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1. EXECUTIVE SUMMARY

Las Delicias is a mangrove restoration project located right outside of the municipality of Colón Island in the Bocas del Toro archipiélago, Panama. In collaboration with Fundación Naturaleza Panamá and local authorities (the Mayor mandated the project), Wildsense will support and certify the project which will generate significant environmental and social co-benefits, such as ecosystem restoration, and species conservation, as well as contributing to local communities' economic empowerment. Over the next three years, local communities will plant a total of **10,000 native trees**, which will absorb a total of **4,804 tonnes of carbon equivalent** over its lifetime (hence **4,804 carbon credits** of which **3,603** can be sold and **1,201** will be set aside as an insurance pool in the case of unexpected events). Wildsense will remotely monitor the project using satellite imagery to ensure the planted trees survive over the project's lifetime.

➜ WILDSENSE

Founded in 2020, Wildsense selects, certifies, and verifies carbon sequestration projects to bring more transparency to voluntary carbon markets. We are on a mission to build a wilder world where people and nature thrive. This is why, since our beginnings, we have been monitoring the health of over 1 million hectares of forests across the world using cutting-edge

remote sensing technology. The company currently employs eleven full-time employees, mainly consisting of remote sensing and data engineers, as well as developers. We are also supported and empowered by the European Space Agency (ESA).

➜ OUR APPROACH [1]

To ensure our alignment with the guiding principles set out by the Task Force on Scaling Voluntary Markets & the IPCC, we have established a rigorous project selection, project verification, and project guarantee process. Beyond the carbon sequestered by each project, we evaluate the co-benefits to biodiversity and communities. Wildsense sources, selects, certifies, and verifies each reforestation and restoration project according to 3 major principles: right tree, right place, right community.

➜ PROJECT DEVELOPER

Founded in 2005, Fundación Naturaleza Panamá is a non-profit organisation that aims to support the Ministry of the Environment in the protection, conservation, and restoration of the biotic resources of the Panamanian state through protection, surveillance, and monitoring. They are committed to conserving and restoring local ecosystems and promoting deeper engagements between the Panamanian population and their natural resources. Fundación Naturaleza ensures the proper use of flora and fauna resources in accordance with current regulations in place. They have been operating in the Province of Chiriqui since 2005, and have collaborated with various institutions, state universities, and non-profit organisations such as Panama Flying Labs, the Municipality of Panama, and the National Authority of Land Management (ANATI). The foundation supports local populations by generating income opportunities and works with young professionals who graduated from the Autonomous University of Chiriqui, especially for photography, video, editing, documentary creation, etc. *Read more about the Fundación Naturaleza Panamá in Appendix 1*.

[1] Refer to the section "Our Methodology" for more information on our selection criteria.

2. THE PROJECT

The mangrove site is located on Las Delicias island on the Caribbean slope, Bocas del Toro Province, North of Colón Island at the following coordinates: 9.3452°, -82.2414°.

Mangrove forests represent very important ecosystems, notably in terms of biodiversity preservation, carbon sequestration, and coastal protection. The Islote of Las Delicias nowadays has a large number of shorebirds that perch on the arbours built on the site so that they do not destroy the small seedlings planted with their weight. The area also boasts the presence of crabs, sea sponges, sea urchins, starfish, schools of small fish that use the larger mangrove trees to protect themselves from predators, as well as the growth of seagrass. Protecting this hybrid ecosystem (both marine and terrestrial) will also contribute to bringing back more species that live in the greater archipelago of Bocas del Toro including: 4 species of turtles, 28 species of reptiles and amphibians, 68 species of birds, and 32 species of mammals (including sloths and bats) which are found in the nearby islands. However, mangrove ecosystems in Las Delicias have suffered severe degradation due to erosion and rising sea levels due to mass tourism and exploitation. On this topic, the mayor of Bocas del Toro, Martín Downer, expressed the following: “The area has practically disappeared. Some time ago there used to be restaurants, piers, and tourist attractions that have ceased to exist due to direct erosion and rising sea levels”. This is why Fundación Naturaleza is on a mission to reverse past trends and restore this fragile ecosystem.

In 2018, they started raising awareness about the importance of these coastal ecosystems and the negative impacts of human activities on their conservation by producing a documentary to raise awareness among Panamanians on the topic. Later that year, they built a mangrove nursery in the provinces of Chiriqui and Bocas del Toro, and are currently in the process of repopulating and restoring affected areas in Islote las Delicias and Cayo Zapatilla Norte Island.

The ARAP (Authority for Aquatic Resources of Panama) and the IDIAP (Panama Institute for Agricultural Innovation) joined forces to start the planting work which Fundación Naturaleza has taken up. Wildsense certifies the project to help them find financing opportunities to rehabilitate **18 hectares** of mangrove forest by planting 10,000 native trees to restore and protect the area against coastal degradation. A minimum of 3,300 trees will be planted per year over the next three years. A mangrove nursery will serve as the main seedling strategy. Nurseries use a flooding system to keep seeds in a humid environment with sunlight while they are growing. They protect young plants until maturity when they are ready to be planted

in the wild. It is estimated that the nursery will produce at least **5,000 seedlings per year**, depending on the availability of seeds.

To measure their impact, Fundación Naturaleza has set up monitoring stations in collaboration with the IDIAP's technical teams to follow the evolution of each mangrove stand planted with an ID number associated with each one.

The Las Delicias project has been carefully selected to meet our three criteria:

1. **Right tree**

   Red mangroves will be the only species of mangrove planted on the selected site, single-species ecosystems being natural in the case of mangrove. Also known as Rhizophora Mangroves or Achaparrado Mangroves, they are native to Panama and specifically to the Bocas del Toro region as the country is very diverse and each mangrove ecosystem boasts different species of mangle. *See Appendix 2 for more details about the tree species planted.*

2. **Right community**

   Local communities are direct actors in this mangrove restoration project. Trees and seeds are grown locally and planted by local communities either paid or voluntary. Civil organisations are also involved in training and educational programs outside of the planting work.

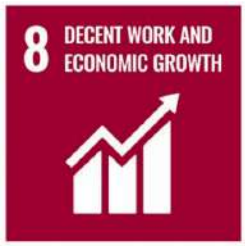
   Local communities are also direct and indirect beneficiaries of the project. The project will directly generate job opportunities and revenues for humble families as well bring the community together through different activities. Indirectly, the community will benefit from the renting of *lanchas*, the purchase of material and equipment, and the booking of hotel rooms, amongst others. The Bocas community is also heavily reliant on fishing as well as other marine resources (including crustaceous) for their livelihood. Restoring mangroves will thus have ripple effects on the marine ecosystem by restoring fish resources hence benefiting local fishermen and tourism by providing opportunities for ecotourism activities. Moreover, the rate of employed women on Fundación Naturaleza's planting sites is usually 65%; women's main activities include planting, monitoring, and preparing meals for events.

3. Right place

Las Delicias is a habitat for many native species and biodiversity. It welcomes birds, mammals, reptiles, amphibians, and marine species. Over 32 species of mammals have been on nearby islands, with numerous populations of two-toed and three-toed sloths, 13 bat species including the Jamaican fruit-eating bat and the bulldog bat as well as various dolphin species. The most endangered animals are turtles who nest on nearby beaches. Our project would provide an extra source of food for them and hopefully another place to nest in the future. Some endangered species include the Pacific Green Turtle (*Chelonia mydas*), Loggerhead Turtles (*Caretta carretas*), Hawksbill Turtles (*Eretmochelys imbricata*).

For further information regarding the current status of the aforementioned species, refer to the list of endangered species in Appendix 3.

The Las Delicias project also meets four United Nations Sustainable Development Goals[2]:



SDG 8: Decent work and economic growth

Our partner employs local communities, with a specific focus on women who receive fair, living wages. Their various activities boost the local economy through consulting services, boat rentals, purchase of materials and equipment, hotel accommodations, food consumption in local restaurants, audiovisual productions, etc.

SDG 13: Climate action

Mangroves can not only capture and store significant amounts of carbon through their soil and root system, but they also act as a natural buffer zone against erosion and sea-level rise for the main island of Bocas, Isla Colón, and all of its inhabitants. Our remote sensing tools monitor each project to ensure the greenhouse gases are effectively being removed from the atmosphere, thus limiting global warming.

[2] The United Nations's 17 Sustainable Development Goals

SDG 14: Life below water

Restoring and protecting mangroves improves life below water and filters water. Mangrove forests provide nutrient-rich natural habitats for a wide variety of plant and animal species (corals, crustaceous, shells, etc.) and are notably nurseries for fish. They are diverse ecosystems with a high rate of biodiversity.

SDG 15: Life on land

Rehabilitating the Island will protect the local wildlife. Mangrove forests are essential ecosystems for various species. For instance, they allow birds to roost and rest on their arbours, they represent a breeding habitat for marine life and nurseries for baby fish.

3. OUR METHODOLOGY [3]

➜ Project Selection

We are currently putting together a scientific committee to verify our selection criteria, double-check our baseline methodology and help us improve our risk modelling matrix to assess project guarantees and insurance (see "Project Guarantee" below). A robust methodology should therefore be released by mid-2022. Until then, we select and rate our projects based on a thorough analysis of the following criteria:

- **Partner background check**

Prior to selecting our on-the-ground partner, we made sure (1) to analyse Fundación Naturaleza's annual impact reports and financial reports for the past 3 years, (2) to make reference calls with their existing financiers and past partners to ensure of their legitimacy and trustworthiness, (3) to formally meet in person with the mayor of Bocas, the person in charge of the nursery and the head engineer of IDIAP in charge of designing the project. Such due diligence is conducted to make sure that our partners have historically had low mortality rates for their replanting projects, that community benefits are reported and quantified, that they are financially stable and that they truly work with local communities to ensure the respect of polyculture and the planting of local species.

- **Project Quality**

We select projects that not only support local communities but also positively impact biodiversity and endangered species. We have established 3 main criteria for our project selection process:

1. **Right tree.** All planted trees must be native species, preferably endemic to the region. A minimum of two species, preferably at least three must be planted, per hectare. Crop plans must be appropriate for the project's location.
2. **Right community.** In order to favour community ownership of projects, seed collecting and tree planting must be carried out by locals, preferably women. All workers must be paid fair living wages. Some workers may be volunteers but only when it is by choice and local communities have other occupations and do not need an extra revenue.

[3] To have a full overview of our methodology, please refer to this document.

3. **Right place.** Projects must improve ecosystems on which local livelihoods depend. Projects that form corridors between- or buffer zones around- existing habitats are preferred, especially if the habitats are home to endangered species. We also strive to select projects that are government-owned but community-managed and that have not been forested for the past 10 years approximately.

- **Carbon Offset Requirements**

We carefully select projects based on existing carbon absorption and the potential for future carbon removal. This is why we have calculated a baseline (see *Appendix 4*) and identified risks (see *Appendix 5*) that might impact our project's ability to absorb carbon in the long term in order to mitigate and compensate for such risks (see "Project Guarantee" below). Such metrics are based on the IPCC's 4 guiding principles, including:

1. **Additionality** ensures that the project is generating a greenhouse gas emission reduction that would not occur otherwise. Wildsense measures project carbon baselines before restoration begins and estimates the carbon potential over the lifetime of the project to respect this principle. The Las Delicias project will absorb approximately **4,804 t CO2e** by the end of the project duration and even more after the project has been completed. 25% of the total carbon absorbed will be "set aside" as an insurance pool and hence will not be sold as carbon credits to make up for any potential unexpected events. Hence, 1,201 credits out of the 4,804 will be saved and **3,603 carbon credits will be sold through this project**. *See Appendix 4 for more information on our calculations.*

2. **Durability** ensures that emissions are kept out of the atmosphere for the entire duration of the project and beyond. We monitor forest cover change to ensure that the project's integrity is maintained **over the next 20 years**. The duration of the monitoring period is determined by the time taken for all planted trees to reach maturity. In this case, Red Mangrove takes 10 to 15 years to reach maturity which is why we monitor the project for 20 years, considering a 5-year buffer. Our risk assessment also looks at the likelihood that the project will survive based on geopolitical, climate change, socio-economic, land-ownership, and management structure factors in each area. *See Appendix 6 for details on each factor.*

3. **Leakage** occurs when emissions avoided through a particular carbon project are displaced, and simply occur elsewhere. For each project, we define and monitor forest

cover change and potential leakage areas around our planting zones. However, this area of mangrove restoration is located off the coast on a stand-alone sand strip which means that it is not technically acting as a buffer zone for an old-growth mangrove ecosystem.

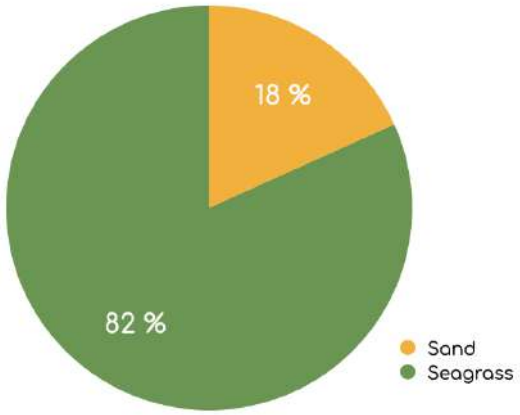
4. **Double counting** is the risk associated with the double claim of a carbon credit by both the project developer and the credit issuer. To avoid such confusion and transparently account for every ton of carbon sold, each of our projects is recorded into a double-registry system. We have created our own registry, accessible on our website, and we are currently in negotiations with IHS Markit to display our sold tons on their meta registry and ensure complete transparency and third-party verification.

➜ Project Verification & Monitoring

Wildsense verifies projects with a three-step process: (1) satellite monitoring, (2) field data collection verification, and (3) in-person audits.

1. **Satellite monitoring**

   Wildsense monitors its projects on a quarterly basis, using cutting-edge remote sensing technology, backed by the European Space Agency. More specifically, we first establish baselines by checking forest and shrub cover prior to the beginning of the project and we then monitor changes in forest cover by following the evolution of the canopy cover using deep learning and machine learning techniques. Such models, developed by our team of engineers, allow us to monitor in almost real-time the evolution of our projects by making sure that trees are actually planted and dieback rates remain low. To do so, we use satellite imagery from the Pléiades constellation which provides very high-resolution optical images designed for both civil/commercial and military purposes. Baseline analyses allowed us to get the following results:


18 %
82 %
Sand
Seagrass

2. Field data collection verification

In collaboration with project developers, we are developing an app to facilitate data collection and verification. Local caregivers can take photos, videos, and audio - geolocated and timestamped, and must report project KPIs on a quarterly basis. This data is then automatically synced to our project platform and can be checked at all times. Our app will also include an essence identification feature allowing users to verify if the right species are actually planted, thus ensuring that it matches the original Project Planning Document.

If the project developer does not wish to use our dedicated field app, they must provide (1) geolocalized and timestamped baseline photos of the sites prior to planting work, (2) additional geolocalized and time-stamped photos of the site every 6 months during the 3-year planting period and (3) every year after planting has been completed. Wildsense will use those pictures to verify tree cover under the canopy, identify tree species and related biodiversity, and assess tree health. Fauna biodiversity & co-benefits are self-reported by project developers and will be subjected to in-person audits.

Please note that verification intervals can vary depending on project type and our contract with project developers. See Appendix 7 for more information on the project timeline and project costs.

3. In-person audits and random sampling

To complement our satellite and field verifications, we are building an internal field team charged with performing in-person audits on all our projects. Every 3 to 5 years, we will go through random sampling exercises on our sites to perform full biodiversity inventories and carbon auditing. A specific focus on fauna biodiversity and co-benefits will be carried out since those topics are self-reported by project developers and not subjected to quarterly verifications. To verify additionality estimates, we use LiDAR technologies as well as *in situ* Soil Organic Carbon (SOC) samples. As for biodiversity assessment, we use Environmental DNA (eDNA) technologies based on molecular genetics, as well as bioacoustics. A first scientific audit will be carried out in the next couple of months (May - June 2022) to complete the first phase of the certification process.

On their end, Fundación Naturaleza will supervise the project by organising field visits every month during the first year of the project and every 2 months at most in the following year. The purpose of these visits is to carry out constant monitoring of the degree of survival of the mangrove seedlings and nurseries. Periodic technical reports will be made after each field trip to ensure the project remains durable over the years.

Quarterly satellite verification and bi-annual field verification will be available on our projects' platform.

➜ Project Guarantee

Not every tree makes it. To insure against any potential losses, we conduct a risk assessment for each project and calculate contribution to an insurance pool accordingly. We then monitor forest cover to verify the validity of carbon credits over the lifespan of the project and replace any credit which fails with a credit from the insurance pool. ***Note that the role of the insurance pool is solely to back projects against losses and cannot be sold.***

The Las Delicias project has a **risk rating of A** with an additionality of 5/5 but a durability of 2/5 due to high risks from sea-level rise. Our risk assessment matrix measures the probability of the project being undisturbed over its lifetime and efficiently absorbing carbon and protecting wildlife. We evaluate geopolitical stability, socioeconomic situation, vulnerability to climate change, as well as additionality, leakage, and project durability. Each criterion is evaluated on a scale from 1 to 5. This project scored well on additionality, leakage, as well as geopolitical, socio-economic, and land ownership factors as risks related to these factors are slim. The project developer built a bamboo barrier between the restoration area and the ocean to mitigate the strength of swell and waves until mangrove trees reach maturity. However, risks related to durability and climate change vulnerability scored lower as their mitigation is beyond Wildsense's control and less predictable.

To guarantee that each ton issued ex-ante will meet its 20-year durability standard, the project financer will fund an insurance pool of **1,201 credits, equivalent to 25% of the project's total additionality.** *See Appendix 6 for a detailed view of our risk rating.*

4. APPENDICES

➜ Appendix 1: Our partner: Fundación Naturaleza Panamá

Founded in 2005, Fundación Naturaleza Panamá is a non-profit organisation that aims to support *MiAmbiente*, the Ministry of the Environment in the protection, conservation, and restoration of the biotic resources of the Panamanian state through protection, surveillance, and monitoring. They are committed to conserving and restoring local ecosystems and promoting deeper engagements between the Panamanian population and their natural resources. Fundación Naturaleza ensures the proper use of flora and fauna resources in accordance with current regulations in place. They have been operating in the Province of Chiriqui since 2005, and have collaborated with various institutions, state universities, and non-profit organisations such as Panama Flying Labs, the Municipality of Panama, and the National Authority of Land Management (ANATI). The foundation supports local populations by working with young professionals who graduated from the Autonomous University of Chiriqui, especially in photography, video, editing, documentary creation, etc.

They have been working in this specific area of Bocas for the past 5 years with the support of state institutions with whom they have signed a cooperation and collaboration agreement, renewed every 5 years.

➜ Appendix 2: List of tree species planted in the project area

Our on-the-ground partner, Fundación Naturaleza sent us the native tree species that qualify to be planted on the Las Delicias site:

- **Rhizophora mangle**

  Also known as the red mangrove, Rhizophora mangle are listed as Least Concern by the *IUCN Red List of Thr*eatened Species in 2007. Despite being the dominant mangrove species, red mangroves have experienced a 17% decline since 1980. Their population has indeed been declining, especially throughout the wider Caribbean region for various threats including habitat conversion, pollution, and hurricanes. In terms of habitat, they live in marine intertidal areas. Flowering occurs every year in mid-winter and spring, and propagules are then maintained on the parent tree for 3 to 6 months, before being dropped before rooting. Red mangroves are native to Panama and other countries: they are native along the Atlantic coast from Florida to southern Brazil, and from western Africa from Senegal to Angola. They commonly form monoculture

stands in their natural habitat[4].

➜ Appendix 3: List of protected species based on the IUCN (International Union for Conservation of Nature) Red List of threatened species.

- **Procnias tricarunculatus**

  Also known as the three-wattled bellbird, this bird species has been assessed as Vulnerable by *The IUCN Red List of Threatened Species* in 2021. Three-wattled bellbirds are native to Panama, Costa Rica, Honduras, and Nicaragua where they typically breed from March to September. They are altitudinal migrants, meaning they breed in highland moist forests in mountainous regions at 1,200 to 2,100 metres, and undertake complex migrations ranging up to 3,000 metres during non-breeding seasons before descending back to foothills and lowlands on the Pacific and Caribbean slopes. In Panama, they have however been seen in Las Bocas del Toro during the mating season near sea levels. Their seasonal migration in Panama is yet to be understood. In terms of diet, they mainly consume fruit vines.

  Despite being a fairly common species in the region, their population has significantly decreased. Between 1970 and 2017, they lost over half of their population, equivalent to a decline of at least 20% over the last three generations. They are threatened by habitat loss due to reserve clearance for agricultural purposes, logging, and wood harvesting.

- **Threnetes ruckeri**

  Also known as Band-tailed Barbthroat, they are medium-small sized birds that are about 12 cm long. They have been assessed as Least Concern by the *IUCN Red List of Threatened Species* in 2021. They are non-migrant birds who live in tropical forests, shrublands, and plantations. They are native to Central America including Panama. Despite being of least concern, their populations have been decreasing.

- **Pionus menstruus**

  Also known as the blue-headed parrot are medium-sized parrots with a green body and a blue head and neck and are about 30 cm long. They have been assessed as Least Concern by the *IUCN Red List of Threatened Species* in 2020. These non-migrant birds are native to Central and South America, including Panama. Their population size is

[4] Global Invasive Species Database

very large and their population trend is stable. They live in tropical and subtropical forests, and shrublands, but also in dry regions in savannas and artificial plantations.

➜ Appendix 4: Additionality and baseline calculations [5]

To calculate the baseline for our project, we estimated the baseline carbon stock in our project's trees and shrubs, as well as in the soil by calculating the change in Soil Organic Carbon (SOC) between the end and the beginning of the project. Calculations for carbon stocks in trees and shrubs are based on tree crown cover at the beginning of each project, denoted respectively as C_{TREE_BSL} and $C_{SHRUB,t}$. This refers to the above-ground and below-ground living biomass of both trees and shrubs. To do so, we used the "estimation by proportionate crown cover" technique as we do not have plot samplings yet that we can base our analysis on. This will be done within the next month (May 2022), when our field team goes to the ground to source more accurate data such as: soil samples, eDNA tests, bioacoustics, LiDAR measurements & social impact assessment of communities. The aforementioned technique is only applicable for estimations of ex-ante projects (trees that are yet to be planted, as opposed to ex-post projects). Please find below our baseline estimations for the project:

Estimation for carbon stock in trees at the beginning of the project

$$C_{TREE\_BSL} = 44/12 \times CF_{TREE} \times b_{FOREST} \times (1 + R_{TREE}) \times CC_{TREE\_BSL} \times A_i$$

$$C_{TREE\_BSL} = 44/12 \times 0.47 \times 48 \times (1 + 0.25) \times 0.03 \times 18$$

$$\mathbf{C_{TREE\_BSL} = 55.83\ t\ CO_2e}$$

Where

C_{TREE_BSL} = Carbon stock in pre-project tree biomass; t CO2e

CF_{TREE} = Carbon fraction of tree biomass; t C $(t.d.m.)^{-1}$. A default value of 0.47 t C $(t.d.m.)^{-1}$ is used.

b_{FOREST} = Mean above-ground biomass in the seagrass in the region or country where the A/R CDM project is located; t d.m. ha^{-1}. Values from Table 3A.1.4 of IPCC GPG-LULUCF 2003[6] are used unless transparent and verifiable information can be provided to justify different values.

[5] All baseline calculations are based on the A/R methodological tool developed by the UN Framework Convention on Climate Change as well as the A/R Methodological Tool for estimation of change in soil organic carbon stocks due to the implementation of A/R CDM project activities

[6] Good Practice Guidance for Land Use, Land-Use Change and Forestry by the IPCC

R_{TREE} = Root-shoot ratio for trees in the baseline; dimensionless. A default value of 0.25 is used unless transparent and verifiable information can be provided to justify a different value.

CC_{TREE_BSL} = Crown cover of trees in baseline stratum i, at the start of the A/R CDM project activity, expressed as a fraction (e.g. 10% crown cover implies = 0.10); dimensionless. We estimated a 3% tree cover on the site as a baseline.

A_i = Area of baseline stratum i, delineated on the basis of tree crown cover at the start of the A/R CDM project activity; ha. The Las Delicias project spans across 18 ha.

Estimation for carbon stock in trees at the end of the project

$$C_{TREE\_PROJECT} = b_{MANGROVE} \times CC_{MANGROVE} \times A_i$$

$$C_{TREE\_PROJECT} = 300 \times 0.90 \times 18$$

$$\mathbf{C_{TREE\_PROJECT} = 4{,}860\ t\ CO_2e}$$

Where

$C_{TREE\_PROJECT}$ = Carbon stock in pre-project tree biomass; t CO2e

$b_{MANGROVE}$ = Mean above-ground biomass in the mangrove in the region or country where the A/R CDM project is located; t CO_2e ha^{-1}. Values from Table 3A.1.4 of IPCC GPG-LULUCF 2003[7] are used unless transparent and verifiable information can be provided to justify different values.

$CC_{MANGROVE}$ = Crown cover of trees in baseline stratum i, at the start of the A/R CDM project activity, expressed as a fraction (e.g. 10% crown cover implies = 0.10); dimensionless. We estimated a 90% tree cover on the site as a baseline.

A_i = Area of baseline stratum i, delineated on the basis of tree crown cover at the start of the A/R CDM project activity; ha. The Las Delicias project spans across 18 ha.

[7] Good Practice Guidance for Land Use, Land-Use Change and Forestry by the IPCC

Total emission reduction by trees and shrubs on the project:

$C_{Captured} = C_{TOTAL,F} - C_{TOTAL,B} = 4,860 - 55.83 =$ **4,804.17 t CO_2e**

Total emission reduction by trees, shrubs and soil on the project:

$C_{Total\ Captured} = 4,804.17/18 =$ **266.89 t CO_2e ha^{-1}**

Carbon captured on Las Delicias site: 266.89 t CO_2e / hectare or 4,804.17 t CO_2e in total.

➜ Appendix 5: Risk assessment matrix for carbon criteria

	1	2	3	4	5
Additionality We ensure that the project is generating a greenhouse gas emission reduction that would not occur otherwise.	The additionality claim is completely erroneous. It is likely that it was based on false data or no data at all. No remote sensing data can be used to monitor the evolution of the project.	There is some additionality to the project but it is unsure how much. The data on which the analysis was based is likely to be flawed and not a perfect representation of reality.	The projects should live up to their additionality promises in the long-run but more accurate data and better remote sensing estimates should be used to validate it.	Remote sensing models and on-the-ground data regarding biomass absorption and co-benefits validated with certainty the fact that the project is additional.	Our technologies have proven that the project is absorbing even more carbon than originally planned for.
Durability We ensure that emissions are kept out of the atmosphere for the entire	Emissions will not be kept out of the atmosphere due to a poorly managed project with	There is not enough data to guarantee permanence which requires assuming the worst and	Without unexpected events and based on the available data, the project is likely to	Low disturbance allows saying with confidence that the project will	Low disturbance allows saying with confidence that the project will

duration of the project.	very high likelihood of fire or deforestation for agricultural purposes. No buffer zone.	being conservative. Emissions are unlikely to be kept out for the duration of the project and beyond. No buffer zone.	absorb carbon according to predictions for the entirety of the project.	absorb emissions beyond the project duration. If the project is negatively impacted, a guarantee is attributed to each ton of carbon to compensate for potential loss of emission reduction.	absorb emissions across multiple generations. If the project is negatively impacted, a guarantee is attributed to each ton of carbon to compensate for potential loss of emission reduction.
<u>Leakage</u> We ensure that emissions avoided through our projects are not displaced, nor occur elsewhere.	The area protected for reforestation is mostly inefficient (i.e. carbon is not absorbed) AND deforestation activities are displaced.	Deforestation activities are not displaced to another location but reforestation efforts are not optimal and agricultural projects remain in place for subsistence.	Deforestation is not displaced and reforestation is conducted as planned. Emissions are not displaced as a consequence and carbon is taken out of the atmosphere.	Trees are planted efficiently and death rates are low which allows the project to expand beyond its original delimitations. If leakage occurs, a guarantee will make up for each lost ton of carbon emission reduction.	Reforestation efforts were so promising and beneficial that they sparked new initiatives in the region or elsewhere. If leakage occurs, a guarantee will make up for each lost ton of carbon emission reduction.

➜ Appendix 6: Factors potentially affecting the durability of our project's carbon sequestration over the full project's duration (see *Appendix 8* for the risk assessment matrix)

- **Geopolitical**[8]

Panama's government is headed by the executive power, which is composed of the President and two Vice Presidents, democratically elected for a five-year term by direct vote. Panama is recognized as a stable government within Central and South America. In 2019, Laurentino Cortizo of the Democratic Revolutionary Party was elected President. Panama generally respects civil liberties and political rights, but corruption remains an important challenge.

Because of its unique location and its role in global trade, Panama holds particular relations with the United States of America. Ensuring the success of the canal is vital to the prosperity and security of the United States. In 1903, after Panama's declaration of independence from Columbia, the country granted the US rights to defend the inter-oceanic canal that then opened in 1914. The US is indeed the first user of the canal, with 68% of the shipments heading to or from the country. The two nations therefore share strong economic ties, expressed through a bilateral investment treaty and a Trade Promotion Agreement.[9]

The Bocas region is also very stable and we have received approval and support from the local mayor of Isla Colón to carry out the project which poses very little political risk. The archipelago is also an important touristic area with strong infrastructures in place and support from local authorities to maintain such activities in place and bring stability.

- **Climate Change**[10,11,12]

Panama experiences two main seasons in a year: a prolonged rainy season from May to January and a short dry season from January to May. Panama is highly vulnerable to climate change. The country is subject to various extreme weather events such as intense and prolonged rainfalls, windstorms, floods, droughts, wildfires, earthquakes, landslides, cyclones, tsunamis as well as El Niño-La Niña events.

[8] Profile of Panama
[9] US relations
[10] Extreme weather Panama
[11] Climate projection
[12] World Bank, Panama risks

In a high emission scenario, the projected change in annual average temperature is expected to climb to approximately 1°C by 2030 and 2°C by 2050. These predictions use the annual average temperatures recorded between 1960 and 1990 and are based on the future greenhouse gas emissions provided by the IPCC's Representative Concentration Pathways (RCP). These estimates are based on a high emissions scenario (RCP 8.5), likely to occur without drastic global emissions reductions. Sea levels are expected to rise 35 cm by 2100 with some coastlines already disappearing.

Being located on the coastal region of Bocas del Toro, our site is vulnerable to a changing climate and is likely to experience a change in weather patterns with an increase in frequency of extreme heat days and precipitation days. Indeed, according to the Partnership for Resilience and Preparedness[13], there will be approximately 50 to 60 extreme heat days annually in a high emission scenario, opposed to about 20 days in 2020. An extreme heat day occurs when the maximum temperature is greater than the 99th percentile maximum temperature during the baseline period, in this case from 1960 to 1990. In a high emissions scenario, an increase in the number of extreme precipitation days is likely to occur as well. They are in fact expected to double in 2050 compared to 2020. These rapid and intense changes leave little time for adaptation.

Dry season temperatures are expected to increase between 0.40°C and 1.10°C by 2020, 1°C and 30°C by 2050, and 1°C and 5°C by 2080. As mentioned above, Panama already suffers from climate variability. Each additional degree will worsen these events in both frequency and intensity. According to the World Bank, impacts of climate change include an increased incidence and intensity of crop failure, increased intensity of heat stress on crop production and vulnerable population, the loss of biodiversity and forests, and a reduction of water quality and quantity.

Despite its vulnerability, Panama is taking legal action to fight climate risks through the ministry of environment MiAmbiente which is launching a massive restoration program for the country. To limit temperature increases below 2 degrees celsius, Panama signed the Paris Agreement in April 2016. The country is committed to reducing its greenhouse gas emissions. They submitted a Nationally Determined Contribution[14], defining their mitigation and adaptation goals, and committing to reduce 24% of greenhouse gases by 2050, which represents approximately 60 million tons of CO2 avoided between 2022 and 2050. Regarding forests, they have developed a National Forest Restoration Program, in which they commit to the restoration of 50,000 ha which will contribute to the absorption of approximately 2.6 M

[13] Partnership for Resilience and preparedness
[14] Panama Nationally Determined Contribution

tons of CO2eq by 2050, an increase equivalent to 10% with respect to the average absorption of the 1994-2017 period. It is important to note that Panamanians do not largely contribute to high emissions. In 2018, the average C02 emissions per capita were 2.42 tons, well below the worldwide average[15].

- **Socio-economic**[16]

Since 2005, Panama has experienced steady economic growth, reaching $67 billion in 2019, before the pandemic hit. The country has the fastest growing economic performance in Latin America and the Caribbean (LAC). It grew at approximately 4.7% from 2014 to 2019, while the rest of LAC countries grew by 0.9 %. This economic growth has not been equally distributed among Panamanians. Indeed, poverty is still a significant issue in the country. According to the World FactBook, Panama has the second-worst income distribution in Latin America, and approximately one-fourth of the population lives in poverty. It has however reduced from 2006 to 2012 with a reduction of 10 percentage points.

According to the World Bank in 2019, Panama's Gini coefficient was 49.8%. The Gini coefficient is the most commonly used measure of income distribution across the world. The higher it is, the greater the income gap is between a country's richest and poorest. Panama ranks as the 17th country with the highest Gini coefficient. The largest wealth disparity in the country is noticeable between urban and rural areas: poverty in rural areas was six times higher than in urban areas in 2019. According to the World Bank, 31.94% of its total population lived in rural areas. These areas rarely see the benefits of the recent boost in economic activity, as 27% of the rural population lives in extreme poverty in comparison to 4% in urban areas.

Panama greatly suffered from the COVID-19 outbreak. The Gross Domestic Product of Panama fell by -17.9% in 2020 compared to the previous year, and the median labour income dropped by 18 % as well. Panama and especially the region of Bocas is highly touristic and attracts a lot of foreigners, students, and scientists which represent a huge regular income for the country. However, the pandemic represented a major curb to these activities and thus lowering revenues for the country.

Panama's challenge is therefore to boost economic activity, while at the same time ensuring that the benefits of growth also reach the rural areas and traditionally excluded groups.

[15] Panamanian emission per capita
[16] Gini coefficient by country in 2022

- **Land ownership and management**

The site is government-owned by the municipality of Isla Colón but is managed by local populations. We received direct confirmation from the mayor for the use of that land by local communities and authorities to participate directly in the planting and monitoring of the sites. Restoring and protecting mangroves is important as the local community depends on them as they provide crustaceans and fish that can be sold in local food markets. Mangroves are also important resources of wood extraction, benefit boatmen who give tours of the islands to tourists who can observe marine life such as dolphins, sloths, and sharks among other marine species.

➜ Appendix 7: Project timeline and costs

The breakdown of the timeline and total cost is outlined in this document.

➜ Appendix 8: Risk assessment matrix for external factors

This matrix was created to evaluate risks associated with ex-ante projects, based on a scale from 1 to 5. The goal is to give an indication of the likelihood of carbon to be absorbed in the long run based on external factors.

	1	2	3	4	5
Geopolitical Stability We evaluate the risk associated with the level of governance according to previous conflicts and government intervention in the location of the project and the probability of the project failing.	Very poor governance. A considerable amount of corruption, ethnic conflicts and wars. Extreme poverty and inequalities.	Poor governance. A significant amount of conflicts. No Government plan to address sustainability efforts.	Decent governance. Low amount of conflicts. Governance intervention (subsidised health coverage, public education etc.) and government plan to address sustainability efforts.	Good governance. Peace, justice and strong institutions. Low poverty. Governance intervention (subsidised and universal health coverage, quality public schools,	Excellent governance. Peace, justice and strong institutions. Very little to no poverty. Governance intervention (subsidised and universal health coverage, quality public schools, decent work and economic growth,

				decent work and economic growth, reduced inequalities etc.) and government plan to address sustainability efforts.	gender equality, reduced inequalities, affordable and clean energy, and government plan to address sustainability efforts, and have met their previous statements.
<u>Climate change vulnerability</u> We evaluate the risk associated with climate change according to the estimated impact of future temperature increases and the ability of trees and vegetation to adapt to such changes.	Extremely vulnerable territory to climate change. Estimates predict climate change will heavily affect the success of the project.	Very vulnerable territory to climate change. Estimates predict climate change will affect the success of the project.	Vulnerable territory to climate change. Estimates predict climate change might affect the success of the project if the country does not take serious action.	Relatively resilient to climate change. The project is likely to adapt to an increase in temperature in the next decades. Estimates predict climate change will not affect the success of the project.	Very resilient to climate change. The project will surely adapt to an increase in temperature in the next decades, Estimates predict climate change will not affect the success of the project.
<u>Socio-economic factor</u> We evaluate the risk associated with socio-economic factors according to the ability of local communities to	Local communities are all smallholder farmers and solely reliant on intensive crop farming, detrimental to the soil but essential to	Local communities are mostly smallholder farmers and heavily reliant on crop farming. They typically have just enough to send the next	Local communities have larger farming plots and make a fair living out of their crop yields. There are other options for income but this	Local communities have diverse sources of economic income and do not need to rely on farming for their livelihood.	Local communities are completely independent of farming and can engage in reforestation projects as leisure.

rely on non-forest resources to live decently.	their livelihoods. There is no other option for income in the area.	generation to school and get out of the cycle but nothing else.	is still the best option and is a choice.		
<u>Land ownership & management</u> We evaluate the risk associated with land ownership and management by assessing the success/failure of previous projects.	No record of ownership or management. The land has been abandoned or destroyed by anthropogenic activities. The land is considered unproductive and unexploitable.	Previous projects were poorly managed, leading to leakage and/or deforestation.	Previous projects were fairly well handled, leading to little leakage and/or deforestation.	Previous projects well managed	Fully managed and owned by local communities with a sustainable management plan.

After assessing risks related to carbon and external factors, we were able to rate each factor of the Delicias project on a scale from 1 to 5 and then translate it to a letter grade.

	1	**2**	**3**	**4**	**5**	TOTAL
Additionality					X	5
Durability		X				2
Leakage					X	5
Geopolitical					X	5
Climate Change		X				2
Socio-economic				X		4
Land ownership				X		4
						27/35

Total points	Score
30 - 35	A+
25 -30	**A**
20 - 25	B
14 - 20	C
7 - 14	D