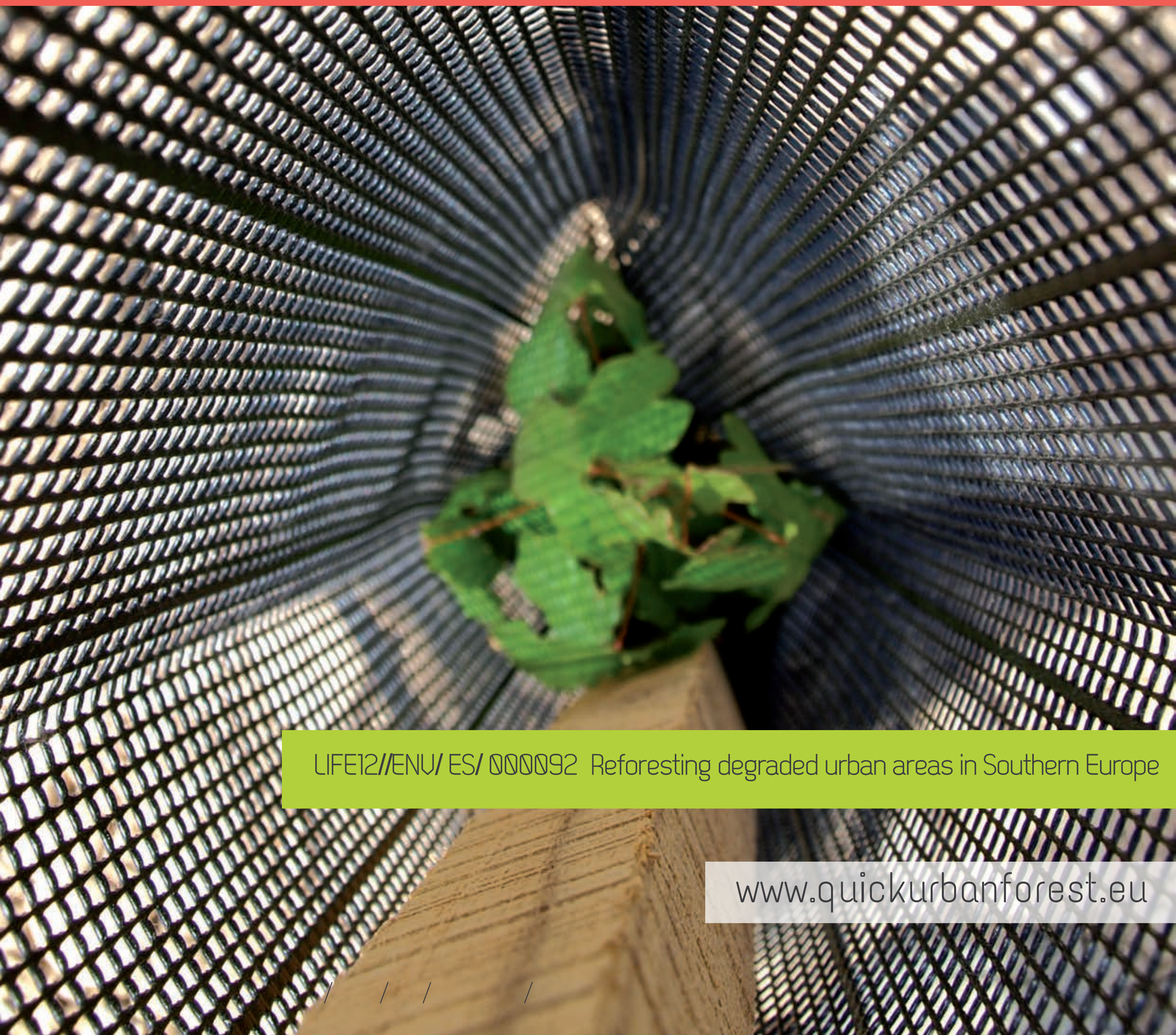
QUICK URBAN FORESTATION

LAYMAN'S REPORT



LIFE12//ENV/ ES/ 000092 Reforesting degraded urban areas in Southern Europe

www.quickurbanforest.eu

QUICK URBAN FORESTATION

CO-FUNDING:

LIFE + es el instrumento financiero de la Unión Europea dedicado al medio ambiente

PARTNERS:

cesefor

iclaves — claves para la innovación

SDL — Investigación y divulgación del medio ambiente

COLLABORATE:

Ayuntamiento de Valladolid

BUDGET:

1.356.782 Euros - 48% UE Co-funding

PERIOD:

Starts 01/08/13 – Ends 31/03/17

QUICK URBAN FORESTATION

There are 181 urban areas in Europe with over 200.000 inhabitants. 26 of these areas are located in the south of Europe, many of them as the result of a rapid immigration to cities in recent years. This figure multiplies by 10 if we consider cities with more than 100.000 inhabitants. Quick construction of industrial zones surrounding large cities, rapid urban planning including very few green zones, and intensive agriculture landscapes now abandoned or industrial deteriorated soil, are configuring the typical landscape of these cities.

Problems that are common to all European cities - soil degradation, air pollution, deforestation, etc.- are worsen in the case of Southern European cities, due to their climate conditions, water availability, and economic problems. This is even more critical due to the important fact that climate change is affecting first those places in the boundary of desertification.

The QUF (Quick Urban Forest) project is a European project, funded by the Life + Programme of the European Commission, which aims at contributing to the improvement of the living conditions and environment of European urban industrial areas by testing and demonstrating the feasibility of combining forestation related techniques in degraded areas. These techniques include the use of mycorrhiza and water retainers (both alone and combined).

The experiment

A key demonstration project has been designed and developed in the Spanish city of Valladolid. The goal was to demonstrate the feasibility of creating green areas and, in this way, recover land in the cities without any major irrigation infrastructure. That has been the main motivation of the project.

As a demonstrator, Valladolid is a perfect example of the cities the project is aimed at. Most of its characteristics may be directly applicable to other southern cities, including all Southern capital cities like Athens, Madrid, Podgorica, Rome, Tirana or Valletta, affecting millions of habitants.

It is located in the centre of the Castile and León region where the clime is semi-arid. The soil, mainly made from inceptisoiles and alfisoiles (per the International Soil Taxonomy) has traditionally been used for agriculture purposes, (mainly dry cultivation), and the gradual installation of industrial settlements and urban areas. Currently industry is, together with services, the main economic drivers of the city.

View of the plantation plot

The plantation

During the project the effect of different treatments (mycorrhiza, retainers and mixed) in the improvement of the survival of six tree species has been tested.

The species tested have been:

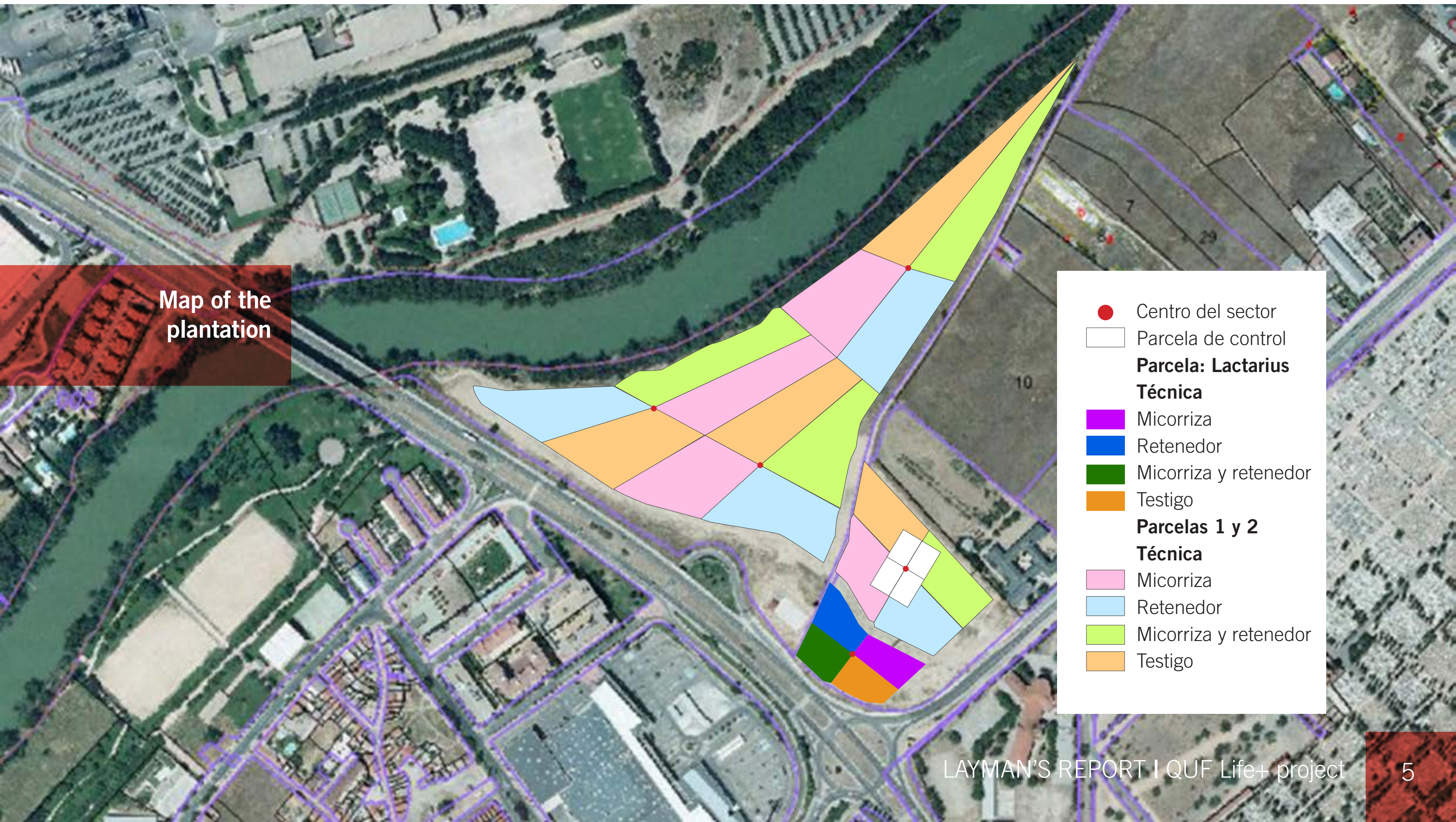
- Trees: *Quercus ilex*, *Quercus faginea*, *Pinus pinea* and *Juniperus thurifera*, *Amigdalus communis* and *Acer campestre*.

These species have been inoculated with the following mycorrhiza:

- Pisolithus tinctorius (Pers.) Coker & Couch (ectomycorrhiza).
- Scleroderma polyrrhizum (JF Gmel.) Pers (ectomycorrhiza).
- Glomus ssp. (Endomycorrhiza).

The retainer used was the Stockosorb retainer. This retainer is easy to use and has no added complementary products that could mask the comparison with the other treatments tested.

The plantation is designed as follows: 6 species have been planted in mixed masses in four blocks. There are four sectors per block depending on the treatments assessed in the project (retainers and mycorrhizae and the combination of both). Therefore, we have a sample for each specie and treatment (main components of the project). We use the soil cahracteristics of the blocks as a secondary component of the project.



Map of the plantation

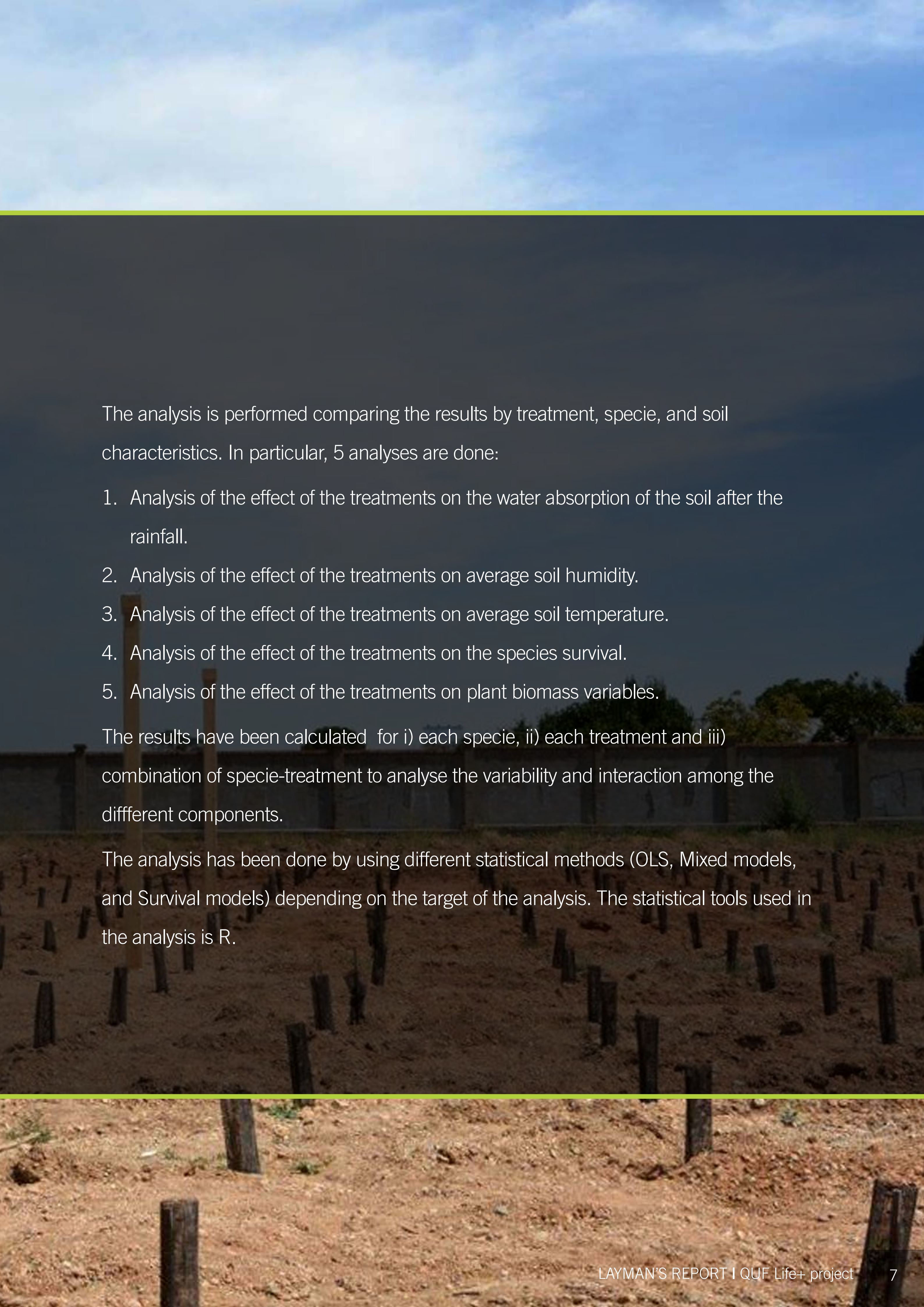
The sensor network and data analysis

The experimental design of the project is based on four control blocks in which different measures at tree-level were taking periodically.

Apart from field data, the impact of the different treatments in the soil has been tracked using automatic remote sensing techniques.

The analysis has been performed by using data from several sources:

- A network of sensors that monitors temperature and humidity at 20 and 40 cm. of 64 plants of 2 species (*Pinus pinea* and *Quercus ilex*) in the 4 control blocks along with climatic variables. The measures are obtained every 30 minutes during the entire duration of the project.
- Observation of the survival of 1.436 trees of the 6 species in the 4 control blocks at key moments of the project.
- Eventually, tree growth was measured at the end of the project.



The analysis is performed comparing the results by treatment, specie, and soil characteristics. In particular, 5 analyses are done:

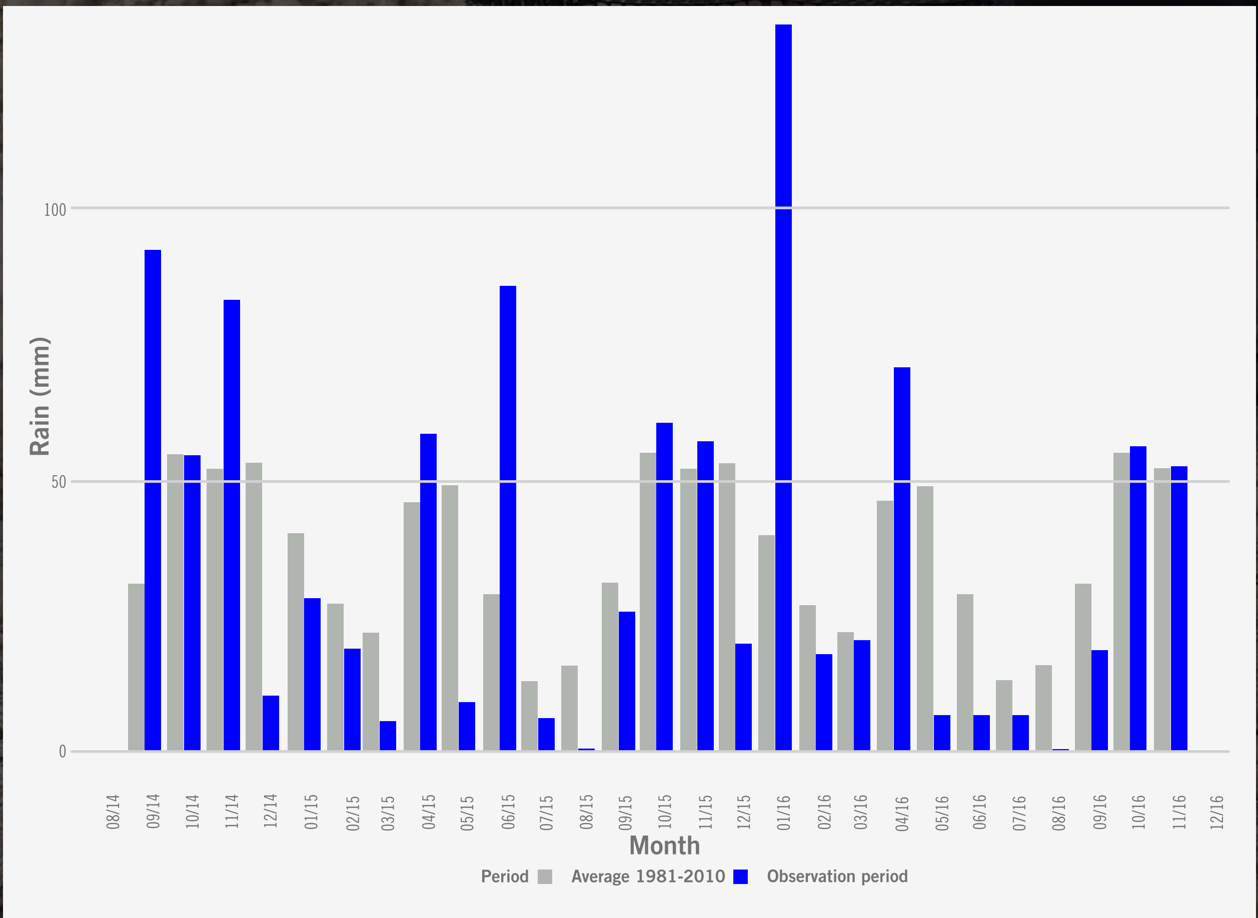
1. Analysis of the effect of the treatments on the water absorption of the soil after the rainfall.
2. Analysis of the effect of the treatments on average soil humidity.
3. Analysis of the effect of the treatments on average soil temperature.
4. Analysis of the effect of the treatments on the species survival.
5. Analysis of the effect of the treatments on plant biomass variables.

The results have been calculated for i) each specie, ii) each treatment and iii) combination of specie-treatment to analyse the variability and interaction among the diffferent components.

The analysis has been done by using different statistical methods (OLS, Mixed models, and Survival models) depending on the target of the analysis. The statistical tools used in the analysis is R.

Results

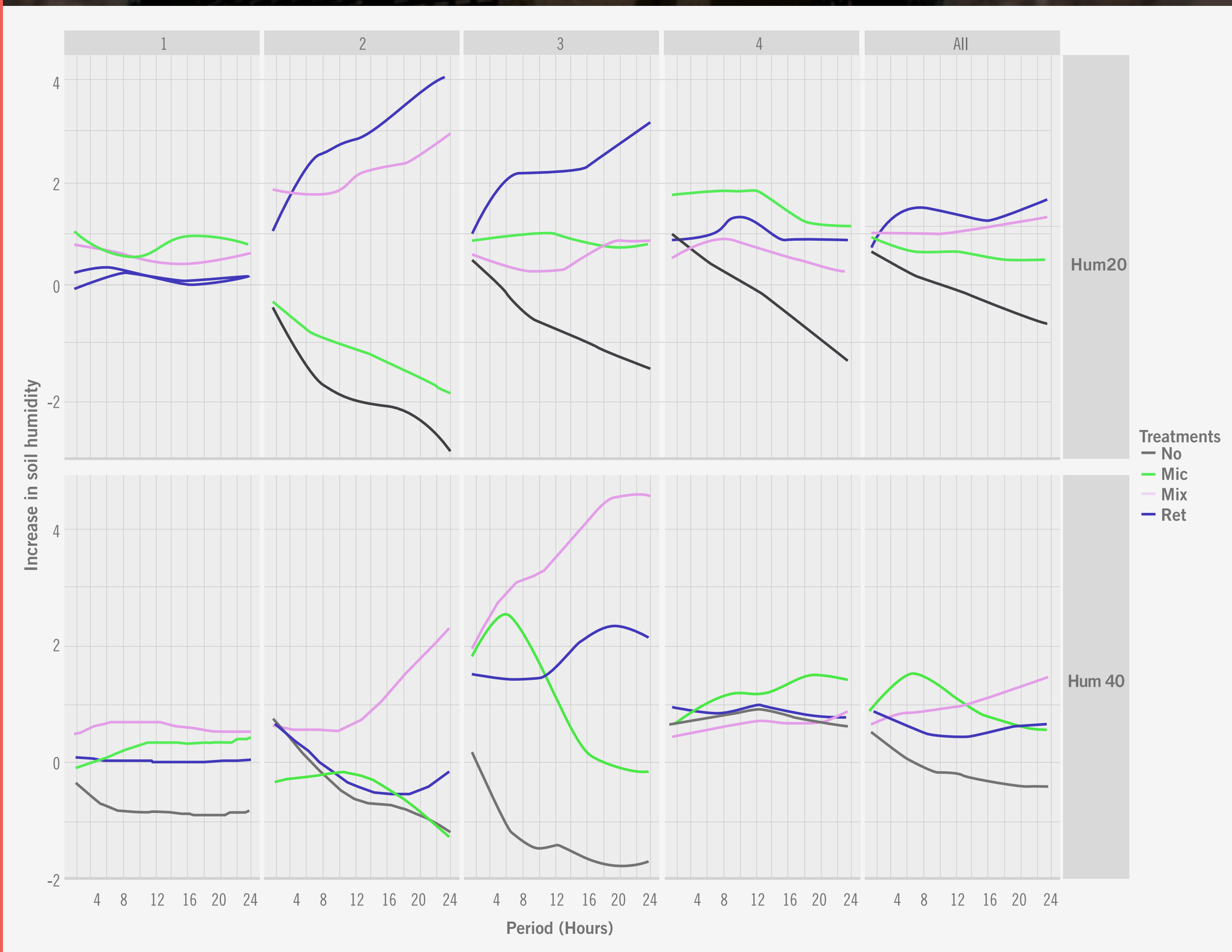
The rainfall during the observation period shows a very different pattern to the historical rainfall in Valladolid. Considering the monthly average rainfall we observe than the smooth historical pattern does not hold in the observation period, challenging the survival of the trees, as shown in the following figure:



Monthly rainfall during the observation period compared to the historical ones

Results

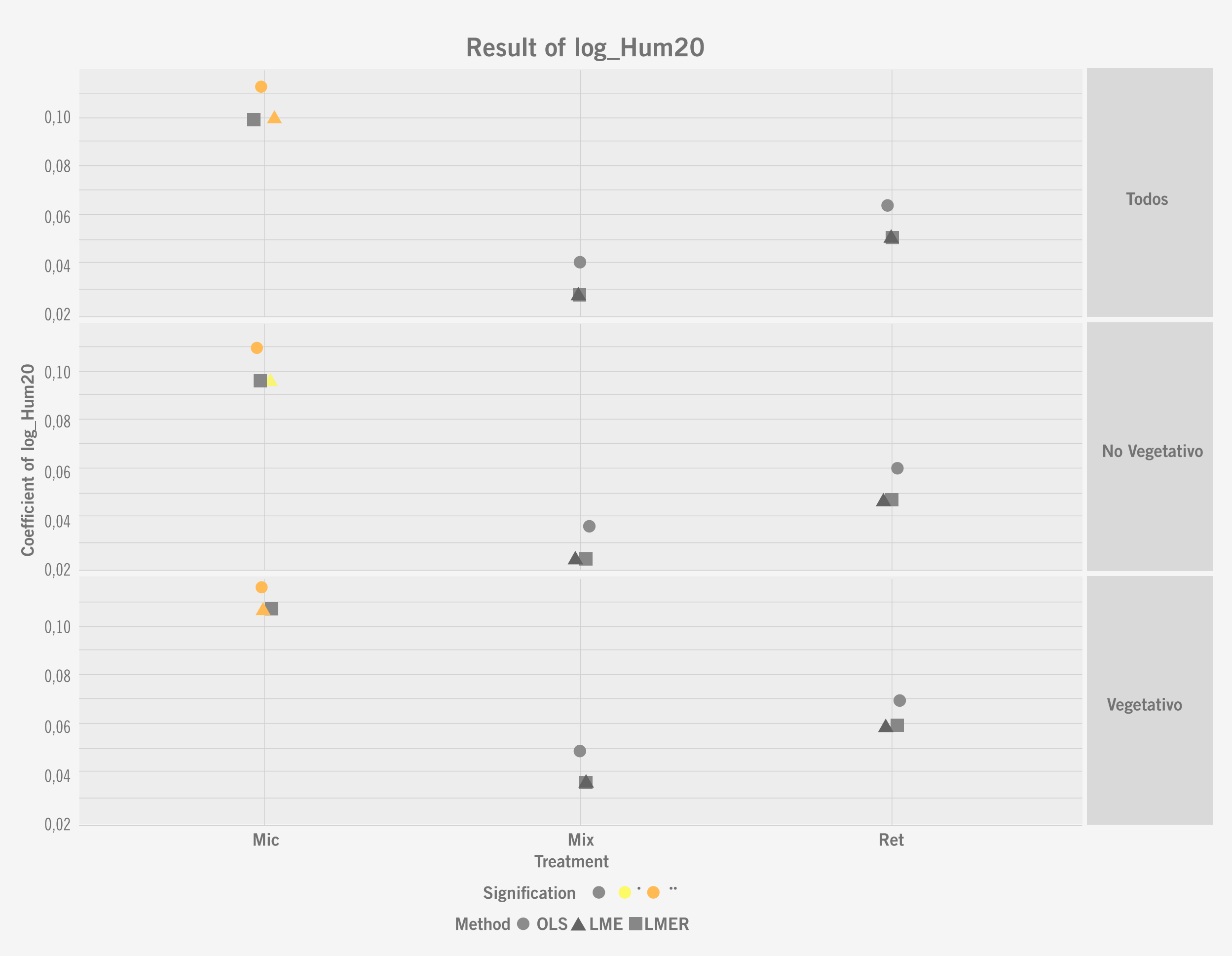
The treatments seem to be related to an increase of the water absorption of the soil after a rainfall, particularly when the soil is dry as can be seen in the following figure:



Soil moisture absorption after a rainfall by treatment and block

Results

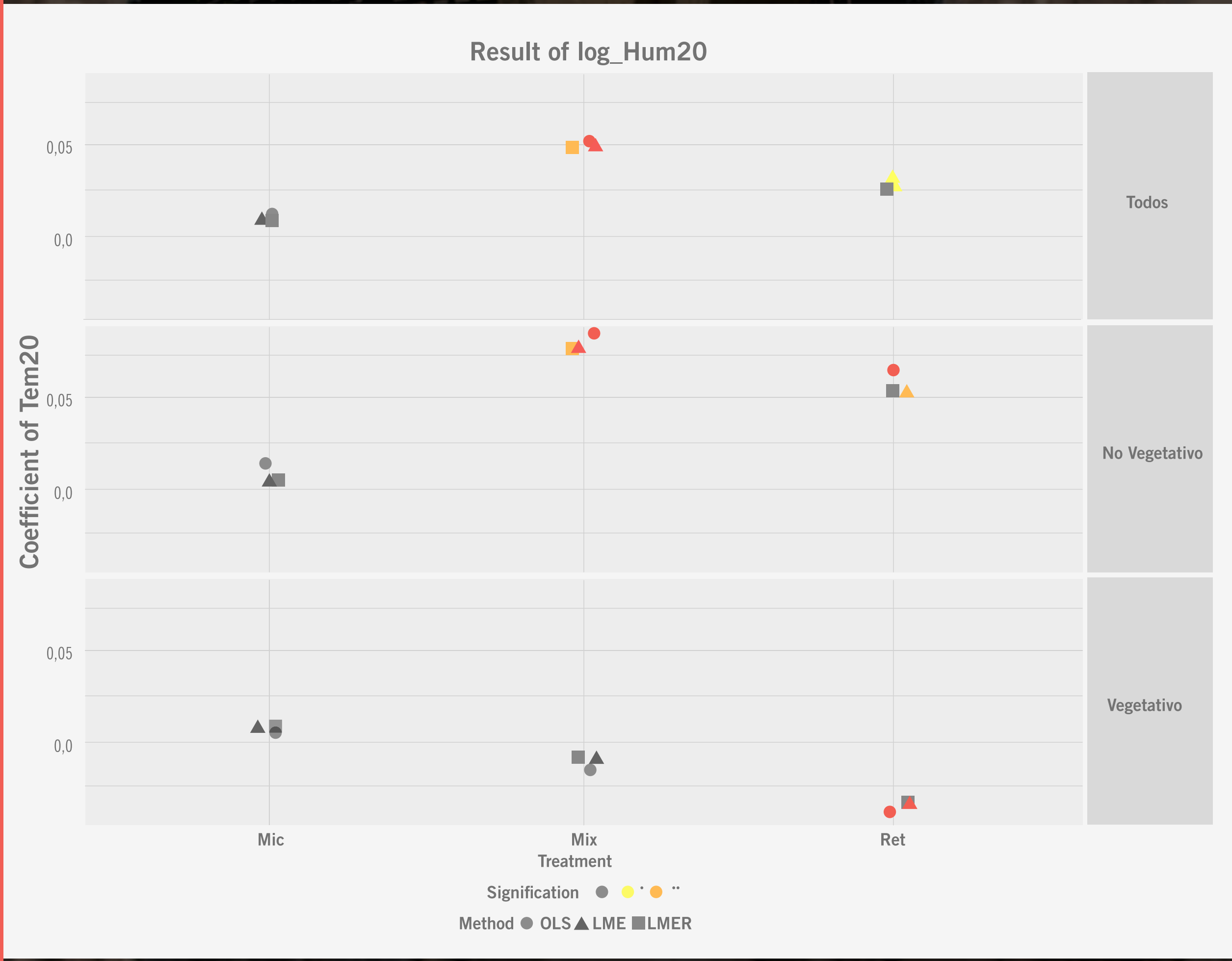
The average moisture of the soil increases when using the treatments (around 10%) although the effect is only significant for the treatment mycorrhiza as can be seen in the following figure:



Graphical representation of the effect of treatment in log (hum 20) all blocks

Results

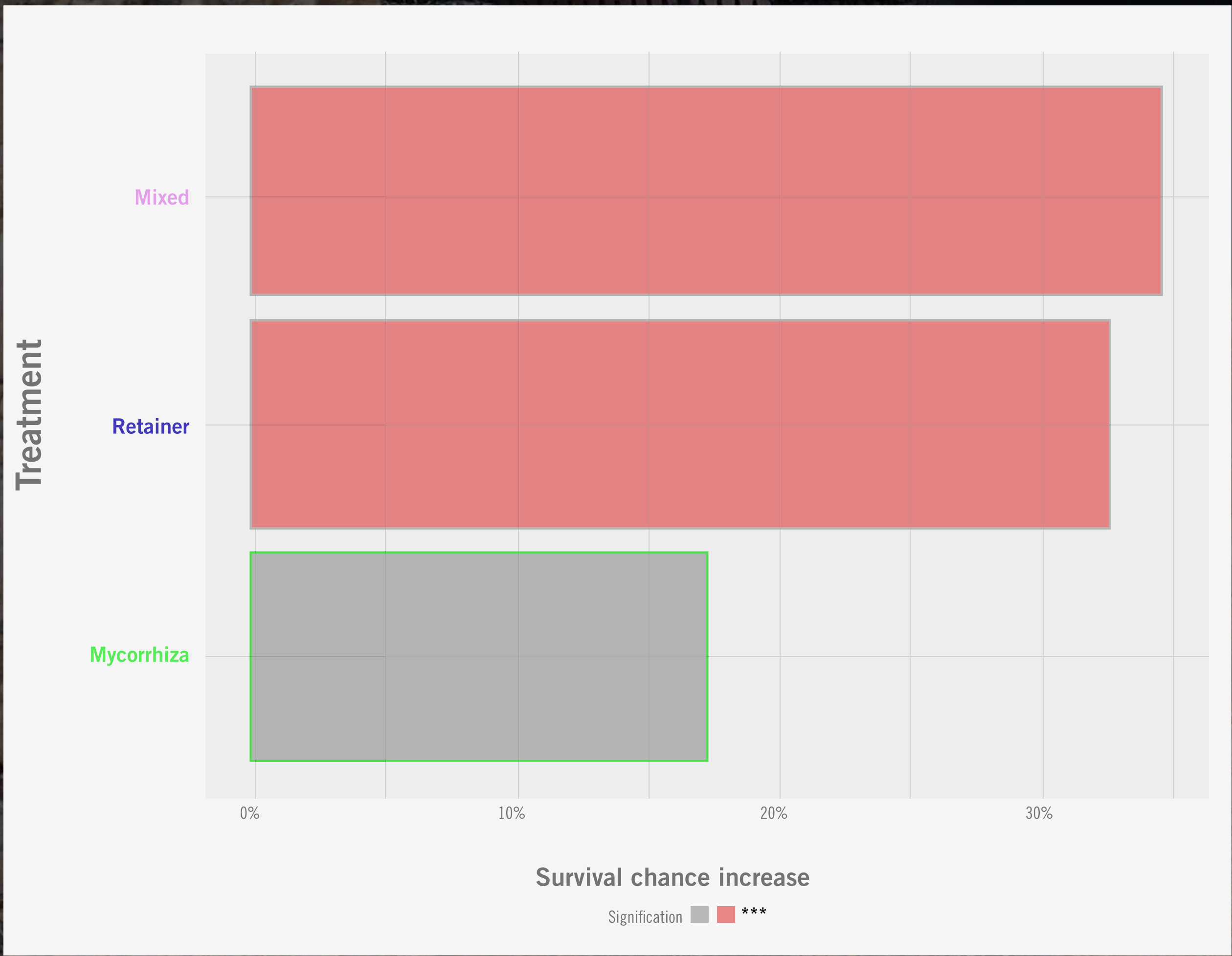
The soil temperature is slightly smother (hotter in the no vegetative period and colder in the vegetative period) when using retainers as can be seen in the following figure:



Graphical representation of the effect of treatment in soil Temperature at 20 cm. all blocks

Results

On average the treatments increase the survival rate of the seedlings around 28%. The treatments based on retainers seem to be more effective. The results by treatment for all the species are shown in the following figure:

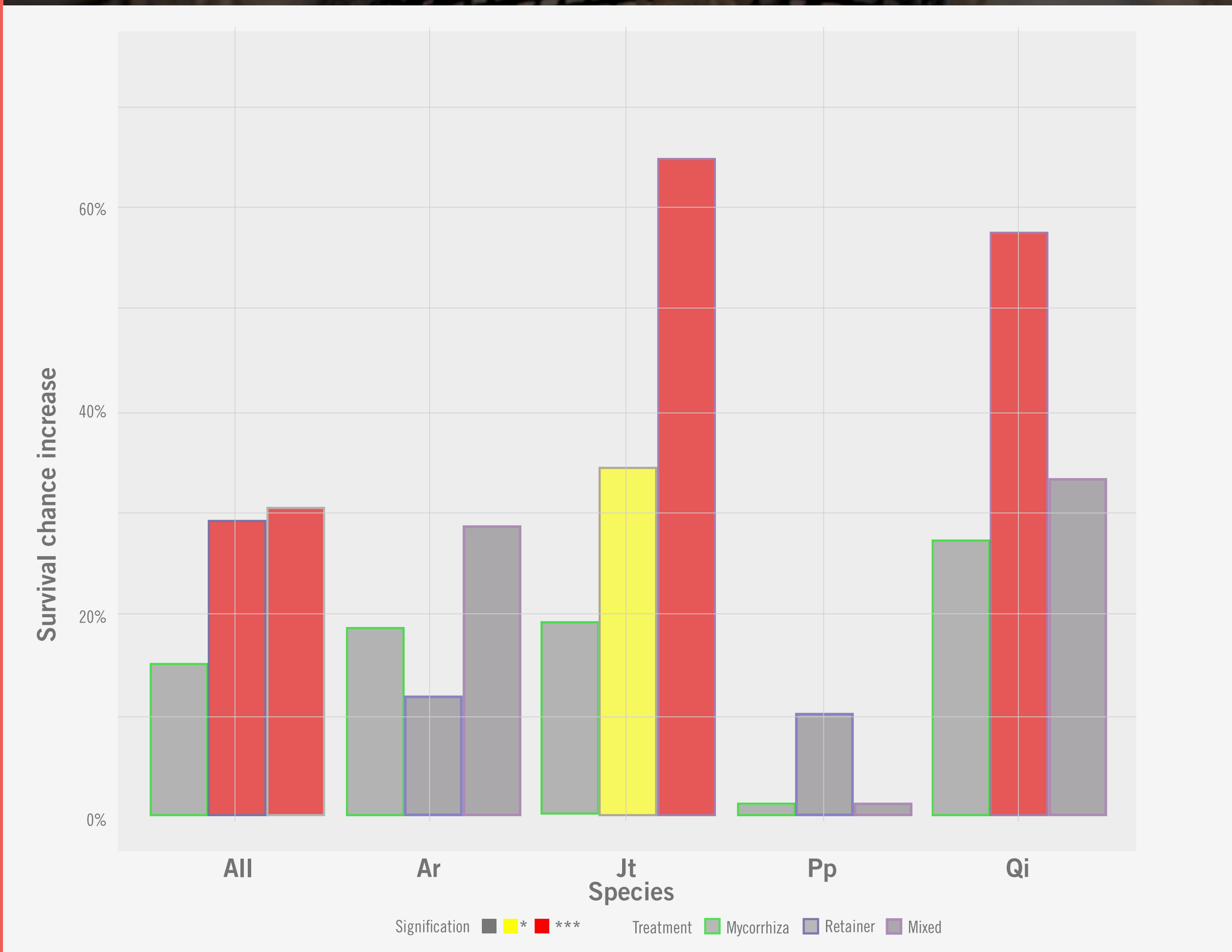


Graphical representation of the effect of treatment in log (hum 20) all blocks

Effect of the treatments for all species

Results

However, the effect depends heavily on the specie and the soil characteristics. While the effect is quite substantial for trees that are partially adapted to tough weather conditions such as the Quercus or Junipers, it is insignificant when working with species very well adapted to the dry climate (such as the Almond or the Pine) or very demanding (Maple). The results of the treatments by specie are shown in the following figure:

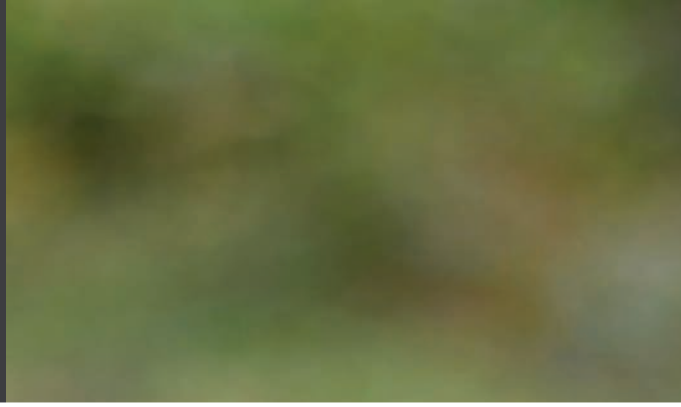


Survival chance increase by specie depending on treatment

We find that the treatments might have a substantial effect on increasing the survival rate of the seedlings, particularly, when some conditions hold:

1. Trees are partially adapted to tough weather conditions such as the *Quercus* or *Junipers*. There is an insignificant effect when working with species very well adapted to the dry climate (such as the almond or the pine) or very demanding (maple).
2. The treatment seems to be more effective when it is easy to apply and yields short term benefits. We see a significant effect of the treatments including retainers and a lower effect of Mycorrhizas.
3. There is a strong dependency on the soil characteristics.

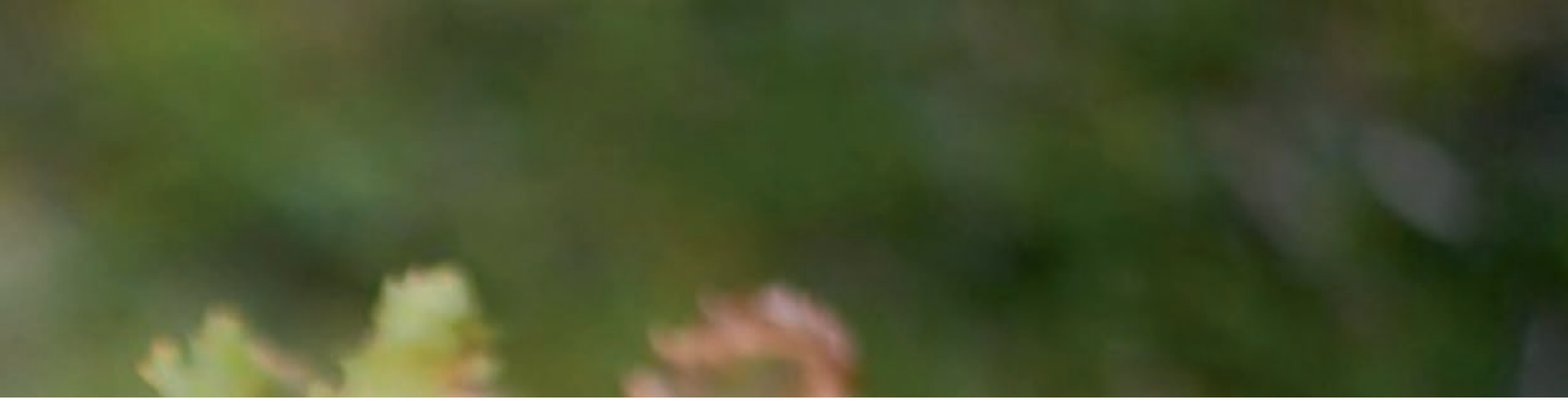
Savings



In using the treatments proposed in the QUF project it is expected that economic savings will be achieved by increasing the survival rate of the seedlings to a point where replanting the trees will not be necessary and without incurring in high costs of watering. To assess and quantify this fact we perform a cost analysis based on the results of the project to compare the expected costs with and without the treatments. The analysis is made considering the specie, the soil characteristics and the treatment.

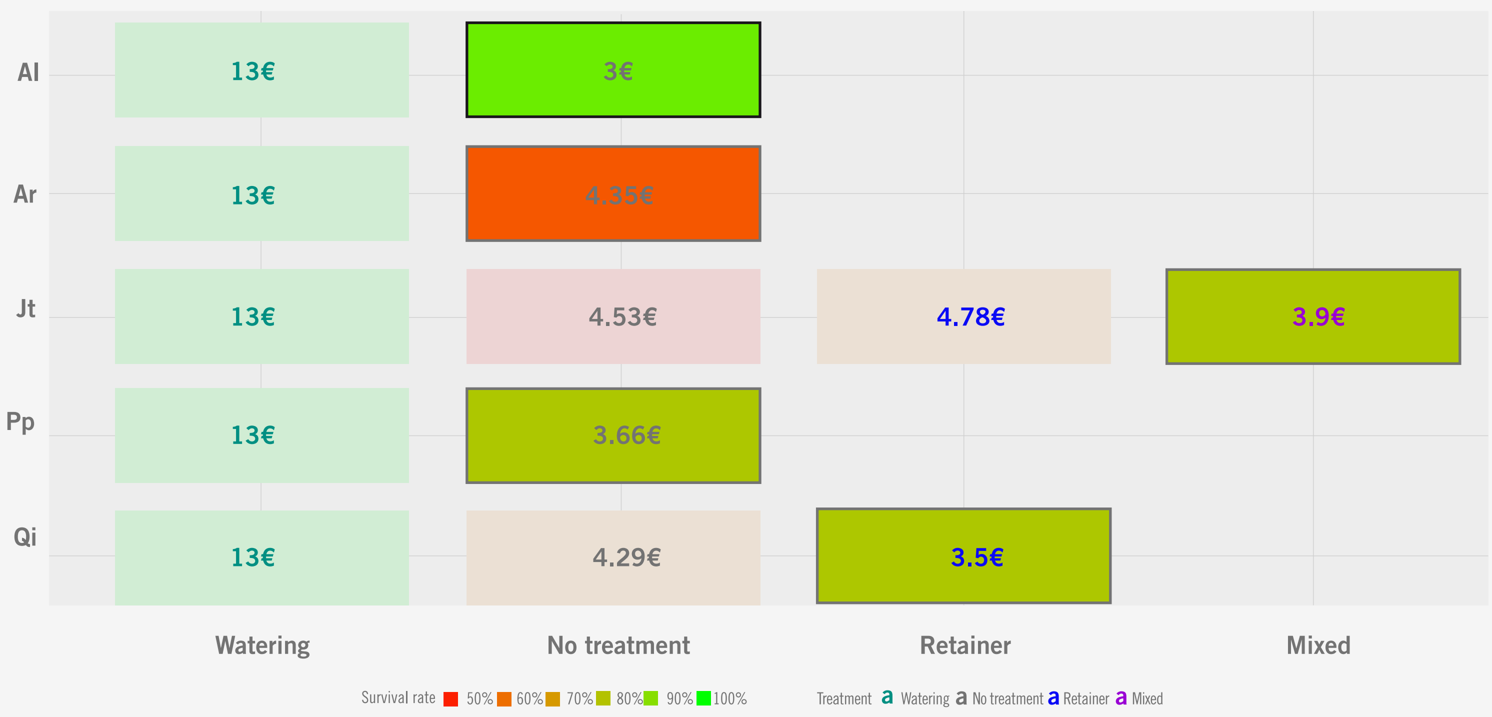
As a delivery of the project, we have developed an online tool that allows the user to specify its own costs. The tool also allows the user to define the minimum threshold to fill the voids with new trees. The tool is available at the web-site of the project.

Based on our project's results and user-specific inputs, the tool estimates the most effective treatment for each type of soil and for a combination of all soils.



Example of cost and survival of plants (all soils)

All soils (average)



Socio-economic benefits

Extensive trees plantations in urban areas are expected to have relevant socio-economic benefits for the cities, such as capture of CO_2, decrease of pollutant gases and particles in the atmosphere, and groundwater protection.

Based on our simulation the carbon storage of the planation will reach 917 Tm in the year 29.

There are also other intangible benefits such as children living in areas with abundant green space being more active and less likely to be obese or showing higher levels of attention, an overall health improvement (less respiratory diseases or stress), and reducing travels to leisure areas.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GSEC - GROUP
GREEN SOUTHERN EUROPEAN CITIES GROUP
otra manera de vivir en los entornos urbanos es posible, se
po de Ciudades Verdes del Sur de Europa, comprometido
ión forestal urbana sostenibles que permitan mejorar la
la calidad de vida de sus habitantes.
del Grupo de Ciudades Verdes del Sur de Europa (GSEC)
Toledo
AJUNTAMENT TORRENT
Valladolid
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¡MADRID!
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Creating the GSEC group

The **Life + Quick Urban Forest** project has among its activities the creation of the GSEC group (Green Cities of Southern Europe as its acronym in English), to support all participants on sharing information, knowledge, experiences, best practices and results, with the main goal of achieving rapid reforestation of arid and polluted areas surrounding cities.

Therefore, it will speed up the restoration of these areas that are suffering the consequences of climate change. The group will function as a pressure group to exert an influence on the regulation and to facilitate and finance projects aiming at the incorporation of QUF and other reforestation techniques.

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I International Forum on URBAN FORESTRY in Mediterranean cities

More than 25 experts from more than 10 different countries worked and discussed about urban forestry in the Mediterranean countries.

Social participation

More than 500 people, both adults and scholars, planted more than 500 trees, learned about the experiment and improved the landscape thought an artistic wallpainting of the evolution of a urban forest.