REFOREST

Two days in the agroforestry landscapes in the province of Girona, Catalonia

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A team of researchers from the EU Horizon Europe project ReForest, Marcos Jiménez Martínez and Prajna Kasargodu Anebagilu, both from the University of Bonn, Johannes Schmitt from the University of Marburg, and Rico Hübner from the German Agroforestry Association – DeFAF, embarked on a two-day field trip in the Catalonian province of Girona. The aim is to get in touch with farmers practicing agroforestry and gain insights into the status, management, and challenges of their agroforestry endeavors.

Day 1 – Silvopastoral Farm with Aubrac and alfalfa at Can Genover

On the first day, the group visited the BioGrassFed silvopastoral farm Can Genover in the Alt Empordà County, stretching approximately 370 hectares of mostly ridged terrain on the pre-Pyrenean foothills. The farm contains a mosaic of Mediterranean forests, shrubland, and pasture where a herd of 180 suckler cows of the Aubrac breed ranges freely all year round.

Figure 1: Farmer Marisa Reig welcomes the researchers from the EU ReForest project.

Figure 2: Panoramic views of the BioGrassFeed farm area with olive trees and flowering cork oaks in the background.

Olive orchards dominated the landscape until 1956, when most trees died due to severe frost damage. Since then, the landscape has regenerated naturally as dense mixed-species Mediterranean woodlands composed of holm oak (*Quercus ilex*), Scots pine (*Pinus sylvestris*), olive (*Olea europaea*), and others.

Meanwhile, cereal and oilseed production continued in some arable plots across the property. In 2004, the current owner, Marisa Reig, took on the responsibility for the land from her father. During the first years, she rotated a wide variety of annual crops, finding out that the soil was too compacted and, in general, too infertile to provide any relevant agricultural production or to improve the ecosystem's productivity. Therefore, she initiated an ambitious plan to put free-range cows at the center of the farm and landscape management strategy. Studying the philosophy of Allan Savory's Holistic Management, Marisa developed the pasture by sowing perennial grass species, mostly leguminous, such as alfalfa (*Medicago sativa*), and stopped using agrochemicals. Since then, the cows graze exclusively on the grassland vegetation from the farm and additionally feed on alfalfa hay.

Figure 3: The Aubrac cattle herd of BioGrassFed graze on natural grassland rich in herbs and medicinal plants.

More recently, inspired by the millennial tradition of agroforestry management across the Southwestern Iberian Peninsula, the farmer has thinned some of the densest woodlands to permit cows to roam throughout the farm segments. This is considered beneficial across the Iberian Peninsula and the Mediterranean basin, in which biomass accumulation in shrubland and forests poses a potential threat due to a higher susceptibility to propagate and increase the severity of wildfires across these drought-prone regions. Truly critical in hilly areas, where extinction operations are complicated – even becoming impossible at times.

Figure 4: Woodland at the farm of BioGrassFed in the initial state un-managed.

Figure 5: Neighboring forest after thinning. The grazing will prevail in a more open structure as less fire-prone biomass accumulates.

By ranging within the woodlands, cows benefit from adding aromatic plants, twigs, and leaves from trees and bushes to their diets, while trampling the terrain and avoiding undesired re-growth of the under-story.

The cattle herd moves weekly across a network of pastures subdivided by electric fences. Rotational grazing and open-air resting promote the re-growth of pastureland species and allow vegetation regeneration. During our visit, we observed a large variety of native leguminous species and vigorous populations of economically valuable plants, such as fennel (*Foeniculum vulgare*). The BioGrassFed initiative is a good example of how biodiversity and human land use can complement each other to support health, income generation, and regional value.

Day 2 – From monocultures of annual crops or tree plantations to silvoarable systems

On the second day of the field trip, the director of EMYS Foundation, Ander Achetegui Castells, joined the group, and we visited more than a handful of silvoarable plots on the properties of Antoni Trincheria in the municipality Riudarenes in the La Selva county. Located in a flat valley bottom, the municipality's name means "sand-river", as we could witness while walking around the plots. Likewise, the county's name means "forest", which indicates its original landscape, which, in turn, may also explain its aptitude for silvicultural production. Along our way, we passed through several monoculture tree plantations, prevailed by hybrid plane (*Platanus × hispanica*).

Figure 6: A 25-year-old hybrid plane (Platanus × hispanica) plantation typical for the Riudarenes floodplain.

Figure 7: A Poplar (Populus spp.) plantation typical for the Riudarenes floodplain.

The first alley-cropping system we encountered had a size of approximately ten hectares and was planted in the winter of 2022 with 4 m poplar rods (*Populus* spp.), placed 80 cm into the ground, and wheat growing underneath. At the same site, a part was planted with poplars six years earlier; one could see the trees more mature. The trees are heavily mulched with straw around the stem to keep the moisture in the soil. Both plots have been converted into agroforestry from previous mono-crop tree plantations.

Figure 8: Agroforestry expert Ander and farmer of Antoni from the municipality Riudarenes proudly present some of their achievements in agroforestry from the past decade.

Figure 9: A poplar alley cropping cultivation system is Antoni's latest development and already showed lush leaf crowns in the first year.

The walnut agroforestry system – approximately two hectares in size – was stocked with walnut hybrids (*Juglans regia x J. nigra*), now seven years of age and cultivated with rapeseed. This site was already the second trial by farmer Antoni on that plot after having suffered a harvest failure from the last cherry tree plantation. The cherries suffered difficulties due to exposure to the sun and drought conditions. Antoni also reports increasing incidents with the wild boar population, as the area is not fenced. Damage includes marks on the young trees, all too often breaking them off, besides feeding on the grain before the harvest. This problem is relieved by placing dry branches of Robinia (*Robinia pseudoacacia*) around the young stems. The plan is to remove damaged or multistemmed trees and free space for cereal production after some years. Intercropping usually involves wheat, rapeseed, and barley in the rotation.

Figure 10: Typical damage caused by boars breaking the stems, forming a rather bush-like structure.

Figure 11: Tearing off the bark, creating potential entry points for diseases or fungi.

Our hosts then took us to the up-slope of the valley to show us a section of a mixed-species woodland formed by cork oak (*Quercus suber*), chestnut (*Castanea sativa*), pines (*Pinus* spp.) and shrub species, which he partially cleared one block in 2022 logging mature pine trees and clear diseased trees, turning the landscape from a closed forest to an intercropped open woodland. In 2023, Tritordeum was sown, a drought-resistant and water-efficient hybrid of durum wheat (*Triticum durum*) and wild barley (*Hordeum chilense*) with good nutritional value and agro-processing features. With this intervention, the farmer expected to promote the growth of healthy trees and their cork-producing aptitude while obtaining an annual income from the arable crop.

Figure 12: Almost a dehesa-like appearance with selected cork oaks (Quercus suber) and Tritordeum production underneath. Visible is the somewhat higher growth of the cereal in the shade of the trees.

Figure 13: Richer soils and impressive growth rates of the poplars in the mixed species silvoarable system.

Finally, farmer Antoni drove us back to the valley bottom near the river to show us a medium-aged mixed-tree plantation of poplar and two varieties of Persian walnut (*Juglans regia*), which he expects to resist climate crisis better than walnut hybrids. Mixing tree species instead of a one-species plantation is still very innovative in the region, but according to Antoni, it works well. The tree population looked healthy and vigorous, but the site benefited from loamy soils near the river and the groundwater table within reach. Poplars, which were about twice as high as the walnut trees, are grown in a rotation of 15 years and will be logged within the next few years, some years earlier as in plantation forestry, opening the space for the cultivation of cereals and giving room in the crown for the walnuts. The farmer is convinced of the beneficial interaction between the walnut and cereal production that he plans to extend to the neighboring fields, but solely with Walnuts.

Figure 14: The premises of the EMYS Foundation is a biodiversity hotspot, with facilities for education, workshops, culinary experiences, and a well-sorted shop for local and organic produce. The main activities are extension services for farmers and the planning of ecological compensation areas.

In the afternoon, we visited the landscape managed by the EMYS Foundation. After a well-deserved meal made from seasonal local and some non-marketable products in Can Moragues and an enriching exchange of perspectives and ideas with Ander and his colleague Carla Cárdenas, a sustainable agriculture and forestry management technician. They showed us three plots within a cropland landscape aligned with woody hedgerows. The trees were planted in spring 2023 within the network of demonstrative sites in the EU Life AgroForAdapt project.

Plot I was a four-hectare wheat field subdivided in its middle section by a row of elderberry (*Sambucus nigra*). The aim is to increase the edge effect for biodiversity and ecosystem functions such as pest control by natural antagonists and pollination services from insects by increasing the perimeter of woody hedgerows without reducing the operational efficiency of common-size tractors. The other two plots were

alley cropping systems with fruit trees following an alley-cropping layout. Plot II was established on a field with very low fertility after decades of intensive cultivation of cereal and ryegrass (*Lolium* spp.). Well-marketable varieties of apple (*Malus* spp.), pear (*Pyrus* spp.), and apricot (*Prunus armeniaca*) saplings were planted in six single species rows at a distance of 16 m in-between rows and 4 m spacing within the row and drip irrigation installed. By appearance, some trees' leaves displayed some sort of unidentified wilt. In the case of the pears, this could even be pear rust. This might have been triggered by the neighboring juniper stands – a common vector for this disease. The planting also showed the absolute necessity for proper protection of the young trees – not only by an outer fence against deer or wild boar but also directly at the stem by a tree protection sleeve – several trees showed fresh gnawing marks from rodents or rabbits. (*Update July '23: EMYS installed planting tubes to protect from rodents)

Figure 15: Well-marketable varieties of fruit trees planted in the spring of 2003 as an alley cropping system in a 16 m by 4 m layout.

Figure 16: Several young apple and pear trees showed fresh gnawing marks from rodents or rabbits.

Plot III is dedicated to vegetable agroforestry (leafy vegetables, gourds, etc.) and was planted with almonds (*Prunus dulcis*). These saplings showed heavy signs of water stress, and many trees appeared dead. Ander and Carla explained what went wrong: 1) the planting date was in spring instead of winter, thus too late in the season; 2) the bare-rooted planting material could not be planted immediately due to a lack of workforce and 3) technical difficulties with the irrigation to distribute water over the long hosepipes to the remote plot exaggerated by some clogging of the drip emitters. Common elements that may clog the system are calcium, magnesium, iron, and manganese, where calcium carbonate is the most common precipitate. As a first reaction, the almond saplings were pruned radically to see if they would regrow. If they fail to display signs of recovery, they will likely be substituted by other tree species.

Towards the end of the tour, Carla and Ander showed us the local seed bank of the EMYS Foundation, where they collect and promote forgotten regional varieties.

Figure 17: The exchange of ideas was lively and fun; we will for sure stay in contact and are eager to receive updates on the successful establishment of the agroforestry plots at the EMYS Foundation in Catalonia.

We are very grateful to all our guests in Catalonia for their hospitality and the time dedicated to us. We thank Jaime Coello from the CTFC and the AgroForAdapt project for facilitating the connections. We return to Germany with many new ideas. This visit was made possible by the EU ReForest project. It was the start of what surely will become a long-lasting and fruitful exchange to promote the re-adoption of agroforestry management across Europe.

Figure 18: Update July '23: EMYS installed planting tubes to protect from rodents (Photo: Ander Achetegui Castell).