The Forests of Atlantic Europe

This is the second in a series of articles on forestry in Atlantic Europe. While production is the primary management objective throughout the region, forests are used for a variety of purposes. This article deals with forest grazing in Galicia, in North-West Spain and in south-central Portugal.

Sheep grazing in a beech forest in Northern Spain.

Forest grazing in Portugal and Spain

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Abstract

Forest grazing, one of the oldest examples of multifunctional forest management has been adapted to plantation forests in Galicia, in north-west Spain, with the aim of increasing profitability while decreasing the risk of fire. The principal plantation species in Galicia, maritime pine (*Pinus pinaster* D. Don) and *Eucalyptus globulus* Labill. can be grown at wide spacing and thus lend themselves to grass production systems, particularly early in the rotation. However, *Pinus radiata* (D. Don) although a minor species in Galicia, is the favoured species for intensively managed silvopastoral systems.

The wood-pastures, treed grasslands or heath-lands of central and southern Portugal and Spain represent the so-called European savannah known as montado, is well-suited to the traditional agroforestry practised in the region. Montado, a mixture of woodlands and scrub, is widely practised, principally in conjunction with cork oak production. The inter-tree spacing is used most commonly for pasture, but also for arable cropping. As in Galicia, management must take account of the ever-present risk of fire.

While neither of the systems described have a direct application in Ireland, they provide us with different perspectives on multiple-use and open to us the prospect of new, imaginative approaches to the multifunctional use of plantation forests.

Keywords: *Silvopastoralism, multifunctionality, montado, wood-pasture.*

Background

Forest grazing is one of the oldest examples of the multifunctional use of forests. The practice of grazing domestic animals, cattle, horses, goats, sheep and pigs in forests dates back many centuries. It is essentially, an agroforestry practice and covers a range of broadly synonymous terms, such as "pasture-woodland" and "silvopastoralism". Historically, it has been widely practiced in Atlantic Europe and this is still the case today.

The earliest recorded examples of silvopastoralism relate to woodland or forests of natural or semi-natural origin. However, this does not mean that these practices were entirely unmanaged. In many parts of Europe, pork, mainly as bacon, was an essential component of the diet in the Middle Ages. For a large part of the year, pannage, running pigs in the forest, was practised. In Britain, it can still be seen, on a small scale in the New Forest in Hampshire. The forest provided acorns, beech mast, chestnuts, or fruits such as apples, pears or cherries. Pannage was highly regulated; records of regulation go back as far as the sixth or seventh century (Vera 2000).

The development of scientific forest management and the narrow focus on the plantation forest as a "wood factory" in the early 19th century ran contrary to the

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concept of multiple use (Farrell et al. 2000). The forest was to be managed for the single purpose of timber production. Other management functions, of which animal production was one, were not permitted to deflect from this single-minded objective. The development of an active interest in silvopastoralism in plantation forests in recent decades, while it represents the modern view of the forest as an ecosystem providing a range of goods and services to society, is in fact a reversion to a much older and long-lived view of the role of the forest.

This article focuses on two aspects of managed grazing in planted forests in Spain and Portugal, grazing in plantation forests, mainly pine, in Galicia, in north-west Spain and the montado, the traditional agroforestry system of Portugal which is dominated by two oak species.

Grazing animals in forest ecosystems

Large herbivores are a natural component of forest ecosystems. Their significant, often complex impact on forest canopy composition has been widely reported (Mitchell and Kirby 1990, Palmer et al. 2004, Evans et al. 2006). The present composition, structure and grazing regimes of current forests are to some extent the legacy of past management, of both domestic animals and the impact of forest management on wild herbivore populations (Bradshaw and Edenius 1998). The current management of silvopastoral systems, even in plantation forests, will have to take account of the wild animal population and may have to, depending upon the scale of operation, devise strategies for its management, which may include culling, as appropriate.

Ruminants have been classified as grazers or browsers, or, sometimes according to more complex schemes (Gordon 2003). Grazers and browsers often coexist in forest ecosystems. Browsers, herbivores which feed on leaves, soft shoots or fruits, actively select woody plants. Herb species form the major part of the diet of grazers, but they also eat woody plants and are apparently less discriminating than browsers in their choice of woody species (Hester et al. 2000). Cattle (*Bos primigenius*) are grazers, predominantly grass and forb feeders. They can also exert a significant trampling effect; the ground pressure exerted by their hooves is almost three times that of sheep (*Ovis aries*). Even low-intensity grazing can reduce infiltration and increase susceptibility to erosion (Pietola et al. 2005). Sheep and goats (*Capra hircus*) are sometimes referred to as intermediate grazers, with sheep predominantly acting as grazers. Sheep are highly selective herbaceous feeders, but they will browse when availability of herbage is limited. Goats are predominantly browsers; they can be very destructive to saplings through bark stripping.

Managed grazing in Galicia, north-west Spain

The total area of Galicia, in northwest Spain, is just under 3 million ha, 35% of the area of the island of Ireland. It is the most important forest region in Spain. Forests account for 69% of the area of Galicia (Fuentes-Santos et al. 2013) and annual production, at close to 7 million m^3 $year^{-1}$, represents about 50% of Spanish timber production (Fearmaga 2011).

Several factors favour silvopastoralism in plantation forests in Galicia. Firstly,

Figure 1: *Uncontrolled cattle grazing, Xesta, Pontevedra Province, Galicia.*

there is a strong tradition of grazing scrubland and woodland in Galicia. Indeed, the word "monte", which is used to describe woodland in Galician, encompasses also riparian communities and natural grasslands. Typically, these areas were grazed during the dry summer season. Traditionally, scrubland was highly valued. Not only was it used for grazing, but it was a source of firewood, charcoal and litter. Multiple land use, promoted by the monastic orders in the Middle Ages, continued into the twentieth century (Villares (1998) in Calvo-Iglesias (2006)).

Wildfire

Wildfire is a major problem in Galicia. Between 1961 and 2011, a total of 245,593 wildfires, affecting an area of almost 1.8 million ha were recorded (Fuentes-Santos et al. 2013). A very high proportion of these fires were started deliberately. According to the same authors, 87% of the fires in a study area in Lugo province, in eastern Galicia, were attributed to arson.

The primary function of plantation forests in Galicia, in northwest Spain, is wood production, for pulp, board and timber. However, the risk of forest fire and low wood prices significantly reduce the financial viability of forest enterprises. Managed grazing of plantation forests is promoted in Galicia as a means of reducing the incidence of wildfires, or of at least mitigating their impact, by reducing the amount of combustible material in the forest. However, it also has a financial benefit as the early return from grazing can enhance the profitability of the plantation.

The practice of poorly managed or unmanaged grazing of forest lands persists and can often increase the risk of forest fire. Fires, employed by shepherds to promote the growth of more palatable grass species, often get out of control. Nevertheless, grazing, even poorly managed, can lessen the incidence of fire through reducing the fuel load of the understory vegetation. The value of grazing as a means of scrub control, thus reducing the serious risk of fire, is widely recognised in Galicia, although its efficacy has not been conclusively confirmed in the literature (Pasalodos-Tato et al. 2009). Nevertheless, there is a clear perception in scientific studies that when land is abandoned, the fire risk is increased. Ironically, although most of the fires are started deliberately, the risk of serious damage increases as the rural population declines.

The catastrophic wildfires of recent years, particularly in 2006, have increased interest in the use of grazing as a fire protection measure. Proposals from the forest administration and from the owners of communal forests include, improbably, the use of sheep to create firebreaks. The Consellería do Medio Rural (Xunta de Galicia) has promoted many projects for the development of managed silvopastoralism on marginal sites, providing funding for fencing, road improvement, the provision of drinking places for animals, as well as for shrub clearance and soil improvement. A feature of this programme is that plantation forest establishment and pasture development are seen as inextricably linked.

Grazers and browsers

Cattle form the most typical animal component of silvopastoral systems in the Atlantic regions of Europe, although horses, goats and pigs are also used. Farmers have traditionally used the Galician Red cattle (*Rubia gallega*) for forest grazing, although it may not always be the most suitable breed. Cattle are particularly useful for trampling bracken, but on the heather-dominated mountains of eastern Galicia, they are of little use. Goats are very effective in vegetation control. They are also commercially interesting, as kid meat is very valuable. Horses are also good for gorse control. Goats may adversely affect regeneration and damage seedlings, but this can be minimised with appropriate stocking levels. Pigs are used in oak and chestnut stands, a practice of long standing, although this is uncommon in Galicia.

Plantation species

The principal plantation species used in Galicia are maritime pine (*Pinus pinaster* Aiton), covering 28% of the forest area, and *Eucalyptus globulus*, 12%. Monterey pine (*Pinus radiata* D. Don), although it comprises only about 4% of the total forest area, is the favoured species for intensively managed silvopastoral systems although cattle are grazed in eucalypt plantations also. These species can be grown at wide spacing and do not form dense canopies. While the results of many studies have shown that grasses compete with trees, presumably for water, others suggest that establishment of grasses results in improved tree growth, because grasses compete less aggressively with trees than native shrub species (Pasalodos-Tato et al. 2009). Following site preparation, trees are planted and grass sown at the same time. Tree tubes are often used to protect seedlings during the establishment phase. Sheep, the

principal livestock species used in these systems, can graze the pastures within the first year, bringing an immediate financial return. Pasture production in these systems is highly dependent on stand development and canopy cover. In a study on optimal management in a Monterey pine silvopastoral system in Galicia, Pasalodos-Tato et al. (2009) modelled the dependence of pasture production on stand basal area and site index. This was a high-production Monterey pine site with site-indices in excess of 25 m at 20 years. Profitability was maximised with initial stand densities of 1,500 stems ha^{-1}. In highly productive pastures, profitability was maximised at lower stand densities. When fire risk was included in the analysis, silvopastoral systems were always more profitable than plantations devoted solely to timber production. Where the fire risk is significant, lower planting densities are favoured, because under these circumstances, income from grazing dominates, reducing the potential fire loss. In highly productive systems, grazing generates significant returns early in the life of the plantation, so financial rotation is optimised at shorter rotations, allowing the early renewal of the productive pasture period. For financial viability, this type of silvopastoral system requires a forest of at least 200–300 ha (Pasalodos-Tato et al. 2009).

In the study described above, grazing was carried out entirely in the plantations. However, in other cases, a proportion of the site is set aside for grass production only. The cattle are free to graze in this area and in the forest. Typically, they prefer the open areas, but use the forest for shelter in bad weather. A 300 ha block of

Figure 2: *Communal eucalypt/pine plantation, Ponte Caldelas, Pontevedra Province, Galicia. Note managed grassland, right centre, within forest boundary.*

pine/eucalypt plantation, typically in communal ownership, might have 10% of the area set aside for grass only.

Benefits of silvopastoral systems

It is suggested that a well-managed silvopastoral system might be mutually beneficial to both the animals and the forest. Not only can the trees offer an improved microclimate for the animals, the trees may also benefit, from the fertilising effect of the animals, their influence on soil disturbance, the control of competing vegetation and possible pest control. Wild boar may contribute to the development of a favourable seedbed for regeneration through soil disturbance, but they can be detrimental to sapling establishment (Kuiters 1998). The essential element of good management is the appropriate regulation of animal numbers and following best practice regarding times of the year when the animals can be safely allowed into the forest.

Montado – a traditional agroforestry system of Portugal

The wood-pastures, treed grasslands or heathlands of central and southern Portugal and Spain represent the commonly-named European savannah (Rackham 1998). This type of vegetation is much more suitable for grazing in this region than closed forest, which carries limited forage for most animal species. The highly artificial ecosystems of the Portuguese montado and the dehesa of central and southern Spain, prime examples of multifunctional use, come under the heading of cultural savannah.

Montado is an extensive multifunctional land-use system dating from the 18th century. Montado covers at least 25% of Portugal and, under the name "dehesa", a proportionately smaller, but large area of Spain. Although montados are found under a range of climates from maritime to continental, it finds its best expression in the Mediterranean climate of Alentejo, in south-central Portugal. It is included here because it is such an excellent example of multifunctional land use.

The montado is an agro-forestry pastoral ecosystem with typically, a tree density of 60–100 stems per ha. The main tree species are cork oak (*Quercus suber* L.) and holm oak (*Q. rotundifolia* Lam.).The management goals vary, but include cork, acorns (particularly of holm oak), pasture, arable crops and hunting. Traditionally, cereals were the principal inter-tree crop, but grassland is more common nowadays. Pig and cattle production are of major importance. Crops include clover, wheat, barley and oats, often grown in rotation with a fallow period when no crop is grown. While the principal value of cork oak lies in the cork, acorns represent the major commercial product of holm oak. Other products of the montado include mushrooms, honey and firewood.

Montado is a very intensive production system. Cork trees are planted, or established by direct seeding. They are pruned to give clean stems. They cannot be felled without permission of the Forest Service. Pine is sometimes grown with the cork oak, but it is usually removed at about 20 years. Cork production begins when the trees are about 20 cm DBH and thereafter at intervals of about nine years, or longer, depending on site quality. The first extraction, known as "male or virgin"

Figure 3: *Montado, springtime, Gambia, Setúbal, Portugal. Note the numbers on the trees indicating their place in the cork production cycle.*

cork, is not used for stoppers. The second and third extractions, "gentle" cork, have higher value and are suitable for stoppers. Harvesting of the cork is carried out in the summertime, when it can be done without damage to the trees. Care must be taken in allowing animals access to cork oak stands as the trees from which cork has been harvested are vulnerable to damage. They are usually excluded for about four months following extraction.

Grazing animals in montados include cattle or sheep, rarely black pigs and occasionally fighting bulls; sometimes these lands are not used for grazing at all. Cattle grazing is not ideal in cork oak stands, although it may be permitted for a limited time. Cattle can cause significant damage, especially to young trees and must be carefully managed. Sheep, on the other hand, can be left to graze all-year round. The critical months for forage production are December and January. Sheep are often provided with supplemental fodder, silage etc., during this period.

Shrub growth, predominantly of the genus *Cistus*, is often vigorous, providing cover for game (hunting is a popular activity on these lands) and fodder for cattle. However, shrubs greatly increase the risk of fire and are also a source of competition for water and nutrients. Artificial control is usually required. Mechanical cleaning is considered harmful so manual cleaning is preferred. Controlled goat grazing has been suggested, but this is rather controversial, because of the potential for damage caused by the goats.

Biodiversity varies considerably in the montado. This is not surprising given

Figure 4: *Montado, sheep grazing, Gambia, Setúbal, Portugal.*

their wide geographical distribution, with climate varying from maritime to continental. Bird diversity is particularly high. The relative importance of natural and human influences on bird populations was studied by Pereira and da Fonseca (2003). They concluded that despite the strong human intervention in the montado, natural environmental influences remain significant. They also point to the contribution of ecological corridors to the maintenance of biodiversity.

Acorns are a major product of holm oak, in comparison with cork oak stands. Acorn production is irregular, but when good, it is very important for cattle, sheep and even deer. Pollen levels during the flowering season and water availability during the period April to September have been reported as major determinants of acorn production (García-Mozo et al. 2012).

Conclusions

Forest grazing practices in Galicia and Portugal have their roots in traditions which extend back many hundreds of years. In Galicia, traditional forest grazing practices are being adapted to plantation forests to develop intensive, profit-oriented management systems. By successively combining wood and animal production, managers can increase productivity while simultaneously reducing the ever-present risk of fire.

In our relatively limited forest tradition in Ireland, grazing animals are often seen as a threat to plantation forests. While it would be foolish to ignore the

potential damage animals can cause to young forests, it is worth considering practices in Galicia, to see if there is anything we can learn from them. Of course, one must take into account the structural differences between our plantation forests and those of Galicia. Most of the species used in Irish plantations, particularly Sitka spruce (*Picea sitchensis* (Bong.) Carr.), cast deep shade on the forest floor, suppressing virtually all ground vegetation, particularly in the pre-thinning stage. The eucalypts and pines used in Galicia have light open crowns. They are also amenable to wide initial spacing and these two factors allow high light levels on the forest floor and consequently vigorous grass and shrub growth. The fire control benefit of grazing is not of great interest in Ireland, but the prospect of an early financial return from a plantation would clearly be attractive. While forest grazing practices in Galicia may have no direct application here, it is worth recognising that the apparent conflict between the forest and grazing animals is fundamentally a tension between different human objectives.

Agroforestry systems, such as the montado, open our eyes to another, very different aspect of the multiple-use of forests. Cork, crop and animal production systems have been managed sustainably in this ancient system for many hundreds of years. Perhaps it is worth considering how the tensions which exist in Ireland between grazing and forest establishment can be minimised, or even, as in the examples cited in Spain and Portugal, converted to a mutual economic and ecological advantage.

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