ASES ON-CHAIN PROTOCOL

# BASELINE REPORT

Verified Carbon Credits (VCC)

## Creating green fences and increasing biodiversity at La Junquera farm, Murcia (Spain)

LT-018-SPA-2402024 JUNQUERA PHASE II, MURCIA, SPAIN

Life Terra (Foundation)

Type B Project


**February 7, 2025**

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## EXECUTIVE SUMMARY

The baseline report of the plantation project is a necessary activity for their certification since it will allow for establishing the initial parameter of biomass generation and therefore the carbon sequestration in each of the projects. The report will consist of the generation of NDVI and biomass indexes, which are generated through a specific methodology and with the use of satellite images and high-resolution ortho mosaics.

The reforestation project in La Junquera phase II, municipality, Murcia (Spain) entailed planting a total of 50,000 trees, representing five (5) distinct species consisting of a mixture of trees, shrubs, and herbs mainly native to the region and well-suited for adverse environmental conditions. The primary objective of this initiative was to enhance biodiversity by creating habitat corridors enabling wildlife movement. Additionally, these green fences will serve to mitigate wind erosion in an area already prone to degradation, improve soil water retention, and provide shade during the hottest months of the year. The project area, situated within the La Junquera municipality, covered 313,301.58 square meters.

The dense planting technique was employed, providing numerous benefits such as increased yield and efficient resource utilization. The planting density within the plot was one tree per 6.3 square meters, equivalent to an average of 1,596 trees per hectare in the plot.

The total $CO_2$ capture for the entire project area was calculated to be between 2,743.33 and 10,813.75 $TCO_2$-eq considering survival scenarios of 25.1% and 98.9% respectively at the end of the 40 years of the project's lifetime. Furthermore, accounting for an 50% survival rate, as proposed by the project developer, and applying it to the total $CO_2$ capture determined by the aOCP results in a total of 5,464.80 $TCO_2$-eq.

Following the field visit in September 2024, it was determined that mortality was worse than expected, with losses attributed to extreme drought conditions, livestock grazing, and accidental damage from machinery. Despite this setback, the project team has implemented corrective measures, including phased replanting efforts, which are expected to bring the survival rate up to 60% over time. As a result, the revised carbon sequestration estimates now project a total $CO_2$ capture of 6,557.76 $TCO_2$-eq under the aOCP methodology and 5,559.60 $TCO_2$-eq based on the project developer's calculations. These adjustments reflect the project's commitment to restoration and long-term resilience, ensuring continued alignment with certification standards.

The successful reforestation endeavor in La Junquera demonstrates the positive impact of employing dense planting techniques and strategically selecting native species to reclaim and revitalize degraded landscapes, providing ecological, economic, and social benefits for the region and its communities.

# I. PROJECT DESIGN

This section is based on the information compiled in the PSF Format - Project Submission Form prepared by the project developer.

## I.1. PROJECT LOCATION

The project is located in the La Junquera municipality, in Murcia (Spain). The reforested plot lies close to adjoining Cropland areas. A project location map is illustrated in Figure 1. Table 1 shows the coordinates of the reforested Plots.

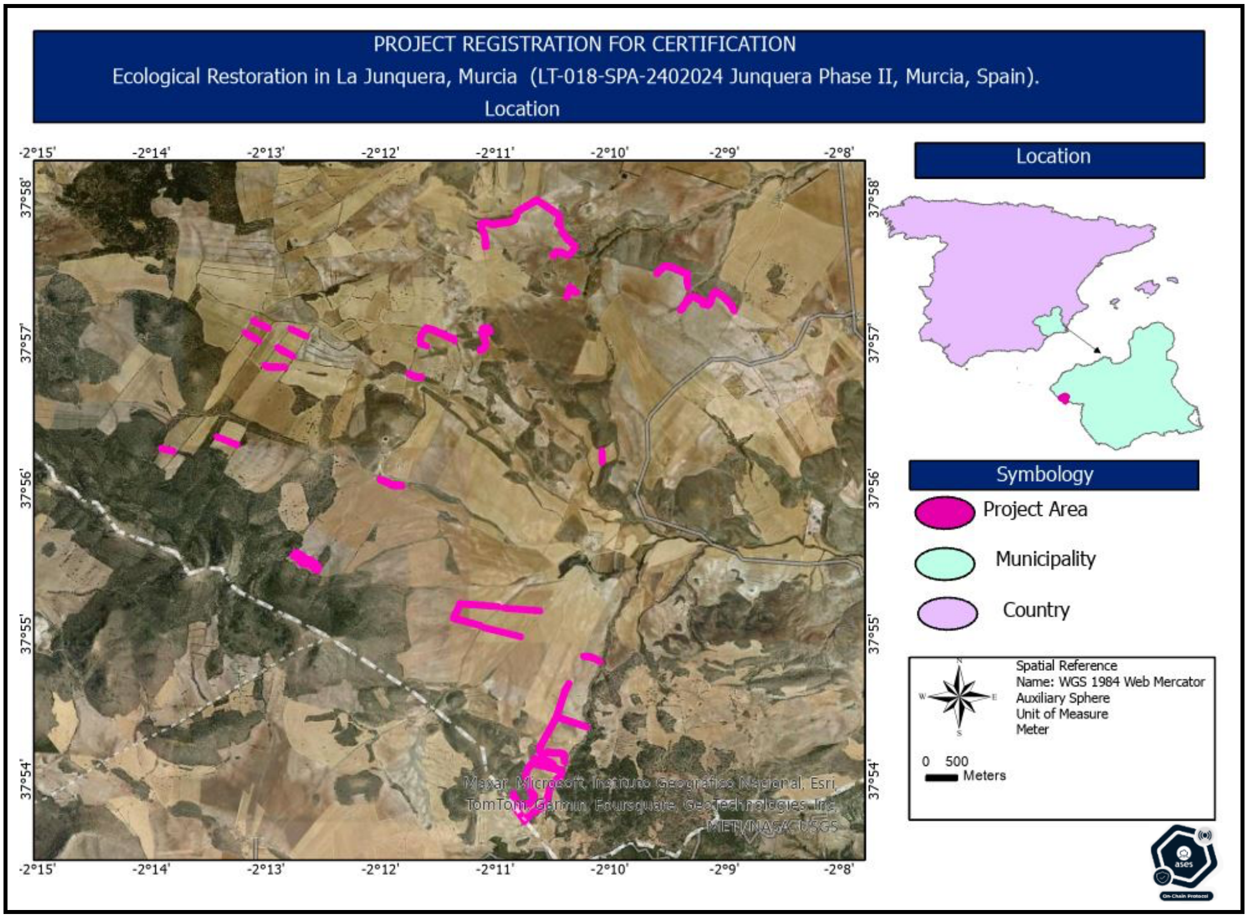



**FIGURE 1 PROJECT LOCATION**

**TABLE 1 LOCATION OF PROJECT PLOT**

| Plot | Coordinates | |
|---|---|---|
| | **Latitude** | **Longitude** |
| **1** | 37.9315469°N | 2.1828943°W |

## I.2. Administrative Specifications

This section introduces the project developer, outlines the project type, and specifies the nature-based credits for which the proponent is applying.

### I.2.1. Project Developer

| | |
|---|---|
| **Key project** | LT-018-SPA-24022024 |
| **Title of the project activity** | Creating green fences and increasing biodiversity at La Junquera farm, Murcia (Spain) |
| **Company** | Life Terra |
| **Person responsible** | Sven Kallen |

### I.2.2. Type of project

| | |
|---|---|
| **Project registration year** | 2025 – Retroactive project (2024) |
| **Project duration** | 40 years |
| **Issuance of credits** | Annual to 10 years |
| **Type** | ☒ Forest management<br>☐ Regenerative agriculture<br>☐ Silvopastoral management<br>☐ Individual tree-based climate action / urban forest<br>☐ Water flow restoration<br>☐ Biochar |

### I.2.3. VNPCs the project is applying to

| | |
|---|---|
| **Type of VNPCs the project is applying for** | ☒ Carbon Removals (VCRm)<br>☐ Carbon Removals (VCRd)<br>☒ Biodiversity Based Credit (VBBC)<br>☒ Water Credits (VWC)<br>☒ Soil Credits (VSC)<br>☐ Climate action bond |

# II. PROJECT AREA BASELINE

According to the Corine Land Cover mapping, the project area falls within agricultural areas and arable lands in the La Junquera municipality Spain. Adjoining land covers are Forest and semi natural areas extending a few kilometers from the site. An evaluation of the ESA-worldcover-v200 for 2021, focusing on land use and land cover, revealed that the project site was situated within a predominantly Cropland area with little Grassland areas. To further ascertain the project's potential contributions to biodiversity, a survey was conducted to count and identify the plant species present in the vicinity of the project area. This will be further elaborated in the biodiversity section of this report.

## II.1. SPECTRAL RESPONSE

When solar radiation interacts with an object, one of three situations can occur, either individually or in combination:

- Reflection: The radiation can bounce off the object partially or entirely, resulting in reflection.
- Absorption: The object can absorb the radiation, taking in its energy.
- Transmission: Radiation can pass through one object and reach another, known as transmission.

The extent to which radiation is reflected, absorbed, or transmitted depends on the specific physicochemical characteristics of the objects involved. However, for object identification purposes, our primary interest lies in the reflected light or radiation at different wavelengths. For instance, vegetation exhibits low reflectance in the visible range, but the presence of chlorophyll in plants increases reflectance in the green channel. On the other hand, plants demonstrate the highest reflectance in the near infrared region of the electromagnetic spectrum.

### II.1.1. INDEX

Vegetation indices (VI) are extensively employed for monitoring and detecting changes in vegetation and land cover. These indices are created by considering the contrasting absorption, transmittance, and reflectance of energy by vegetation across the red and near-infrared portions of the electromagnetic spectrum. Numerous studies have demonstrated that the Normalized Difference Vegetation Index (NDVI) is particularly resilient against the influence of topographic factors. NDVI is commonly utilized as a broad indicator of photosynthetic activity in plants and the corresponding aboveground primary production.

The calculation of NDVI was performed using Sentinel-2 satellite images in the Google Earth Engine platform. Images with less than 30% cloud cover were selected for each month. The assessment focused on the average monthly NDVI time series spanning from January 2019 to November 2024. The findings are presented in Figure 2, which covers both pre- and post-project implementation periods. To delineate the pre- and post-project implementation periods, it is important to note that the reforestation activities took place in April 2024. Consequently, all months prior to these dates are considered the pre-project implementation period, while months after are regarded as the post-project implementation period for the purpose of this analysis. The analysis of NDVI in Figure 2 illustrates a spectrum closely correlated with rainfall distribution.

From January 2019 to March 2020, NDVI values fluctuated around 0.30. However, from April 2020 to May 2021, a marked increase in vegetation activity occurred, with NDVI values consistently exceeding 0.35. After this period, NDVI stabilized around 0.30 between June 2021 and August 2022 before beginning a gradual decline. Seasonal patterns are evident, with NDVI generally peaking mid-year, coinciding with increased rainfall, and tapering off towards the year's end. The 12-month mobile average (MA) of NDVI values shows a steady decline from April 2022 onward, suggesting a potential decrease in overall vegetation health. This downward trend persists in the latest data, with NDVI values averaging around 0.22 from December 2023 to November 2024.

Given this decline in vegetation health, reforestation efforts are needed to restore and enhance the ecosystem's vitality. By introducing native species and promoting natural regeneration, reforestation will help reverse the loss of vegetation, improve biodiversity, and stabilize the region's ecological balance.

Given the known information that a healthy, dense vegetation canopy typically exhibits NDVI values above 0.5, while sparse vegetation generally falls within the range of 0.2 to 0.5, the current assessment indicates that the reforestation project has potential to foster an ascending trend in the plot's NDVI as it transitions to a dense healthy forest. With the project in place, it is anticipated that the NDVI will continue to rise further, indicating a healthy and thriving vegetation cover.

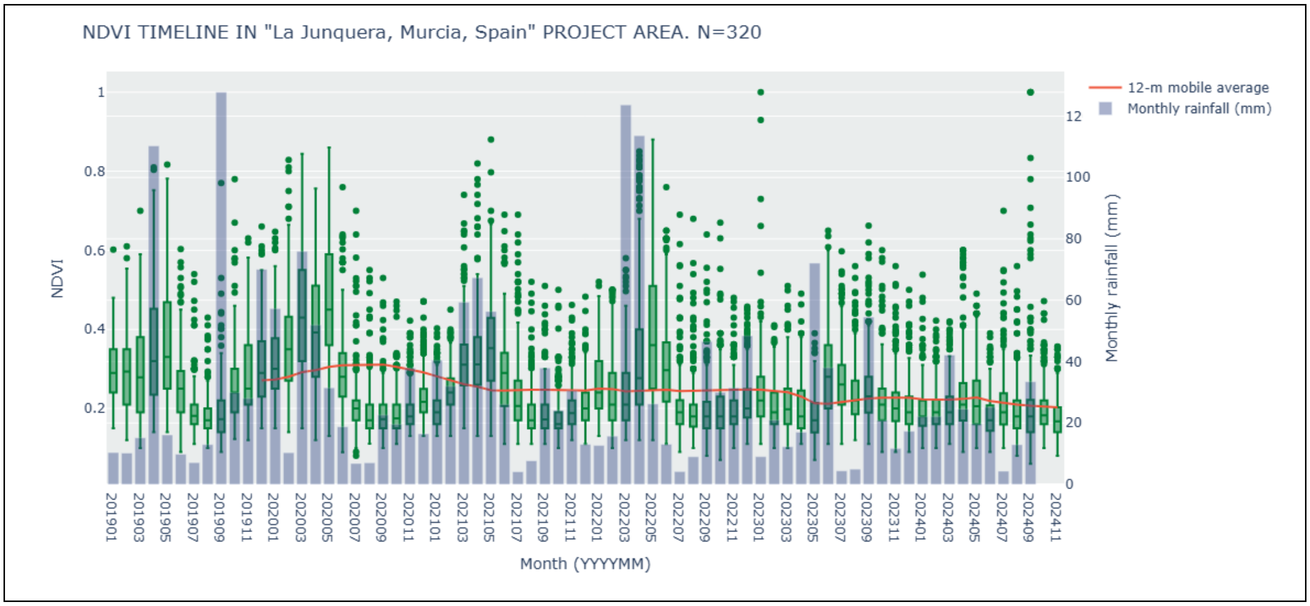



**FIGURE 2 NDVI TIMESERIES IN THE AREA OF INTEREST**

## II.2. IMPACT ON THE LANDSCAPE

Prior to the afforestation of the area, it experienced decreased biodiversity, and reduced ecosystem services. The afforestation project has introduced green barriers and hedgerows strategically planted along crop field boundaries, which serve multiple ecological functions. These vegetative borders enhance biodiversity by creating habitat corridors, enabling wildlife movement, and offering essential shelter for various species. Additionally, these green barriers function as natural windbreaks, protecting primary crops from wind erosion and environmental stress. By replanting field boundaries, the project contributes to a more resilient landscape, fostering a habitat that supports wildlife, improves soil retention, and promotes water infiltration, all of which are critical for sustaining long-term ecological health and agricultural productivity in the area.

2020


2023

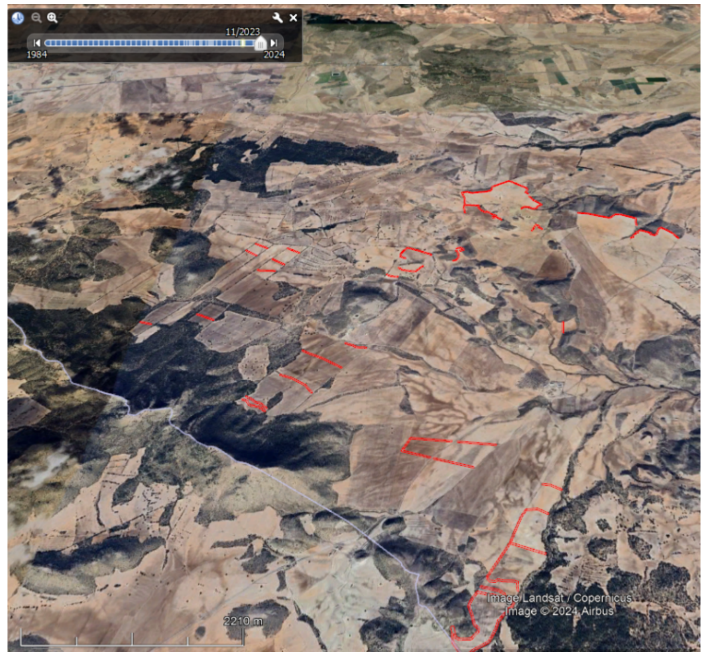



**Figure 3 Satellite aerial view of Project area (Pre- project implementation)**

## III. Technical specifications

### III.1. Carbon removal

This section analyzes the estimated carbon sequestration expected from the reforestation efforts implemented by the project.

#### III.1.1. Reforested area

The project encompasses a plot with a total area measuring 313,301.58 m$^2$ situated in La Junquera municipality, in the Murcia Region (Spain). The demarcated plot is shown in Figure 4.

#### III.1.2. Species

The reforestation project successfully planted a total of 50,000 trees, encompassing five (5) different species. The number of individuals of each species is shown in Table 2. The selection of species was based on a preliminary assessment of the region, considering available bibliographic information, as well as the prevailing climatic, vegetational, and meteorological conditions. All species chosen are indigenous to the area and well-suited to the local climate and environmental conditions.

Out of the total number of trees planted (50,000), the percentage by species is presented in Table 2.

TABLE 2. NUMBER OF TREES BY SPECIES

| Species | Number of trees | Percentage (%) | Origin |
|---|---|---|---|
| *Pistacia terebinthus* | 13,980 | 27.96 | Native |
| *Juniperus oxycedrus* | 4,245 | 8.49 | Native |
| *Juniperus thurifera* | 7,025 | 14.05 | Native |
| *Pinus halepensis* | 12,375 | 24.75 | Introduced |
| *Quercus ilex* | 12,375 | 24.75 | Introduced |
| **Total** | **50,000** | **100%** | |

### III.1.2.1. Distribution of the species selected for reforestation

The distribution of plant species is influenced by a variety of abiotic and biotic factors, including:

- Climate
- Soil
- Topography
- Hydrology
- Competition between plants for resources
- Seed dispersal

These factors interact in complex ways to determine the distribution of plant species across a landscape.

Understanding and knowing the distribution of the flora species that have been selected for reforestation is important to ensure the adaptation of the new trees and their survival, to secure the long-term benefits of the project, and to avoid altering the ecosystem balance by introducing non-adapted species.

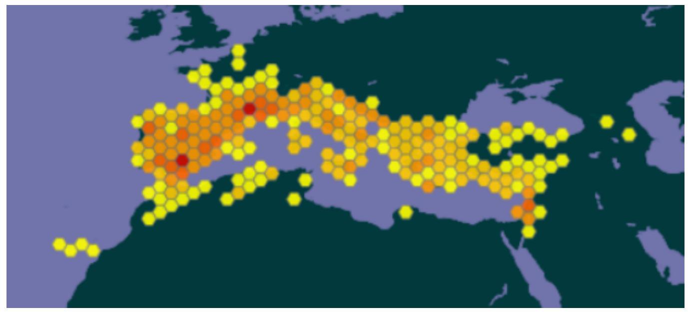
To achieve this, each species was consulted in the Global Biodiversity Information Facility GBIF (https://www.gbif.org). This database allows you to know the species classified as introduced in each country, their EUNIS habitat, their native range, and observation records.

**The Global Register of Introduced and Invasive Species (GRIIS)** presents validated lists of introduced (alien) and invasive alien species at the country, territory, and associated island level. The International Union for Conservation of Nature (IUCN) describes an introduced/alien and invasive alien species as follows:

- Introduced/alien species: A species, subspecies, or lower taxon occurring outside of its natural range (past or present) and dispersal potential (i.e., outside the area, it could occupy without human intervention) and which has been transported by human activity; this includes any parts, gametes, seeds, eggs, or propagules of such species that might survive and subsequently reproduce.
- Invasive alien species: A species that becomes established in natural or semi-natural ecosystems or habitats, is an agent of change, and threatens native biological diversity. This includes widespread species, rapidly expanding, or present in high abundance and that hurt biodiversity.

**According to the aOCP's eligibility criteria, species classified as invasive alien species cannot be counted towards the project's benefits.**

- ***Pistacia terebinthus***

| | |
|---|---|
| **Recorded as introduced in Spain** | ☐ Yes ☒ No |
| **Habitat EUNIS** | Not specified |
| **Native range** | Not specified |
| **Georeferenced records** |  |

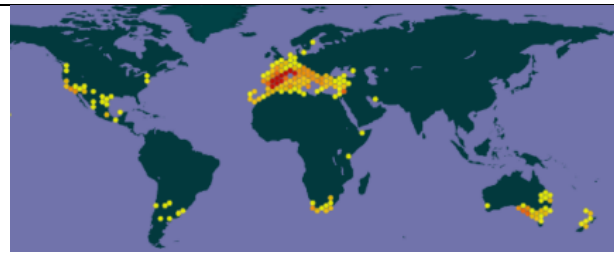
- ***Juniperus oxycedrus***

| | |
|---|---|
| **Recorded as introduced in Spain** | ☐ Yes ☒ No |
| **Habitat EUNIS** | Not specified |
| **Native range** | Not specified |
| **Georeferenced records** |  |

- ***Juniperus thurifera***

| | |
|---|---|
| **Recorded as introduced in Spain** | ☐ Yes ☒ No |
| **Habitat EUNIS** | Not specified |
| **Native range** | Not specified |
| **Georeferenced records** |  |

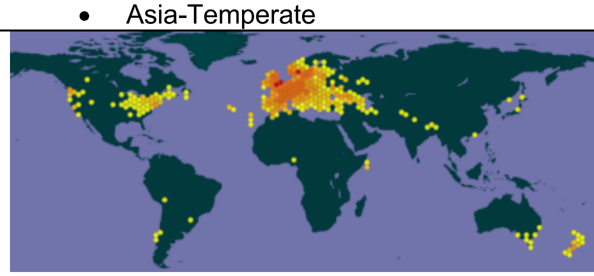
- ***Pinus halepensis***

| | |
|---|---|
| **Recorded as introduced in Spain** | ☐ Yes ☒ No |
| **Habitat EUNIS** | • Coastal habitats (B level 1)<br>• Coniferous woodland (G3 level 2)<br>• Mixed deciduous and coniferous woodland (G4 level 2) |
| **Native range** | • Arabian Peninsula<br>• Europe<br>• Northern Africa<br>• Western Asia |
| **Georeferenced records** |  |

The species *Pinus halepensis* with the taxon identifier number 126512, is not classified as an invasive alien species according to the GRIIS database of Spain:

https://www.gbif.org/species/160949942/verbatim. Therefore, its integration and counting in the project is accepted.

- ***Quercus ilex***

| | |
|---|---|
| **Recorded as introduced in Spain** | ☒ Yes ☐ No |
| **Habitat EUNIS** | • Regularly or recently cultivated agricultural, horticultural and domestic habitats (I level 1) |
| **Native range** | • Europe<br>• Southeastern Europe<br>• Southwestern Europe<br>• Africa<br>• Eastern Asia<br>• Eastern Europe<br>• Asia-Temperate |
| **Georeferenced records** |  |

**The species *Quercus ilex* with the taxon identifier number 126203, is not classified as an invasive alien species according to the GRIIS database of Spain:** [https://www.gbif.org/species/160950579/verbatim](https://www.gbif.org/species/160950579/verbatim). **Therefore, its integration and counting in the project is accepted.**

Of the 5 species planted, 3 are native, and 2 are introduced. Since the introduced species are not classified as invasive alien species according to the GRIIS database for Spain, their inclusion in the project is accepted.

The technical data sheets providing detailed information about the species utilized for the reforestation project are included below, in Table 3. These sheets offer comprehensive insights into the characteristics, growth patterns, environmental requirements, and other relevant details of the selected plant species. These data sheets serve as valuable references for understanding the specific attributes and suitability of each species for the reforestation efforts.

**TABLE 3 TECHNICAL DATA SHEETS OF SPECIES USED FOR REFORESTATION**

| | |
|---|---|
| ***Pistacia terebinthus***<br>◦ Native Range: Mediterranean region, including Spain.<br>◦ Ecological Role: Supports pollinators and provides food for birds and mammals.<br>◦ Drought Resistance: Highly resistant to dry, rocky soils.<br>◦ Uses: Traditionally used for resin extraction and medicinal purposes. |  |
| ***Juniperus oxycedrus***<br>◦ Native Range: Mediterranean woodlands and scrublands.<br>◦ Ecological Role: Helps prevent soil erosion and provides habitat for birds.<br>◦ Drought Resistance: Extremely drought-tolerant, thrives in poor soils.<br>◦ Uses: Berries used to make essential oils and traditional remedies. |  |

| | |
|---|---|
| ***Juniperus thurifera***<br>◦ Native Range: Mountainous regions of Spain and North Africa.<br>◦ Ecological Role: Provides shelter and food for wildlife, especially birds.<br>◦ Drought Resistance: Adapts well to extreme temperatures and arid conditions.<br>◦ Uses: Wood is durable and aromatic, historically used in construction. |  |
| ***Pinus halepensis***<br>◦ Native Range: Mediterranean Basin.<br>◦ Ecological Role: Fast-growing species that stabilize degraded soils.<br>◦ Drought Resistance: Extremely resilient, thrives in dry and nutrient-poor soils.<br>◦ Uses: Widely used for reforestation and resin production. |  |
| ***Quercus ilex***<br>◦ Native Range: Mediterranean forests and woodlands.<br>◦ Ecological Role: Key species in Mediterranean ecosystems, supporting diverse wildlife.<br>◦ Drought Resistance: Very resistant to drought and poor soils.<br>◦ Uses: Acorns serve as food for livestock (e.g., Iberian pigs), and its wood is highly valued for charcoal and firewood. |  |

### III.1.3. Reforestation technique

The reforestation technique implemented is the Dense Planting technique. Dense planting technique, also known as high-density planting or intensive planting, refers to a method of crop cultivation where plants are spaced closely together to maximize productivity and yield. Instead of the traditional practice of leaving significant spaces between plants, dense planting involves reducing the interplant spacing, resulting in a higher number of plants per unit area. The goal of this technique is to optimize the use of available resources, such as sunlight, water, and nutrients, by creating a more efficient growing environment. By reducing the space between plants, several benefits can be achieved which include enhanced resource utilization, weed suppression, and increased yield. Nonetheless, it is important to note that the success of dense planting depends on various factors, such as the specific plants being grown, local climate conditions, soil fertility, and management practices. Adequate irrigation, nutrient management, and careful monitoring of tree health are crucial to ensure optimal growth and prevent issues such as overcrowding, nutrient deficiencies, or increased disease susceptibility.

The assessment revealed an average planting density of one tree per 6.3 square meters, equivalent to an average of 1,596 trees per hectare in the plots. This high-density approach offers several ecological, environmental, and economic advantages. The increased tree density, combined with the implementation of various tree species, will foster biodiversity and enhance ecological resilience within the restored ecosystem. Moreover, the high density will expedite canopy closure, creating a continuous cover as the tree canopies interlock. This canopy closure plays a crucial role in weed suppression, creating improved microclimates, moisture retention and reducing soil erosion. However, it's important to note that high planting densities can also lead to competition for resources among trees, which may result in stunted growth, reduced health, and increased mortality of some trees. In addition, the proximity between trees can facilitate the rapid spread of diseases and pests. Controlling and managing these issues becomes more complex in densely planted areas.

As a result of this high-density planting strategy, the afforestation project is well-positioned to maximize carbon sequestration potential, promote wildlife habitat, and provide essential ecosystem services. The management of this densely planted plot will be critical to ensure the continued success and long-term sustainability of the reforestation efforts. Figure 4 shows the mapped planting density of the geolocalized trees within the plots with the location of each tree represented by dot symbols.

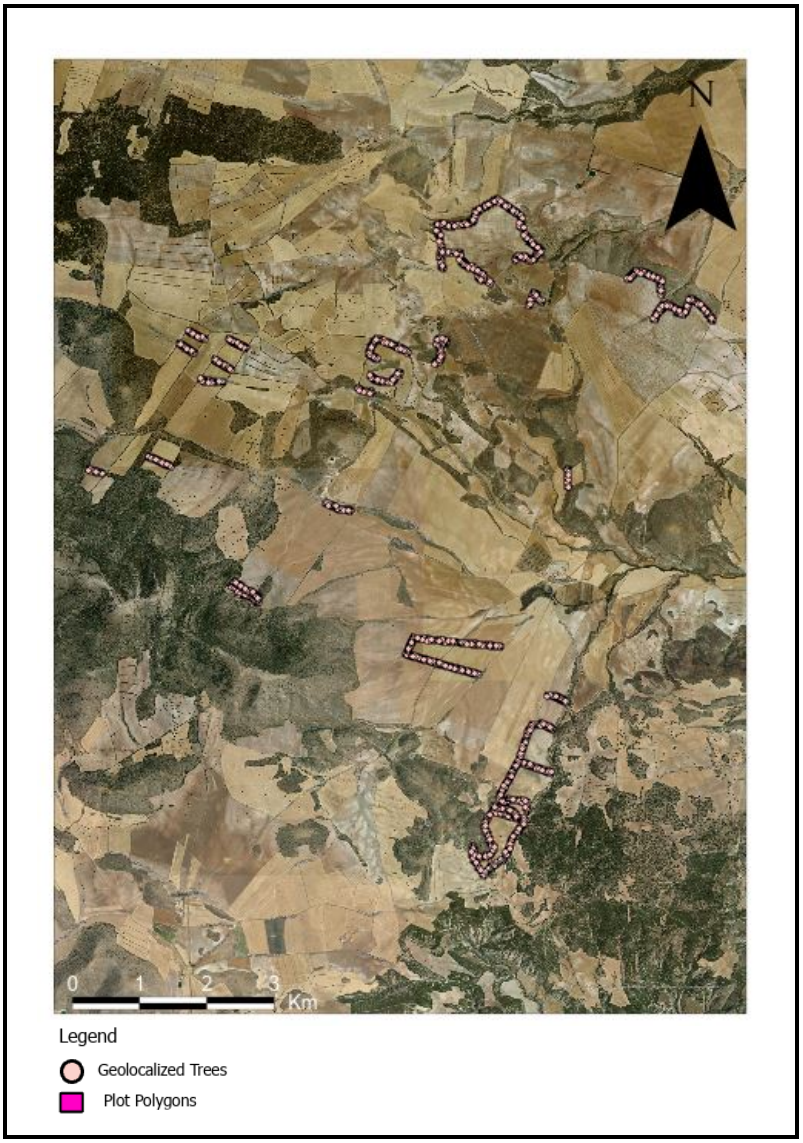



FIGURE 4 TREE PLANTING DISTRIBUTION

### III.1.3.1. Methodological process

The operational phase is divided into three steps as shown in Figure 5.

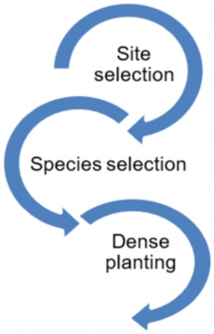



FIGURE 5 METHODOLOGICAL PROCESS

The reforestation process involved a well-defined series of steps. Firstly, a thorough evaluation was conducted to select the most suitable reforestation area, considering restoration needs, climatic and soil feasibility, permit requirements, and cost considerations. It ensured that the chosen location was conducive to successful reforestation. To preserve the ecological integrity of the region, afforestation was not carried out on scarified ground. This approach aimed to leverage the existing ecosystem to facilitate the growth and development of the newly planted trees, promoting biodiversity and increasing the chances of successful reforestation. Local community stakeholders were actively involved in the process, fostering a sense of ownership and sustainability in the reforestation initiative.

### III.1.4. GEOLOCALIZATION OF PLANTED TREES

Using Spatial Analyst tools in ArcGIS Pro environment, a detailed count of geolocalized trees was conducted within the project plot. The results indicate the distribution of 50,000 trees within the reforested plot spaced at approximately 3.5 meters intervals as illustrated in Figure 4 above.

This analysis provides valuable insights into the spatial relative abundance of trees within each plot. The distribution percentages highlight the varying densities and concentrations of trees, indicating areas with higher and lower tree populations in cases where the reforested plots are segmented. These findings help understand tree distribution and estimate the project's carbon absorption capacity. The number of trees and their carbon sequestration capacity are crucial for the estimation of the Project's carbon sequestration potential. The count of geolocalized trees provides an overall measure, serving as a basis for estimating carbon sequestration. Combining tree count with species-specific data allows estimation of biomass and carbon capture potential. This provides a quantitative assessment of the project's capacity to absorb and sequester $CO_2$.

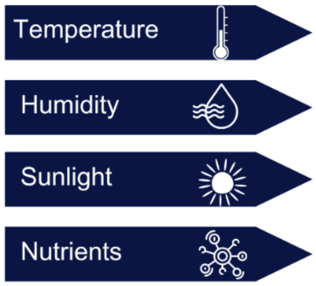
### III.1.5. PROJECT CAPACITY

This section determines the project's and the area's capacity to absorb $CO_2$ using Net Primary Productivity (NPP) as a reference parameter. Then, the amount of $CO_2$ that can be captured is estimated with allometric equations considering the age and height of each species.

#### III.1.5.1. Net Primary Productivity (NPP)

Net Primary Productivity (NPP) is the result of organic matter production through the process of photosynthesis. However, primary productivity involves more than photosynthesis; it also encompasses the uptake of inorganic nutrients and the assimilation of diverse organic compounds into protoplasm, which are vital for all photosynthetic organisms. Among various ecosystem processes, NPP is extensively measured due to its ability to reflect carbon accumulation in ecosystems. The calculation of NPP is based on the increase in biomass per unit area over a specified time period.

NPP is influenced by several factors, including:




Hence, the net primary productivity (NPP) can be expressed as the difference between the carbon absorbed by vegetation through photosynthesis (referred to as Gross Primary Production or GPP) and the carbon lost through respiration. Temperature and precipitation are key limiting factors for NPP, and it is generally assumed that NPP increases with both temperature and precipitation. However, it is important to note that the NPP cannot exceed the saturation value of 3000 gDM/m$^2$/year (DM stands for dry matter).

For the calculation of NPP in the La Junquera green fences and biodiversity enhancement project, the Miami methodology outlined in section “IV.1. aOCP Methodology for carbon removal and storage in vegetation” was employed. This methodology incorporates the following equations to determine NPP:

$$\mathbf{NPP} = \mathbf{min}\ (\mathbf{NPP_T}, \mathbf{NPP_P})$$

Where:

$$NPP_T = 3000(1 + exp(1.315 - 0.119\ x\ T))^{-1}$$

$$NPP_P = 3000(1 - \exp(-0.000664\ x\ P))$$

Where:

**T:** average annual temperature

**P:** accumulated precipitation

Carbon capture capacity was calculated using the conversion factor 0.47 (IPCC, 2006), using the following equation:

$$NPP_c = NPP_{dm}\ x\ 0.47$$

Where:

**$NPP_c$**: Net primary productivity, gC m² yr-1

**$NPP_{dm}$**: Net primary productivity, gDM m² yr-1

Then, the equivalence to carbon dioxide was calculated using the conversion factor of 3.67. This factor represents the molar mass ratio of $CO_2$:C. $CO_2$ molar mass is 44 and C is 12, therefore, 44/12 = 3.67. The conversion was done using the following equation:

$$CO_2\ capture\ capacity = 3.67\ (NPP_c)$$

Finally, the maximal $CO_2$ capture capacity for the Project area was computed by multiplying the previous result by the Project area surface. The calculation was repeated for each scenario (present with real data, present with CMIP data and future with CMIP data). Real data is privileged over modelled data for the present scenario. In order to estimate future NPP, the percent change was calculated between present and future estimates done with CMIP6 data. This percent change was then applied to the present estimate done with real data, this way we obtain a future NPP estimate based on present real data.

The results (**Erreur ! Source du renvoi introuvable.**4) indicate that the project area currently has an NPP of 510.81 gDM $m^{-2}$ $yr^{-1}$, which, due to the climatic conditions, will decrease to 434.21 gDM $m^{-2}$ $yr^{-1}$ in 2062. This change, of --76.60 gDM $m^{-2}$ $yr^{-1}$, represents a decrease of 15.00%. In terms of $CO_2$, **the Project restoration area (31.3 ha) is currently capable of capturing 276,050.22 kg$CO_2$ $yr^{-1}$ and is expected to capture around 234,654.76 kg$CO_2$ $yr^{-1}$ by 2062**.

Based on these results, it has been determined that **234.65 T$CO_2$-eq/year** will serve as the base parameter for the estimation of maximum achievable annual $CO_2$ capture. For the 40 years of the project, it equals **9,386 T$CO_2$-eq.**

**TABLE 4 MAXIMUM ATTAINABLE NPP AND BIOMASS WITHIN PROJECT SITE**

| NPP | Present Real Data | Present CMIP | 2062 CIMP | CMIP Change | CMIP % Change | 2062 Based On Real Data | Real Data Change |
|---|---|---|---|---|---|---|---|
| **gDM/m²/yr** | 510.81 | 681.70 | 579.47 | -102.22 | -15.00 | 434.21 | -76.60 |
| **g$CO_2$/m²/yr** | 881.10 | 1,175.86 | 999.53 | -176.33 | -15.00 | 748.97 | -132.13 |
| **gC/m²/yr** | 240.08 | 320.40 | 272.35 | -48.05 | -15.00 | 204.08 | -36.00 |
| **Kg$CO_2$/plot/ yr** | 276,050.22 | 368,397.57 | 313,154.05 | - 55,243.52 | -15.00 | 234,654.7 6 | -41,395.46 |

### III.1.5.2. Allometric Equations

Allometric equations are mathematical formulas used to estimate the amount of CO2 that can be captured and stored in certain types of vegetation, such as trees or shrubs, depending on their morphometry. Table 5 shows the allometric equations used for each species planted.

TABLE 5 ALLOMETRIC EQUATIONS USED FOR EACH SPECIES

| Species | Allometric Equation $CO_2$ absorbed (Kg) | Reference |
|---|---|---|
| *Pistacia terebinthus* | Biomass=5.825+1.982*(DBH) | Rai, S.N. 1984. Bole, branch, current year twig, leaf and root biomass production in tropical rain forests of western ghats of Karnataka. Indian Forester, 110(9): 901-913 |
| *Juniperus oxycedrus* | Biomass=0+0*(DBH)+0.1632*((DBH)^(2.2454)) | Schnell; R; 1976; Biomass estimates of eastern redcedar tree components; Tech; Note B15; Norris; TN; Tennessee Valley Authority; Division of Forestry; Fisheries and Wildlife Development; |
| *Juniperus thurifera* | Biomass=0+0*(DBH)+0.1632*((DBH)^(2.2454)) | Schnell; R; 1976; Biomass estimates of eastern redcedar tree components; Tech; Note B15; Norris; TN; Tennessee Valley Authority; Division of Forestry; Fisheries and Wildlife Development; |
| *Pinus halepensis* | Biomass= 0.1129 DBH^2.4241 | Montero, G. (2004). Cuantificacion de la biomasa forestal aerea y radical de distintas especies arboreas. Montes y energyιas renovables. Ponencias y Comunicaciones Santiago de Compostela, 115-131. |
| *Quercus ilex* | Biomass = 0.089*(DBH)^2.5226 | "Návar, J. 2009. Allometric equations for tree species and carbon stocks for forests of northwestern Mexico.Forest Ecology and Management 257:427-434 |

Carbon stocks in planted trees and shrubs at year 40 were calculated by applying these allometric equations to the tree dimensions expected at age 40. The total carbon storage at year 40 for the 50,000 trees and shrubs is estimated to be 10,929.60 Tons of $CO_2$.

Due to natural ecological processes, a fraction of the planted trees and shrubs will die. The survival/mortality percentages were computed with two different approaches, as described in the following subsection.

### III.1.5.3. $CO_2$ Capture

In reforestations carried out in degraded areas, a planting density of 1 tree every four meters is considered, since distributing the trees in this way allows each tree to have enough space to grow and develop adequately, avoiding excessive competition for resources such as sunlight, water, and soil nutrients. The reference density for this scenario is 16 square meters per tree. At present, the project has achieved a density of 6 square meters per tree, which is less than the targeted reference density. This planting density will have significant implications for the success of reforestation efforts. By providing adequate space for individual tree growth, the chances of survival and healthy development are increased. However, in this case, proper management practices will be essential to ensure the optimal utilization of resources, especially as the trees grow and compete for sunlight, water, and nutrients. Maintaining the appropriate balance between tree density and resource availability is crucial to sustaining the health and productivity of the reforested ecosystem over time.

The avoidance of resource competition promotes optimal access to sunlight for photosynthesis, sufficient water uptake, and efficient nutrient absorption from the soil as defined by the Net Primary Productivity (NPP). These factors are crucial for the establishment of a sustainable and resilient forest ecosystem.

### III.1.5.3.1 Survival rate based on forest tree density.

*Tree density as a function of mean DBH and latitude.*

The estimation of survival rate is based on the results from Madrigal-González et al. (2023). These authors established the relationship between mean Diameter at Breast Height (DBH) and latitude in determining forests' tree density (Figure 6).

According to this reference, predicted tree density for an area located at latitude 38.2°N, and with a mean tree diameter of 18.8 cm is around 400 trees per hectare. Considering that 50,000 trees and shrubs were planted in the restoration area (31.33 ha), i.e. 1,596 trees per hectare, a survival of 25.1% would lead to the density of 400 trees ha-1, proposed by Madrigal-González et al. (2023).

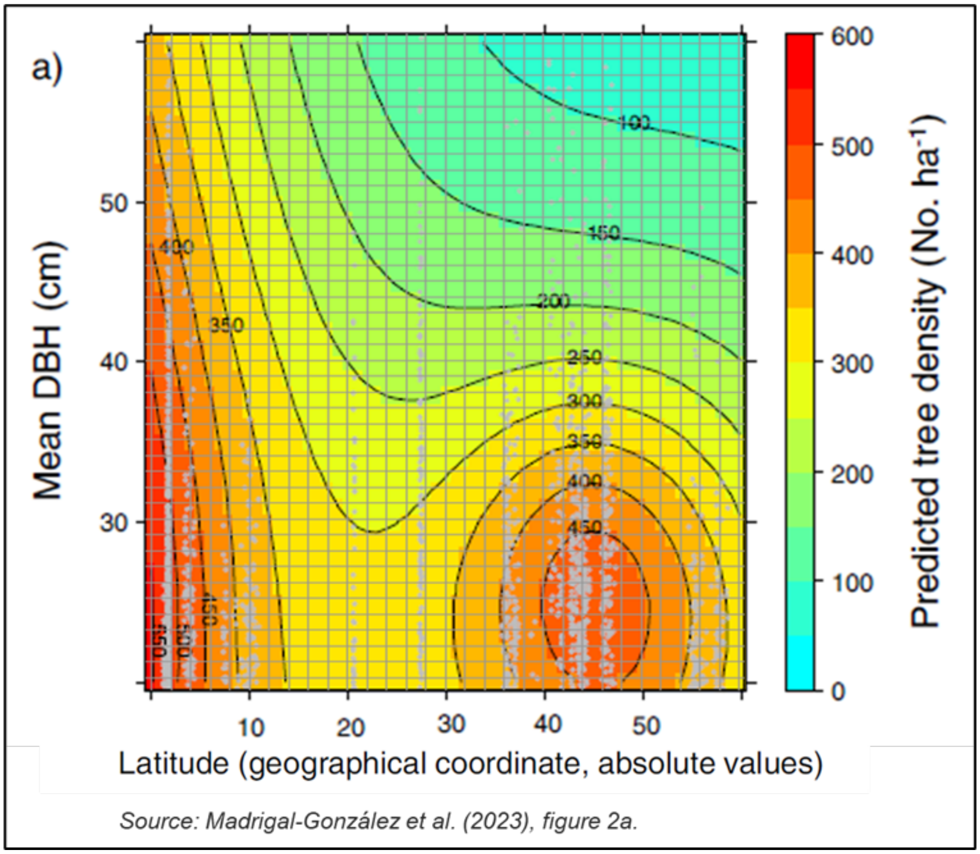



**FIGURE 6 PREDICTED TREE DENSITY AS A FUNCTION OF MEAN DBH AND LATITUDE. SOURCE: MADRIGAL-GONZÁLEZ ET AL. (2023).**

*Tree density according to timber plantation tables.*

Cienciala et al. (2022) provided estimated survival rates considering tree mortality and management interventions across various biogeographic regions and species groups. For Continental Broadleaves, they reported a stand density of 1,579 trees per hectare at year 40 post-plantation. Given the restoration area's initial planting density of 1,596 trees per hectare, a survival rate of 98.9% would achieve the density reported by the authors.

In summary, the project currently has a density of 1,596 trees and shrubs per hectare, resulting in significant initial competition for resources. However, as typical with reforestation projects, the expected mortality will reduce planting density over time. The surviving trees will then have increased access to resources such as water, sunlight, and nutrients, allowing them to continue growing.

Based on the two density references, the project's survival rate at year 40 can be estimated under two scenarios: one with an 25.1% survival rate and the other with a 98.9% survival rate.

#### III.1.5.3.2. Carbon capture in vegetation

The carbon removal potential, calculated using the allometric equations, was adjusted to account for survival/mortality, as follows. Survival scenario 1, calculated from tree density predicted by Madrigal-González et al. (2023), results in survival of 25.1% of planted trees and shrubs. Therefore, 25.1% of the carbon removal potential equals 2,743.32 T $CO_2$-eq over the 40 years of the project. Survival scenario 2, calculated from tree density predicted by Cienciala et al. (2022), results in survival of 98.9% of planted trees and shrubs. Therefore, 98.9% of the carbon removal potential equals 10,813.75 T $CO_2$-eq over the 40 years of the project.

Considering these 2 scenarios, the amount of carbon removals the project can generate attributable to the planted trees and shrubs lies between 2,743.32 and 10,813.75 T $CO_2$-eq. However, it is important to note that this ex-ante estimation excludes carbon removals from vegetation that develops in the project area natural regeneration, triggered by Project activities. As the reforestation matures, it is expected that monitoring campaigns reveal carbon stocks higher than those estimated ex-ante. These estimates were and will continue to be cross-referenced with the maximum carbon removal determined through Net Primary Productivity (NPP), which for this project equals 9,386 T$CO_2$-eq, to ensure adherence to biophysical ecological limits, thus avoiding overestimates.

### III.1.5.4. Carbon Credits

According to the *aOCP Methodology for carbon removal and storage in vegetation V2.0,* this ecological restoration project in La Junquera (Phase II), Murcia (Spain) spanning an area of 31.33 hectares with 50,000 trees and shrubs planted, has the potential to generate between 2,743 and 10,813 Verified Carbon Credits (VCC) from removals. This range considers survival scenarios of 25.1% and 98.9%, as elaborated above. However, the inclusion of carbon capture calculations conducted by the project developers will further refine these estimates and provide a more comprehensive assessment of the project's environmental impact.

The project developer's methodology indicates a carbon capture of 4,633.00 tons over the project's lifetime, with a 50% survival rate by year 40. Applying this survival rate to the initially aOCP-determined carbon capture yields 5,464.80 TCO2-eq. Table 6 presents a summary of the aforementioned considerations.

Therefore, based on the information and considerations outlined above, the estimated carbon capture of this project ranges from 4,633.00 to 5,464.80 TCO2-eq using both the aOCP and the project developer's methodology considering a survival of 50%.

**TABLE 6 ESTIMATED CARBON CAPTURE OF ECOLOGICAL RESTORATION PROJECT AT YEAR 40.**

| | Survival Scenarios | | Carbon Capture ($TCO_2$-eq) | Carbon credits (VCC) |
|---|---|---|---|---|
| aOCP Determined | Total Derived | 100.00% | 10,929.60 | 10,929 |
| | Madrigal-González et al. (2023). | 25.10% | 2,743.33 | 2,743 |
| | Plantation Tables | 98.90% | 10,813.75 | 10,813 |
| | Project Developer expected survival | 50.00% | 5,464.80 | 5,464 |
| Project Developer Determined | Project Developer | 50.00% | 4,633.00 | 4,633 |
| | Project Developer | 100.00% | 9,266.00 | 9,266 |

## IV. MORTALITY RATES (PROJECT VISIT: SEPTEMBER 25-26, 2024)

The ecological restoration project "*Creating Green Fences and Increasing Biodiversity at La Junquera Farm, Murcia (Spain)"* took place between 2021 and 2024 at La Junquera farm, an area characterized by arid Mediterranean conditions with continental climatic influences due to its altitude. With an average annual rainfall of 380 mm and an average temperature of 15°C, the region presents significant environmental challenges. The soils, degraded by past intensive agriculture, are undergoing restoration through soil conservation practices and a transition to ecological almond farming. Additional measures, such as the creation of ponds and swales, have been implemented to enhance water availability.

The reforestation effort, led by Life Terra, prioritized native and resilient species, planting in both small plots and linear formations surrounding agricultural fields. Some areas were enriched with a broader range of plant species to boost biodiversity. Given the harsh environmental conditions, a high mortality rate of approximately 50% was anticipated, leading to a decision to plant at a higher density than standard for similar plots. Irrigation was provided by local workers and volunteers during the initial phase and throughout the summer months. However, during a field visit on September 25–26, 2024, Life Terra's project manager and the ASES team identified some unexpected irregularities.

Despite irrigation efforts, 2024 proved to be one of the driest years on record, resulting in significant plant mortality, estimated at 35–40%.

Moving forward, several corrective and preventative measures have been implemented:

1. Annual irrigation will be provided during the driest months.
2. Future years are not expected to be as dry as 2024.
3. Revenue from carbon credits will be shared with the landowner to support ongoing maintenance.
4. The originally projected 50% mortality rate remains within acceptable limits.
5. Replanting will occur in phases—up to 10% in Year 2 and up to 5% in Year 3.
6. The issues with livestock access and machinery have been identified and corrected.
7. All incidents were transparently communicated to the certifier and landowner.

Given these mitigation strategies, the project remains eligible for issuing carbon removal and biodiversity credits, and no further increases in mortality rates are anticipated that would impact its alignment with certification requirements. A conservative estimate of 60% survival is assumed for credit calculation following replanting in Year 2 and 3 of the project. Table 7 provides the revised carbon calculations based on findings from the field visit.

**TABLE 7 ESTIMATED CARBON CAPTURE OF ECOLOGICAL RESTORATION PROJECT AT YEAR 40 FOLLOWING SEPTEMBER 2024 FIELD VISIT**

| | Survival Scenarios | | Carbon Capture ($TCO_2$-eq) | Carbon credits (VCC) |
|---|---|---|---|---|
| aOCP Determined Pre-Visit | Total Derived | 100.00% | 10,929.60 | 10,929 |
| | Project Developer expected survival (using aOCP methodology) | 50.00% | 5,464.80 | 5,464 |
| Project Developer Determined Pre-Visit | Project Developer | 50.00% | 4,633.00 | 4,633 |
| | Project Developer | 100.00% | 9,266.00 | 9,266 |
| **Updated Credits Post-Project Visit** | Updated aOCP Derived | 60.00% | 6,557.76 | 6,557 |
| | Updated Project Developer | 60.00% | 5,559.60 | 5,559 |

Derived from the survival scenarios presented above, a **conservative approach** will be maintained for the allocation of carbon credits. This means that VCC will be awarded based on 60% of the survival rate estimated by the project developer after the project site visit (5,559 VCC).

It is important to note that carbon credits will be calculated annually in the dynamic baseline. This baseline will be adjusted based on the results of audits, monitoring, and the action plan implemented by the project developer.

35% of the credits generated by the project will be withdrawn for the buffer pool as a measure to guarantee the permanence of the project benefits (1,946 VCC), resulting in a total of **3,613 Verified Carbon Credits** to be issued according to the Contingency Table (Table 8).

**TABLE 8. CONTINGENCY TABLE**

| Description | Percentage of VCCs issued on each year (%) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | After project implementation | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 | 2032 | 2033 | 2034 | 2035 | 2036 |
| Percentage of VCCs issued on each year (%) | 34% | 10% | 10% | 10% | 6% | 5% | 5% | 5% | 5% | 5% | 5% | **100%** |
| Number of VCCs issued each year | 1,229 | 361 | 361 | 361 | 217 | 181 | 181 | 181 | 181 | 181 | 181 | **3,613** |

## V. RELEVANT SUSTAINABLE DEVELOPMENT GOALS

The 17 Sustainable Development Goals (SDGs), established by the United Nations in 2015, are essential in guiding restoration projects toward meaningful and enduring outcomes by addressing the interconnected nature of global challenges such as biodiversity loss, climate change, poverty, and social inequalities (https://sdgs.un.org/goals). Acting as a comprehensive framework, the SDGs enable project activities and their associated restoration and conservation efforts to align environmental, social, and economic objectives, ensuring that projects contribute not only to ecological recovery but also to broader sustainable development. By embedding these principles into restoration efforts, projects contribute not only to ecological recovery but also to the broader pursuit of sustainable development envisioned by the UN. Project initiatives can foster ecosystem resilience, support climate adaptation, enhance community livelihoods, and promote responsible resource use. This holistic approach acknowledges the intricate linkages between healthy ecosystems and human well-being, emphasizing that environmental restoration is also a pathway to achieving social equity and economic stability.

Moreover, aligning restoration projects with specific SDGs facilitates measurable progress, enhances accountability, and ensures the initiatives' relevance within a global context. It also opens pathways to partnerships with stakeholders who share a commitment to these goals, from local communities and governments to international organizations and private entities. By adopting this approach, restoration projects can amplify their impact, making meaningful contributions to global sustainability targets. The following table (Table 8) highlights the SDGs most relevant to the project initiatives, illustrating how each goal serves as a guiding principle in shaping the strategies and ensuring the long-term success of the project.

TABLE 9 SUSTAINABLE DEVELOPMENT GOALS APPLICABLE TO THE PROJECT

| SDG # | Goal | Positive Benefits / Indicator |
|---|---|---|
| 4 QUALITY EDUCATION | ***Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all*** | Education for sustainable development and global citizenship – Camp Altiplano, located at the site of the plantation, is responsible for planting with volunteers and schools, while providing a space for environmental education. The planting was done strictly through this organization. |
| 12 RESPONSIBLE CONSUMPTION AND PRODUCTION | ***Ensure sustainable consumption and production patterns*** | Sustainable Management and use of natural resources - Life Terra engages in the compromise of sustainable management and use of natural resources through good practices reflected in the Collaboration Agreement between the foundation and the landowners. |
| 13 CLIMATE ACTION | ***Take urgent action to combat climate change and its impacts*** | Enhances carbon sequestration through biomass generation and tree planting. It promotes ecological restoration, which helps enhance ecosystem resilience against climate change impacts like desertification and extreme weather events. |
| 15 LIFE ON LAND | ***Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss*** | The reforestation effort restores degraded landscapes by planting 17,461 trees of 21 native species, supporting biodiversity and improving ecosystem functions. The project enhances soil quality, water infiltration, and overall forest health, ensuring long-term sustainability and habitat restoration. |
| 17 PARTNERSHIPS FOR THE GOALS | ***Strengthen the means of implementation and revitalize the global partnership for sustainable development*** | Knowledge sharing and cooperation for access to science, technology and innovation - Life Terra's transparent action-taking enhances the possibility of third parties to access our methodologies and learn from our process. Target 17.16.: Enhance the global partnership for sustainable development - Key in Life Terra's mission, as our information and strategies are shared with our partners in several countries around the world. |

This project showcases a nature-based solution to environmental degradation, demonstrating how targeted reforestation can drive climate resilience, biodiversity restoration, and sustainable land use. By sequestering carbon and improving local ecosystems, it supports global sustainability efforts while delivering long-term ecological and community benefits.

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