Three-dimensional farming: agroforestry in Spain and its relevance to Scotland

By Philip Gordon and Kate Holl

Introduction

Across parts of south-west Spain and southern Portugal there is an area of approximately 3.5–4 million hectares where it appears that there is little distinction between forestry and farming. You can travel on roads for hour after hour and pass through woodland of low but varying tree densities in a well populated landscape. What is striking, especially in spring, is the abundance of wildlife supported by the largely native trees and flora. Yet, like most of Scotland, these are marginal lands with poor soils, the difference being that their limiting season for crops and livestock is the hot, dry summer in contrast to our cold, wet winter. This landscape supports a strong rural economy based on primary production and local processing of a variety of forestry and agricultural products.

Photo 1: Typical *dehesa* landscape.

The *dehesa* is the name given to this cultural landscape and land-use, which derives from the Spanish for 'fenced' or 'enclosed'. The origins of the *dehesa* are considered to be centuries of management and grazing of natural Mediterranean, primarily oak, woodland. As is the case across much of the world, the woodland component of the habitat has survived because it is used and hence valued by local people. The *dehesa* has not been immune to the impact of agricultural production subsidies under the EU Common Agricultural Policy, in terms of both the intensification and extensification in farming and forestry, as well as rural depopulation. Yet, despite such influences and impacts, substantial areas of *dehesa* have survived largely intact due the success of this land-use in sustaining income from the land in marginal areas where alternative options are limited. Here at the southern margins of Europe where climate change means soil loss, fires and droughts, their wider environmental benefits are coming increasingly into focus. Yet to date these still go largely unrecognised in terms of additional public financial support to local landowners.

In terms of rural economies and climate-change mitigation, can we in Scotland, on the northern margins of Europe, learn anything from this? We might be interested in how the management of the *dehesa*, using largely native species of trees and native livestock, and local processing of primary production, can be almost viable economically on basic European agricultural grant payments. Additional payments should be going to landowners for the environmental benefits. It is refreshing to be in a place where land-use integrates diverse rural skills and livelihoods with nature conservation.

This article is informed by visits to the area and to the Dehesa San Francisco, a farm in Andalucía owned by the environmental organisation Fundación Monte Mediterráneo and managed by Ernestine Lüdeke. In May 2019, through the Erasmus + programme, ARCH enabled eight participants, including the authors, to spend a fascinating week of study in the region, based at the 500ha Dehesa San Francisco.

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Above: **Photo 2.** Natural regeneration in oak woodland. Below: **Photo 3.** New planting in the *dehesa*.

Geographical location

The geographical area of the *dehesa* (*montado* in Portugal) landscape coincides with areas of low soil fertility and gently undulating topography within the provinces of Andalucía and Extremadura (in Spain) and Alentejo (Portugal). The boundaries of the *dehesa* where there are abrupt changes in fertility, especially to flatter fertile arable cropping areas, can be well defined. However, elsewhere the boundaries may be less distinct and the factors determining change may be due to climate, soils or current and historic land-use practices.

The land-use

The *dehesa* is a form of agroforestry referred to as an agrosilvopastoral system (Soil Association, 2019), as it combines trees, crops and livestock. The commercial tree species are cork oak (*Quercus suber*) and holm oak (*Quercus ilex*) with additional minor tree and shrub species. The livestock are mainly sheep (principally native Merino) and cattle (native breeds such as Retinto or Berrenda) as well as Iberian pigs. The management of the land is heavily influenced by the need to prevent or limit the spread of wild fires. This is achieved by cropping or grazing to limit the development of a shrub layer, which comprises a significant proportion of different *Cytisus* species. However, the traditional management of the *dehesa* is complex in terms of management of livestock numbers and tree-cover to sustain the long-term value of the habitat, and relies upon practices developed over many generations.

The tree element

Typically in the *dehesa* the density of trees is no more than 35–80 stems/ha. Woodland management is targeted at creating low-spreading tree-crowns that can be pruned to shape. At typical densities of 60 stems/ha in mature areas on fertile soils, canopy cover can be almost 100%, but perhaps more typically appears to be 50%–70%. Whilst natural regeneration of the woodland does occur where grazing densities are lower (**Photo 2**), this practice is not widespread as it also leads to the development of an understorey of shrubs that increases the risk of fire.

Woodland regeneration is typically therefore by planting, this being generally at about 60 stems/ha in high mesh guards (**Photo 3**). These guards protect against cattle and wild deer.

Usable tree products were probably more varied historically, but nowadays are primarily cork sold commercially, acorns as feed for grazing pigs, and firewood. Other products include olives from wild or cultivated trees.

The other role for the tree-cover is shade and shelter for livestock. The variety of functions of the trees explains the focus on management to optimise canopy-cover rather than stem numbers.

Livestock and crops

Historically, the livestock are likely to have been herded, but under current practice they are contained within extensive, internal fenced areas that allow a degree of manipulation of the grazing, according to the seasonal habitat conditions. Arable cropping on slightly better soils may in some areas be for commercial grain production, but at Dehesa San Francisco this is for livestock-feed to reduce costs of buying in feedstuffs. Livestock products, in addition to meat and breeding animals, are wool (merino is a high-quality product) and ham, in particular the *jamón ibérico de bellota* (ham from acorn-fed pigs).

Until the 1960s there was a practice of moving sheep north during the summer, to areas of pasture in cooler and wetter central and northern mountain ranges of Spain. Traditionally this was undertaken on foot, taking many weeks along the network of drove routes or *cañadas*. These movements as well as being dictated by economics and the lack of summer feed in the *dehesa*, fulfilled an ecological role in terms of maintaining grassland habitats and associated wildlife in the northern areas. Part of the recent focus at Dehesa San Francisco has been to develop systems of transhumance using road transport of animals. The re-establishment of these sheep movements is also helping to counter the loss of grassland habitats to scrub encroachment in the

Cantabrian Mountains, resulting from extensive cattle grazing substituting for the traditional herded sheep grazing. There is a social element to this work, in providing rural jobs in the north of Spain where depopulation is having severe impacts on villages and communities. Obtaining funding to sustain the re-establishment of this practice is not proving easy.

The role of cooperatives

A significant factor in securing the future survival of the *dehesa* is the operation of various cooperatives at local and provincial level, both in terms of marketing of produce and as agents of change.

There are two levels of cooperative. The first-level cooperative comprises farmers or producers. The second-level cooperative comprises a number of first-level cooperatives. Activities such as slaughtering, butchering, wool grading and marketing can take place at either level, according to the opportunities.

Initiatives such as the transhumance project are to an extent financially supported by the cooperatives. They also offer a service to allow government satellite data to be used at the farm level, to assist farmers in adjusting livestock numbers to pasture availability and quality, and promote and certify high-value products such as merino wool or jamón ibérico de bellota.

Biodiversity and ecosystem services

Spring in the *dehesa* heralds the appearance of a striking variety of wild lavender, irises, orchids, rock roses and other flowering plants. Bee eaters call constantly and swoop to river-bank nest sites. Black and griffin vultures take advantage of rising thermals. At dusk nightingales call and frogs croak. Red deer are hunted for sport, as are grey partridge. In areas where the trees have been lost or grazing is sub-optimal, a dense thicket of shrubs grows which creates a high fire-hazard and the risk of consequent soil loss. The biodiversity case for traditional management of the *dehesa* is not hard to make.

Economics

There is some evidence that Mediterranean agroforestry can be more profitable than the corresponding agricultural system, whereas in Atlantic Europe agroforestry is only profitable if non-marketable ecosystem services and dis-services (groundwater, nutrient loss, soil loss, carbon sequestration, pollination deficit) are taken into account (Kay and Herzog, 2019).

The manager of Dehesa San Francisco, Ernestine Lüdeke, was clear that farms like hers can be self-sustaining. This view is based on the premise that farmers should be paid for the provision of public benefits such as fire control, prevention of desertification (soil loss) and wildlife. The route for doing this, Ernestine suggests, could be through the cooperatives as the agents for other progressive marketing mechanisms. In the absence of such targeted funding then it would seem that a continued decline in the area of *dehesa* in the Iberian peninsula is highly likely.

Photo 4. Retinto cattle in the *dehesa*.

Relevance to Scotland

There is some agroforestry practised in the UK, however this is against the tide of historic divisions in education, culture, policy and practice between forestry and agriculture. Examples are grazing of wood-pasture in traditional parkland or policy landscapes, 'pannage' in the New Forest where pigs are allowed into beech or oak forests to feed on fallen nuts, and 'woodland egg' production with free-ranging hens. Silvopasture is the most common form of agroforestry in the UK (Soil Association, 2019), which by definition is where livestock are combined with trees, and encompasses the growing of fodder crops.

In Scotland, silvopastoral systems are perhaps of most relevance, given the limited amount of arable land. You do not need to go far to find examples of livestock overwintering in grazed broadleaved or native woodlands, albeit this is often undertaken without the long-term sustainability of the woodland in mind. Field trial research work ongoing since 1988 at Glensaugh in Aberdeenshire, by the James Hutton Institute, has been looking at integrating sheep grazing and woodland management, but as yet there has been little impact from this work on wider farm management.

However, what is apparent is that an opportunity is being missed if we cannot overcome the historic divisions referred to above. We are at a time of significant change in agriculture to meet Scottish Government objectives. In particular, rural businesses will have to demonstrate their contribution to delivering Scotland's net-zero carbon targets for mitigation of climate change. It is a massive challenge to also deliver from our land all that is required in terms of food, energy, timber, flood protection, soil conservation and biodiversity. The attraction of agroforestry as a land-use is that it does not involve tinkering with the margins of current systems that do not deliver, but offers an alternative land-use system that can be matched to these objectives on every acre.

There is a grant available under the Scottish Government's Forestry Grant Scheme for agroforestry, with planting at tree densities of 200 or 400 per hectare, probably a little high for there to be much agricultural production

below the canopy. Moreover, this is targeted at better-quality land, with a limit per farming business of 5ha, and has had almost no uptake. Greater policy and funding support to develop and implement appropriate models at a larger scale and at lower stem densities, could help to progress a wider uptake of these approaches, as well as models that specifically address the vegetation component.

In the Spanish *dehesa*, the management of the trees is considered to be key in order to optimise agricultural productivity and biodiversity. In a Scottish agroforestry model there may be a concern that the trees will only produce low-grade timber and biomass or fuel-wood. However, on better land there could, for example, be options for integrating fruit or nut production with livestock management. In addition, woodlands on farms in Scotland are primarily valued as being part of the farm capital rather than as a source of direct revenue (Gordon, 2010).

There is an urgent need to broaden perceptions to agroforestry beyond the benefits to livestock farming, which relate to the value of trees as shelter in terms of increasing lambing percentages, improving livestock conversion efficiency, and reducing feed and housing costs through out-wintering of livestock. Through the adoption of more integrated agroforestry systems, there are opportunities to develop new and existing markets for a range of products that could at the same time enhance environmental and economic resilience. If we need to visualise what agroforestry might look like in Scotland, a starting point can be upland wood pasture, or existing new native woodlands where cattle have been re-introduced. The landscape benefits also then become apparent – look back to **Photo 1** for an example of mature wood pasture.

Agroforestry systems are more complex than single land-use systems, and in the absence of a tradition in Scotland, and with many site variables, what is found to work in one place may not in another. As with other significant land-use changes, we need to go ahead and try the change from two- to three-dimensional farming, then learn from what works, and share the experience.

The Spanish *dehesa* is inspiring as a model in helping us to realise new climate-resilient options for the future management of upland Scotland.

A short film produced as a result of the visit by Kate Holl of SNH is available at: **https://www.youtube.com/watch?v=HucLsijB87c**

Above: **Photo 5.** Wood pasture in Galloway. Below: **Photo 6**: Luing cattle in the Trossachs grazing a developing, upland, new native woodland.

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