# Local Project Overview Document (L-POD) - Paulownia in Spain

## *Part of program: Dealin.Green –Paulownia in the European Union*

Country: Spain

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## Authors


Matthijs van Staalduinen, Co-Founder, Dealin.Green

Guillaume de la Ruée, GHG Project Senior Consultant, GD Consulting

Arjen Crul, Strategic knowledge partner, Naturevest

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# 1. Local Project Overview

## 1.1. Local Stakeholders

| | |
|---|---|
| ***Project management location:*** (postal address, including region/country) | KiriFarm Europa GmbH & Co. KG<br>Tönisvorst, Kehn 20, 47918<br>Germany<br><br>WeGrow KiriFarm GmbH<br><br>WeGrow AgriTec S.L.<br>45646 San Román de los Montes (Toledo)<br>Spain<br><br>*Referred in this document as 'WeGrow'* |
| ***Main contact person (Local Project Developer):*** (name, email, company phone number | *Certain details are withheld from this public consultation for data protection and confidentiality reasons and are available to the appointed Validation and Verification Body (VVB) or upon request.* |
| ***Other project stakeholders:*** (list the various stakeholders involved in implementing or monitoring the project) | Annex 1, Local Stakeholder Consultation |

## 1.2. Time and duration of L-POD

| | |
|---|---|
| Date of first plot onboarded | 2025 |
| End project date: | 2065 |
| Already planted area (ha): | 330 |
| Year of first area planted | 2017 |

**Retroactive crediting**

**The approach to retroactive crediting under this program is currently under review and has not yet been finalized. While the Proba Standard allows for retroactive crediting under specific conditions, the exact retroactive crediting period, eligibility criteria, and procedural safeguards applicable to this program will be determined at a later stage, following:**

- **feedback received during the public consultation**
- **further technical assessment**
- **approval through the applicable program governance and Proba review processes.**

**As such, no retroactive crediting period is confirmed or guaranteed at this stage, and no credits will be issued retroactively until the final rules have been formally adopted and publicly disclosed.**

In accordance with the Dealin.Green Retroactive Crediting Procedure (Section 1.6 in the Master Program Overview Document) and the Proba Standard v1.3 (Section 6.2.1), this L-POD applies retroactive crediting for a part of the already established plantations. The first areas under this project were planted in 2017, while the first plots are formally onboarded under the Dealin.Green program in 2025. Following the program rule, retroactive crediting is limited to activities that occurred up to two years prior to the submission of the first monitoring report to the Proba Registry. Accordingly, only verifiable carbon removal activities from the eligible retroactive window—i.e., from 31st October 2023 onwards—will be considered for credit issuance. All earlier planting years remain documented for baseline and performance continuity but are not eligible for retroactive credit issuance.

# 2. Local Applicability and Eligibility

## 2.1. Overview of Local Context

The Spanish context is representative of the Southern European agro-ecological zones defined in the Master POD (Mediterranean North and South). The Local Project Developer (WeGrow) implements the project on former cropland, pastureland, and fallow land in accordance with the inclusion criteria and methodological boundaries described in the Master POD (§1.4 and §2.3).

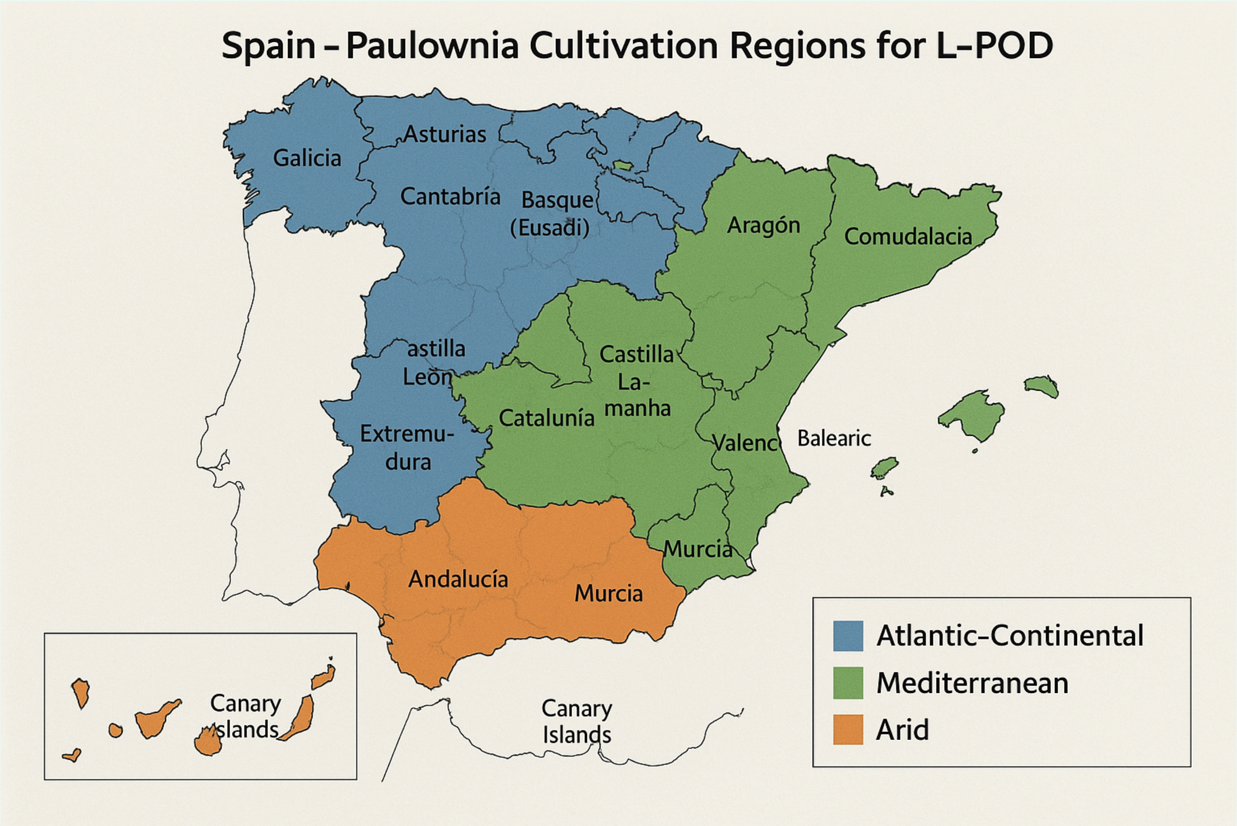
**The L-POD therefore confirms that the Master POD requirements are fully applicable to Spain, with country-specific adaptations described below.**

## 2.2. Geographical Applicability

This L-POD focuses on the country of Spain, which is divided into 50 provinces. These provinces are organized into 17 autonomous communities.
Because of regional differences in climate and agriculture practices, soil, and crop types across the country, baseline emissions used to calculate the carbon yield of the project also vary. To account for these differences, Dealin.Green chose to divide Spain into 3 main regions that share climatic (rainfall, temperature, soil type) and agricultural similarities to ensure a more accurate reflection of the project's impact.
For each main region identified, Dealin.Green provides specific baseline calculations and values to be used based on the plot location. Here are the 3 regions identified:

- Atlantic-Continental Spain

- Mediterranean Spain
- Arid Spain




**Atlantic-Continental Spain**

The combination of the Northern regions (Galicia, Asturias, Cantabria, Basque Country) with the Central-Northern regions (Castilla León, La Rioja, Navarra) creates a unified Atlantic-Continental zone characterized by temperate continental climate influences and adequate natural precipitation. Both sub-regions experience similar winter frost risks that require comparable protection strategies, making frost management the primary cultivation concern rather than water scarcity. The temperature ranges across these areas remain moderate during summer months, creating optimal conditions for steady Paulownia growth without extreme heat stress. Water management strategies align well between these regions, as neither faces critical water limitations that would require intensive irrigation infrastructure. Both areas can rely substantially on natural precipitation patterns influenced by Atlantic weather systems, with only supplemental irrigation needed during occasional dry periods. The soil characteristics are complementary, featuring well-draining compositions that require similar organic matter management and fertilization approaches without the need for major drainage modifications or complex soil amendments.

**Mediterranean Spain**

The Mediterranean Spain combination unites the Central regions (Madrid, Castilla La Mancha) with the Eastern regions (Catalonia, Aragon, Valencia) under a shared Mediterranean climate framework characterized by hot, dry summers and moderate winter conditions. Both sub-regions experience true Mediterranean seasonal patterns with wet winters followed by extended dry periods, creating comparable drought stress conditions that require similar irrigation management strategies.
The temperature profiles across these areas generate similar heat stress challenges during summer months. Water requirements align closely, with both sub-regions requiring moderate to high irrigation infrastructure investments like drip irrigation systems. The timing of water stress periods and irrigation scheduling follows similar patterns, allowing for unified management protocols.
Soil characteristics show compatibility, with both areas featuring calcareous soils that shows similar pH and clay content that demands comparable drainage improvement approaches.

**Arid Spain**

The Arid Spain combination brings together the Western region (Extremadura) and Southern regions (Andalusia, Murcia) based on their shared climatic and water conditions. Both sub-regions face severe water limitations that make irrigation infrastructure not just beneficial but essential for project viability. The extreme heat stress experienced during summer months require similar cultivation protocols.
Water management becomes the defining characteristic of this combined region, with both areas requiring irrigation systems to be in place.
The regulatory environment aligns well, with both sub-regions operating under similar water rights frameworks and drought management regulations. Infrastructure development needs are intensive in both areas, requiring investments in water management systems. The economic models are necessarily high-input approaches with potential for high returns, but both areas face similar risks related to water availability and extreme weather events.

#### 2.2.1. Plot-Level Eligibility

All plots included under this L-POD are geographically located within the boundaries of the three regions defined above (Atlantic-Continental, Mediterranean, or Arid Spain).
The applicable regional baseline scenario and emission factors are assigned based on the geographical position of each plot.
At the time of onboarding, Dealin.Green verified the location of every plot through GPS coordinates and cadastral references to confirm that it falls within an eligible region.
Evidence of this verification, including plot boundaries, coordinates, and land-use classification, is recorded in the Plot Datasheet and stored on the Dealin.Green Insights Platform.

## 2.3. Soil and Climate Applicability[1]

[1] https://www.aemet.es/en/serviciosclimaticos/datosclimatologicos

Summary table:
The implications of the data in this table on the baseline calculations are further described in the chapter Baseline Calculations.

| Combined regions | Atlantic-Continental Spain | | Mediterranean Spain | | Arid Spain | |
|---|---|---|---|---|---|---|
| **Regions** | **Northern** | **Central-Northern** | **Central** | **Eastern** | **Western** | **Southern** |
| **Communities** | Galacia, Asturias, Cantabria, Basque Country | Castilla León, La Rioja, Navarra | Madrid, Castilla La Mancha | Catalonia, Aragon, Valencia | Extremadura | Andalucia, Murcia |
| **Climate** | Atlantic climate with high rainfall | Continental climate with cold winters and warm summers | Continental Mediterranean with hot summers and cold winters | Mediterranean climate with mild winters and hot summers | Continental Mediterranean climate with hot, dry summers | Mediterranean climate with mild winters and very hot summers |
| **Annual rainfall** | 1000 – 1500mm | 400 – 600mm | 300 – 500mm | 400 - 700mm | 400 - 600mm | 300 - 600mm |
| **Temperature average winter/ summer** | W: 9°C<br>S: 18-22°C | W: 2-5°C<br>S: 20-25°C | W: 3-6°C<br>S: 24-30°C | W: 8-10°C<br>S: 23-28°C | W: 7-9°C<br>S: 26-35°C | W: 10-12°C<br>S: 28-40°C |
| **Cultivation challanges** | Potential waterlogging | Frost risks to young trees, irrigation requirements | High irrigation needs, summer heat stress, winter frost risk | Summer drought stress, irrigation needed | Extreme summer heat, irrigation needed | Extreme heat stress, severe water limitations |
| **Dominant soil type %** | Sand: 80<br>Silt: 17<br>Clay: 3[2] | Sand: 40<br>Silt: 30<br>Clay: 30[3] | Sand: 55<br>Silt: 15<br>Clay: 30[4] | Sand: 35<br>Silt: 40<br>Clay: 25[5] | Sand: 65<br>Silt: 25<br>Clay: 10[6] | Sand: 20<br>Silt: 35<br>Clay: 45 |

## 2.4. Former Land Use Eligibility

[2] https://www.frontierspartnerships.org/journals/spanish-journal-of-soil-science/articles/10.3389/sjss.2023.11201/full

[3] chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://forest.jrc.ec.europa.eu/media/filer_public/97/71/97717e48-714a-47c6-b70b-41c397c6f8f4/esp_soil.pdf

[4] https://www.mdpi.com/2077-0472/10/3/66

[5] https://www.gondwanatalks.com/l/catalonia-soils-impressions-wrb-excursion-2023/

[6] https://www.researchgate.net/figure/Geographical-location-of-Extremadura-and-its-soil-profile-description-sites_fig1_345432401

For each plot, the historical (minimum of 5 years) and current use of the land is required, including former land management practices. This can be filled in the Plot datasheet(s), or presented as a table in an annex to this L-POD document with a description for each plot.

### 2.5. Legal and Administrative Eligibility

The Local Project Developer provides evidence that they have legal or statutory tenure rights or ownership of all land/cadastral location(s) where the intervention(s) will occur. This right of tenancy must cover at least the contract duration and the expected duration of the Carbon Credits, or longer. To be filled in the Plot datasheet.
Evidence must be delivered to the Program Developer during onboarding.

## 3. Local Additionality Assessment

See Annex 2 for the assessment.

## 4. Local Project Boundaries

### 4.1. GHG Sources, Sinks, and Reservoirs

Sources, Sinks and Reservoirs are similar to Section 2.2 of the M-POD.

**Exclusion of Below Ground Biomass (BGB)**

As of the start date of the project, the carbon accrual in the Below Ground Biomass (BGB) will not be included as a carbon pool for this L-POD. As the program scales and there is more information available to evaluate risks of non-permanence in the long run, Dealin.Green may re-evaluate the inclusion of the BGB for all plots part of this L-POD. All BGB rules and criteria from the M-POD under Sections 2.2 and 6.3 will apply.

### 4.2. Project Emissions considered

The Project emissions are the emissions related to the project's operations. They are to be calculated per ha, per plot, and per L-POD. Project emissions should follow the conservativeness principle and caution should be exerted to prevent underestimation of these emissions.
Project emissions are to be deducted from the project s' yield.
Standard values to be used for Spain are:

- Electricity, average grid: 0.108 kgCO2e/kWh [7]

[7] Nowtricity: https://www.nowtricity.com/country/spain/ over 2024

- Electricity, guaranteed renewable: 0.00 kgCO2e/kWh
- Diesel B (agriculture): 2.719 kgCO2/liter[8]
- Fertilizer NPK 24-16-16: 3.8 kg $CO_2e$ per kg N (0.92 $tCO_2e$ ÷ 0.24 t N)[9]
- Raw slurry: 0.01 kgN2O per kg N (= 2.73 kgCO2e/kg N)[10]

| Description | Unit | EF, in kgCO2e /unit | Estimated Yearly quantity per ha | Total per ha year (kgCO2e) |
|---|---|---|---|---|
| Example: diesel for tractor | L | 2.719 | 100 | 271.19 |
| Diesel sources | | | | |
| Mowing | liter | 2.719 | | |
| Drainage/tillage | liter | 2.719 | | |
| Transport | liter | 2.719 | | |
| Planting/harvest machinery | liter | 2.719 | | |
| Irrigation machinery | liter | 2.719 | | |
| Soil inputs | | | | |
| Fertilizer NPK 24-16-16 | kg | 2.719 | | |
| Raw slurry | kgN | 2.73 | 75 | 204.75 |
| Electrical sources* | | | | |
| Water pump | kWh | 0.108 | | |
| ... | | | | |

8 https://www.miteco.gob.es/es/cambio-climatico/temas/mitigacion-politicas-y-medidas/calculadoras.html, document: "Calculadora de huella de carbono de organización de alcance 1+2 para explotaciones agrícolas"

9 Calculation done using: https://www.fertilizerseurope.com/wp-content/uploads/2020/01/The-carbon-footprint-of-fertilizer-production_Regional-reference-values.pdf and Carbon footprint analysis of mineral fertilizer production in Europe and other world regions

10 default EF1, IPCC 2006/2019 - https://www.ipcc-nggip.iges.or.jp/public/2019rf/pdf/4_Volume4/19R_V4_Ch11_Soils_N2O_CO2.pdf

* If the plot manager uses certified renewable electricity and the EF 0.00 gCO2/kWh, Dealin.Green will require the proof that renewable electricity is sourced from the provider.

# 5. Local Project Baseline

Considering this L-POD has a national scope, the baseline will follow the regional breakdown described in Section 2.3, under Geographical Applicability. Three regions have been identified based on geographical criteria:

- Atlantic/Continental Spain
- Mediterranean Spain
- Arid Spain

Therefore, three baseline scenarios are presented. For each plot, the LPD must use the baseline scenario of the region where it is located.

| Region | BAU Crops (inc. Citrus) | BAU Trend w/o Trees | BAU vs. Paulownia Plantation |
|---|---|---|---|
| Atlantic | cereals, potatoes, legumes, citrus, cattle (cows) | Crop/pasture decline, mild abandonment, limited urbanization | Much higher carbon storage, erosion/fire risk reduced |
| Mediterranean | wheat, maize, grapes, olives, citrus, almonds, sheep, goats, | Abandonment, scrub/maquis regrowth, intensification in valleys; urban expansion in select zones | Plantation yields higher carbon storage, better resilience to drought, lower fire risk |
| Arid | olives, almonds, grapes, citrus, cotton, sheep, goats | Widespread marginal abandonment, desertification, coastal urbanization | Major carbon gains from tree plantations vs. degraded abandoned land |

It is important to consider that the following:

- Values are conservative central estimates in $tCO_2e \cdot ha^{-1} \cdot yr^{-1}$ (except when stated otherwise, like for SOC values for Fallow land, due to higher variation and uncertainty.
- Positive net balance = emissions (sources).
- Negative net balance = sink

## 5.1. Atlantic/Continental Spain

**Baseline scenario, based on recent trends (5–10 yr)**

Mixed farming dominates: rainfed cereals ((wheat, barley, oats)) and fodder/maize in Castilla-León, intensive dairy and grassland systems in Asturias/Cantabria, vineyards in La Rioja , fruit pockets in Navarra/Galicia, and a strong dairy sector (Asturias, Cantabria, Basque Country). Farm consolidation continues nationally while many small, marginal holdings in uplands lose active management. Regional patterns show measurable farmland abandonment and afforestation in northwest provinces, driven by rural depopulation and a shift away from low-profit crops[11] [12].

**Alternative scenarios**

In many Atlantic uplands the alternative trajectory is natural regrowth or commercial eucalyptus/pine plantation — not continued cropping.

**Cropland (major crops: wheat, barley, maize/forage, potatoes, apples, vineyards)**

- *Short–medium term (5–15 yrs):* Productive valley/irrigated cropland and high-value orchards/vineyards remain in production or intensify (yield and mechanisation gains). Marginal cereal parcels continue to be abandoned or leased to larger farms. Where abandonment occurs, natural succession proceeds quickly (bramble/shrub → pioneer trees → pine/eucalyptus in some areas)[13].
- *Persisting N-fertilizer use* on cereals and maize; little acreage expansion of irrigated tree crops compared with Mediterranean regions[14].
- *Drivers:* low cereal margins, ageing farmer population, local industrial demand for pulp/timber (in Galicia) and economies of scale favouring consolidation.

**Pastures / grazing**

[11] https://www.ine.es/dyngs/Prensa/en/EEEA2023.htm?

[12] https://www.researchgate.net/publication/383569128_Farmland_Abandonment_and_Afforestation-Socioeconomic_and_Biophysical_Patterns_of_Land_Use_Change_at_the_Municipal_Level_in_Galicia_Northwest_Spain?

[13] https://www.researchgate.net/publication/383569128_Farmland_Abandonment_and_Afforestation-Socioeconomic_and_Biophysical_Patterns_of_Land_Use_Change_at_the_Municipal_Level_in_Galicia_Northwest_Spain?

[14] https://www.cocampo.com/es/es/noticias/wp-content/uploads/2024/11/Report-2023-Cocampo-Crops-evolution-in-Spain.pdf?

- *BAU:* Dairy and permanent grasslands in Atlantic provinces continue but with structural pressure (economic margins, consolidation). Upland communal pastures out of agricultural use will trend toward woody encroachment.
- *Emergent landscape:* semi-natural grassland where maintained; otherwise shrub encroachment with eventual woodland pockets.

**Fallow / abandoned agricultural land**
*BAU:* Rapid afforestation/plantation establishment (private eucalyptus or pine) or spontaneous woodland regeneration, especially where markets (pulp/paper) or planting incentives exist. These transitions can sequester biomass carbon that will be short-lived (pulp) but often form low-diversity plantations and raise wildfire/ecosystem concerns[15] [16].

**Baseline emissions**

Selected Emission factors:
Cropland — top ~10 crops (regional mix; cereals, maize/forage, potatoes, apples, vineyards, sugar beet locally, oilseed, vegetables)

- **Main sources:** $N_2O$ from synthetic fertilizer application (cereals/maize), $CO_2$ from tillage and fuel use, $CO_2$ from soil organic matter depletion where intensive tillage is practiced.
- **Potential sinks:** increased soil organic carbon (SOC) via cover crops, no-till and residue retention, agroforestry in marginal lands (vineyard hedgerows)[17].

Pastures / grazing

- **Main sources:** $CH_4$ from enteric fermentation (dairy cattle, sheep), manure $N_2O$, and methane from wetter organic soils in some humid zones.
- **Sinks:** well-managed permanent pastures can sequester SOC; restoration of semi-natural grasslands increases carbon stocks and biodiversity[18].

Fallow / abandoned agricultural land

- **Main sources:** episodic $CO_2$/$CH_4$ from burning (if fires occur) and potential pulse emissions during land-use change; reduced management may cause slow loss of cultivated-soil SOC initially but regrowth can become a net sink.

[15] https://www.mdpi.com/2073-445X/11/12/2186
[16] https://www.researchgate.net/publication/383569128_Farmland_Abandonment_and_Afforestation-Socioeconomic_and_Biophysical_Patterns_of_Land_Use_Change_at_the_Municipal_Level_in_Galicia_Northwest_Spain?
[17] https://www.oecd.org/content/dam/oecd/en/publications/reports/2023/06/policies-for-the-future-of-farming-and-food-in-spain_9acda081/a93d26be-en.pdf
[18] https://www.fao.org/statistics/highlights-archive/highlights-detail/agrifood-systems-and-land-related-emissions-%28global--regional-and-country-trends-2001-2021%29/en

- **Sinks:** natural vegetation regrowth (scrub/woodland) can sequester carbon over decades (but with trade-offs for biodiversity and fire risk)[19].

**Cropland**

| | EF per ha /year tCO2e/ha/year | EF chosen (average) | Rationale |
|---|---|---|---|
| Sources[20] | | | |
| Soil | 0.4 - 0.7 | 0.55 | Wet cool climate, modest N2O, slow SOC loss. |
| Tillage (fuel and disturbance) | 0.1 - 0.22 | 0.16 | Diesel use by farm machinery |
| Machinery (fuel and maintenance) | 0.14 - 0.3 | 0.22 | Moderate mechanization vs Spain average |
| Fertilizers (direct + indirect N2O) | 0.76 - 1.1 | 0.93 | Higher N application in cereal dominance. |
| Total Sources | | 1.86 | |
| Sinks[21] | | | |
| AGB crops | n.a. | n.a. | |
| AGB plant residue | n.a. | n.a. | |
| BGB | n.a. | n.a. | |
| SOC | -0.4 - -0.6 | -0.5 | Wet soils enable moderate SOC sequestration. |
| Total Sinks | | 0.15 | |
| GHG balance (net) tCO2e/ha/year | +1.71 | | |

**Pasture land**

| | EF per ha /year tCO2e/ha/year | EF chosen (average) | Rationale |
|---|---|---|---|
| Sources[22] | | | |
| Soil (includes enteric $CH_4$ & manure) | 0.35–0.60 | 0.475 | N2O from grazing N inputs; slower SOC loss. |
| Livestock | 4.5 - 5.6 | 5.05 | Cows. Livestock density ~0.4 to 0.95 LU/ha; main source methane (enteric + manure)[23] |

[19] https://ftp.itacyl.es/Atlas_Agroclimatico/03_ActividadAgraria/Agricultura/CultivosYSuperfNaturales/2017-03-10-ESAWorldCoverConference2017_DavidNafria.pdf
[20] https://www.sciencedirect.com/science/article/pii/S0959378021000984
[21] https://www.sciencedirect.com/science/article/pii/S0959378021000984 and https://di.unfccc.int/ghg_profiles/annexOne/ESP/ESP_ghg_profile.pdf
[22] https://www.sciencedirect.com/science/article/pii/S0959378021000984
[23] https://idf-fundazioa.eus/wp-content/uploads/2022/06/Jebarietal2022.pdf

| | | | |
|---|---|---|---|
| Tillage | n.a. | n.a. | |
| Machinery | 0.08 - 0.18 | 0.13 | Grassland machinery events (mowing, spreading) |
| Fertilizers | 0.47–0.82 | 0.645 | Moderate N fertilisation (primarily manure) |
| Total Sources | | 6.3 | |
| Sinks | | | |
| AGB crops | n.a. | n.a. | |
| AGB plant residue | n.a. | n.a. | |
| BGB (root inputs from grasses) | n.a. | n.a. | |
| SOC | -0.3 - +0.6 | 0.15 | SOC accrual via grass, wet soils |
| Total Sinks | | 0.15 | |
| **GHG balance (net) tCO2e/ha/year** | **+ 6.15** | | |

**Fallow land**

| | EF per ha /year tCO2e/ha/year | EF chosen (average) | Rationale |
|---|---|---|---|
| Sources | | | |
| Soil ((decomposition & small fires) | n.a. | n.a. | |
| Tillage | n.a. | n.a. | |
| Machinery | n.a. | n.a. | |
| Fertilizers | n.a. | n.a. | |
| Total Sources | n.a | n.a | |
| Sinks | | | |
| n.a. | n.a. | n.a. | |
| n.a. | n.a. | n.a. | |
| n.a. | n.a. | n.a. | |
| SOC | 0.1 - 0.6[24] | +0.35 | SOC recovers rapidly after abandonment. |
| Total Sinks | | 0.35 | |
| GHG balance (net) tCO2e/ha/year | -0.15 | | |

## 5.2. Mediterranean Spain

**Baseline scenario**

The Mediterranean macro-zone shows a bifurcation: irrigated coastal/valley zones intensify (citrus, greenhouse vegetables, irrigated almonds/pistachios), while many interior dry cereal lands

[24] https://pubmed.ncbi.nlm.nih.gov/33190903/ and https://www.osti.gov/pages/biblio/1787201

face progressive conversion to permanent tree crops (pistachio, almond) or abandonment. Water stress, rising irrigation costs, and heat extremes are accelerating crop shifts toward drought-tolerant tree crops. Urban and peri-urban soil sealing is also significant around major cities[25] [26].

**Alternative scenarios**

In many interior Mediterranean parcels the most likely BAU is either (a) conversion to drought-tolerant permanent crops (pistachio/almond), or (b) abandonment to shrubland.

**Cropland (major crops: citrus, olive, almond, pistachio, vineyards, horticulture/greenhouse, cereals)**

- *Coastal/irrigated zones:* continued intensive horticulture and citrus under drip irrigation where water is available; incremental intensification (greenhouses, mechanisation). Some peri-urban horticultural plots will be lost to urban expansion/soil sealing[27].
- *Interior drylands:* brisk conversion of marginal cereals to pistachio and almond orchards (economic incentive + drought tolerance). Where conversion is not economical, abandonment to low-productivity shrubland is likely. Pistachio expansion in Castilla-La Mancha is a major, ongoing trend[28].

**Pastures / grazing**

- *BAU:* Shrinking grazing area in intensifying zones; continued extensive sheep systems in less favoured lands but with risk of reduced stocking and gradual extensification/abandonment. Where grazing declines, early-successional shrubland is the common outcome.

**Fallow / abandoned agricultural land**

- *BAU:* Transition to Mediterranean maquis/shrubland and, over decades in favourable microsites, to low-density oak/pine woodland. These land covers store some carbon but typically much less than managed plantations designed for durable carbon removal, and they increase landscape fire hazard where accumulation of dry biomass is unmanaged [29] [30].

**Baseline emissions**

**Cropland**

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[25] https://www.mdpi.com/2073-4441/16/17/2484?
[26] https://www.ine.es/dyngs/Prensa/en/EEEA2023.htm?
[27] https://www.mdpi.com/2072-4292/12/7/1131?
[28] https://phys.org/news/2024-10-droughts-spanish-boom-pistachio-farming.html?
[29] https://environment.ec.europa.eu/news/abandoned-agriculture-valencia-region-spain-transition-woodland-and-scrubland-over-50-year-period-2022-10-05_en?
[30] https://www.mdpi.com/2073-4441/16/17/2484?

| | EF per ha /year tCO2e/ha/year | EF chosen (average) | Rationale |
|---|---|---|---|
| **Sources**[31] | | | |
| Soil | 0.45–0.8 | 0.625 | Higher N2O due to fertilizer, moderate SOC loss. |
| Tillage | 0.13–0.25 | 0.19 | More tillage, crop rotations, higher fuel use. |
| Machinery | 0.15–0.34 | 0.24 | Moderate mechanization. |
| Fertilizers | 0.80–1.3 | 1.05 | Intensive fertilization, more irrigated crops. |
| **Total Sources** | | **2.1** | |
| **Sinks** | | | |
| AGB crops | n.a. | n.a. | |
| AGB plant residue | n.a. | n.a. | |
| BGB | n.a. | n.a. | |
| SOC | -0.15–0.4 | 0.125 | SOC increases with organic inputs and cover / decreases with tillage[32] |
| **Total Sinks** | | **0.125** | |
| | | | |
| **GHG balance (net) tCO2e/ha/year** | **1.975** | | |

**Pastureland**

| | EF per ha /year tCO2e/ha/year | EF chosen (average) | Rationale |
|---|---|---|---|
| **Sources**[33] | | | |
| Soil | 0.38–0.7 | 0.54 | N2O, warmer climate enhances loss. |
| Livestock | 1.2 – 2.0 | 1.6 | Sheep and goats. Lower emissions due to smaller ruminants and more extensive grazing[34]. |
| Tillage | n.a. | n.a. | |
| Machinery | 0.09–0.20 | 0.145 | Mechanization depends on grazing system. |

[31] https://www.sciencedirect.com/science/article/pii/S0959378021000984
[32] https://di.unfccc.int/ghg_profiles/annexOne/ESP/ESP_ghg_profile.pdf
[33] https://www.sciencedirect.com/science/article/pii/S0959378021000984
[34] https://pmc.ncbi.nlm.nih.gov/articles/PMC11640683/

| | | | |
|---|---|---|---|
| Fertilizers | 0.58–0.92 | 0.75 | More N application in improved pastures. |
| **Total Sources** | | **3.03** | |
| **Sinks** | | | |
| AGB crops | n.a. | n.a. | |
| AGB plant residue | n.a. | n.a. | |
| BGB | n.a. | n.a. | |
| SOC | -0.1– +0.4 | +0.15 | SOC accrual possible in well-managed systems[35] |
| **Total Sinks** | | **+0.15** | |
| | | | |
| **GHG balance (net) tCO2e/ha/year** | | **2.88** | |

**Fallow land**

| | **EF per ha /year tCO2e/ha/year** | **EF chosen (average)** | **Rationale** |
|---|---|---|---|
| **Sources** | | | |
| Soil | n.a. | n.a. | |
| Tillage | n.a. | n.a. | |
| Machinery | n.a. | n.a. | |
| Fertilizers | n.a. | n.a. | |
| **Total Sources** | **n.a.** | **n.a.** | |
| **Sinks** | | | |
| AGB crops | n.a. | n.a. | |
| AGB plant residue | n.a. | n.a. | |
| BGB | n.a. | n.a. | |
| SOC | -0.1 - +0.5 | +0.2 | SOC recovery possible, slower than Atlantic region.[36] |
| **Total Sinks** | **1.3** | **+0.2** | |
| | | | |
| **GHG balance (net) tCO2e/ha/year** | | **-0.2** | |

## 5.3. Arid Spain

**Baseline scenario, based on recent trends (5–10 yr)**

[35] https://di.unfccc.int/ghg_profiles/annexOne/ESP/ESP_ghg_profile.pdf
[36] https://www.sciencedirect.com/science/article/pii/S0959378021000984

Arid Spain features large olive landscapes and intensive irrigated horticulture (Murcia, SE Andalusia) plus major livestock and pork/poultry industrial zones in western Andalusia. Groundwater over-exploitation, salinization and land degradation are prominent concerns. Marginal cereal areas increasingly face abandonment or conversion to permanent tree crops where feasible[37] [38].

**Alternative scenarios**

In arid Spain the BAU is frequently soil degradation, abandonment, or conversion to lower-diversity perennial crops.

**Cropland (major crops: olives, cereals, sunflower, irrigated vegetables/fruits, almonds, vineyards)**

- *Irrigated valleys (Murcia/SE Andalucía):* continued intensive vegetable & fruit production where water and market access justify irrigation; coastal and valley cropland face pressure from salinization and aquifer decline.
- *Dryland areas:* many marginal cereal plots either convert to low-input olive/almond systems or are abandoned and degrade (shrub/desert-steppe) where aridity and erosion dominate.

**Pastures / grazing**

- *BAU:* Extensive sheep/goat grazing continues but with signs of reduced productivity and increased degradation on over-grazed parcels. Pig/poultry industrial zones remain major concentrated emissions sources (manure management).
- *Emergent landscape:* degraded rangeland with lower biomass, more bare soil and susceptibility to erosion.

**Fallow / abandoned agricultural land**

- *BAU:* Progressive desertification and low-biomass shrubland are common — slow recovery rates and high erosion/fire vulnerability. Carbon sequestration under natural regrowth is slow and often limited by moisture and soil loss[39].

**Baseline emissions**

**Cropland**

| | **EF per ha /year tCO2e/ha/year** | **EF chosen (average)** | **Rationale** |
|---|---|---|---|
| **Sources[40]** | | | |

[37] https://easac.eu/fileadmin/PDF_s/reports_statements/Spain_Groundwater_country_report.pdf?
[38] https://www.mdpi.com/2073-4441/13/1/90?
[39] https://easac.eu/fileadmin/PDF_s/reports_statements/Spain_Groundwater_country_report.pdf?
[40] https://www.sciencedirect.com/science/article/pii/S0959378021000984

| | | | |
|---|---|---|---|
| Soil | 0.35–0.65 | 0.5 | Dry soils, less N2O, possible net SOC loss |
| Tillage | 0.09–0.19 | 0.14 | Less frequent tillage, low fuel use. |
| Machinery | 0.10–0.25 | 0.175 | Few machinery passes, low mechanization. |
| Fertilizers | 0.60–1.05 | 0.825 | Lowest fertilization rates. |
| **Total Sources** | | **1.64** | |
| **Sinks** | | | |
| AGB crops | n.a. | n.a. | |
| AGB plant residue | n.a. | n.a. | |
| BGB | n.a. | n.a. | |
| SOC | -0.15 to 0 | -0.075 | Aridity limits SOC buildup. |
| **Total Sinks** | | **-0.075** | |
| | | | |
| **GHG balance (net) tCO2e/ha/year** | | **1.715** | |

**Pasture land**

| | **EF per ha /year tCO2e/ha/year** | **EF chosen (average)** | **Rationale** |
|---|---|---|---|
| **Sources** | | | |
| Soil | 0.22–0.43 | 0.375 | Dry pastures yield low N2O |
| Livestock | 0.8 – 1.5 | 1.15 | Sheep and goats. Reflects low-density extensive grazing in dry/arid zone[41] |
| Tillage | n.a. | n.a. | |
| Machinery | 0.07–0.12 | 0.95 | Low density operations. |
| Fertilizers | 0.31–0.68 | 0.495 | Some input for improved grassland only. |
| **Total Sources** | | **2.97** | |
| **Sinks** | | | |
| AGB crops | n.a. | n.a. | |
| AGB plant residue | n.a. | n.a. | |
| BGB | n.a. | n.a. | |
| SOC | 0 to -0.10 | 0.05 | SOC sequestration unlikely, set at conservative low. |
| **Total Sinks** | | **0.05** | |

[41] https://pmc.ncbi.nlm.nih.gov/articles/PMC11640683/, https://research.wur.nl/en/publications/accounting-for-multi-functionality-of-sheep-farming-in-the-carbon

| | | | |
|---|---|---|---|
| | | | |
| **GHG balance (net) tCO2e/ha/year** | **2.92** | | |

**Fallow land**

| | EF per ha /year tCO2e/ha/year | EF chosen (average) | Rationale |
|---|---|---|---|
| **Sources** | | | |
| Soil | n.a. | n.a. | |
| Tillage | n.a. | n.a. | |
| Machinery | n.a. | n.a. | |
| Fertilizers | n.a. | n.a. | |
| **Total Sources** | | | |
| **Sinks** | | | |
| AGB crops | n.a. | n.a. | |
| AGB plant residue | n.a. | n.a. | |
| BGB | n.a. | n.a. | |
| SOC | -0.5–0.8 | 0.15 | SOC recovers after abandonment. |
| **Total Sinks** | | | |
| | | | |
| **GHG balance** | | | |

## 5.4. Baseline data justification

The baseline data are based on multiple data sources, varying in terms of granularity and reliability. Not all data required by the Proba methodology and the M-POD is readily available at Spanish regional level.
To ensure consistency and transparency, we prioritized the use of official national datasets, supplemented by peer-reviewed literature and regional studies where gaps existed.

**Activity data**

Primary activity data (e.g. fertilizer consumption, livestock numbers, agricultural area, and fuel use) are sourced from official national reports:

- **Spain National Inventory / Informative Inventory Report (IIR / NIR) 2023 (MITECO)** — activity data (fertilizer consumption by crop/region, livestock numbers, land area, fuel use). This is the Spanish official dataset to base activity data on. Spain NIR/IIR 2023 on UNFCCC: https://unfccc.int/documents/627815

**Emission Factors and Calculation Methods**

Emission factors (EFs) and methodological approaches follow the IPCC 2019 Refinement to the 2006 Guidelines for National Greenhouse Gas Inventories.

- **IPCC 2019 Refinement to the 2006 Guidelines** — official emission factors and methods for AFOLU ($N_2O$ from N inputs, $CH_4$ from enteric fermentation and manure, SOC accounting, fuel $CO_2$, etc.). Use Chapter 11 (soils/$N_2O$) and Chapter 10 (livestock) for default EFs and climate modifiers. https://www.ipcc.ch/report/2019-refinement-to-the-2006-ipcc-guidelines-for-national-greenhouse-gas-inventories/

**Land use change**

Where official SOC data were unavailable or incomplete, peer-reviewed studies were used to provide representative values for Mediterranean and Spanish agroecosystems:

- **Bell S.M. et al., 2021 —** "Soil organic carbon accumulation rates on Mediterranean abandoned agricultural lands" — meta-analysis for SOC change after abandonment in Spain / Mediterranean. https://pubmed.ncbi.nlm.nih.gov/33190903/
- **Regional SOC & biomass studies** —
    - **Muñoz-Rojas et al. : (2012)** – Organic carbon stocks in Mediterranean soil types under different land uses (Southern Spain) https://se.copernicus.org/articles/3/375/2012/se-3-375-2012.html
    - **Muñoz-Rojas et al. (2011)** – Changes in land cover and vegetation carbon stocks in Andalusia, Southern Spain (1956–2007), https://pubmed.ncbi.nlm.nih.gov/21531444/,

**Agricultural Emissions and Regional Practices**

To capture Spanish-specific farming conditions and identify research gaps:

- **Spain specific study about agricultural emissions**
    - **Eduardo Aguila et al., 2921**, – Greenhouse gas emissions from Mediterranean agriculture: Evidence of unbalanced research efforts and knowledge gaps https://www.sciencedirect.com/science/article/pii/S0959378021000984

**Biomass and Shrubland Systems**

For above-ground biomass estimates in Mediterranean shrubland and maquis ecosystems, regional literature was consulted:

- **Local studies on shrubland/maquis biomass**
    - **Cerrillo et al, 2006**.,Estimation of above-ground biomass in shrubland ecosystems of southern Spain, https://fs.revistas.csic.es/index.php/fs/article/view/964 ,
    - **Sirca et al. (2016)** – Methods for biomass stock estimation in Mediterranean maquis systems https://iforest.sisef.org/contents/?id=ifor1769-009%3B&

**Data interpretation and conservative approach**

We have looked at the main crops, farming practices (e.g. greenhouses, irrigation, intensiveness, cattle type, etc) for each main region. As the regions are broad, the data often comes in a bandwidth. In order to remain pragmatic, we have used the average within a bandwidth for each chosen value, and added a conservative factor where relevant, for example for SOC values.

# 6. Expected GHG Yields

The project starts with 330ha. The scale is expected to grow to 1,000 ha in Spain.
As the participating plantations have different planting/start years, only the values for the eligible years will be counted in the yield. That means that for older plantations, the yield for earlier years may not be included in the yield and not lead to the issuance of carbon credits.

The growth table in the M-POD shows the expected CO2 accrual on a 40 year period, and per scale The value includes AGB, and a 7% waste. The 10% buffer is not included.

Based on the planned scale, and with a correction factor for plantation started before end 2023, the yield is expected to reach:

| | Full Yield Estimation (tCO2e/ha/y) | Corrected Yield estimation to account for CO2 non included (tCO2e/ha/y) (minus 15%) |
|---|---|---|
| 1 ha | 1,310 | 1,113.5 |
| 300 ha | 393,000 | 334,050 |
| 500 ha | 655,000 | 556,750 |
| 750 ha | 982,500 | 835,125 |
| 1,000 ha | 1,310,000 | 1,113,500 |

The above table is provided as an indication. The actual yield and related issued credits will solely be based on achieved carbon storage and real life measurements.

## 6.1. Leakage Assessment

In Spain (and most EU countries) agricultural products are widely imported and exported within and outside the EU. At the scale of the project (1,000 ha), Paulownia cultivation is not expected to influence regional or EU-level production patterns or cause measurable displacement of other crops. Farmers are switching crops when deemed opportune to adjust to price and demand variation. Moreover, the small scale of the project is not sufficient to influence crop displacement in the EU market. No activity-shifting leakage is expected, as no grazing, fertilizer-intensive, or fuelwood activities are displaced.

Looking at Spain where the UAA (Usable Agricultural Area) is shrinking due to land abandonment[42] [43], there will always be enough land to restore for agricultural purposes.

In line with the methodology, the Spain project is therefore considered very unlikely to generate leakage emissions, and this residual risk is further covered by the program's conservative buffer.

# 7. Monitoring of the Project

## 7.1. Monitoring plan

The monitoring procedures for the Spain program follow the framework described in Section 7 of the M-POD, including data collection, training, QA/QC, and reporting procedures. Local adaptations specific to Spain are summarized below:

**Responsible Entities:**

The Local Project Developers (LPDs) designated for Spain coordinate data collection using the Dealin.Green Insights App or the Plot Measurement Template, as described in the M-POD.

**Training:**

All field technicians receive training through Dealin.Green workshops. Training includes instruction on GPS measurement, data entry, and local regulatory compliance (fertilizer management, water rights).

**Sampling Adaptation:**

Sampling design follows the M-POD, adjusted for the three main Spanish agro-climatic zones (Mediterranean, Atlantic, and Arid) to ensure representation of soil and management variability.

**Verification:**

Dealin.Green compiles monitored data annually for submission to the VVB. Any new plots onboarded since the previous audit will be clearly identified in the Spain Monitoring Report.

## 7.2. Monitoring Report

[42] MAPA, 2021: https://www.mapa.gob.es/es/estadistica/temas/publicaciones/anuario-de-estadistica
[43] Cerda et al., 2017: https://www.mapa.gob.es/es/estadistica/temas/publicaciones/anuario-de-estadistica

Dealin.Green consolidates data submitted by LPDs into annual L-POD-level Monitoring Reports, which are provided to the VVB. These reports include:

- Aggregated results per region and per plot,
- A list of new plots added since the last Verification Audit, with their respective baseline regions, planting year, and ownership details.

**Plot Datasheet**

Each plot must have a completed *Plot Datasheet* (Annex 4). When new plots are added, the LPD submits a new datasheet signed by the plot owner. The datasheet confirms land eligibility, ownership, baseline region, and environmental conditions relevant to Paulownia cultivation. The completed datasheets (filename: Spain - Plot datasheets) are available as a separate document in the Proba platform and registry.  Plots that are part of this project, should be added before each verification event.

## 7.3. Managing data quality

**Local responsible person:**

Certain details are withheld from this public consultation for data protection and confidentiality reasons and are available to the appointed Validation and Verification Body (VVB) or upon request.

**Training:**

Completed on-site training provided by Dealin.Green on 15 July 2025 in Spain. The session covered field measurement protocols (DBH, THT, sampling design), use of the Dealin.Green Insights Platform for data entry and verification, QA/QC and calibration procedures, environmental and social compliance (Do No Harm principle), and preparation for verification and audit in line with the M-POD Sections 7.1–7.4.

**Data Entry and Management:**

All plot-level data are managed through the Dealin.Green Insights Platform.

- Field measurements are entered directly in the platform using the Dealin.Green Insights App (Android/iOS).
- Onboarding of new plots is done using the Plot Measurement Template, which will be uploaded to the Proba platform and linked to the corresponding plot ID.

Data are entered per plot and at the intervals defined in the M-POD.
All data management procedures follow Section 7.4 of the M-POD, including validation, version control, and data protection requirements.
All other procedures remain as defined in the M-POD.

# 8. Local Stakeholder Consultation

Each LPD is required to fill in Annex 1 Local Stakeholder Consultation.

# 9. Local Project Risks and Mitigation Measures

At the program level, the Program Developer has identified several risks. These are listed together with the mitigation measures in Annex 9 of the M-POD document. Plantation specific risks are listed in below table:

| **Project specific Risk name/type** | **Impact** | **Mitigation Measure(s)** |
|---|---|---|
| **Land development and urbanization:** | Due to the project's long duration, rapid urbanization has to be considered. | Maintaining regular contact with local government bodies:<br>- Ayuntamiento de Talavera de la Reina (Municipality of Talavera)<br>- Ayuntamiento de Calera y Chozas: neighboring municipality with jurisdiction over part of the project zone.<br>- Diputación Provincial de Toledo: oversees regional infrastructure and rural development projects.<br>- Consejería de Fomento de Castilla-La Mancha – regional department responsible for spatial planning and infrastructure at the autonomous community level. |
| **Fire** | Although the flashpoint is relatively high (450 degrees Celsius), fires can damage or in extreme cases destroy Paulownia trees. | Monitoring of national fire risks using official maps: https://www.meteorologiaenred.com/mapa-de-riesgo-de-incendios-en-espana.html<br>*Because paulownia wood contains few lignins, it generates very little combustible gas when* |

| | | |
|---|---|---|
| | | *heated. Furthermore, Oxygen is not sufficiently supplied in the large and independent vessel structure of paulownia wood, compared to cedar wood, which has a thin and continuous tracheids structure. Thus, it is difficult to ignite, and only carbonizes when heated.*[44]<br><br>Buffer pool of 10% at program level |
| **Weather event Spain** | The Spanish climate may be exposed to extreme weather events such as heat waves, droughts, heavy rainfall events and cold extremes. | Buffer pool of 10%<br>Designing irrigation systems, soil and drainage management to reduce erosion and flooding impacts. Continuous monitoring of climate alerts and adjusting field operations. This is done through AEMET[45] (national weather warmings and climate bulletins) and EFFIS[46] (drought and fire risk indexes). |
| **Water availability** | Changes in water availability due to factors like drought or water pollution can limit the ability of Paulownia to access water for growth. | Embedded water management in the first 3 years ensures a high tree survival rate |
| **Pest and diseases** | Insects and pests can impair tree growth, lead to tree death, and/or slow carbon sequestration | Buffer pool of 10%<br>The Paulownia species have a strong natural defense against pest and diseases. The plantations are regularly inspected by a local team to look for any signs of pests or diseases. |

44 https://www.researchgate.net/publication/36431424_Flame_retardancy_of_paulownia_wood_and_its_mechanism
45 https://www.aemet.es/es/portada
46 https://forest-fire.emergency.copernicus.eu/

## 9.1. Environmental and Social Do Not Harm Principle

The LPD has evaluated the impact of establishing Paulownia plantations. The result is that none of the plantations on the applicable baseline pose any significant harm. More details are to be found in the Plot Datasheet.

| | Description | Mitigation Measure(s) |
|---|---|---|
| **Local Grievance Mechanism**<br>Detail the procedure for addressing grievances related to environmental and social issues. | The grievance mechanism allows any stakeholder, including landowners, community members, workers, or partners to raise concerns, complaints, or suggestions related to Dealin.Green's Paulownia projects in Europe. | The program and local project developer have implemented a Grievance mechanism form on their websites. |
| **Local Assessment of Environmental Impact** | Each LPD assesses whether a formal Environmental Impact Assessment (EIA) is required. For the Spain L-POD, a full EIA is not required as all plantations are established on former cropland or fallow land and outside protected areas. Environmental screening and biodiversity checks are recorded in the Plot Datasheet. | Compliance with Spanish Law 21/2013 and Natura 2000 requirements is verified through the Plot Datasheet. Monitoring and biodiversity measures are implemented to ensure no significant harm. |
| **Local Stakeholder Consultation** | Stakeholder consultation is conducted in accordance with M-POD and Proba requirements, involving municipalities, water authorities, neighbors, and local organizations. A summary of outcomes is provided in Section 9 of this L-POD and referenced in each Plot Datasheet. | Stakeholder feedback is incorporated into project design and monitoring. Ongoing engagement ensures transparency and early resolution of any local concerns. |

# Annexes

## Annex 1: Local Stakeholder Consultation

| Stakeholder Group | Contacted Y/N | Date of Consultation | Consultation method (e.g., in-person, email, phone) | Key issues raised | Project response | Evidence provided |
|---|---|---|---|---|---|---|
| Ayuntamiento de Talavera de la Reina | Yes | 02-2018 | Formal written consultation via Delegación Provincial | Land-use compatibility, building permit, irrigation system legality | Certified that land classified as *suelo No urbanizable de Especial Protección Agícola* allows agricultural and irrigation use | Environmental Evaluation_Talavera -2-3 (Resolution) |
| Ayuntamiento de Pepino | Yes | 11-2020 - 03-2021 | Official letter and written response | Confirm land-use zoning and permit requirements | Confirmed *Suelo Rústico de Especial Protección Agraria*; drip irrigation fully compatible with municipal planning | Environmental Evaluation_Pepino-1 (Resolution) |
| Confederación Hidrográfica del Tajo (CHT) | Yes | 02-2018 - 02-2021 | Written consultation | Hydrological impacts; compliance with concessions; nitrate vulnerability; buffer zones | Confirmed valid concessions; required flow meters, buffers (5–100 m near rivers); no works in public hydraulic domain without permit | Environmental Evaluation_Talavera -2-3 (Resolution).pdf and Environmental Evaluation_Pepino-1 (Resolution) |

| | | | | | | |
|---|---|---|---|---|---|---|
| Delegación Provincial de Agricultura, Agua y Desarrollo Rural (Toledo) | Yes | 02-2018 - 11-2020 | Written consultation | Water and soil management; irrigation transformation | Confirmed parcels inside *Zona Regable Canal Bajo del Alberche*; recommended fertigation and control systems | Environmental Evaluation_Pepino-1 (Resolution) |
| Agentes Medioambientales (Unidad Provincial Toledo) | Yes | 02-2018 - 11-2020 - 03-2021 | Field inspections + reports | Fauna/flora sensitivity; nesting seasons | Confirmed no protected habitat affected; advised to avoid works during breeding season | Environmental Evaluation_Pepino-1 (Resolution).pdf and Environmental Evaluation_Talavera-2-3 (Resolution) |
| Servicio de Cultura y Patrimonio Histórico (Toledo) | Yes | 02-2018 - 11-2020 | Written consultation | Risk of affecting archaeological or heritage sites | Issued favorable report; requires 48h notice if remains are found | Environmental Evaluation_Talavera-2-3 (Resolution).pdf and Environmental Evaluation_Pepino-1 (Resolution) |
| Servicio de Política Forestal y Espacios Naturales | Yes | 02-2018 - 11-2020 | Emailed and notified via legal procedure (Ley 21/2013) | General environmental concern; habitat effects | No objections or negative feedback received | Environmental Evaluation_Talavera-2-3 (Resolution).pdf, Environmental Evaluation_Pepino-1 (Resolution) |
| Comunidad General de Regantes Canal Bajo del Alberche | Yes | 03-2021 | Official certificate | Confirmed water rights and usage monitoring | Certified water allocation (9,500 $m^3$/ha·year) and authorized irrigation | Environmental Evaluation_Pepino-1 (Resolution) |

| | | | | | | |
|---|---|---|---|---|---|---|
| Local Residents and Farmers (Public) | Yes (via public notice) | 2018 - 2021 | Public information process in regional gazette | General interest in employment, land use, and biodiversity | No objections filed; projects seen as beneficial for local economy | Environmental Evaluation_Talavera -2-3 (Resolution).pdf, Environmental Evaluation_Pepino-1 (Resolution) |

## Annex 2 - Additionality assessment

# Proba Additionality Assessment

For simplification purposes, sections purely related to the program context or the methodology have been removed, as they are already addressed in the M-POD.

## SECTION A: Regulatory Additionality

### A.1 Legal Framework Assessment

| | |
|---|---|
| • Is the project activity required by any existing law, policy, or regulation? | No, the planting of Paulownia trees is not required by any national law, policy or regulation in the geographical scope of the program. |
| • Are there any upcoming regulations that would mandate this activity during the crediting period? | No, there are no clear upcoming regulations in Spain that would mandate planting Paulownia trees. The EU CRCF[47] framework will provide an incentive for carbon farming and carbon storage in building via various biomass streams, but not prescribe specific interventions. There is no mention of Paulownia in the whole CRCF framework and directives. |
| • If the project is required by regulation but goes beyond the minimum requirements, describe how the intervention exceeds the legal baseline. | No, not required. |
| • Are there any sector-wide GHG reduction targets or current trends that indicate that the project | In Spain, as in all other EU countries, there are plans to reduce GHG emissions in many sectors, including construction. Plans concern Energy, GHG emissions, corporate reporting. Here are the main ones: |

[47] https://climate.ec.europa.eu/eu-action/carbon-removals-and-carbon-farming_en

| | |
|---|---|
| activity is becoming standard? | • energy efficiency (not competing with the project)<br>• GHG emission reporting requirement for construction (Royal Decree 214/2025), not competing with the project<br>• LCA project INDICATE to gather LCA data for the construction sector (not competing with the project<br>• The BIOSMATER project and fund, EU level and spearheaded by Spain. It aims at promoting biobased materials in the construction sector, However their focus is to utilize agriculture waste, and not tree crops, and as such is not competing with the project.<br>• Inclusion of the Global Warming Potential (GWP) indicator in the Spanish Technical Building. The CTE update would contemplate the mandatory declaration of life cycle carbon starting in 2026. Not competing with the Project. Source: page 13.<br><br>While bio-based materials are mentioned, there are no prescriptions that include Paulownia. As Paulownia is relatively new in the timber sector, the biobased materials would likely not focus on Paulownia but on traditional tree essences like spruce despite the various qualitative advantages compared to other timber types (fast growth, light structure, insulation properties). |

## A.2 Supporting Evidence

| | |
|---|---|
| • Where applicable, attach policy documentation, sectoral trend reports, or legal assessments. | For Spain Dealin.Green searched the website of the Ministerio para la Transición Ecológica y el Reto Demográfico (Ministry of Ecological Transition and Demographic Challenge), that is responsible for Agriculture, and all climate related plans, and Paulownia is not mentioned of part of the strategy. We have checked the following:<br>• The **Plan Nacional Integrado de Energía y Clima (PNIEC)**, Spain's Integrated National Energy and Climate Plan for 2021–2030, includes agriculture among the sectors tasked |

with reducing greenhouse gas emissions.[48]

- The Climate Change and Energy Transition Law (Law 7/2021)[49]
- the Strategic CAP (Common Agricultural Policy) Plan for Spain[50]
- The Spanish Forest Plan (2022-2032) targets reforestation, sustainable management, and carbon sequestration strategies, though it does not specifically refer to short-rotation species[51]

# SECTION B: Financial Additionality

Proba accepts the usage of the CDM Tool for the Demonstration and Assessment of Investment Additionality[52] as a valid and structured approach to assess financial additionality. Project developers may refer to this tool to guide their analysis, using its accepted logic and structure to demonstrate the need for carbon finance. Alternatively project developers can use the following checklist.

## B.1 Investment Viability

*Conduct a simple cost analysis demonstrating that the total costs of implementing and operating the project exceed any financial benefits.*

48 https://www.agronegocios.es/agronegocios/nacional/el-paquete-sobre-energia-y-clima-del-gobierno-impactara-de-lleno-sobre-el-agro-y-el-medio-rural/
49 https://en.wikipedia.org/wiki/Climate_change_in_Spain
50 https://www.agroportal.pt/spain-cap-strategic-plan-2023-27/
51 https://climate-laws.org/document/spanish-forest-plan_eafb
52 https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-01-v7.0.0.pdf

Business case: Certain details are withheld from this public consultation for data protection and confidentiality reasons and are available to the appointed Validation and Verification Body (VVB) or upon request.

| | |
|---|---|
| • Conduct a simple cost analysis demonstrating that the total costs of implementing and operating the project exceed any financial benefits. | The project's total costs XXX nearly equal its total revenue XXX, resulting in only XXX cumulative profit over 9 years—equivalent to XXX/ha/year, with all income realized only in year 9.<br>This yields a ROI of XXX and an IRR of XXX, demonstrating that implementation and operating costs exceed reasonable financial returns, and the project is not financially viable without carbon finance. |
| • If the project does generate revenues, quantify the business case using an investment analysis method like Net Present Value (NPV) or Internal Rate of Return (IRR). | The Spain business case (XXX) demonstrates that without carbon finance, the project remains financially marginal and highly exposed to risk.<br>Over the 9-year cycle, total revenue reaches XXX while total costs amount to XXX, resulting in a cumulative profit of only XXX — equivalent to XXX per ha per year.<br>All revenue is realized only in year 9, while the first eight years require continuous investment totalingXXX million with no income.<br>The resulting Return on Investment (ROI) is XXX and the Internal Rate of Return (IRR) only XXX, indicating limited attractiveness for private financing and significant exposure to long-term capital and operational risks.<br>This profile—8 years of negative cash flow followed by a single harvest-year inflow—yields a low IRR and ROI, leaving the project highly exposed to operational and market risks (weather, pests, price volatility, delays) and making it unattractive for conventional financing at scale.<br>The project will generate revenue from the sale of wood. In order to realize the ambition to remove and store above one million $tCO_2e$ over the course of 40 years, the supply for Paulownia wood needs to increase much faster than the current BAU course in Spain, where the investments are still risky due to high upfront costs.<br>Addition and regular revenue during the tree growth phase contributes to lower the financial risks of expanding Paulownia cultivation. |

## B.2 Financing conditions and constraints

| | |
|---|---|
| • Are there cost-related barriers (e.g., high upfront CAPEX, long ROI periods)? | Short-rotation Paulownia cultivation for high-value timber and carbon sequestration presents several financial challenges:<br>High Upfront Investment: Significant costs are associated with site preparation, purchasing high-quality Paulownia clones/seedlings, planting, installation of potential irrigation systems, and initial intensive maintenance (weeding, pruning).<br>Operational Costs: ongoing costs for maintenance, monitoring, harvesting, and transportation add to the financial burden.<br>Delayed Revenue Streams: Unlike traditional annual crops, revenue from timber harvesting occurs only after several years (typically 3-12 years per rotation), creating cash flow challenges.<br>Market Uncertainty: While Paulownia wood has desirable properties, markets for sustainably sourced, certified Paulownia timber for long-term applications (construction, furniture) are still developing compared to conventional timber or agricultural products. Price volatility and securing long-term off-take agreements can be challenging. |
| • Would this project proceed without carbon financing? | It is very unlikely the scaling up of the program in Spain would proceed and scale up. The project has a lot of costs without any payment for 8 to 10 years, when the wood is harvested.<br>The income from carbon credits in years before harvest is needed to:<br>• scale the project up and accelerate and increase the climate impact generated by the carbon storage,<br>• keep the project running and deliver an income to the staff<br>• reduce the investment risks<br>The revenue stream generated from the sale of Carbon Credits is essential to overcome the above barriers.<br>Carbon finance improves the overall financial attractiveness of the project, reduces the payback period, mitigates investment risks, and provides the necessary incentive for landowners and investors to adopt this alternative land use practice over the baseline scenario. |

- Has the project received subsidies or public incentives related to emissions reductions? Please explain their role and impact.

No, this project has not received any subsidies nor incentives

## B.3 Supporting Evidence

- Include cost analysis or calculations in a spreadsheet supporting the first condition (B1).

**Carbon Finance Intent:**
Project documentation from 2010 (WeGrow GmbH) shows that Paulownia cultivation was designed with carbon sequestration and carbon finance in mind from the start. The plantations were planned and quantified to capture measurable amounts of $CO_2$ (up to 300 t $CO_2$/ha over 12 years) and to generate certified $CO_2$ credits ("$CO_2$-Gutschriften") under the voluntary carbon market framework. References to $CO_2$ accounting systems and quantifiable carbon binding targets confirm that climate-mitigation outcomes were part of the core project design, not added later. This demonstrates that carbon finance intent was embedded in the project's original planning and implementation, fulfilling the Proba Standard requirement for retroactive crediting eligibility.

**Cost Benefit:**

The price of Paulownia wood in Spain is between XXX and XXX per m3, depending on type, diameter size, and quality. Once processed, it can be sold for XXX per $m^3$. In this case the LPD is processing the wood on site, which can be sold for XXX per $m^3$.

**Subsidies**
While there are some subsidies for Short Rotation Forestry/Coppice available in Europe, they are not focussed on Paulownia and target biomass for energy or pulp (paper), timber is not the main goal of the subsidies. Other schemes are aimed at afforestation, landscape

| | |
|---|---|
| | enhancement, or biodiversity habitats.[53][54] |

# SECTION C: Prevalence

## C.1 Prevalence / Common Practice

| | |
|---|---|
| • What is the adoption rate of this practice in the relevant region/sector? | There are no official records of surface planted with Paulownia in Spain. The cultivation exists at small scale and there are several experimental projects in the Mediterranean region for Paulownia planting, mostly focused on biomass to fuel |
| • Is it below 25% (Proba threshold for non-common practice)? | While there are no official sources for Paulownia in Spain, there are sources for other types of wood, see: https://www.miteco.gob.es/es/ministerio/servicios/estadisticas/estadisticas-forestales/balance-nacional-de-la-madera.html?utm_source=chatgpt.com<br>and the file located here: https://www.miteco.gob.es/es/biodiversidad/estadisticas/forestal_balance_nacional_madera.aspx shows the cultivated surface in ha per tree species, with a 1% threshold.<br>Paulownia being considered a “niche” species due to low volume, the traded volume is not tracked.<br>We can therefore safely assume that Paulownia cultivation in Spain is below 1% of cultivated surface within the wood sector. |

## C.2 Benchmarking

[53] https://capnetworkireland.eu/schemes-and-grants-in-forestry-agroforestry/
[54] https://www.agroberichtenbuitenland.nl/actueel/nieuws/2022/07/07/romania-ec-clears-eur-500-mln-afforestation-scheme

| | |
|---|---|
| • Provide performance data showing that the project significantly exceeds average practice (for example achieving lower nitrogen input per hectare) | Not applicable to L-POD, covered in M-POD. |
| • Name the benchmark (e.g., regional nitrogen norm, GHG intensity benchmarks, FAO or peer-reviewed studies). | Not applicable to L-POD, covered in M-POD. |

### C.3 Supporting Evidence

| | |
|---|---|
| • Provide adoption data, expert interviews, and baseline vs. project datasets. | Page 7 on this file: https://www.miteco.gob.es/es/biodiversidad/estadisticas/forestal_balance_nacional_madera.aspx shows the cultivated tree species and the surface in ha starts at 1% threshold. Paulownia is not listed, and is considered a niche species. |

## Declaration by Project Developer

I declare that the information provided is accurate, and the project would not have occurred without the enabling role of carbon finance.

Signature: ______________________

Name: ______________________

Date: ______________________

## Annex 3: Plot measurement data template

The Local Project Developer is responsible for recording detailed annual measurements for each sample tree, including DBH, THT, and selected volume samples, using Excel or Google Sheets for systematic data entry. Once compiled, the data is delivered and securely stored in the Dealin.Green Insights platform, ensuring that all information is centrally organized, safeguarded against unauthorized modification, and readily accessible for validation, review, and verification processes. By maintaining this centralized repository, the platform upholds transparency, data integrity, and accountability, thereby strengthening the reliability of project reporting and facilitating efficient future verification and validation efforts.

| Data Collection/Measurements (annually and harvesting stage) | | | | | | |
|---|---|---|---|---|---|---|
| Employee in charge (Data Collector): | | | | | | |
| Tree ID | Location | Date | THT (m) | DBH (m) | Volume (m3) based on Huber's formula | Notes |
| 1 | | | | | | |
| 2 | | | | | | |
| 3 | | | | | | |
| … | | | | | | |
| 25 | | | | | | |

# Annex 4 - Plot Datasheet

A datasheet must be filled in for each registered plot. Certain details are withheld from this public consultation for data protection and confidentiality reasons and are available to the appointed Validation and Verification Body (VVB) or upon request.

| | **Answer** | **Comments** |
|---|---|---|
| Spanish Region (Mediterranean, Atlantic, Arid) | | |
| Plot ID | | |
| Plot name | | |
| Plot address | | |
| Plot owner (name, address,email, phone number) | | |
| Type of land ownership(owned, tenancy, etc). Provide proof | | |
| GPS Coordinates | | |
| Is the land situated on protected areas (e.g., Natura 2000, National Parks? | | |
| Is the plot situated on lands of significant historical or societal value? | | |
| Assessment that the plot does not occur on land where rare plant / tree species grow, such as:<br>Endangered plants, wild or cultivated species (e.g. very rare breeds, heirloom species) | | |

| | | |
|---|---|---|
| Crops that are culturally or locally significant to the local tradition or culinary heritage | | |
| Soil conditions suitable for Paulownia growth | | |
| Climate conditions within the tolerance range for Paulownia species (provide local temperature range) | | |
| Proof of adequate water availability or irrigation capabilities (rights, permits, etc) | | |
| Surface (ha) | | |
| Year of field preparation | | |
| Year of planting the trees | | |
| Tree density (per ha) | | |
| Cultivation type: | ❑ Traditional<br>❑ Mid-harvest<br>❑ Fiber | |
| Former land use: | ❑ Agricultural cropland<br>❑ Pasture/grazing land<br>❑ Fallow land<br>❑ Abandoned farmland | |
| Describe the land cover for each year for the past 5 years (annual crops, pasture,cereals, fallow, etc).Include former landmanagement practices. | | |
| Is the land still being used for another purpose after trees are planted? Y/NIf Yes, specify land use (grazing, grass production,etc) | | |

| | | |
|---|---|---|
| Baseline used for this field<br>Mention main region and former land use as described in Section 4 | *Example: Mediterranean Spain, former cropland* | |
| Is the risk assessment of theL-POD applicable to this plot? If not, a new risk assessment will be required | | |
| **Social and Environmental Impact**<br>List all anticipated environmental and social impacts of the project, both positive and negative. Conduct a biodiversity survey to understand the local flora and fauna. Consider potential impacts on local ecosystems, and include measures to protect biodiversity. | | |
| **Is an Environmental Impact Assessment required?**<br>Where required by local regulations, perform an Environmental Impact Assessment (EIA). | | Provide a summary in the Annex to this document. |