ASES ON-CHAIN PROTOCOL

BASELINE REPORT

Verified Carbon Credits (VCC)

Forest 4Future

LT-002-LEN-052023 LENTILLERES, ARDECHE

Life Terra (Foundation)

Type B Project

January 10, 2025

www.nat5.bio

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EXECUTIVE SUMMARY

The baseline report for plantation projects is an essential undertaking for their certification process. This step is vital as it lays the groundwork for determining the initial metrics of biomass production and subsequent carbon sequestration in each project. The report will encompass the computation of NDVI and biomass indices, both derived through a specific methodology utilizing satellite imagery and high-resolution ortho-mosaics.

The ecological restoration of a previously deforested area in Lentillères, Ardèche, France entailed planting of a total of 1,078 trees of thirty distinct species. These tree species were chosen as they are mainly native to the region, and therefore adapted to the unique environmental conditions of the project area. The primary objective of this initiative was to enhance biodiversity, improve soil quality, and increase water infiltration. The project area covers 0.29 hectares.

The high-density technique was employed, providing numerous benefits such as improved yield and efficient resource utilization. The average planting density within the plot was one tree per 2.69 square meters, equivalent to an average of 3,717 trees per hectare in the plot.

The total CO_2 capture for the project area was calculated to be between 38.19 and 241.09 TCO_2-eq considering survival scenarios of 6.73% and 42.48% respectively at the end of the 40 years of the project's lifetime. These figures underscore the project's potential contribution to carbon sequestration and overall environmental restoration. The successful reforestation endeavor in Lentillères will demonstrate the positive impact of 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 Forest 4Future initiative, sponsored by Life Terra, is classified as a Forest Management project under the Ases on-chain protocol (aOCP). Located in Lentillères, Ardèche, France in an area that was once densely forested (Figure 1), the project began its first phase in April 2023. This phase involved the planting of trees of 30 different species of trees and undertaking soil restoration to reduce erosion and prevent further degradation.

A project location map is illustrated in Figure 1. Table 1 shows the coordinates of the reforested Plot.

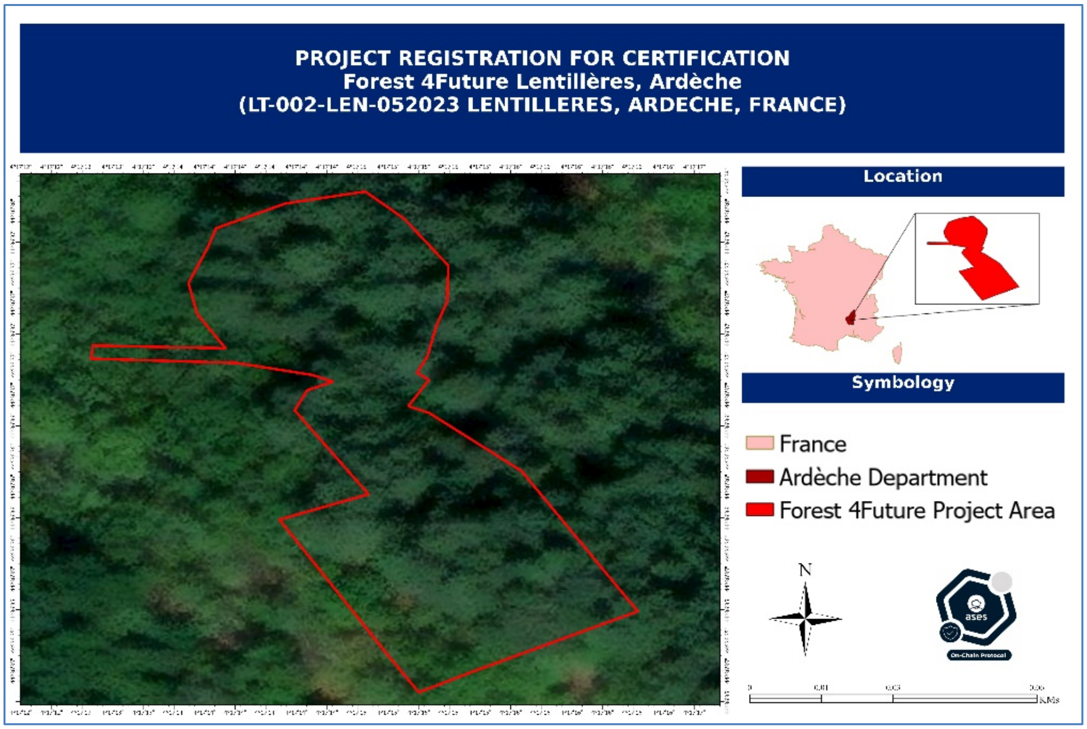
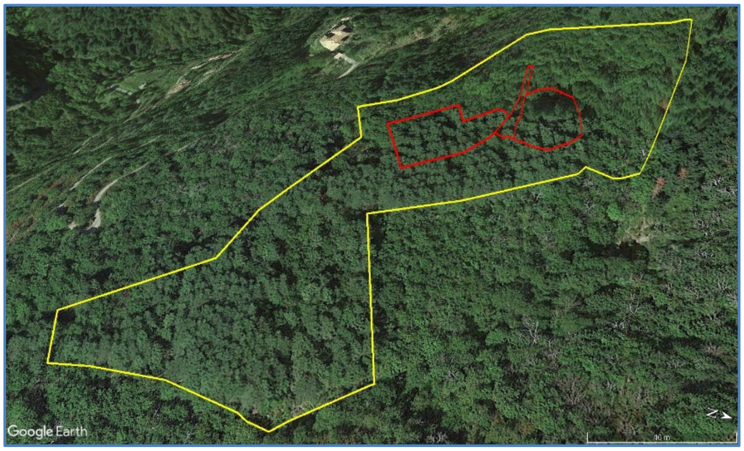


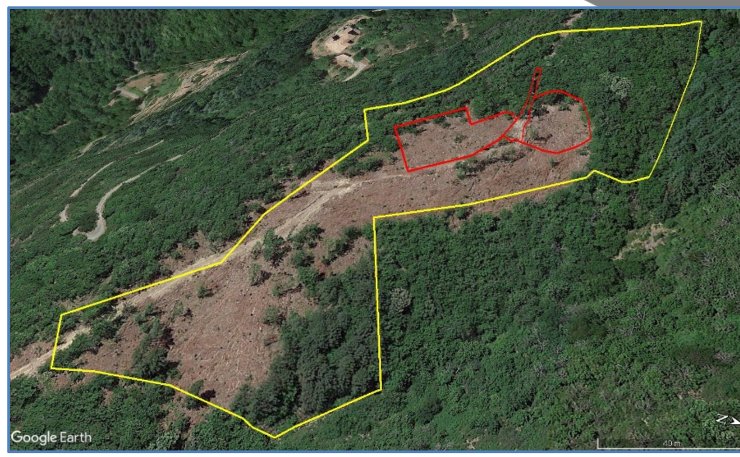
FIGURE 1. PROJECT LOCATION

TABLE 1. COORDINATES OF PROJECT PLOT

Plot	Coordinates	
1	**Latitude**	**Longitude**
	44.610154	4.287403

The project was incorporated into the aOCP as a biodiversity restoration project due to significant vegetation and biodiversity loss caused by ground clearing and deforestation between November 2021 and January 2022. In Phase 1, 1,078 trees were planted across 0.29 hectares, with another 2.21 hectares set aside as a preserved zone (Figure 2). This preserved area will be the focus for Phase II of the restoration. Google Earth images in Figure 2 show the extensive loss of vegetation resulting from the clearing activities.





August 2018 | June 2022

FIGURE 2. GOOGLE EARTH IMAGES SHOWING CHANGES IN THE PROJECT AREA (RED LINE) AND PRESERVED AREA (YELLOW LINE) BETWEEN 2018 AND 2022 (PRE- AND POST-DEFORESTATION).

I.2. ADMINISTRATIVE SPECIFICATIONS

This section introduces the project developer and provides a clear understanding of the roles and responsibilities assigned to each party involved. It also addresses the status of landownership, ensuring transparency and certainty regarding the agreements made with the landowners.

I.2.1. PROJECT DEVELOPER

Key project	LT-002-LEN-052023 LENTILLERES, ARDECHE
Project nanme	Ecological Restoration in Lentillères, Ardèche (France)
Company	Life Terra
Person responsible	Sven Kallen

I.2.2. TYPE OF PROJECT

Project registration year	2023
Project duration	40 years
Issuance of credits	Annual
Methodology applied	Update Baseline Report in 2025 with *aOCP Methodology for estimating carbon removal capacity of projects V2.0*[1]

[1] https://www.nat5.bio/wp-content/uploads/2024/03/aOCP-Methodology-for-estimating-the-carbon-removal-capacity-of-projects-V2.0.pdf

Type	☒ Forest management ☐ Regenerative agriculture ☐ Silvopastoral management ☐ Individual tree-based climate action / urban forest ☐ Water flow restoration ☐ Biochar

I.2.3. VNPCs THE PROJECT IS APPLYING TO

Type of VNPCs the project is applying for	☒ Carbon Removals (VCRM) ☐ Carbon Removals (VCRD) ☐ Biodiversity Based Credit (VBBC) ☐ Water Credits (VWC) ☐ Soil Credits (VSC) ☐ Climate action bond

II. PROJECT AREA BASELINE

According to the mapping information from the CORINE Land Cover (CLC) of France, the project area is in a broadleaf forest, represented by vegetation formation composed mainly of trees, including shrubs and bush understory. Prior to project implementation, the area suffered degradation due to exploitative tree logging, specifically impacting the *Pseudotsuga menziess* population. To further ascertain the project's potential contributions to biodiversity, a survey was conducted to count and identify the plant species present around the project area. This will be further elaborated in the biodiversity section of the baseline 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. It provides information on the quantity and quality of vegetation in a given area. It varies from -1 to +1, where values closer to +1 indicate dense and healthy vegetation, while values close to -1 suggest a lack of vegetation or presence of artificial surfaces.

The calculation of NDVI was performed using Sentinel-2 satellite images in the Google Earth Engine platform. Images with less than 20% cloud cover were selected for each month. Additionally, random control points were created within the reforestation area and the monthly NDVI and rainfall value at each point were extracted. Google Colab was then used to generate a box plot showing the distribution of NDVI values at the control points. The assessment focused on the average monthly NDVI time series spanning from January 2019 to December 2024. The findings are presented in Figure 3, which covers both pre- and post-project implementation periods. To delineate the initial deforestation and the pre- and post-project implementation periods, it is important to note that deforestation and ground clearing occurred in December 2021 and that the soil restoration and reforestation activities took place between December 2022 and February 2023.

The NDVI analysis (Figure 3) reveals significant trends in vegetation health across the study period, with variations indicating periods of recovery and decline. From January 2019 to late 2021, NDVI values remained relatively high, with most months exceeding 0.8, reflecting stable vegetation health. However, starting in early 2022, there is a marked decline in NDVI values, with a significant drop in the 12-month moving average, reaching a low of 0.459 by December 2022. This decline follows the deforestation and land clearing in December 2021.

From 2023 onwards, following project implementation, there is evidence of gradual recovery. NDVI values begin to stabilize and increase steadily, with the 12-month MA rising from 0.420 in January 2023 to 0.670 by December 2024. This upward trend suggests successful vegetation recovery or restoration efforts, with monthly values in late 2024 approaching pre-2022 levels. Peaks in NDVI during the latter months of 2024, exceeding 0.8, signal a return to healthier vegetation conditions, possibly supported by favorable climatic conditions and/or effective land management interventions. These results highlight both the impacts of environmental stressors and the potential for restoration over time.

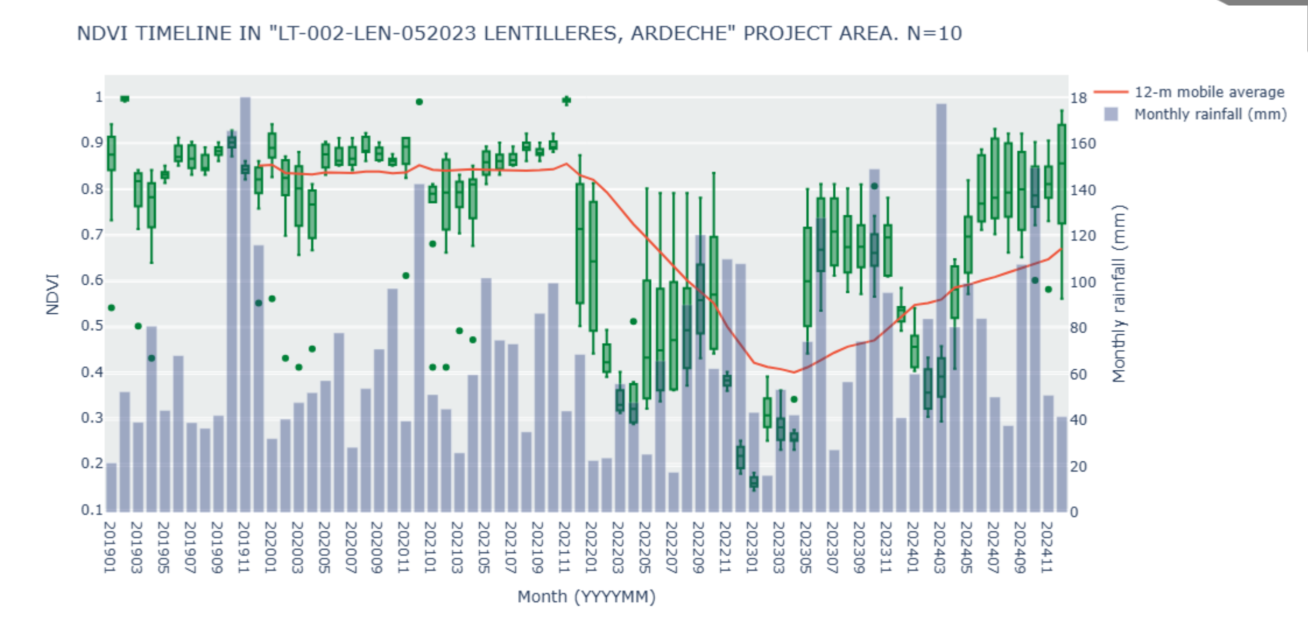


FIGURE 3. NDVI TIME SERIES IN THE AREA OF INTEREST

II.2. IMPACT ON THE LANDSCAPE

This project aims to restore the degraded ecosystem and regenerate vegetation in Lentillères, Ardèche, France. Deforestation in the area led to significant declines in soil health and water infiltration, leaving the land barren. Through reforestation, soil restoration, and subsequent project phases, this initiative is expected to enhance biodiversity and contribute to long-term carbon sequestration. Figure 4 illustrates the geolocated trees planted as part of this effort.

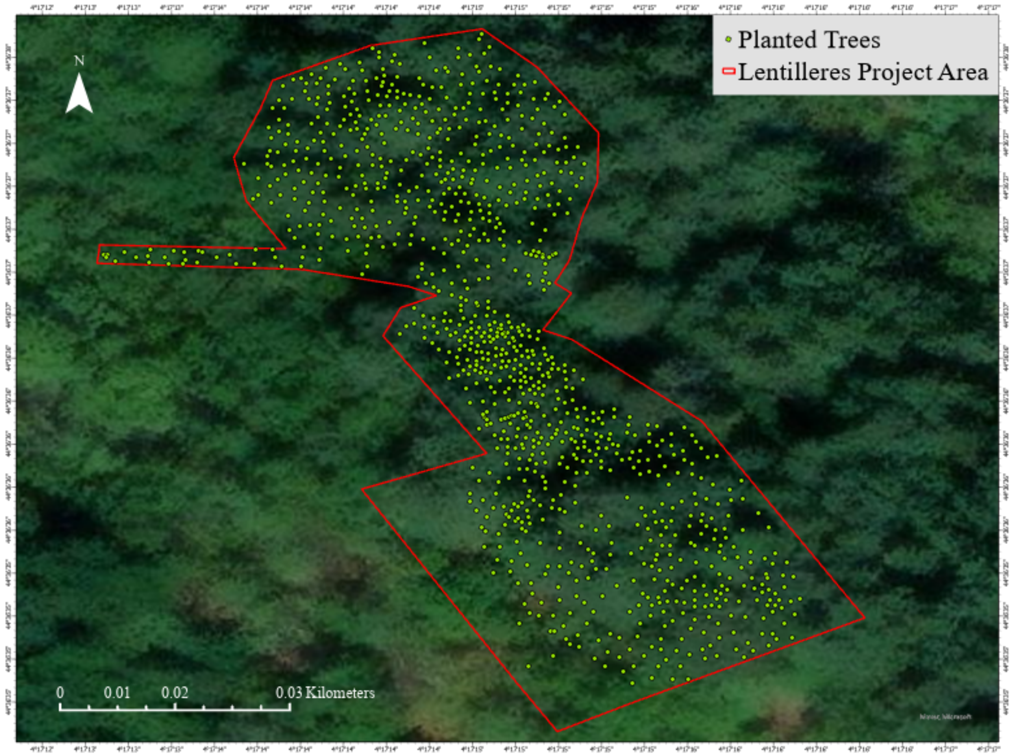


FIGURE 4. GEOLOCATED PLANTED TREES

III. TECHNICAL SPECIFICATIONS

III.1. CARBON REMOVAL

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

III.1.1. REFORESTED AREA

The project encompasses a reforested plot with a total area measuring 0.29 hectares situated in Ardèche, France.

III.1.2. SPECIES

The reforestation project successfully planted a total of 1,078, encompassing six 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, vegetative, 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 (1,078), the percentage by species and origin is presented in Table 2.

TABLE 2. NUMBER AND ORIGIN OF TREES BY SPECIES

Species	Number of trees	Percentage (%)	Origin
Acer campestre	45	4.2	Native
Acer monspessulanum	19	1.8	Native
Cedrus atlantica	15	1.4	Introduced
Cedrus libani	15	1.4	Native
Ceratonia siliqua	78	7.2	Introduced
Corylus colurna	54	5.0	Native
Crataegus monogyna	20	1.9	Native
Cryptomeria japonica	21	1.9	Native
Cupressus sempervirens	19	1.8	Introduced
Ficus carica	80	7.4	Introduced
Fraxinus angustifolia	5	0.5	Native
Fraxinus excelsior	45	4.2	Native
Olea europea arberquina	18	1.7	Native
Olea europea picual	21	1.9	Native
Pinus halepensis	40	3.7	Introduced
Pinus pinea	14	1.3	Introduced
Pistacia lentiscus	50	4.6	Native
Pistacia terebinthus	37	3.4	Native
Prunus mahaleb	23	2.1	Native
Prunus spinosa	15	1.4	Native
Pseudotsuga menziesii	24	2.2	Native
Quercus coccifera	104	9.6	Native
Quercus ilex	95	8.8	Native

Species	Number of trees	Percentage (%)	Origin
Quercus petraea	20	1.9	Native
Quercus suber	64	5.9	Native
Rhamnus lycioides	25	2.3	Introduced
Salix purpurea	34	3.2	Native
Sequoia sempervirens	15	1.4	Native
Sequoiadendron giganteum	20	1.9	Native
Taxus baccata	43	4.0	Native
Total	**1,078**	**100%**	

The assessment revealed an average planting density of one tree per 2.7 square meters, equivalent to an average of 3,717 trees per hectare in the plot. This high density approach could offer 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 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.

It is important to note, however, that high planting densities, such as what was implemented here, may lead to competition for resources among trees, which can 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, therefore, controlling and managing these issues can become more complex in densely planted areas.

Overall, this reforestation 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.

III.1.2.1. Distribution/Origin 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.

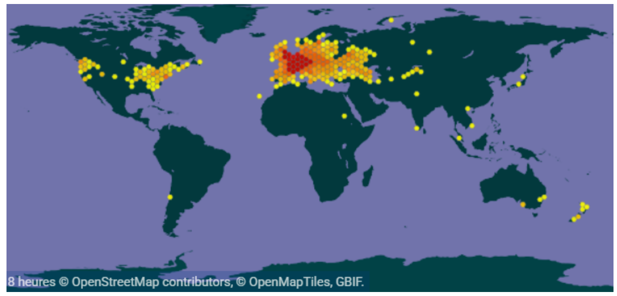
To achieve this, each species was consulted in the Global Biodiversity Information Facility GBIF (https://www.gbif.org). This database allows you to know the species classified as introduced in each country, their EUNIS habitat, their native range, and observation records.

- **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.

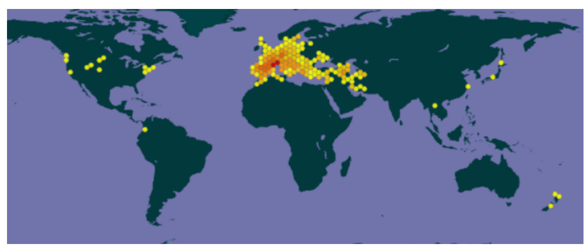
According to the aOCP's eligibility criteria, species classified as invasive alien species cannot be counted towards the project's benefits.

- *Acer campestre*

Recorded as introduced in France	☐ Yes ☒ No
Habitat EUNIS	Not specified
Native range	Not specified

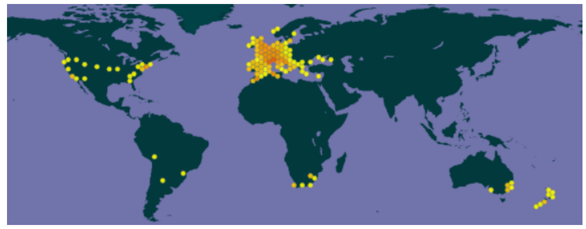
Georeferenced records	

- *Acer monspessulanum*

Recorded as introduced in France	☐ Yes ☒ No
Habitat EUNIS	Not specified
Native range	Africa Europe Eastern Asia
Georeferenced records	

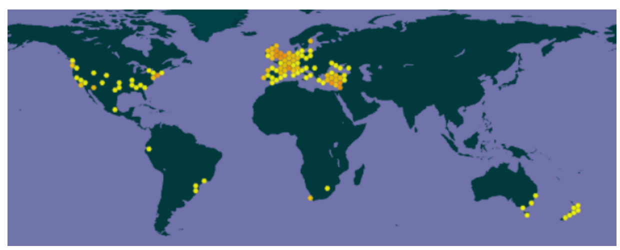
- *Cedrus atlantica*

Recorded as introduced in France	☒ Yes ☐ No
Habitat EUNIS	Marine habitats (A level 1) Woodland and forest habitats and other wooded land (G level 1)
Native range	Europe Northern Africa Southeastern Europe Southern America Southwestern Europe

Georeferenced records	

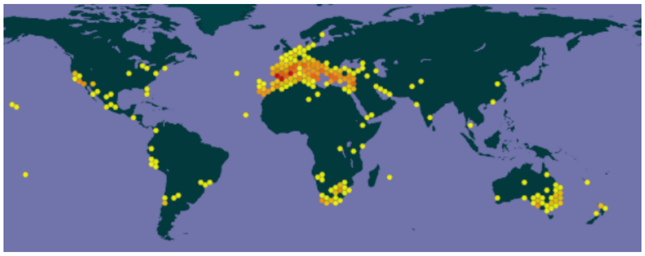
Cedrus atlantica is considered an introduced species in France (https://www.gbif.org/fr/species/148792230/verbatim). No negative impact has been reported from the species, therefore, it will be included in any calculations relevant to this project and is considered *noninvasive.*

- *Cedrus libani*

Recorded as introduced in France	☐ Yes ☒ No
Habitat EUNIS	Buildings of cities, towns and villages (J1 level 2)
Native range	Arabian Peninsula Southwestern Europe Western Asia
Georeferenced records	

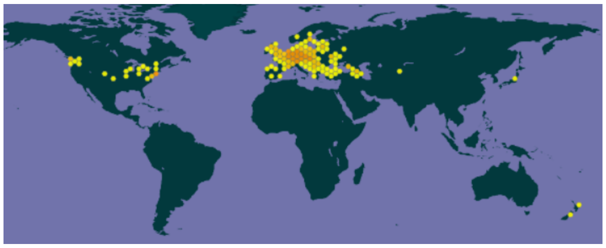
- *Ceratonia siliqua*

Recorded as introduced in France	☒ Yes ☐ No
Habitat EUNIS	Coastal habitats (B level 1) Inland cliffs, rock pavements and outcrops (H3 level 2) Low density buildings (J2 level 2)
Native range	Europe Northern Africa Southeastern Europe Southwestern Europe

Georeferenced records	

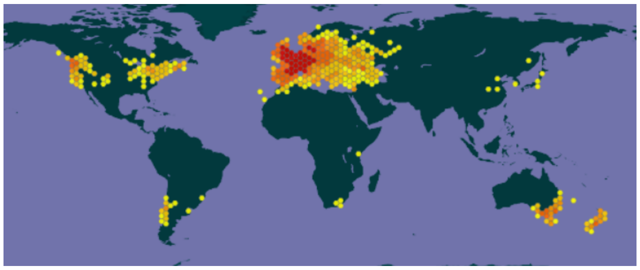
Ceratonia siliqua is considered an introduced species in France (https://www.gbif.org/species/148790435/verbatim). No negative impact has been reported from the species, therefore, it will be included in any calculations relevant to this project and is considered *noninvasive*.

- *Corylus colurna*

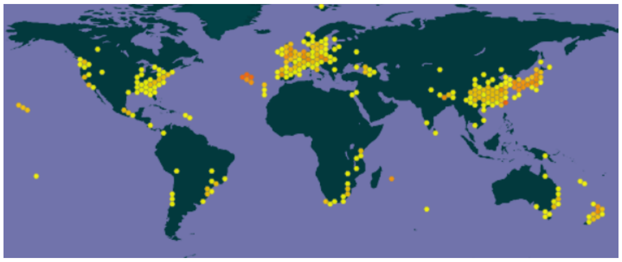
Recorded as introduced in France	☐ Yes ☒ No
Habitat EUNIS	Constructed, industrial and other artificial habitats (J level 1) Woodland and forest habitats and other wooded land (G level 1)
Native range	Africa Asia-Temperate Asia-Tropical Europe Eastern Asia Eastern Europe
Georeferenced records	

- *Crataegus monogyna*

Recorded as introduced in France	☐ Yes ☒ No
Habitat EUNIS	Domestic gardens of villages and urban peripheries (X25 level 2)
Native range	Europe

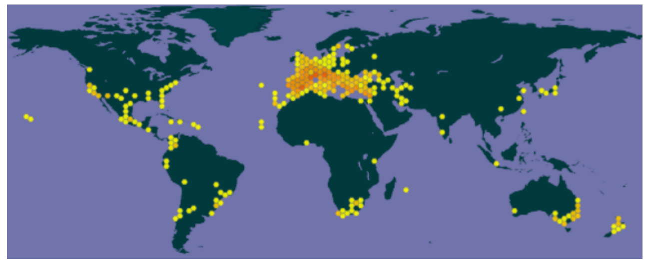
	Northern Africa Southwestern Europe Western Asia
Georeferenced records	

- *Cryptomeria japonica*

Recorded as introduced in France	☐ Yes ☒ No
Habitat EUNIS	Coastal habitats (B level 1) Inland surface water habitats (C level 1) Mire, bog and fen habitats (D level 1)
Native range	China Japan Southwestern Europe
Georeferenced records	

- *Cupressus sempervirens*

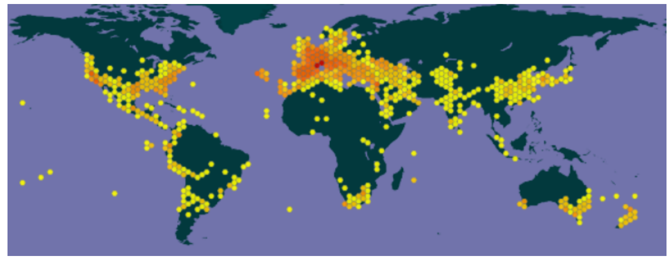
Recorded as introduced in France	☒Yes ☐No
Habitat EUNIS	Buildings of cities, towns and villages (J1 level 2) Coniferous woodland (G3 level 2) Transport networks and other constructed hard-surfaced areas (J4 level 2) Woodland and forest habitats and other wooded land (G level 1)

Native range	Asia-Temperate Europe Northern Africa Southeastern Europe Southwestern Europe
Georeferenced records	

Cupressus sempervirens is considered an introduced species in France (https://www.gbif.org/species/148791008/verbatim). No negative impact has been reported from the species; therefore, it will be included in any calculations relevant to this project and is considered *noninvasive.*

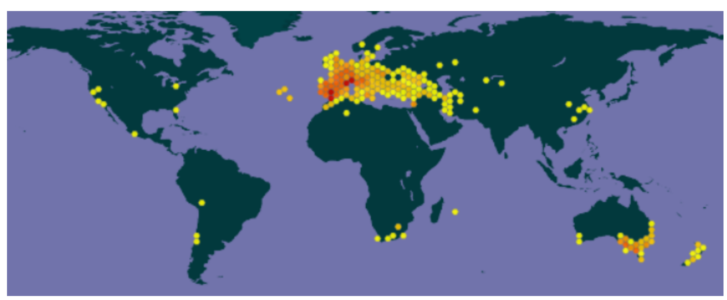
- *Ficus carica*

Recorded as introduced in France	☒Yes ☐No
Habitat EUNIS	Constructed, industrial and other artificial habitats (J level 1) Inland unvegetated or sparsely vegetated habitats (H level 1) Low density buildings (J2 level 2) Regularly or recently cultivated agricultural, horticultural and domestic habitats (I level 1) Thermo-Atlantic xerophytic scrub (F8 level 2)
Native range	Arabian Peninsula Asia-Temperate Asia-Tropical Caucasus Europe Indo-China Malesia Middle Asia Northern Africa Southeastern Europe

	Southwestern Europe Western Asia
Georeferenced records	

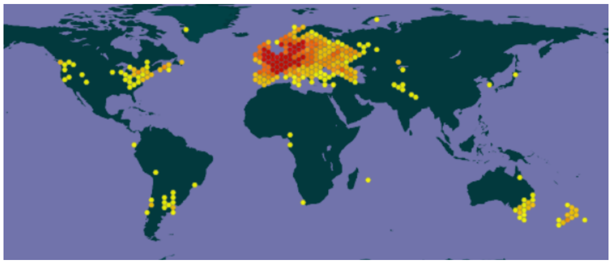
Ficus carica is considered an introduced species in France (https://www.gbif.org/species/148791489/verbatim). No negative impact has been reported from the species; therefore, it will be included in any calculations relevant to this project and is considered *noninvasive.*

- *Fraxinus angustifolia*

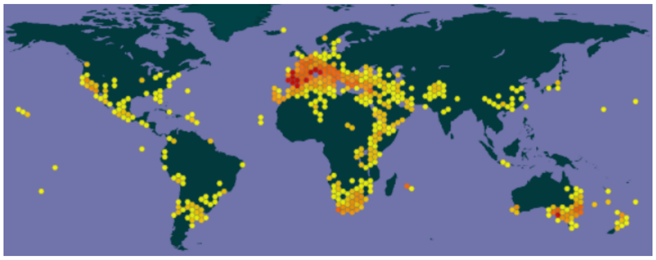
Recorded as introduced in France	☐ Yes ☒ No
Habitat EUNIS	
Native range	Europe Northern Africa Western Asia
Georeferenced records	

- *Fraxinus excelsior*

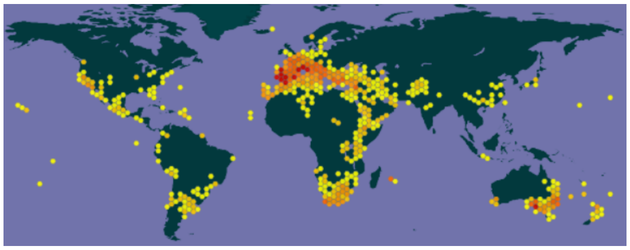
Recorded as introduced in France	☐ Yes ☒ No
Habitat EUNIS	
Native range	Asia-Temperate Europe

Georeferenced records	

- *Olea europaea arberquina*

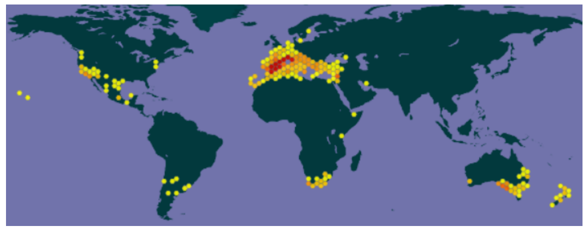
Recorded as introduced in France	☐ Yes ☒ No
Habitat EUNIS	
Native range	Europe Northern Africa
Georeferenced records	

- *Olea europaea picual*

Recorded as introduced in France	☐ Yes ☒ No
Habitat EUNIS	
Native range	Europe Northern Africa
Georeferenced records	

- *Pinus halepensis*

Recorded as introduced in France	☒Yes ☐No

Habitat EUNIS	Coastal habitats (B level 1) Coniferous woodland (G3 level 2) Mixed deciduous and coniferous woodland (G4 level 2)
Native range	Arabian Peninsula Europe Northern Africa Western Asia
Georeferenced records	

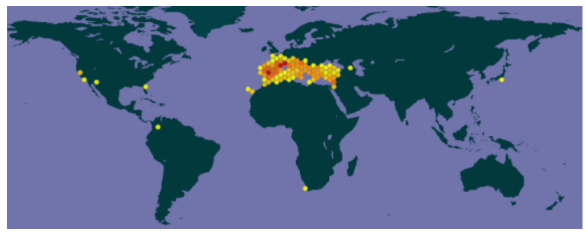
Pinus halepensis is considered an introduced species in France (https://www.gbif.org/species/164745491/verbatim). No negative impact has been reported from the species; therefore, it will be included in any calculations relevant to this project and is considered *noninvasive.*

- *Pinus pinea*

Recorded as introduced in France	☒Yes ☐No
Habitat EUNIS	Coastal habitats (B level 1) Coniferous woodland (G3 level 2) Cultivated areas of gardens and parks (I2 level 2) Marine habitats (A level 1)
Native range	Europe Southeastern Europe Southwestern Europe Western Asia
Georeferenced records	

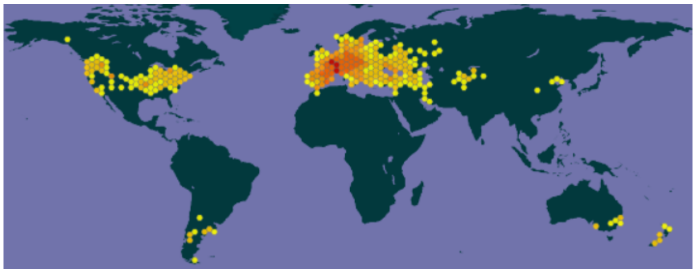
Pinus pinea is considered an introduced species in France (https://www.gbif.org/species/164745488/verbatim). No negative impact has been reported from the species; therefore, it will be included in any calculations relevant to this project and is considered *noninvasive*.

- *Pistacia terebinthus*

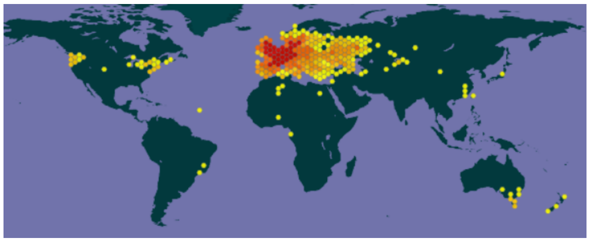
Recorded as introduced in France	☐ Yes ☒ No
Habitat EUNIS	
Native range	
Georeferenced records	

- *Prunus mahaleb*

Recorded as introduced in France	☐ Yes ☒ No
Habitat EUNIS	Broadleaved deciduous woodland (G1 level 2) Coniferous woodland (G3 level 2) Constructed, industrial and other artificial habitats (J level 1) Cultivated areas of gardens and parks (I2 level 2) Mixed deciduous and coniferous woodland (G4 level 2) Woodland and forest habitats and other wooded land (G level 1)
Native range	Europe Middle Europe Southeastern Europe Southwestern Europe Western Asia

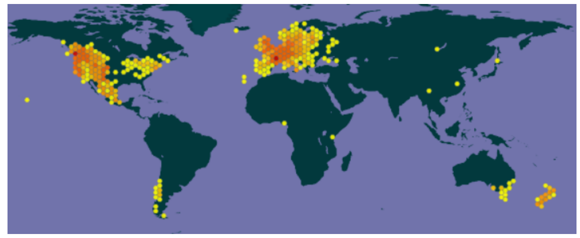
Georeferenced records	

- *Prunus spinosa*

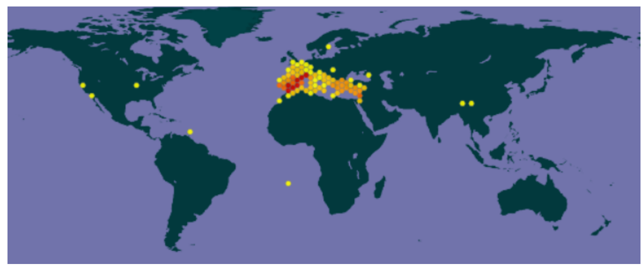
Recorded as introduced in France	☐ Yes ☒ No
Habitat EUNIS	
Native range	
Georeferenced records	

- *Pseudotsuga menziesii*

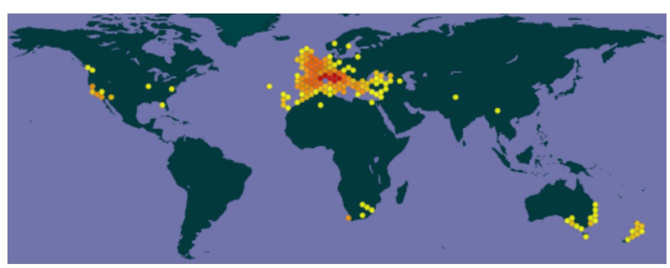
Recorded as introduced in France	☐ Yes ☒ No
Habitat EUNIS	Broadleaved deciduous woodland (G1 level 2) Coniferous woodland (G3 level 2) Constructed, industrial and other artificial habitats (J level 1) Cultivated areas of gardens and parks (I2 level 2) Mixed deciduous and coniferous woodland (G4 level 2) Woodland and forest habitats and other wooded land (G level 1)
Native range	Northern America Northwestern USA Southern America Western Canada

Georeferenced records	

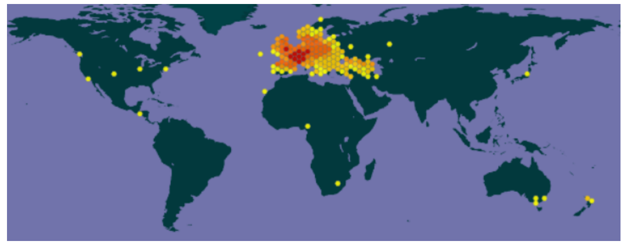
- *Quercus coccifera*

Recorded as introduced in France	☐ Yes ☒ No
Habitat EUNIS	
Native range	
Georeferenced records	

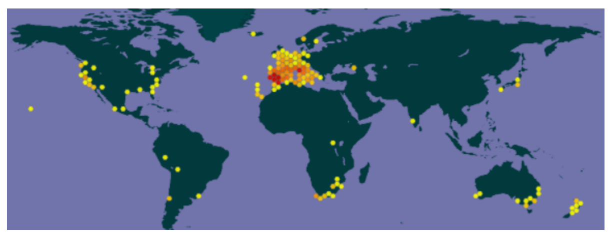
- *Quercus ilex*

Recorded as introduced in France	☐ Yes ☒ No
Habitat EUNIS	Regularly or recently cultivated agricultural, horticultural and domestic habitats (I level 1)
Native range	Europe Southeastern Europe Southwestern Europe Africa Eastern Europe
Georeferenced records	

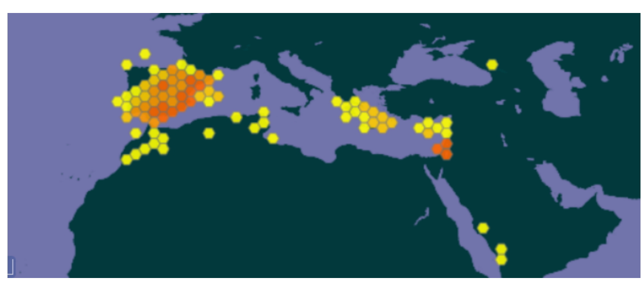
- *Quercus petraea*

Recorded as introduced in France	☐ Yes ☒ No
Habitat EUNIS	
Native range	
Georeferenced records	

- *Quercus suber*

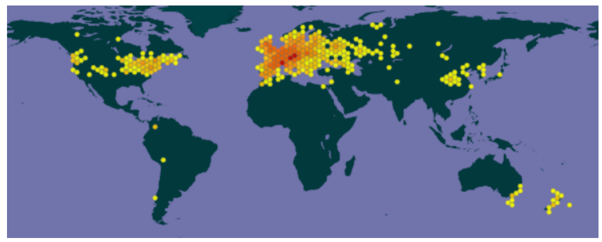
Recorded as introduced in France	☐ Yes ☒ No
Habitat EUNIS	
Native range	
Georeferenced records	

- *Rhamnus lycioides*

Recorded as introduced in France	☒Yes ☐No
Habitat EUNIS	
Native range	
Georeferenced records	

Rhamnus lycioides is considered an introduced species in France (https://www.gbif.org/species/164744703/verbatim). No negative impact has been reported from the species; therefore, it will be included in any calculations relevant to this project and is considered *noninvasive.*

- *Salix purpurea*

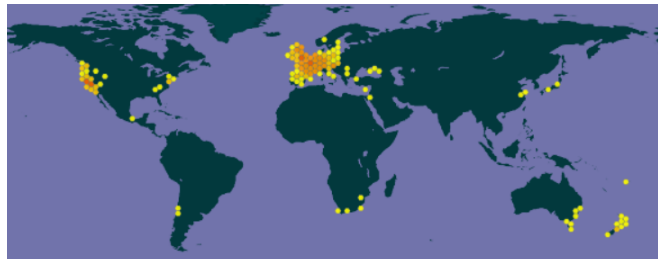
Recorded as introduced in France	☐ Yes ☒ No
Habitat EUNIS	
Native range	
Georeferenced records	

- *Sequoia sempervirens*

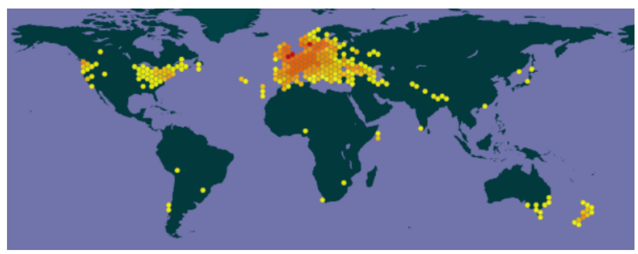
Recorded as introduced in France	☐ Yes ☒ No
Habitat EUNIS	
Native range	Asia-Temperate Middle Europe Northern Europe Northwestern USA
Georeferenced records	

- *Sequoiadendron giganteum*

Recorded as introduced in France	☐ Yes ☒ No
Habitat EUNIS	Inland surface water habitats (C level 1) Surface standing waters (C1 level 2) Woodland and forest habitats and other wooded land (G level 1)

Native range	Northern America Northwestern USA
Georeferenced records	

- *Taxus baccata*

Recorded as introduced in France	☐ Yes ☒ No
Habitat EUNIS	Woodland and forest habitats and other wooded land (G level 1)
Native range	Western Asia
Georeferenced records	

From the 30 implemented plants species, seven species are considered introduced in France, however, no species are considered invasive; therefore, all species can be considered for biodiversity or carbon credit generation for the project.

III.1.3. REFORESTATION TECHNIQUE

Here's the revised version emphasizing the high-density technique:

The reforestation technique implemented is the high-density planting technique. High-density planting is a reforestation method where tree seedlings are planted closer together, promoting competition among trees. This contrasts with wide spacing or moderate-density planting, where seedlings are positioned farther apart to allow for more individual resource access.

The high-density technique encourages trees to grow taller and straighter as they compete for sunlight, leading to a more uniform canopy. This method can enhance carbon sequestration, improve soil stabilization, and accelerate ecosystem recovery by mimicking natural forest regeneration patterns. Additionally, dense planting can help suppress weed growth and reduce soil erosion, creating a more resilient reforested area.

However, the effectiveness of high-density planting depends on factors such as soil fertility, climate conditions, and species selection. Proper management, including thinning when necessary, ensures that trees do not become overly stressed due to competition, ultimately balancing ecosystem health and long-term forest development.

III.1.3.1. Methodological process

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

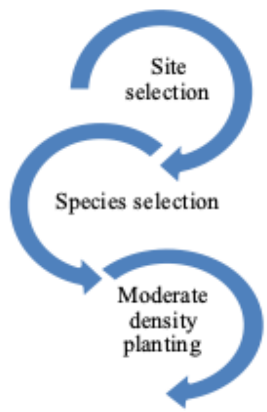


FIGURE 5. METHODOLOGICAL PROCESS

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, reforestation 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. 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. Three approaches are used to arrive at a sound result considering various ecological aspects and data sources:

A. Species-specific allometric equations, survival/mortality defined by tree density according to mean DBH of trees and latitude, according to (Madrigal-González et al., 2023).
B. Species-specific allometric equations, survival/mortality defined by tree density according to regional timber plantation tables,
C. Carbon stocks derived through a machine learning model trained with the Global Forest Aboveground Carbon Stocks and Fluxes from GEDI and icesat-2, a global carbon dataset.

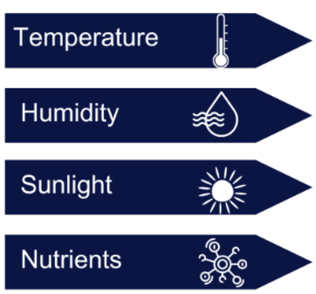
For all three approaches, Net Primary Productivity (NPP) is regarded as the upper limit, representing the maximum achievable carbon sequestration potential based on biophysical considerations.

Using Net Primary Productivity (NPP) as a reference parameter. The amount of CO_2 that can be captured is then estimated with allometric equations considering the age and height of individual species. Subsequently, the estimation of survival rates is derived from tree density projections published in the study by Madrigal-González et al. (2023).

III.1.4.1. 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 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) in either case.

For the calculation of NPP in the Murcia Ecological Restoration project, the Miami methodology outlined in section “IV.1. aOCP Methodology for carbon removal and storage in vegetation” was employed. Present and future NPP were computed to take into consideration ecosystem’s vulnerability to climate change and to define the threshold for carbon sequestration. Both were computed on Google Earth Engine using the resources available in the catalog. Present NPP was calculated for 2022 from 2 data sources: a) precipitation data from the “CHIRPS Daily: Climate Hazards Group Infrared Precipitation with Station Data (Version 2.0 Final)” dataset (Funk et al., 2015) and b) temperature data from the MODIS/Terra Land Surface Temperature/Emissivity Daily L3 Global 1km SIN Grid V061 [Dataset] (Wan et al., 2021). Future NPP was computed using precipitation and temperature data for the year 2062, from the NEX-GDDP-CMIP6 dataset

(Thrasher et al. 2022). This dataset, comprised of global downscaled climate scenarios derived from the General Circulation Model (GCM), runs conducted under the Coupled Model Intercomparison Project Phase 6; the CMIP6 GCM runs were developed in support of the Sixth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC AR6).

This methodology incorporates the following equations to determine NPP:

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

Where:

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

$$NPP_P = 3000(1 - \mathrm{Exp}(-0.000664 * P))$$

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:

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

Where:

Npp_c: Net primary productivity, gc m-2 yr-1

Npp_{dm}: Net primary productivity, gdm m-2 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. 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 (Table 3) indicate that the project area currently has an NPP of 1,436.48 gDM m^{-2} yr^{-1}, which, due to the climatic conditions, will decrease to 1,371.83 gDM m^{-2} yr^{-1} in 2062. This change, of -111.64 gDM m^{-2} yr^{-1}, represents a decrease of -7.77%. In terms of CO_2, **the Project restoration area (0.29 ha) is currently capable of capturing 7,158.56 kgCO_2 yr^{-1} and is expected to capture around 6,602.20 kgCO_2 yr^{-1} by 2062**.

Based on these results, it has been determined that **6.60 TCO_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 264.09 **TCO_2-eq.**

TABLE 3. NPP AND BIOMASS POTENTIAL BY ALL PLOTS WITHIN THE PROJECT SITE.

NPP	Present Real Data	Present CMIP	2062 CIMP	CMIP Change	CMIP % Change	2062 Based On Real Data	Real Data Change
$gDM/m^2/yr$	1436.48	1487.43	1371.83	-115.60	-7.77	1324.84	-111.64
$gCO_2/m^2/yr$	2477.78	2565.67	2366.26	-199.40	-7.77	2285.21	-192.57
$gC/m^2/yr$	675.15	699.09	644.76	-54.33	-7.77	622.67	-52.47
$KgCO_2$/plot/ yr	7158.56	7412.46	6836.37	-576.10	-7.77	6602.20	-556.36

III.1.4.2. 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 4 shows the allometric equations used for each species planted.

TABLE 4. SPECIES-SPECIFIC ALLOMETRIC EQUATIONS

Species	Allometric Equation CO_2 absorbed (Kg)	Reference
Acer campestre	Biomass = (0.5825*(DBH)^1.6178)	Návar, J. 2009. Allometric equations for tree species and carbon stocks for forests of northwestern Mexico. Forest Ecology and Management 257:427-434
Acer monspessulanum	Biomass = (0.5825*(DBH)^1.6178)	Návar, J. 2009. Allometric equations for tree species and carbon stocks for forests of northwestern Mexico. Forest Ecology and Management 257:427-434
Cedrus atlantica	Biomass=0.0072*(DBH)^(3)-0.1118*(DBH)^(2)+0.5714*(DBH)-0.2522	FSI. 2001. Carbon stocks in Indias forest.
Cedrus libani	Biomass=0.0072*(DBH)^(3)-0.1118*(DBH)^(2)+0.5714*(DBH)-0.2522	FSI. 2001. Carbon stocks in Indias forest.
Ceratonia siliqua	Biomass = (0.5825*(DBH)^1.6178)	Návar, J. 2009. Allometric equations for tree species and carbon stocks for forests of northwestern Mexico. Forest Ecology and Management 257:427-434

Species	Allometric Equation CO_2 absorbed (Kg)	Reference
Corylus colurna	Biomass= 0.017*((D10)^2.924)	Li, X., Guo, Q., et al. (2010). "Allometry of Understory Tree Species in a Natural Secondary Forest in Northeast China." Scientia Silvae Sincae 46(8): 22-32
Crataegus monogyna	Biomass = (0.5825*(DBH)^1.6178)	Návar, J. 2009. Allometric equations for tree species and carbon stocks for forests of northwestern Mexico. Forest Ecology and Management 257:427-434
Cryptomeria japonica	Biomass = (0.5825*(DBH)^1.6178)	Návar, J. 2009. Allometric equations for tree species and carbon stocks for forests of northwestern Mexico. Forest Ecology and Management 257:427-434
Cupressus sempervirens	Biomass = (0.5825*(DBH)^1.6178)	Návar, J. 2009. Allometric equations for tree species and carbon stocks for forests of northwestern Mexico. Forest Ecology and Management 257:427-434
Ficus carica	Biomass = (0.5825*(DBH)^1.6178)	Návar, J. 2009. Allometric equations for tree species and carbon stocks for forests of northwestern Mexico. Forest Ecology and Management 257:427-434
Fraxinus angustifolia	Biomass = (0.5825*(DBH)^1.6178)	Návar, J. 2009. Allometric equations for tree species and carbon stocks for forests of northwestern Mexico. Forest Ecology and Management 257:427-434
Fraxinus excelsior	Biomass= 2.213+2.417*(Log10(DBH))	Wang, C. (2006). "Biomass allometric equations for 10 co-occurring tree species in Chinese temperate forests." Forest Ecology and Management 222(1-3): 9-16
Olea europea arberquina	Biomass=0.1892*(DBH)^(2)+0.4478*(DBH)-0.0970	FSI. 2001. Carbon stocks in Indias forest.
Olea europea picual	Biomass=0.1892*(DBH)^(2)+0.4478*(DBH)-0.0970	FSI. 2001. Carbon stocks in Indias forest.
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 energyıas

Species	Allometric Equation CO_2 absorbed (Kg)	Reference
		renovables. Ponencias y Comunicaciones Santiago de Compostela, 115-131.
Pinus pinea	Biomass= 0.1129 DBH2.4241	Montero, G. (2004). Cuantificacion de la biomasa forestal aerea y radical de distintas especies arboreas. Montes y energyıas renovables. Ponencias y Comunicaciones Santiago de Compostela, 115-131.
Pistacia lentiscus	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
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
Prunus mahaleb	Biomass = 0.12 x DBH^ 2.33	Alberti, G., Marelli, A., Piovesana, D., Peressotti, A., Zerbi, G., Gottardo, E., & Bidese, F. (2006). Carbon stocks and productivity in forest plantations (Kyoto forests) in Friuli Venezia Giulia (Italy). Forest@, 3, 488-495.
Prunus spinosa	Biomass=0.0102*((DBH)^(2.5848))	Hung, N.D., Giang, L.T., Tu, D.N., Hung, P.T., Lam, P.T., Khanh, N.T., Thuy, H.M. (2012) Tree allometric equations in Evergreen broadleaf and Bamboo forests in the North East region, Viet Nam, in (Eds) Inoguchi, A., Henry, M. Birigazzi, L. Sola, G. Tree allometric equation development for estimation of forest above-ground biomass in Viet Nam, UN-REDD Programme, Hanoi, Viet Nam.
Pseudotsuga menziessi	Biomass = 0.2883*(DBH)^1.7343	Bourrier, A., Damesin, C., Gauthier, P., Negrón-Juárez,R., Buffo, A., Berbigier, P., & Heinesch, B. (2020).Estimation of carbon dioxide fluxes of Cedruslibani A.Richard stands in south-eastern France. Annals of ForestScience, 77(4),21.https://doi.org/10.1007/s13595-020-00930-4

Species	Allometric Equation CO_2 absorbed (Kg)	Reference
Quercus coccifera	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
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
Quercus petrea	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
Quercus suber	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
Rhamnus lycioides	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
Salix purpurea	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
Sequoia sempervirens	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
Sequoiadendron giganteum	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
Taxus baccata	Biomass= Exp(-0.7152+1.7029)ln DBH	McPherson, E. G., van Doorn, N. S., & Peper, P. J. (2016). Urban tree database and allometric equations (Vol. 253). Albany, CA, USA: US Department of Agriculture, Forest Service, Pacific Southwest Research Station.

Carbon stocks in planted trees and shrubs at year 40 was calculated applying these allometric equations to the tree dimensions expected at age 40. The total carbon storage at year 40 for the 1,078 trees and shrubs is estimated to be 567.54 Tons 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. 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 2.69 square meters per tree, which is much more dense than the targeted reference density.

Planting density can 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. 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 will be crucial to sustaining the health and productivity of the reforested ecosystem over time.

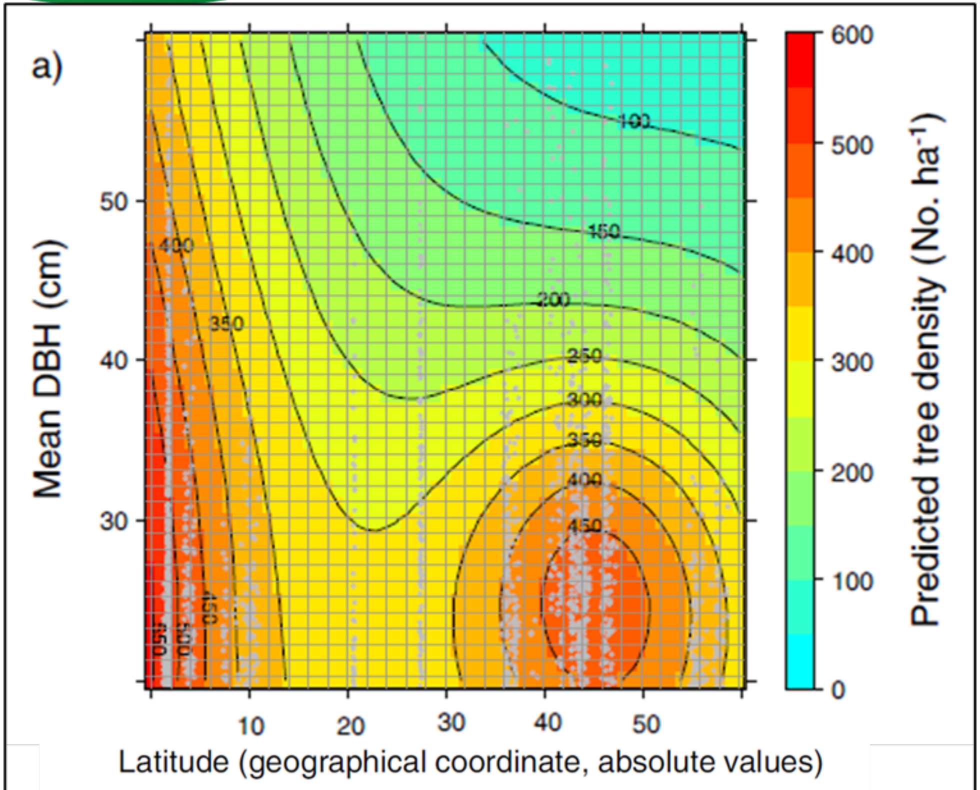
The avoidance of resource competition promotes optimal access to sunlight for photosynthesis, sufficient water uptake, and efficient nutrient absorption from the soil as defined by the Net Primary Productivity (NPP). These factors are crucial for the establishment of a sustainable and resilient forest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

III.1.5.1 Survival rate based on forest tree density.

Tree density as a function of mean DBH and latitude.

One 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 44.6°N, and with a mean tree diameter of 42.75 cm is around 250 trees per hectare. Considering that 1,078 trees and shrubs were planted in the restoration area (0.29 ha), i.e. 3,717 trees per hectare, a survival of 6.73% would lead to the density of 250 trees ha-1, proposed by Madrigal-González et al. (2023).



Source: Madrigal-González et al. (2023), figure 2a.

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) elaborated a list of estimated survival rate due to tree mortality and management interventions by biogeographic regions and species group types. For Continental broadleaves, they report a stand density at year 40 from plantation, of 1,579 trees per hectare. Since the plantation in the restoration area has a density of 3,717 trees ha-1, a survival of 42.48% would lead to the final density reported by the authors.

In conclusion, currently the project has a density of 3,717 trees and shrubs per hectare, which will generate an initial competition for resources. However, due to the expected mortality that occurs in each reforestation project, the planting density will progressively decrease and the trees that manage to adapt and survive will have increasing access to the available resources (water, sunlight, and nutrients), and will be able to continue growing.

Based on the 2 density references, there are 2 scenarios for survival rate of the project at year 40. One, estimates survival at 6.73% and the other at 42.48%.

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 a survival of 6.73% of planted trees and shrubs.

Therefore, 6.73% of the carbon removal potential equals 38.19 T CO_2-eq along the 40 years of the project. Survival scenario 2, calculated from tree density predicted by Cienciala et al. (2022), results in a survival of 42.48% of planted trees and shrubs. Therefore, 42.48% of the carbon removal potential equals 241.09 T CO_2-eq along 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 38.19 and 241.09 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 6.6022 T CO_2-eq, to ensure adherence to biophysical ecological limits, thus avoiding overestimates.

III.1.5.2. Carbon Credits

According to *aOCP Methodology for estimating carbon removal capacity of projects V2.0,* this ecological restoration project in Ardèche, France, spanning an area of 0.29 hectares with 1,078 trees and shrubs planted, has the potential to generate between 38 and 241 Verified Carbon Credits (VCC) from removals. This range considers survival scenarios of 6.73% and 42.48%, 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 developers did not indicate a predicted carbon capture for the project; however, they did state that they expected a 85% survival of the reforested individuals at the completion of the project period. By applying this survival rate to the initially aOCP determined carbon capture, this rate yields 482.41 T CO_2-eq. Table 5 presents a summary of the of the considerations.

TABLE 5. 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%	567.54	567
	Madrigal-González et al. (2023).	6.73%	38.19	38
	Plantation Tables	42.48%	241.09	241
	Project Developer expected survival	85%	482.41	482

To maintain a conservative approach in the allocation of carbon credits, VCCs will be granted based on 85% of the survival rate estimated by the project developer **(482 VCCs).**

As established in section III.1.2. of the *Project Procedures version 2.0*, 20% 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 (96 VCC), resulting in a total of **386 Verified Carbon Credits** to be issued according to the Contingency Table (Table 6).

TABLE 6. CONTINGENCY TABLE

Project Size	Percentage of VCCs issued on each year (%)											
	API	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	Total
Percentage of VCCs issued on each year (%)	38	12	10	5	5	5	5	5	5	5	5	**100**
Number of VCCs issued each year	147	46	39	19	19	19	19	19	19	19	19	**386**

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.

IV. 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 its' 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 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.

SDG #	Goal	Positive Benefits / Indicator
6 CLEAN WATER AND SANITATION	***Ensure availability and sustainable management of water and sanitation for all***	• Increased vegetation helps with **water infiltration**, reducing runoff and enhancing local **water retention**. • Improved soil health ensures better **water regulation and filtration** in the region.
13 CLIMATE ACTION	***Take urgent action to combat climate change and its impacts***	• The project contributes to climate change mitigation by sequestering between **38.19 to 241.09 TCO2-eq** over 40 years. • By restoring degraded land, it helps build resilience against climate-related impacts such as 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 enhances **biodiversity** by planting **30 native species**, supporting habitat restoration. • It improves **soil quality and water infiltration**, fostering healthier ecosystems.

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.

CONSULTED REFERENCES

- Beaulieu, J., et al. (2015). Long-term survival of Quercus cerris in a fragmented landscape in the French Alps. Forest Ecology and Management, 336, 75-85)
- Bontemps, J.D., et al. (2003). Long-term dynamics of Quercus coccifera plantations in southwestern France. Forest Ecology and Management, 177(1): 49-60.
- Bouffier, L., Paillet, Y., & Ourcival, J. M. (2005). Long-term dynamics of a Quercus ilex L. Plantation in France. Forest Ecology and Management, 209(1-3), 231-241. Doi:10.1016/j.foreco.2005.01.039
- Briffa, K.R., Osborn, T.J., Schweingruber, F.H., Jones, P.D., Shiyatov, S.G., Vaganov, E.A. 2003. Reduced sensitivity of recent tree-growth to temperature at high northern latitudes. Nature, 411: 541-544.
- Cienciala, E., Palmero-Barrachina, J., Albert, J., Blažek, P., & Santana, T. (2022). Guidance on biomass estimation at age 40 years since planting. *Technical Annex of the Life Terra foundation*.
- Lecomte, P. Gauquelin, J.B. Bessou, R. Roger, and F. Poumarat. “Long-Term Dynamics of an Acer campestre Plantation in Northeastern France.” Forest Ecology and Management, vol. 220, no. 1-3, 2006, pp. 58–68., doi:10.1016/j.foreco.2006.01.017.
- Climaterra.org. (03 de 09 de 2022). Mini bosques para el cambio climático. Obtenido de climaterra: https://www.climaterra.org/post/mini-bosques-para-el-cambio-clim%C3%a1tico-akira-miyawaki-y-su-m%C3%a9todo
- Genty, P., Huc, R., & Guédon, Y. (2006). Long-term survival of blackthorn (Prunus spinosa L.) Plants in southwestern France. Annals of Forest Science, 63(1), 41-46.
- Lefèvre, M., Chambon, C., & Burdet, H. (2003). Survival of Cercis siliquastrum in France over 40 years. Annals of Forest Science, 60(7), 715-719.
- INRA (2014). Inventaire forestier national - Résultats par région. Https://www.ifn.fr/spip.php?Article163
- Madrigal-González, J., Calatayud, J., Ballesteros-Cánovas, J. A., Escudero, A., Cayuela, L., Marqués, L., ... & Stoffel, M. (2023). Global patterns of tree density are contingent upon local determinants in the world’s natural forests. *Communications Biology*, *6*(1), 47.
- Malle, J.C., Lecomte, J., Dury, J., 2004. Survival of Olea europaea in France over 40 years. Plant & Soil Environment 50, 447–452.
- Nargi, L. (24 de 07 de 2019). Una mejor manera de construir bosques ? Obtenido de Daily jstor: https://daily.jstor.org/the-miyawaki-method-a-better-way-to-build-forests/
- NORTH NORFOLK DISTRICT COUNCIL. (2022). Proyecto Forestal De Miyawaki. Obtenido de NORTH NORFOLK DISTRICT COUNCIL: https://www.north-norfolk.gov.uk/tasks/projects/miyawaki-forest-project/

- Long-term survival of Crataegus monogyna in a temperate climate: a 40-year study in France," by F. Lebourgeois, C. Stahl, P. Cailleret, et al., in Annals of Forest Science, vol. 65, 2008, pp. 1-10.
- Pistacia lent Forest Ecosystems Research Group, INRA, France.
- Source: Planfor, “Prunus mahaleb,” https://www.planfor.fr/arbre/prunus-mahaleb.html.
- Tixier, P., Roussel, J., & Fournier, J. (2000). Conservation of Phyllirea angustifolia (L.) Desv. (Rhamnaceae): A long-term study in the south of France. Biological Conservation, 93(2), 183-189).
- Webber, D. S. (23 de 05 de 2022). El método Miyawaki para crear bosques. Obtenido de creating tomorrows forests: https://www.creatingtomorrowsforests.co.uk/blog/the-miyawaki-method-for-creating-forests.