efforts.
2.4: Artificial infrastructure for biodiversity is established	● There are not any artificial structures on this farm that relate to biodiversity, but a neighbor works closely with bees.	● Speak with neighbors to learn more about working with bees and other pollinators and to identify some potential strategies to attract them to this farm.
2.5: Invasive, exotic species are identified, eliminated and expansion is controlled	● There is no knowledge of any invasive species on the farm.	● Work to identify any present invasive species according to this list: http://www.iucngisd.org/gisd/pdf/100Spanish.pdf
2.6: Waste is managed and used with minimal environmental impact	● Any bottles are returned to Coopetarrazu as part of their recycling program. Fertilizer bags are reused for storage.	● Maintain a weekly log of the type and amount (ideally in weight) of inorganic waste.

Level 3: Landscape

Objective of level 3: The farm minimizes its environmental impacts towards its surroundings, contributes to the environmental education of the communities and collaborates with other actors in favor of biodiversity.

Goal	Results	Recommendations
3.1: The business identifies protected areas and their services and reduces production impacts on them	• Coopetarrazu has not identified any nearby protected areas.	• Work with neighboring farms to identify any nearby protected land if there are not any particular areas on this property.
3.2: The business participates in activities for basin management	• There are not any known activities that relate to basin management.	• Draw a map of the property and visually identify any water sources.
3.3: Alliances and awareness programs are established with communities and other local actors, in favor of the conservation and sustainable use of biodiversity	• There are not any known alliances between this farm or other local actors that relate to conservation/biodiversity.	• Develop a network with neighbors and Coopetarrazu to see who may be able to assist with biodiversity monitoring.

Farm 4

Level 1: Productive Area

Objective of level 1: Production management is based on the optimized use of inputs and agricultural and industrial practices that are friendly to biodiversity and the environment.

Goal	Results	Recommendations
1.1: The ground is conserved	• A chemical analysis of the soil is done about every 3 years.	• Monitor excess water levels throughout the rainy season to ensure that the system is draining properly.
1.2: Pests and diseases are controlled through the application of IPM or low toxicity pesticides	• The farmer applies chemical control for pests about once every month, or month and a half. A variety of chemical products are used such as Sircomil and Cepex.	• When possible, visually inspect plants for pests to evaluate the effectiveness of the current agrochemical plan.
1.3: Genetic resources and production systems facilitate optimal productivity, resistance to pests and reduce vulnerability to climate change	• There are no known biological or organic products used on the farm.	• Reach out to Coopetarrazu to see if there are any ways to incorporate biological and/or organic products on the farm.
1.4: Water is used efficiently	• Water is mainly used for applying chemical products.	• Maintain written records of product applications, including how much liquid is used for each application.

Level 2: Farm

Objective of Level 2: Production management is based on the optimized use of inputs and agricultural and industrial practices that are friendly to biodiversity and the environment.

Goal	Results	Recommendations

2.1: Land and aquatic ecosystems are conserved and not degraded	● The landowner exhibited a positive attitude toward biodiversity and believes it is important to leave nature in good condition.	● Ensure that full-time and temporary employees understand the importance of minimizing impact on ecosystems and that trash is not left on the property. This could be accomplished through signs on the farm.
2.2: Wildlife and beneficial organisms are identified and protected	● The landowner has noticed that trees are important for maintaining the health of the farm ecosystem.	● Collect seeds for large trees, such as the *encino,* if possible.
2.3: Areas not suitable for production are identified and actions for restoration are defined	● There are no officially designated protected areas, but there is a small wooded area with biological corridors where wildlife is known to exist. Large native trees are kept on the farm and not cut down.	● Ensure that biological corridors exist throughout the farm. A local conservation group or ecologist may be able to assist with this.
2.4: Artificial infrastructure for biodiversity is established	● There are no specific policies relating to biodiversity on this farm, including artificial structures. However, fruit trees are protected on the farm as a way to attract birds.	● Create a 5-year plan for biodiversity protection in collaboration with the cooperative.
2.5: Invasive, exotic species are identified, eliminated and expansion is controlled	● There is no species inventory for this farm.	● Develop a plan with the cooperative over the next 1-2 years to maintain a list of plant and animal species, paying special attention to any potential invasive or at-risk species.
2.6: Waste is managed and used with minimal environmental impact	● Most of the waste produced on the farm is organic. Non-organic waste is bored in bags. There are not any exact records of how much waste is produced.	● Create a weekly log with approximate quantities of organic and inorganic waste used. Work with the cooperative to return inorganic waste to the manufacturer for recycling, instead of burning.

Level 3: Landscape

Objective of level 3: The farm minimizes its environmental impacts towards its surroundings, contributes to the environmental education of the communities and collaborates with other actors in favor of biodiversity.

Goal	Results	Recommendations
3.1: The business identifies protected areas and their services and reduces production impacts on them	• Paths and terraces are maintained throughout the farm as a way to aerate the soil.	• Create a map of the productive and non-productive areas of the farm to see if there are additional sections that should be established for protection.
3.2: The business participates in activities for basin management	• There are not any known activities that relate to basin management.	• Work with neighbors to maintain any local water systems.
3.3: Alliances and awareness programs are established with communities and other local actors, in favor of the conservation and sustainable use of biodiversity	• There are not any known alliances with local actors for biodiversity initiatives.	• Contact the ADI and/or other neighboring landowners to identify any potential for wildlife monitoring

Farm 5

Level 1: Productive Area

Objective of level 1: Production management is based on the optimized use of inputs and agricultural and industrial practices that are friendly to biodiversity and the environment.

Goal	Results	Recommendations
1.1: The ground is conserved	• A chemical analysis is done on the soil every year.	• Create a map of the farm area, making note of any sections that are prone to flooding.
1.2: Pests and diseases are controlled through the application of IPM or low toxicity pesticides	• A variety of products, such as Atemi and Zinc-Boro, are applied throughout the year. Chemical control for pests is used about every week. Chemical and organic fertilizer is used about three times per year.	• Work with Coopetarrazu to identify the environmental impacts of all products used.
1.3: Genetic resources and production systems facilitate optimal productivity, resistance to pests and reduce vulnerability to climate change	• The farm is given some organic fertilizer by Coopetarrazu, but does not use all of it.	• Collaborate with the cooperative to see if there is a more efficient way to distribute and apply non-chemical products.
1.4: Water is used efficiently	• Water is mainly used for product application according to industry standards. The landowner noted that this past year was an especially intense rainy season.	• Ensure that the productive areas of the farm have a proper drainage system to avoid flooding during heavy rains.

Level 2: Farm

Objective of Level 2: Production management is based on the optimized use of inputs and agricultural and industrial practices that are friendly to biodiversity and the environment.

Goal	Results	Recommendations
2.1: Land and aquatic ecosystems are conserved and not degraded	• The landowner is mindful to adjust farming practices to the changing climate. For example, with a longer raining season the pruning process starts earlier.	• Work with the cooperative and other local actors to see if there is a potential to monitor local watersheds for agrochemicals.
2.2: Wildlife and beneficial organisms are identified and protected	• The landowner noted that some of his neighbors are aware of endangered species in the area and have reported them to SINAC. Also, the landowner is aware of different native plant, vertebrate, and invertebrate species on the farm. Coopetarrazu has done some monitoring of species before.	• Identify particular “indicator” species that can serve as a symbol for the farm’s overall health. These may include birds or pollinators.
2.3: Areas not suitable for production are identified and actions for restoration are defined	• There are not any particular protected areas. The landowner has planted some trees, such as eucalyptus.	• Develop biological corridors throughout the farm, including planting native vegetation to minimize erosion.
2.4: Artificial infrastructure for biodiversity is established	• There are no specific conscious actions taken for biodiversity protection, including any artificial structures. However, the landowner noticed that some plants such as *granadilla* attract pollinators.	• Continue planting native fruit trees that are friendly to pollinators.

2.5: Invasive, exotic species are identified, eliminated and expansion is controlled	● While not necessarily an invasive species, cashew is a non-native plant that has been found on the farm due to warming temperatures.	● The next time that Coopetarrazu does any biodiversity monitoring, identify any present invasive species according to this list: http://www.iucngisd.org/gisd/pdf/100Spanish.pdf
2.6: Waste is managed and used with minimal environmental impact	● Organic waste is left on the ground to decompose. Inorganic waste, such as cans and tins, are returned to Coopetarrazu.	● Maintain a weekly log of the types and quantities of waste produced. Identify which steps of the growing process produce the most waste.

Level 3: Landscape

Objective of level 3: The farm minimizes its environmental impacts towards its surroundings, contributes to the environmental education of the communities and collaborates with other actors in favor of biodiversity.

Goal	Results	Recommendations
3.1: The business identifies protected areas and their services and reduces production impacts on them	● Large trees are not cut down on the property in compliance with SINAC regulations. Coopetarrazu has not identified any designated protected areas for the property.	● Identify potential areas of the farm for future protection and reforestation.
3.2: The business participates in activities for basin management	● There is a river with a small sloped area near the farming area. There are not any known activities that relate to basin management.	● Join with neighbors to help monitor any local waterway systems and track pollution.

3.3: Alliances and awareness programs are established with communities and other local actors, in favor of the conservation and sustainable use of biodiversity	● There are not any known alliances with local actors for biodiversity initiatives.	● Identify local actors (e.g., company employees, ADI, universities, environmental groups, etc.) who may be able to develop ideas for a biodiversity monitoring program.

Farm 6

Level 1: Productive Area

Objective of level 1: Production management is based on the optimized use of inputs and agricultural and industrial practices that are friendly to biodiversity and the environment.

Goal	Results	Recommendations
1.1: The ground is conserved	● The landowner cleans up flooded areas and mitigates holes in roads and pathways during the rainy season.	● Create a map of the property with special attention given to the most flood-prone areas.
1.2: Pests and diseases are controlled through the application of IPM or low toxicity pesticides	● A chemical control for pests is applied every week. The most commonly used products are Zinc-Boro and Opera.	● Collaborate with cooperative employees, including agronomists to understand the environmental impacts of the products that are used.

1.3: Genetic resources and production systems facilitate optimal productivity, resistance to pests and reduce vulnerability to climate change	● The farm applies organic fertilizer from Coopetarrazu. Because there was more rain in the past year, the farmer had to work an additional day each week to collect the harvest.	● Work with the agronomists to see if the use of organic fertilizer can be scaled up.
1.4: Water is used efficiently	● Water is mainly used for applying chemical products.	● In collaboration with the cooperative, create a log for monitoring water and identify any potential for more efficient use.

Level 2: Farm

Objective of Level 2: Production management is based on the optimized use of inputs and agricultural and industrial practices that are friendly to biodiversity and the environment.

Goal	Results	Recommendations
2.1: Land and aquatic ecosystems are conserved and not degraded	● The landowner cleans up flooded areas and mitigates holes in roads and pathways during the rainy season.	● Create a map of the property with special attention given to the most flood-prone areas.
2.2: Wildlife and beneficial organisms are identified and protected	● A chemical control for pests is applied every week. The most commonly used products are Zinc-Boro and Opera.	● Collaborate with cooperative employees, including agronomists to understand the environmental impacts of the products that are used.

2.3: Areas not suitable for production are identified and actions for restoration are defined	● The farm applies organic fertilizer from Coopetarrazu. Because there was more rain in the past year, the farmer had to work an additional day each week to collect the harvest.	● Work with the agronomists to see if the use of organic fertilizer can be scaled up.
2.4: Artificial infrastructure for biodiversity is established	● Water is mainly used for applying chemical products.	● In collaboration with the cooperative, create a log for monitoring water and identify any potential for more efficient use.
2.5: Invasive, exotic species are identified, eliminated and expansion is controlled	● The landowner cleans up flooded areas and mitigates holes in roads and pathways during the rainy season.	● Create a map of the property with special attention given to the most flood-prone areas.
2.6: Waste is managed and used with minimal environmental impact	● There are no recorded numbers of the amount of wastes produced on the farm. He disposes of non-organic waste by taking it to the municipality. Sometimes during the summer season the landowner has noticed people who come to the property and litter.	● Place up signs that warn against littering. Work with the local government to see if there is a way to report violations.

Level 3: Landscape

Objective of level 3: The farm minimizes its environmental impacts towards its surroundings, contributes to the environmental education of the communities and collaborates with other actors in favor of biodiversity.

Goal	Results	Recommendations

3.1: The business identifies protected areas and their services and reduces production impacts on them	• There is a biological corridor at the bottom of the hilly area.	• Create a map of the productive and non-productive areas of the farm to see if there are additional sections that should be established for protection.
3.2: The business participates in activities for basin management	• There are no known activities for basin management.	• Work with neighbors to maintain any local water systems.
3.3: Alliances and awareness programs are established with communities and other local actors, in favor of the conservation and sustainable use of biodiversity	• There are not any known alliances with local actors for biodiversity initiatives.	• Contact Coopetarrazu and local landowners to evaluate the feasibility of collaboration on biodiversity initiatives such as monitoring.

Farm 7

Level 1: Productive Area

Objective of level 1: Production management is based on the optimized use of inputs and agricultural and industrial practices that are friendly to biodiversity and the environment.

Goal	Results	Recommendations
1.1: The ground is conserved	• The landowner mentioned building terraces and using insecticides to conserve the soil.	• Keep a detailed log of insecticide use. Speak with Coopetarrazu agronomists to determine the potential environmental impacts of any products.

1.2: Pests and diseases are controlled through the application of IPM or low toxicity pesticides	● The farmer applies fertilizers Opus and Fera to the soil. Calcium is also used, but in an unknown amount.	● Maintain a written record of the amounts of product that are applied each year.
1.3: Genetic resources and production systems facilitate optimal productivity, resistance to pests and reduce vulnerability to climate change	● The landowner did not say that any biological or organic products were used on the farm.	● Collaborate with Coopetarrazu to assess which biological fertilizers can be used, and where dependence on chemicals can be minimized.
1.4: Water is used efficiently	● There is not any specific protocol to manage or conserve water use.	● Maintain records of water use on the property. Note which products require the heaviest water usage.

Level 2: Farm

Objective of Level 2: Production management is based on the optimized use of inputs and agricultural and industrial practices that are friendly to biodiversity and the environment.

Goal	Results	Recommendations
2.1: Land and aquatic ecosystems are conserved and not degraded	● Generally, the landowner does not have an official conservation policy but there is an unwritten philosophy that he follows about protecting natural areas.	● Post signs throughout the property that prohibit any hunting, fishing, littering, or general degradation of nature. Make sure that any workers or visitors on the farm are informed of this policy.

2.2: Wildlife and beneficial organisms are identified and protected	• Bees have been identified as a species that is overall useful to the property. He notes which areas tend to have more bees so he does not spray insecticide in those regions.	• Map any parts of the property that are known to have more pollinators.
2.3: Areas not suitable for production are identified and actions for restoration are defined	• There are not any officially recognized protected areas. The landowner does not cut large trees especially those that exist in the mountainous part of the property.	• Maintain a written biodiversity inventory, paying particular attention to species that may be threatened or endangered. If possible, collect seeds of large trees for future replanting.
2.4: Artificial infrastructure for biodiversity is established	• There is not any artificial infrastructure for biodiversity on the property.	• Plant a variety of colored flowers to attract bees and other pollinators.
2.5: Invasive, exotic species are identified, eliminated and expansion is controlled	• There are no identified invasive species on the farm.	• In collaboration with Coopetarrazu, identify any present invasive species according to this list: http://www.iucngisd.org/gisd/pdf/100Spanish.pdf
2.6: Waste is managed and used with minimal environmental impact	• The farmer reuses fertilizer bags to store coffee during the harvesting season. Any cans or containers that are not reused are given to Coopetarrazu for recycling.	• Maintain a record of all waste that is produced during the growing season. Separate by organic and inorganic.

Level 3: Landscape

Objective of level 3: The farm minimizes its environmental impacts towards its surroundings, contributes to the environmental education of the communities and collaborates with other actors in favor of biodiversity.

Goal	Results	Recommendations

3.1: The business identifies protected areas and their services and reduces production impacts on them	• Coopetarrazu has not identified any specific protected areas for this property.	• Draw a map of the property to identify any potential areas that could be designated for protection.
3.2: The business participates in activities for basin management	• There are natural water sources on the property, but there are not any specific restoration activities for them.	• Meet with neighbors to see if a collaboration to monitor streams for litter can be set up.
3.3: Alliances and awareness programs are established with communities and other local actors, in favor of the conservation and sustainable use of biodiversity	• There are not any known alliances between this farm and other local actors that relate to conservation and/or biodiversity.	• Leverage local connections to support local conservation projects, including but not limited to trash collection or species monitoring.

Farm 8

Level 1: Productive Area

Objective of level 1: Production management is based on the optimized use of inputs and agricultural and industrial practices that are friendly to biodiversity and the environment.

Goal	Results	Recommendations
1.1: The ground is conserved	• The landowner creates and maintains terraces to conserve soil.	• Work with Coopetarrazu to conduct an annual soil analysis.

1.2: Pests and diseases are controlled through the application of IPM or low toxicity pesticides	● The landowner does receive some organic fertilizer from Coopetarrazu, but does not use it on the farm. Also, the landowner does not use products such as fungicides that are sold with a “red” label, which indicates extremely harmful impacts on pollinators.	● Work with Coopetarrazu to discuss the challenges of implementing organic fertilizer and see if there are any potential alternatives.
1.3: Genetic resources and production systems facilitate optimal productivity, resistance to pests and reduce vulnerability to climate change	● Biological products are not used on the farm due to the high intensity of pests.	● Connect with agronomists to better understand how the agrochemical products used impact crop productivity, and to evaluate if there is potential for implementing biological and organic resources.
1.4: Water is used efficiently	● There are no records of water usage on the farm. The landowner does regularly inspect local water sources.	● Maintain a weekly record of water usage throughout the property.

Level 2: Farm

Objective of Level 2: Production management is based on the optimized use of inputs and agricultural and industrial practices that are friendly to biodiversity and the environment.

Goal	Results	Recommendations
2.1: Land and aquatic ecosystems are conserved and not degraded	● The landowner recognizes that it is generally important to be aware of biodiversity, but there is not an official conservation policy.	● Maintain biological corridors between the forested section of the property and the rest of the landscape.

2.2: Wildlife and beneficial organisms are identified and protected	● The landowner was generally aware of several tree and animal species that he had noticed. There is not a specific plan to protect any of these organisms, but he noted the importance of maintaining a biological "equilibrium" on the farm.	● Maintain a written biodiversity inventory that includes plants and animals, paying attention to species that may be threatened or endangered. Ideally can be updated yearly, but may require support from neighboring groups or Coopetarrazu.
2.3: Areas not suitable for production are identified and actions for restoration are defined	● There are not any official areas that have been identified for protection. Some fruit trees have been planted to develop greater biodiversity.	● Maintain an inventory of tree seeds for species that exist on the property.
2.4: Artificial infrastructure for biodiversity is established	● The landowner places honeycomb on coffee plants to attract bees and other pollinators.	● Plant additional flowers of varying colors to attract pollinators.
2.5: Invasive, exotic species are identified, eliminated and expansion is controlled	● The landowner mentioned that an unnamed fungus has killed some large trees, and that it is not native to this area. However, it is unknown if it is specifically invasive.	● Work with local conservation groups and/or government agencies to identify any foreign species and develop a mitigation plan.
2.6: Waste is managed and used with minimal environmental impact	● Waste is returned about once every year to Coopetarrazu. The landowner tries to reuse cans and tins to reduce waste.	● Keep a written record of any inorganic waste that is returned to Coopetarrazu throughout the year.

Level 3: Landscape

Objective of level 3: The farm minimizes its environmental impacts towards its surroundings, contributes to the environmental education of the communities and collaborates with other actors in favor of biodiversity.

Goal	Results	Recommendations

3.1: The business identifies protected areas and their services and reduces production impacts on them	• Coopetarrazu has not identified any specific protected areas for this property.	• Create a map of the property to identify any potential areas that could be designated for protection.
3.2: The business participates in activities for basin management	• There are not any known activities relating to watershed management.	• Identify any water sources while mapping the farm and surrounding property.
3.3: Alliances and awareness programs are established with communities and other local actors, in favor of the conservation and sustainable use of biodiversity	• There are not any known alliances between this farm and other local actors that relate to conservation and/or biodiversity.	• Collaborate with Coopetarrazu to see if any connections can be made with local actors to implement biodiversity monitoring.

Farm 9

Level 1: Productive Area

Objective of level 1: Production management is based on the optimized use of inputs and agricultural and industrial practices that are friendly to biodiversity and the environment.

Goal	Results	Recommendations

1.1: The ground is conserved	● An annual chemical analysis concluded that the soil was at a healthy quality.	● See with Coopetarrazu if it is feasible to conduct a microbiological analysis of the soil. This can be useful for figuring out if there is any potential to use biological products on the farm.
1.2: Pests and diseases are controlled through the application of IPM or low toxicity pesticides	● *Roya* is a common pest on the farm. The fungicide *Esfera* is applied 3 times a year.	● With Coopetarrazu, maintain written records of agrochemical product applications and conduct annual analysis on their effectiveness.
1.3: Genetic resources and production systems facilitate optimal productivity, resistance to pests and reduce vulnerability to climate change	● Banana leaves are used as a type of organic fertilizer to facilitate productivity.	● Continue to visually monitor productive areas for pests throughout the growing season.
1.4: Water is used efficiently	● There are not any official records of water usage, or any specific strategies to maximize water efficiency.	● Maintain a written record of water usage on the farm, taking particular note of which products require the most water.

Level 2: Farm

Objective of Level 2: Production management is based on the optimized use of inputs and agricultural and industrial practices that are friendly to biodiversity and the environment.

Goal	Results	Recommendations

2.1: Land and aquatic ecosystems are conserved and not degraded	● The landowner reported that he generally takes care of natural ecosystems on the farm. He also monitors the area for flooding.	● Develop a biodiversity inventory of all known plant and animal species. Work with Coopetarrazu and/or neighboring environmental groups to update yearly.
2.2: Wildlife and beneficial organisms are identified and protected	● While there is not an official protection policy, the landowner has personally chosen to not cut certain large trees like *bijarro.*	● Set up signs throughout the property that clearly advertise the policy on cutting trees.
2.3: Areas not suitable for production are identified and actions for restoration are defined	● There are not any specific protected areas.	● Continue pruning and maintaining large trees.
2.4: Artificial infrastructure for biodiversity is established	● There are no known artificial structures for biodiversity on the farm.	● After completing a biodiversity inventory, work with local conservationists to see what structures can be developed.
2.5: Invasive, exotic species are identified, eliminated and expansion is controlled	● The landowner identified cypress as an exotic species that decreases soil fertility. He has also noticed that some non-invasive species, such as toucans, have shown up in recent years that were previously not in the area.	● Reach out to the local tree-planting group to identify a mitigation strategy for invasive species.
2.6: Waste is managed and used with minimal environmental impact	● The landowner returns a ~25-30 L bag of inorganic waste to Coopetarrazu about once every day. Some fertilizer bags are burned. Other plastic	● Reuse bags for storage during the harvest season instead of burning.

	containers may be reused for storage.	

Level 3: Landscape

Objective of level 3: The farm minimizes its environmental impacts towards its surroundings, contributes to the environmental education of the communities and collaborates with other actors in favor of biodiversity.

Goal	Results	Recommendations
3.1: The business identifies protected areas and their services and reduces production impacts on them	• Coopetarrazu has not identified any protected areas on the farm.	• Map the farm and productive areas, including any biological corridors, to identify any potential areas that could be designated for protection.
3.2: The business participates in activities for basin management	• There are no known activities for water basin management.	• Continue evaluating the property for flooding and identify any areas that may need additional management.
3.3: Alliances and awareness programs are established with communities and other local actors, in favor of the conservation and sustainable	• Some of the trees on the property were donated by a local group that plants them.	• Leverage existing connections with the *bibero* (planting group) to conduct a biodiversity inventory.

use of biodiversity		

Farm 10

Level 1: Productive Area

Objective of level 1: Production management is based on the optimized use of inputs and agricultural and industrial practices that are friendly to biodiversity and the environment.

Goal	Results	Recommendations
1.1: The ground is conserved	• The landowner builds terraces and limits the use of herbicides whenever possible to conserve soil.	• Identify any particular sections of the farm that are more prone to flooding.
1.2: Pests and diseases are controlled through the application of IPM or low toxicity pesticides	• The landowners visually monitor the property every week to check for any plant disease. They limit chemical control for pests, but use some fungicides such as Opera during the dry season.	• Continue to adjust the product application cycle based on climate and collaborate with Coopetarrazu to find any potential for improvement.
1.3: Genetic resources and production systems facilitate optimal productivity, resistance to pests and reduce	• The landowners did not mention any biological products that are used on the farm.	• Collaborate with agronomists at Coopetarrazu to evaluate if organic fertilizer can be substituted for chemical in at least instances.

vulnerability to climate change		
1.4: Water is used efficiently	• There are not any official records of water usage on the farm.	• Track the amount of water that is required to apply each agricultural product during the growing cycle and identify the most water-intensive ones.

Level 2: Farm

Objective of Level 2: Production management is based on the optimized use of inputs and agricultural and industrial practices that are friendly to biodiversity and the environment.

Goal	Results	Recommendations
2.1: Land and aquatic ecosystems are conserved and not degraded	• The landowners view environmental protections as an important aspect of both natural and human health. There are not any official conservation-related policies.	• Check for biological corridors throughout the property to ensure wildlife can move throughout.
2.2: Wildlife and beneficial organisms are identified and protected	• The landowners take effort to not kill or harm any wildlife on the property. They have noticed a number of birds and vertebrates on the property.	• Write down names of any plant and animal species that exist on the farm, taking pictures whenever possible to develop an inventory.

2.3: Areas not suitable for production are identified and actions for restoration are defined	● There are not any designated protected areas on the property. The landowners have planted some fruit trees, such as lemon and orange.	● Continue to monitor recently planted trees for any potential pests.
2.4: Artificial infrastructure for biodiversity is established	● There are no known artificial structures for biodiversity.	● Identify other areas of the farm that could be used for reforestation, particularly for planting additional fruit trees or flowering plants to attract pollinators.
2.5: Invasive, exotic species are identified, eliminated and expansion is controlled	● There are no known invasive species on the farm.	● Identify any present invasive species according to this list: http://www.iucngisd.org/gisd/pdf/100Spanish.pdf
2.6: Waste is managed and used with minimal environmental impact	● Product tins are regularly kept for reuse or storage, and are occasionally returned to Coopetarrazu.	● Maintain a weekly log of the types and quantities of waste produced. Identify which steps of the growing process produce the most waste.

Level 3: Landscape

Objective of level 3: The farm minimizes its environmental impacts towards its surroundings, contributes to the environmental education of the communities and collaborates with other actors in favor of biodiversity.

Goal	Results	Recommendations
3.1: The business identifies protected areas and their services and reduces	● Coopetarrazu has not identified any designated protected areas for the property.	● Create an inventory of the property and surrounding coffee farms. Reach out to neighboring farmers to identify any protected areas.

production impacts on them		
3.2: The business participates in activities for basin management	● There are no specific activities for watershed management.	● Create a map of the property and label any water sources.
3.3: Alliances and awareness programs are established with communities and other local actors, in favor of the conservation and sustainable use of biodiversity	● There are not any known alliances with local actors for biodiversity initiatives. The landowners are affiliated with a local university.	● Leverage existing connections to conduct a biodiversity monitoring program.

Appendix E

Coopetarrazu Quantitative Biodiversity Results

Farm 1	
Number of arboreal strata	2
Percentage of shade cover	36

Habitat subscore	*38*
Number of herbicide applications	-2
Number of pesticide applications	-23
Number of fertilizer applications	-3
Chemical use subscore	*-2.8*
TOTAL	**35.2**

Note: A yellow cell indicates that a specific agrochemical could not be identified for this farm, so an estimate was made based on the median agrochemical score from other farms

For further details on how the calculations were conducted, please consult the Biodiversity chapter of the Coopetarrazu Final Diagnosis document and notes on CATIE (2008).

Farm 2	
Number of arboreal strata	3
Percentage of shade cover	41
Habitat subscore	*43*
Number of herbicide applications	-3
Number of pesticide applications	-24
Number of fertilizer applications	-3
Chemical use subscore	*-3*
TOTAL	**40**

Farm 3	
Number of arboreal strata	3
Percentage of shade cover	33
Habitat subscore	*36*
Number of herbicide applications	-19
Number of pesticide applications	-13
Number of fertilizer applications	-3
Chemical use subscore	*-3.5*
TOTAL	**32.5**

Farm 4	
Number of arboreal strata	2
Percentage of shade cover	57
Habitat subscore	*59*
Number of herbicide applications	-3
Number of pesticide applications	-35
Number of fertilizer applications	-3
Chemical use subscore	*-4.1*
TOTAL	**54.9**

Farm 5	
Number of arboreal strata	4
Percentage of shade cover	57
Habitat subscore	*61*
Number of herbicide applications	-3
Number of pesticide applications	-6
Number of fertilizer applications	-3
Chemical use subscore	*-1.2*
TOTAL	**59.8**

Farm 6	
Number of arboreal strata	3
Percentage of shade cover	36
Habitat subscore	*39*
Number of herbicide applications	-2
Number of pesticide applications	-14
Number of fertilizer applications	-3
Chemical use subscore	*-6.33*
TOTAL	**32.67**

Farm 7	
Number of arboreal strata	3

Percentage of shade cover	47
Habitat subscore	*50*
Number of herbicide applications	-3
Number of pesticide applications	-16
Number of fertilizer applications	-3
Chemical use subscore	*-2.2*
TOTAL	**47.8**

Farm 8	
Number of arboreal strata	2
Percentage of shade cover	27
Habitat subscore	*29*
Number of herbicide applications	-10
Number of pesticide applications	-24
Number of fertilizer applications	-3
Chemical use subscore	*-3.7*
TOTAL	**25.3**

Farm 9	
Number of arboreal strata	3
Percentage of shade cover	41
Habitat subscore	*44*
Number of herbicide applications	-3
Number of pesticide applications	-14
Number of fertilizer applications	-3
Chemical use subscore	*-2*
TOTAL	**42**

Farm 10	
Number of arboreal strata	2
Percentage of shade cover	52
Habitat subscore	*54*

Number of herbicide applications	0
Number of pesticide applications	-12
Number of fertilizer applications	-4
Chemical use subscore	*-1.6*
TOTAL	**52.4**

Appendix F

Coopetarrazu ELCA Calculation Examples

Farm 1 Example Simapro Inputs

	farm 1	unit	DATA SET	DATA BASE
AN	0.553846	kg	Nitrogen fertiliser, as N {RoW}| urea ammonium nitrate production | Cut-off, U	Ecoinvent 3
P	0.048161	kg	Phosphate fertiliser, as P2O5 {RoW}| triple superphosphate production | Cut-off, U	Ecoinvent 3
K	0.144482	kg	Potassium chloride, as K2O {RoW}| potassium chloride production | Cut-off, U	Ecoinvent 3
Mg	0.000000	kg	Magnesium oxide {RoW}| production | Cut-off, U	Ecoinvent 3
S	0.000000	kg	Sulfur dioxide, liquid {RoW}| production | Cut-off, U	Ecoinvent 3
Ca	0.055741	kg	Lime {RoW}| production, milled, loose | Cut-off, U	Ecoinvent 3
Zn	0.000000	kg	Zinc monosulfate {RoW}| production | Cut-off, U	Ecoinvent 3
B	0.000000	kg	Boric acid, anhydrous, powder {RoW}| production | Cut-off, U	Ecoinvent 3
Cu	0.000000	kg	Copper oxide {RoW}| production | Cut-off, U	Ecoinvent 3
Fe	0.000000	kg	Iron sulfate {RoW}| production | Cut-off, U	Ecoinvent 3
Mo	0.000000	kg	Molybdenum {RoW}| production | Cut-off, U	Ecoinvent 3
Ciproconazol	0.000074	kg	Pesticide, unspecified {RoW}| production | Cut-off, U	Ecoinvent 3
Pyraclostrobin	0.000000	kg	Pesticide, unspecified {RoW}| production | Cut-off, U	Ecoinvent 3
Epoxiconazole	0.000185	kg	Pesticide, unspecified {RoW}|	Ecoinvent

			production | Cut-off, U	3
Carbendazina	0.000000	kg	Quaternary ammonium herbicides, at plant/RER Mass	Ecoinvent 3
Diquat	0.000000	kg	Diquat, at plant/RER Mass	Ecoinvent 3
Glyphosate	0.024080	kg	Glyhposate {RoW}| production | Cut-off, U	Ecoinvent 3
Chlorpyrifos	0.000000	kg	Organophosphorus-compound, unspecified {RoW}| production | Cut-off, U	Ecoinvent 3
citratos	0.000741	kg	Citric acid {RoW}| production | Cut-off, U	Ecoinvent 3
Edatos Queletantes	0.000741	kg	EDTA, ethylenediaminetetraacetic acid {RoW}| EDTA production | Cut-off, U	Ecoinvent 3
Polyoxiethylene Alkyl ether	0.000000	kg	Non-ionic surfactant {GLO}| non-ionic surfactant production, fatty acid derivate | Cut-off, U	Ecoinvent 3
Alcohol etoxilado	0.000000	kg	Ethoxylated alcohol (AE>20) {RoW}| ethoxylated alcohol (AE>20) production, palm oil | Cut-off, U	Ecoinvent 3
Indicador de alcalinidad	0.000000	kg	-- (cut-off criteria)	--
Validamycin	0.000593	kg	Antibiotic and fungicide	

Farm 1 Example Simapro Input View

Materials/fuels		
Inorganic nitrogen fertiliser, as N {RoW}| nutrient supply from urea ammonium nitrate mix | Cut-off, U	0.553846	kg
Inorganic phosphorus fertiliser, as P2O5 {RoW}| nutrient supply from triple superphosphate | Cut-off, U	0.05	kg
Inorganic potassium fertiliser, as K2O {RoW}| nutrient supply from potassium chloride | Cut-off, U	0.144482	kg
Magnesium oxide {RoW}| production | Cut-off, U	0	kg
Pesticide, unspecified {RoW}| production | Cut-off, U	0.000074	kg
Fungicide, at plant/RER Mass	0	kg
Pesticide, unspecified {RoW}| production | Cut-off, U	0.000185	kg
Glyphosate {RoW}| production | Cut-off, U	0.02408	kg
Citric acid {RoW}| production | Cut-off, U	0.000741	kg
EDTA, ethylenediaminetetraacetic acid {RoW}| EDTA production | Cut-off, U	0.000741	kg
Fungicide, at plant/RER Mass	0.000593	kg
Lime, packed {RoW}| lime production, milled, packed | Cut-off, U	0.055741	kg

Electricity/heat		
Gasoline mix (regular) at refinery, from crude oil and bio components, fuel supply, production mix, at refinery, 10 ppm sulphur, 5.75 wt.% bio components EU-27 S	0.005217	kg
Transport, passenger car, large size, diesel, EURO 3 {RoW}| transport, passenger car, large size, diesel, EURO 3 | Cut-off, U	0.133779	km
Heat, hardwood chips from industry, at furnace 1000kW/CH U	64.69	kWh
Electricity, high voltage, production BR, at grid/BR U	9.58	kWh

Farms 1-6 Analysis Results

Impact category	**Unit**	**Farm 1**	**Farm 2**	**Farm 3**	**Farm 4**	**Farm 5**	**Farm 6**
Global warming	kg CO2 eq	7.169	7.459	23.391	3.747	4.228	3.811
Stratospheric ozone depletion	kg CFC11 eq	0.000	0.000	0.000	0.000	0.000	0.000
Ionizing radiation	kBq Co-60 eq	1.305	1.295	1.687	1.232	1.243	1.232
Ozone formation, Human health	kg NOx eq	0.045	0.045	0.079	0.038	0.039	0.038
Fine particulate matter formation	kg PM2.5 eq	0.027	0.027	0.053	0.023	0.024	0.023
Ozone formation, Terrestrial ecosystems	kg NOx eq	0.045	0.045	0.081	0.039	0.040	0.039
Terrestrial acidification	kg SO2 eq	0.033	0.034	0.108	0.020	0.022	0.020

Freshwater eutrophication	kg P eq	0.002	0.002	0.009	0.001	0.001	0.001
Marine eutrophication	kg N eq	0.000	0.000	0.001	0.000	0.000	0.000
Terrestrial ecotoxicity	kg 1,4-DCB	44.623	47.559	155.832	26.262	29.713	25.460
Freshwater ecotoxicity	kg 1,4-DCB	0.295	0.320	1.432	0.105	0.140	0.116
Marine ecotoxicity	kg 1,4-DCB	0.405	0.439	1.859	0.156	0.203	0.172
Human carcinogenic toxicity	kg 1,4-DCB	0.296	0.312	1.273	0.114	0.142	0.133
Human non-carcinogenic toxicity	kg 1,4-DCB	9.880	10.363	31.428	6.392	7.059	7.149
Land use	m2a crop eq	1.803	1.816	2.473	1.694	1.715	1.695
Mineral resource scarcity	kg Cu eq	0.034	0.035	0.222	0.013	0.021	0.012
Fossil resource scarcity	kg oil eq	1.472	1.555	5.985	0.569	0.696	0.539
Water consumption	m3	78.289	78.296	78.604	78.213	78.223	78.210

Farms 7-10 Analysis Results

Impact category	**Unit**	**Farm 7**	**Farm 8**	**Farm 9**	**Farm 10**	**Average**

Global warming	kg CO2 eq	5.779	15.134	5.692	2.237	7.865
Stratospheric ozone depletion	kg CFC11 eq	0.000	0.000	0.000	0.000	0.000
Ionizing radiation	kBq Co-60 eq	1.267	1.462	1.261	0.042	1.203
Ozone formation, Human health	kg NOx eq	0.042	0.061	0.042	0.004	0.043
Fine particulate matter formation	kg PM2.5 eq	0.025	0.038	0.025	0.003	0.027
Ozone formation, Terrestrial ecosystems	kg NOx eq	0.042	0.062	0.042	0.004	0.044
Terrestrial acidification	kg SO2 eq	0.028	0.066	0.026	0.008	0.037
Freshwater eutrophication	kg P eq	0.001	0.005	0.001	0.001	0.002
Marine eutrophication	kg N eq	0.000	0.000	0.000	0.000	0.000
Terrestrial ecotoxicity	kg 1,4-DCB	36.899	105.648	34.664	12.142	51.880
Freshwater ecotoxicity	kg 1,4-DCB	0.216	0.877	0.219	0.125	0.384
Marine ecotoxicity	kg 1,4-DCB	0.301	1.170	0.309	0.164	0.518
Human carcinogenic toxicity	kg 1,4-DCB	0.220	0.777	0.239	0.116	0.362

Human non-carcinogenic toxicity	kg 1,4-DCB	8.407	20.577	9.292	2.304	11.285
Land use	m2a crop eq	1.751	2.190	1.748	0.085	1.697
Mineral resource scarcity	kg Cu eq	0.026	0.108	0.020	0.012	0.050
Fossil resource scarcity	kg oil eq	1.097	3.667	1.009	0.583	1.717
Water consumption	m3	78.256	78.477	78.249	0.048	70.486

Nicoverde eLCA Results and Calculations Example

Farm 1 Simapro Inputs Example

Materials/fuels		
Organic nitrogen fertiliser, as N {GLO}| nutrient supply from compost | Cut-off, U	0	kg
Inorganic nitrogen fertiliser, as N {RoW}| nutrient supply from urea ammonium nitrate mix | Cut-off, U	0.007532	kg
Inorganic phosphorus fertiliser, as P2O5 {RoW}| nutrient supply from triple superphosphate | Cut-off, U	0.003387	kg
Inorganic potassium fertiliser, as K2O {RoW}| nutrient supply from potassium chloride | Cut-off, U	0.009534	kg
Organic phosphorus fertiliser, as P2O5 {GLO}| nutrient supply from compost | Cut-off, U	0	kg
Organic potassium fertiliser, as K2O {GLO}| nutrient supply from compost | Cut-off, U	0	kg

Magnesium oxide {RoW}| production | Cut-off, U	0.003801	kg
Sulfur dioxide, liquid {RoW}| production | Cut-off, U	0.004151	kg
Lime, packed {RoW}| lime production, milled, packed | Cut-off, U	0.044775	kg
Zinc oxide {RoW}| production | Cut-off, U	0.000099	kg
Sodium borates {RoW}| production | Cut-off, U	0.000164	kg
Copper oxide {RoW}| production | Cut-off, U	0	kg
Iron sulfate {RoW}| production | Cut-off, U	9.56E-05	kg
Manganese sulfate {GLO}| production | Cut-off, U	1.13E-06	kg
Pesticide, unspecified {RoW}| production | Cut-off, U (Ametryn)	0.000117	kg
Diuron, at plant/RER Mass	0.000125	kg
Pesticide, unspecified {RoW}| production | Cut-off, U (quizalofop-p-ethyl)	2.25E-06	kg
Molybdenum {RoW}| production | Cut-off, U	0	kg
Pesticide, unspecified {RoW}| production | Cut-off, U (Cyproconazole)	0	kg
Pesticide, unspecified {RoW}| production | Cut-off, U	0	kg
Fungicide, at plant/RER Mass	0	kg
Glyphosate {RoW}| production | Cut-off, U	0	kg
Citric acid {RoW}| production | Cut-off, U	0	kg
EDTA, ethylenediaminetetraacetic acid {RoW}| EDTA production | Cut-off, U	0	kg
Pesticide, unspecified {RoW}| production | Cut-off, U (Ethephon)	4.69E-05	kg

Pesticide, unspecified {RoW}| production | Cut-off, U	0	kg
Pesticide, unspecified {RoW}| production | Cut-off, U (Spinetoram)	9.38E-07	kg
Fatty acids, from vegetarian oil, at plant/RER U	0.000197	kg
Sodium borates {RoW}| production | Cut-off, U	7.5E-06	kg
Petrol, low-sulfur {RoW}| production | Cut-off, U	0.000788	kg
Non-ionic surfactant {GLO}| non-ionic surfactant production, ethylene oxide derivate | Cut-off, U	3.22E-05	kg
Ethoxylated alcohol (AE3) {RoW}| ethoxylated alcohol (AE3) production, petrochemical | Cut-off, U	4.84E-05	kg
Electricity/heat		
Transport, freight, lorry 7.5-16 metric ton, EURO3 {RoW}| transport, freight, lorry 7.5-16 metric ton, EURO3 | Cut-off, U	0.025	kgkm
Application of plant protection product, by field sprayer {RoW}| processing | Cut-off, U	0.000871	ha

Farms 1-4 Impact Assessment Results

Impact category	**Unit**	**Farm 1**	**Farm 2**	**Farm 3**	**Farm 4**
Global warming	kg CO2 eq	0.08135	0.08003	0.00661	0.00550
Stratospheric ozone depletion	kg CFC11 eq	0.00000	0.00000	0.00000	0.00000
Ionizing radiation	kBq Co-60 eq	0.00191	0.00188	0.00008	0.00005

Ozone formation, Human health	kg NOx eq	0.00018	0.00017	0.00002	0.00001
Fine particulate matter formation	kg PM2.5 eq	0.00019	0.00018	0.00001	0.00001
Ozone formation, Terrestrial ecosystems	kg NOx eq	0.00019	0.00018	0.00002	0.00001
Terrestrial acidification	kg SO2 eq	0.00056	0.00055	0.00003	0.00002
Freshwater eutrophication	kg P eq	0.00003	0.00003	0.00000	0.00000
Marine eutrophication	kg N eq	0.00000	0.00000	0.00000	0.00000
Terrestrial ecotoxicity	kg 1,4-DCB	0.57818	0.57110	0.02188	0.01303
Freshwater ecotoxicity	kg 1,4-DCB	0.00595	0.00588	0.00013	0.00004
Marine ecotoxicity	kg 1,4-DCB	0.00786	0.00777	0.00018	0.00007
Human carcinogenic toxicity	kg 1,4-DCB	0.00503	0.00492	0.00020	0.00011
Human non-carcinogenic toxicity	kg 1,4-DCB	0.13053	0.12796	0.00293	0.00146
Land use	m2a crop eq	0.00731	0.00688	0.00084	0.00085
Mineral resource scarcity	kg Cu eq	0.00077	0.00077	0.00002	0.00001
Fossil resource scarcity	kg oil eq	0.02180	0.02142	0.00170	0.00150

Water consumption	m3	0.00311	0.00311	0.00078	0.00075

Farms 6,8,9 Impact Assessment Results

Impact category	Unit	Farm 6	Farm 8	Farm 9
Global warming	kg CO2 eq	0.00003	0.00007	0.00066
Stratospheric ozone depletion	kg CFC11 eq	0.00000	0.00000	0.00000
Ionizing radiation	kBq Co-60 eq	0.00000	0.00000	0.00001
Ozone formation, Human health	kg NOx eq	0.00000	0.00000	0.00001
Fine particulate matter formation	kg PM2.5 eq	0.00000	0.00000	0.00000
Ozone formation, Terrestrial ecosystems	kg NOx eq	0.00000	0.00000	0.00001
Terrestrial acidification	kg SO2 eq	0.00000	0.00000	0.00000
Freshwater eutrophication	kg P eq	0.00000	0.00000	0.00000
Marine eutrophication	kg N eq	0.00000	0.00000	0.00000
Terrestrial ecotoxicity	kg 1,4-DCB	0.00021	0.00040	0.00355
Freshwater ecotoxicity	kg 1,4-DCB	0.00000	0.00000	0.00004
Marine ecotoxicity	kg 1,4-DCB	0.00000	0.00001	0.00005
Human carcinogenic toxicity	kg 1,4-DCB	0.00000	0.00000	0.00005
Human non-carcinogenic toxicity	kg 1,4-DCB	0.00013	0.00009	0.00130

Land use	m2a crop eq	0.00001	0.00000	0.00022
Mineral resource scarcity	kg Cu eq	0.00000	0.00000	0.00000
Fossil resource scarcity	kg oil eq	0.00001	0.00002	0.00019
Water consumption	m3	0.00000	0.00000	0.00000