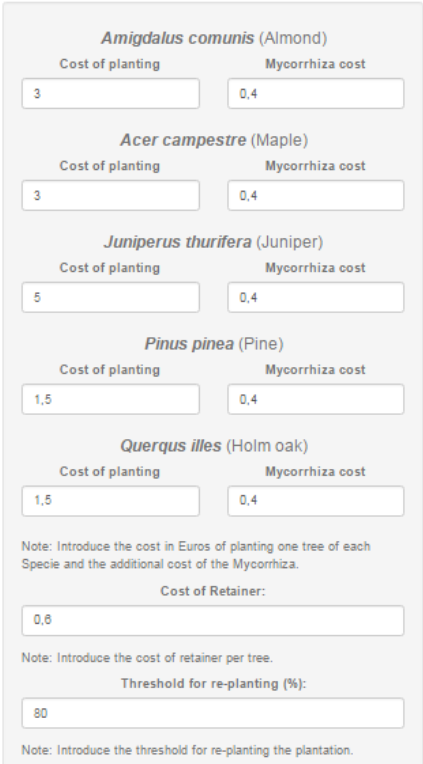
Interactive cost-benefit analysis of treatments

Through the cost-benefit tool of the QUF-project, the users will be able to apply the survival results of the project to their own plantations takin into account the species and the type of soil. Instead of providing the results for a fixed cost we think that this is the most valuable way to use the results because the costs can change depending on the user (due to different bargaining power, market conditions, location, etc.).

At the top left of the screen, we find the different species of the project, namely *Amigdalus comunis* (Almond), *Acer campestre* (Maple), *Juniperus thurifera* (Juniper), *Pinus Pinea* (Pine), and, *Querqus illes* (Holm Oak). For all the species, we must introduce the cost per tree (including the cost of planting the tree), as well as the incremental cost of the mycorrhiza for each specie. The incremental cost of the retainer is supposed to be the same for all the species. In our example, the cost of the *Amigdalus comunis* (Almond) and *Acer campestre* (Maple) is 3 euros per tree. In the case of *Juniperus thurifera* (Juniper) it is 5 euros, while in the cases of *Pinus pinea* (Pine) and *Querqus illes* (Holm oak) it is 1.5 euros. With regard to the treatments we have introduced a treatment price for the mycorrhiza of 0.4 euros (the same for all species) and 0.6 euros for the treatment retainer. In addition, we have to introduce a threshold for replanting. If the survival rate of the trees for a specific specie is below that threshold, then new trees should be planted, thus incrementing the average cost per tree. We have stablished an 80% threshold in our example. The threshold can also be modified. We show below the data introduced in the tool for this example:

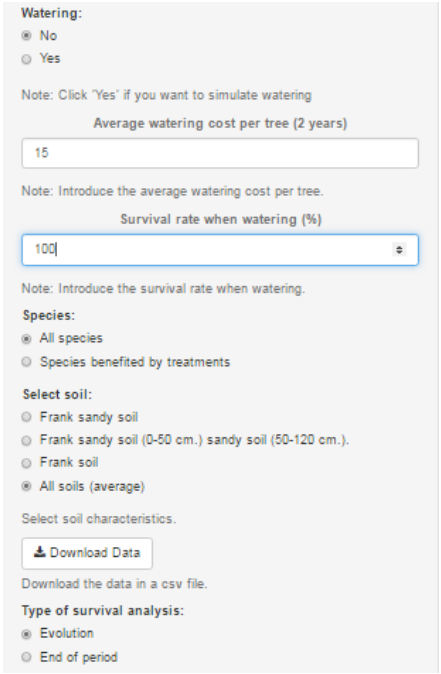


In the left-lower side of the tool, the user can choose the possibility of selecting an additional scenario of watering and, if so, the average cost per plant of the irrigation during 2 years, as well as the estimated survival rates of the plants with watering. This option can be used to compare the costs of the treatments without watering to the costs of watering without using the treatments. In our example, we have not used this option.

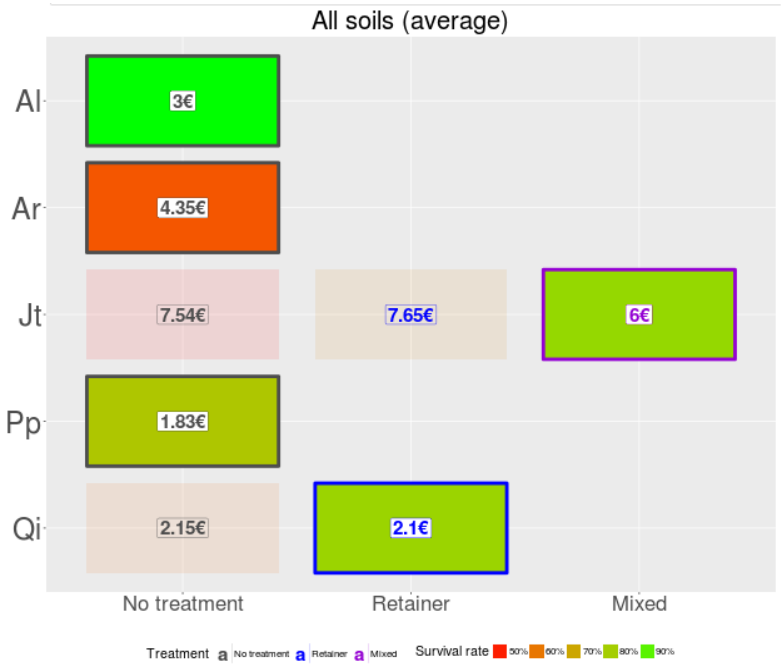
The user can select weather the tool will show the results for all species or only those in which the treatments improve the survival of the plants. The user can also select different types of soil or to make the estimation considering the average of the different soils of our plantation.

Eventually, the user can select if the estimation will be made by taking the results only at the end of the project or by considering the evolution of the trees during the different observation periods (more conservative). In this cases we consider that a tree has died if it seems to be death during any of the intermediate observations regardless of the status at the end of the project (some trees may appear as death in one observation to further being alive in another observation).

In our example we have not used the option of irrigation, we want to see all species, for an average soil, and, finally, we have taken into account the evolution of observations during the project. We show these options below:



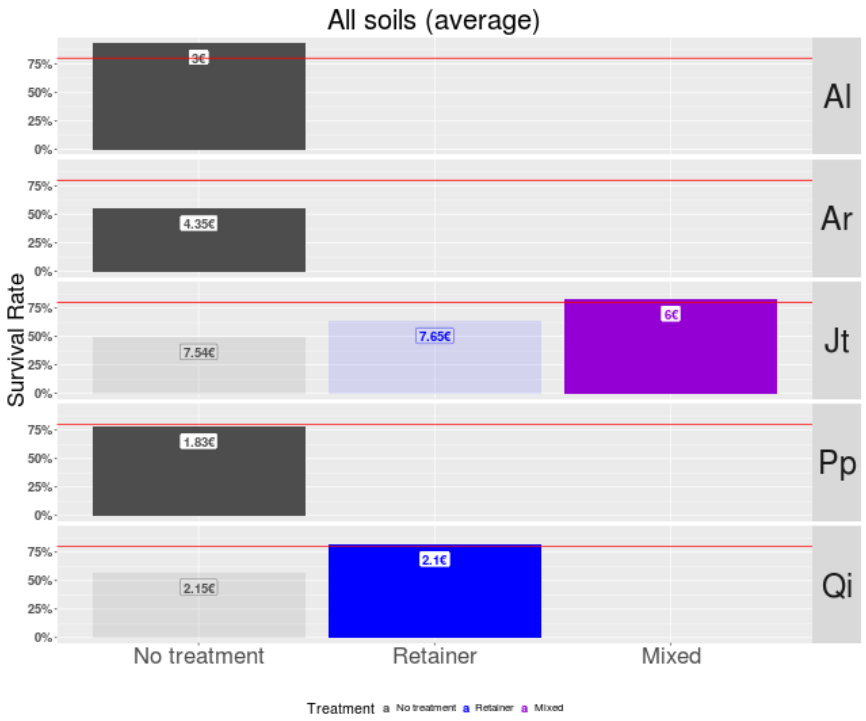
With all these inputs we get the results of our example:



We can see in the upper margin of the graph that the estimation is made for an average soil considering all the soils of our project (remember that this option is one of the four that are presented in the tool). In the Y axis, you can see the different species analysed. In the X axis, we show the treatments. The border of the rectangles emphasize the treatments (in gray the absence of treatment, in blue the treatment with retainer, and in purple, the mixed treatment. Obtained are based on the chosen options) The survival rate of the plants is observed in the color of the rectangle (the color may change depending on the options) In our case, red indicates a survival of plants around 50%, orange for 60%, brown for 70%, dark green for 80%, and light green for more than 90%. The number within the rectangles is the average cost per tree. The rectangles in full color are those with the lower price for each specie. We only show the rectangles of the "No treatment" and of the treatments with a statistically significant improvement compare to the "No treatment" case.

In our example we see that, for the *Amigdalus comunis* (Almond), using "No treatment" is the best choice, costing 3 euros per plant and achieving a survival rate of 90%. Regarding the *Acer campestre* (Maple), we find that also the "No treatment" is the best choice, with the cost of the plant at 4.35 euros and a survival rate of around 60% (therefore replanting is required and that is the reason the average cost has increased). Regarding the *Juniperus thurifera* (Juniper), the best choice is the "Mixed" treatment, although also the "Retainer" treatment is better than the base case (increases survival rate) but at a higher cost. The best choice has an average cost of 6 euros per plant, and the survival is around 90%. In relation to *Pinus pinea* (Pine), the best choice is "no treatment" with a cost of 1.83 euros and its survival rate is around 80%. Eventually, for the *Querqus illes* (Holm oak) the best choice is the "retainer" treatment, showing a cost of 2.1 euros and a survival rate of 80%.

We also provide a second graph to show the improvement or worsening of survival rate:



As in the previous graph, in the upper part of the graph you can see the choice of all soils, while in the X axis we show the treatments. In the right margin we present the species, and in the Y axis, the percentages of survival of the plants. We draw a red line with the threshold of replanting. Remember that we indicated a threshold of repopulation of 80%. We can see that in our case only, the *Acer campestre* (Maple) and the *Pinus pinea* (Pine) are below the threshold, and therefore the average price is increased to include the cost of replanting. There is no need of replanting neither for the *Juniperus thurifera* (Juniper) nor for *Querqus illes* (Holm oak) due to the treatments that have increased the survival rate above the threshold compared to no using treatments and therefore has reduced the average price, although the treatments increase the cost per tree.