Regenerating Villa Fortuna

Purpose: Thanks to the revenues of Almo Nature, Fondazione Capellino,through its RVF farm, experiments with Biodiverse Agriculture practices, whichconsists in restoring biodiversity and increasing soil fertility simultaneouslywith the production of food for humans. Through data collection for a scientificand systematic measurement of the effects obtained, it will be possible todefine truly effective practices that can be replicated, adapted and furthervalidated in other contexts and environments. The primary aim is to organizesustainable food production that goes beyond the current agricultural model,which works vertically while still using high quantities of pesticides andsynthetic fertilizers to guarantee adequate production. The intensiveagriculture model which considers the field a blank sheet, on which tointervene with fertilizers and pesticides functional to the agro-industry, hasprogressively eliminated soil fertility, increased water and air pollution andextinguished, where practiced , biodiversity.
Other partecipants: RVF Società Agricola Sperimentale S.r.l.
Our investment: 300.000€ /year
Duration: From 2019, indefinitely

State of the art of the Project at the current date:
- 2019-2021 Evaluation of the current ecosystem services before the start of the regeneration activity, through in-depth chemical-physical analysis of the soil, biological quality of the soil (QBS) and with analysis of the environmental DNA present throughout the area and monitoring of the flora and local fauna.
- 2021 Insertion of a varied agroforestry system, in an area of 3.6 hectares, organized so that there are production trees (60%) including cherry, apple, pear and plum trees, fast-growing biomass trees (20%) such as paulownias, the white poplar and the white mulberry and trees that support the ecosystem such as the wild service tree, the field maple and the laburnum. To support biodiversity, productive shrubs have also been included, such as hazelnuts and pomegranates and ecosystem shrubs such as Elaeagnus umbellata.
- 2021-2023 Study and monitoring of parasitoid insects present in the area to define a new minimally invasive biological control strategy with local antagonists to harmful insects.
- 2022 Ecological corridor system, with trees supporting biodiversity including the field maple, hazel, hornbeam, oak, wild service oak, turkey oak, peraster and wild apple, surrounded by shrubs such as the dog rose, the dogwood, common privet, hawthorn, buckthorn, wild blackthorn, priest's cap and dogwood.
- 2022 Fortification of the wooded areas of the property with planting of local trees.
- 2022 Planting of 0.65 hectares of Slarina type vineyard, ancient and native variety and 0.65 hectares of Freisa type vineyard. - 2022-2024 Start-up of a zero-copper vineyard with testing of resistance inducers as a preventive measure and use of various anti-sporulants to combat vine diseases.
- 2022-2023 Conducted study for the calculation of CO_2 absorptions, carbon stocks and the mitigation potential of the agroforest, the ecological corridor and the wooded areas.
- 2023 sows experimental cover crops to encourage increased soil organic matter and reduce erosion.

- 2024 start of experimentation on soil health and biodiversity with distribution of soil improvers and natural fertilizers of various kinds (compost, biochar, pectin, biofertilizers) to evaluate the effects on the crops present and the reaction of the local soil type.
- 2024 Start of renovation of the historic farmhouses which will become the headquarters of Fondazione Capellino and the biodiversity school.

The importance of constant monitoring

Regenerating Villa Fortuna is an experimental agricultural company whose aim is to understand what is the maximum possible biodiversity in a productive environment and therefore create a balanced ecosystem capable of producing healthy food and which at the same time maintains synergy with nature. Field testing is complex and, unlike studies in a controlled environment, where the variables are reduced to the minimum possible, it is crucial to have the greatest amount of data possible, in order to validate the practices that are truly effective in rehabilitating an exhausted ecosystem. from intensive agriculture. Precisely for this reason, careful monitoring was activated from the first day of the project through soil analysis, biodiversity monitoring and IoT sensors.

Zero point

At the start of the project, a great variety of analyzes were implemented to verify the state of the area and to have a solid reference point to compare in the applied practices, also considering the wooded areas present and not just the agricultural ones:

- - chemical-physical analyzes for homogeneous areas
- Soil biological quality analysis (QBS).
- Environmental DNA analysis
- Monitoring of the biodiversity present through a census of fungi and bacteria (beneficial and pathogenic), listening points for avifauna and camera traps for the detection of mammals.

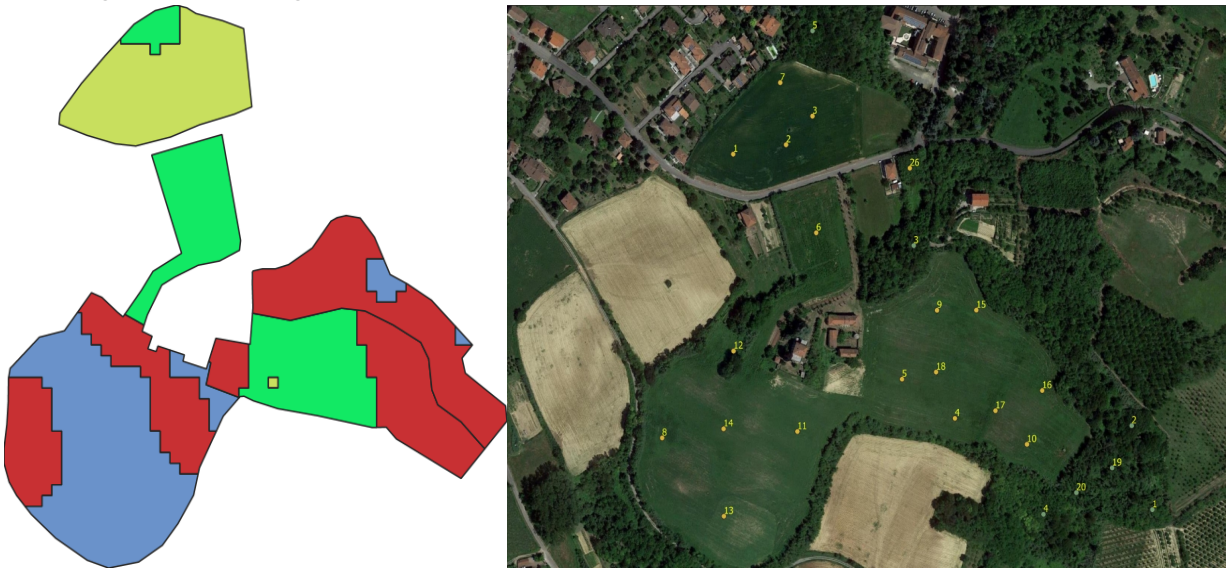
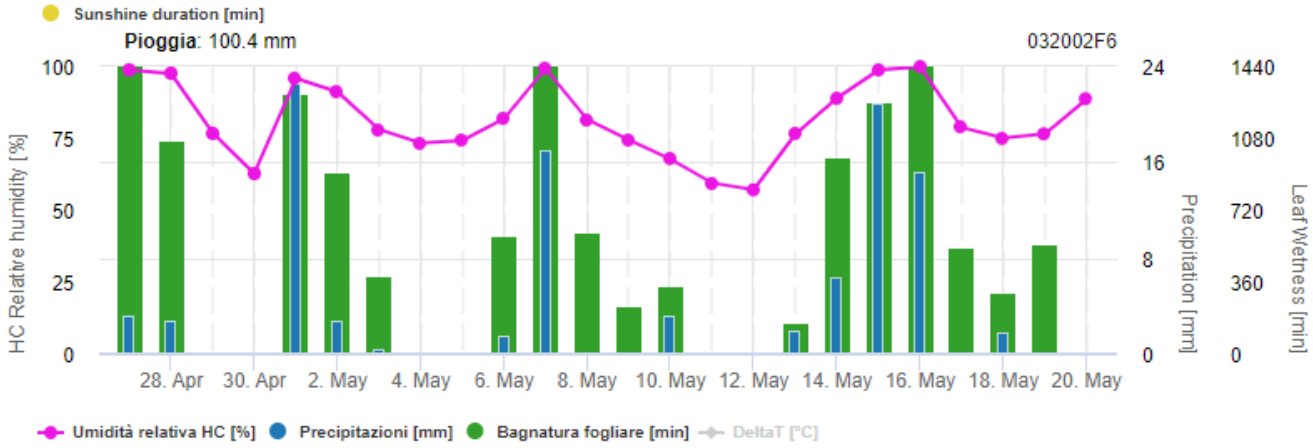


Figure 1: homogeneous areas of the agricultural estate and sampling points for chemical-physical analyses

Figure 2: Mammal and avifauna monitoring points in the period 2020 - 2022

The agricultural area is also equipped with sensors with a weather station that monitors the main environmental parameters and sensors that continuously collect data on soil humidity and temperature. The data is used for agricultural activities and as a corollary information to experimental activities.



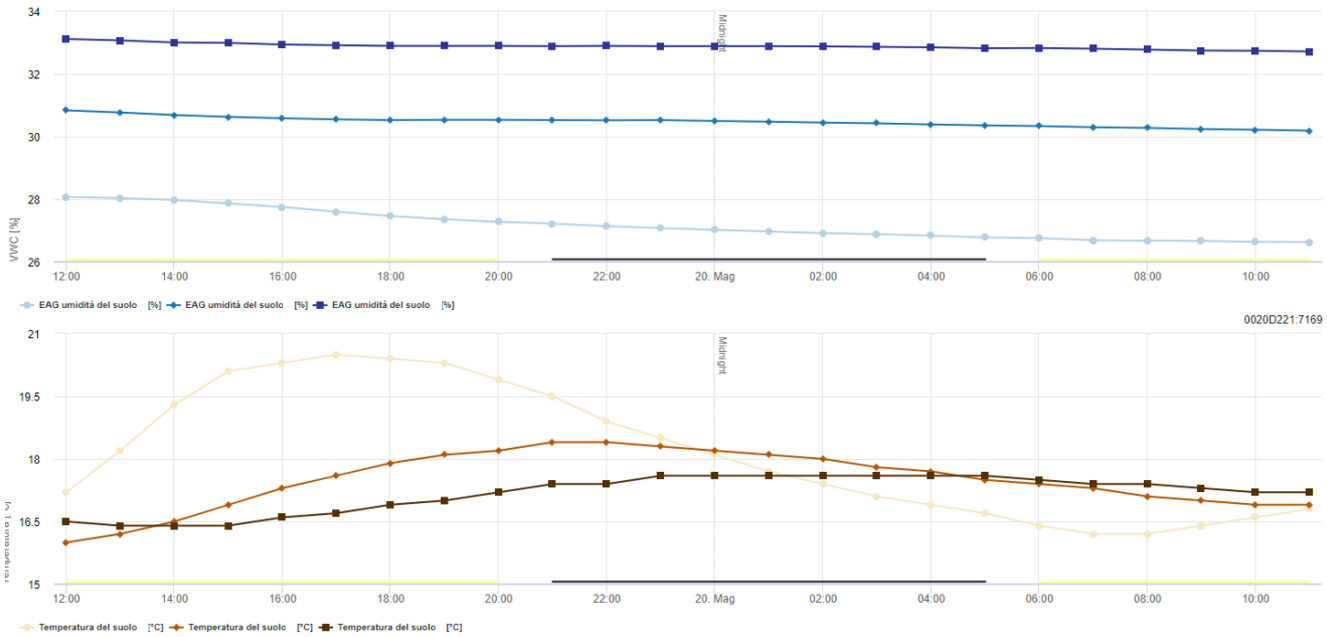


Figure 3: IoT monitoring sensors

Experimentation

The project has several active experiments aimed at studying the restoration of soil fertility without the use of synthetic fertilizers and studies to bring the use of pesticides to zero through biological control.

Our commitment against pesticides

The zero copper vineyard

As is known, copper is considered the only truly efficient contrast against some vine diseases such as downy mildew, however this element is also a heavy environmental pollutant, which accumulates in ecosystems, contaminating them. An experiment has been implemented in our vineyard to test alternative practices that allow us to reduce and possibly eliminate the use of this heavy metal. The imagined defense scheme involves the exclusive use of sulfur as a fungicide and resistance inducers as a preventive measure and the use of various antisporulants when the disease occurs, in order to compare their effectiveness (lime, bicarbonate, potassium soaps, orange oil).

The biological struggle

In recent years, careful monitoring of local parasitoid insects has been carried out, both in production areas and in areas of high biodiversity, the aim was to understand which species of parasitoid insects were present in the area. Parasitoid insects need another insect to complete their life cycle, they normally deposit their eggs in the reference host which dies

during the growth of the larvae. Thanks to the use of existing databases, it is possible to understand which insects are attacked by the insects present and develop biological struggles with local insects, favoring a given insect or artificially increasing its population in predetermined periods, to combat specific insect attacks on crops. This will allow us to limit the damage caused by insects, reducing the alteration of the environment to a minimum, as happens for example when alien antagonists are inserted to counter harmful insects that come from other countries.

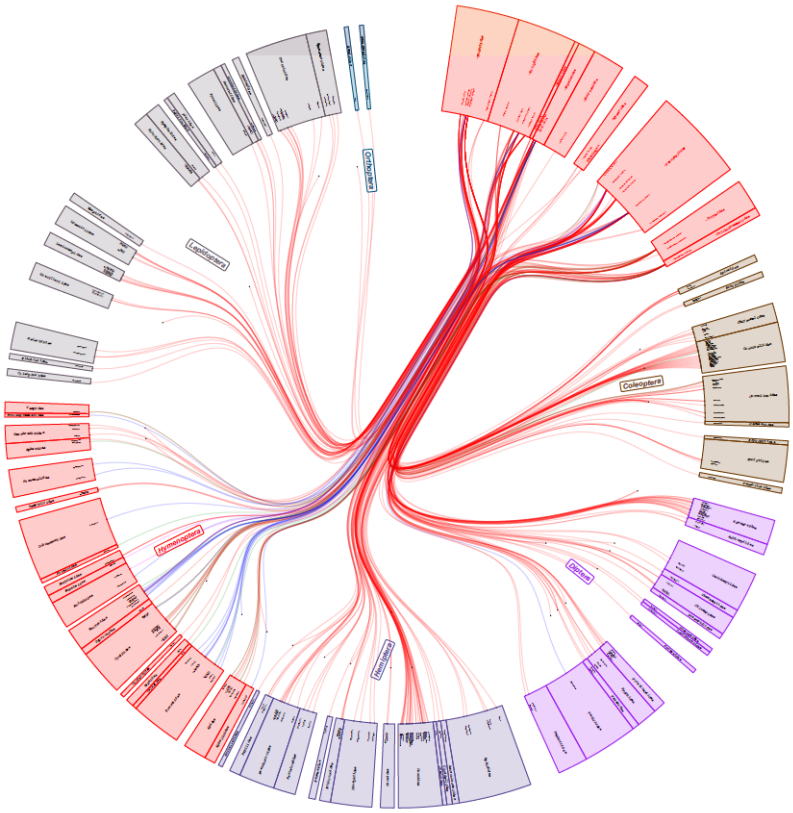


Figure 4: example of a parasitoid relationship graph, on one part of the circumference (top right) we find the species monitored on site by the project, on the other part there are the parasitized species, the arrows indicate the parasitoid/parasite relationships.

Our commitment against synthetic fertilizers

Soil research

In the first quarter of 2024 we started the experimentation on soil health, which extends over 6000 square meters of agro-forest, the aim is to validate the best practices to accelerate soil reintegration from a broad perspective, both from the point of view of chemical parameters, first of all the organic substance, and that of the activity of soil microorganisms. The experimentation was designed from a circular perspective, to ensure that everything tested as a supplement to the soil can be obtained from waste derived internally in the company, once production has started, in order to avoid the continuous need to buy from external fertilizers and to minimize agricultural environmental impact.

Soil improvers such as compost with the addition of beneficial compounds such as biochar , derived from lignocellulosic waste from the maintenance of orchards, vineyards and forests, and pectin, derived from the peel after fruit processing, were included in the experimental plots of our agroforest.
The experimentation involves a monitoring plan of the chemical-physical parameters and biological activity of the soil through quantification of the microbial biomass, with quantification of the environmental DNA and the variation in intensity of the main nutrient cycles, such as carbon, nitrogen, phosphorus thanks to the analysis of the activities of the bacterial enzymes involved in the mobilization of these elements. Everything will be correlated with the monitoring of tree growth, with measurements of the volume of the crown, the height of the trees and the diameter of the trunk.
The experimentation includes a monitoring plan consisting of:
- analysis of the chemical-physical parameters of the soil; - microbial biomass quantification through quantification of environmental DNA;
- variation in intensity of the main nutrient cycles, such as carbon, nitrogen, phosphorus thanks to the analysis of the activities of the enzymes of the microorganisms involved in the mobilization of these elements; - monitoring of tree growth, with measurements of crown volume, tree height and trunk diameter.

Monitoring of carbon absorption and reserve

Between 2022 and 2023 a study was conducted to calculate CO2 absorptions, carbon stocks and the mitigation potential of:
1. Agroforest
2. Ecological corridor
3. Wooded areas
The situations analyzed are characterized by different dynamics:
- Agroforest and ecological corridor have implied the transformation of the management system of two areas, managed conventionally until 2017.

The methodology used in this part of the study complies with the 2006 IPCC (International Panel on Climate Change) Guidelines.

In relation to these two cases, the mitigation potential was quantified with an absorption of CO2 from the atmosphere of 525.93 Mg, considering a time frame of 20 years and of 665.69 Mg considering a time frame of 30 years.
Agroforest and ecological corridor can therefore be considered as a real additional intervention that generates climate benefits, as well as other co-benefits mainly in terms of biodiversity and possible positive impact on water management.
- As regards the plots characterized by the presence of forest, the objective of the study was to quantify the carbon stored in the epigeal biomass.
The calculation of absorptions was carried out according to the methodologies proposed in the Italian National Inventory of Emissions and Absorptions (NIR 2024).
The study estimates that approximately 123.3 Mg C equal to 451.3 Mg CO2 are stored: this is a current snapshot that cannot quantify the temperate evolution of the populations.