

Module 2 – Agroforestry for grazed Woodlands
Course 1 – Introduction to agroforestry for grazed woodlands

Chapter 2 – Agroforestry for grazed woodlands

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Agroforestry for grazed woodlands

Woodlands and Pasture land are primary and used simultaneously for the production of both livestock and timber. But, although there are some benefits of this multiple land use, much care should be taken to avoid or prevent any problems that may result from grazing livestock in woodlands

- In most cases, woodlands are grazed simply because the trees are present as part of the farm or operation
- Fencing part of the woodland to protect it from livestock could decrease the cost of boundary maintenance but requires time and financial resources and limits the landmass on which livestock have access to graze, each of which can be scarce
- Other operations may choose to utilize silvo-pastoral techniques to improve the investment in landmass, while focusing on both livestock and tree enterprises





Benefits of grazing livestock in woodlands – Access to additional forages

- Production benefits or losses are difficult to quantify, but at best, woodland forage production is estimated to be only 10 percent of the mass of improved pastures:
 - When woodlands alone provide the animal with all of its grazing and browsing opportunities, 10 to 40 acres of woodland are required to provide the same days of cow grazing as does 1 acre of improved pasture
 - However, when paired with additional pasture or grazing opportunities, woodlands may reduce overall pasture requirements or help to conserve pasture forages without resulting a decrease in productivity

Nonetheless, the effects of grazing combined pasture and woodlands versus pasture alone on livestock performance remain to be quantified and are expected to be dependent on each situation, as they would be impacted by a number of factors





Benefits of grazing livestock in woodlands – Access to additional forages

- ‘Grazers’ feed on grasses and legumes without selection or preferences, as for ‘browsers’ they do have preferences for some species or parts of plants that usually don’t have access to them in pastures and in a sense, help to minimize competition for nutrients between these species and desirable woodland species. When compared to improved pasture, woodland forage alone is often lower in protein and energy





Benefits of grazing livestock in woodlands – Protection from environmental stress

- Temperature extremes, whether excessively high or low, have a negative impact on livestock:
 - High temperatures and humidity, increase the animal's susceptibility to heat stress
 - Atmospheric temperatures in the woodland during summer months can be several degrees cooler than in open pasture and provide livestock with a source of shade, which helps to further alleviate heat stress
 - Cold, wet weather, when combined with high wind, causes cold stress, which increases the animal's nutrient requirements for maintenance. If it is not corrected, it may decrease livestock performance.
 - Nonetheless, woodlands can provide shelter to livestock and help to avoid some of the negative consequences of extreme temperatures
 - Shade offers protection from high temperatures and put less stress on livestock





Disadvantages of Grazing Livestock in Woodlands

- Natural woodlands operate in repeating patterns called cycles. Cycles may be simple or complicated, fast or slow and includes: the water cycle, plant cycle, carbon and nitrogen cycles and wildlife cycles
- Woodland grazing, particularly as intensity increases, affects these cycles
- Over-grazing should be expected to impact long-term woodland forest composition and may lower the market value of timber. The potential damage of grazing to woodlands should be strongly considered and generally fall into three categories: forest productivity, toxic plants and the environment





Disadvantages of Grazing Livestock in Woodlands – Forest productivity

- Timber production requires the input of natural resources, specifically sunlight, water and soil nutrients. Although sunlight is generally not an issue, the availability of water and nutrients can be limited in grazed woodlands. The latter of these are affected by soil compaction and erosion. Another area of concern is the destruction of seeds, seedlings and saplings
- Deciduous hardwood woodlands include woody plants and herbaceous species that can be poisonous or toxic to livestock. Many poisonous or toxic plants are not palatable and are thus avoided by livestock, but many may be consumed, particularly during times of drought or limited forage resources

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Disadvantages of Grazing Livestock in Woodlands – The environment

Aside from the environmental effects that have been referred to in the prior sections, woodlands grazing also may affect the environment through influencing wildlife, aquatics and aesthetics / recreation. The extent of the adverse effect on each of these is directly related to the extent of grazing. Seasonal, rotational or low-intensity grazing minimizes the effect on the environment when compared to year-round or long-term intensive grazing





Management Recommendations to Minimize the Effects of Grazing on Woodlands

- Livestock and woodlands are goods that each generate income. The highest level of productivity for each can be expected by managing them as separate enterprises when the opportunity exists. However, this is not always possible, and sometimes the two converge
- The following part will present general management recommendations that aims to assist with developing management practices that protect the forest while meeting the needs of a livestock operation

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Management recommendations: Policies

- **Identify woodland areas that should and should not be grazed:** through an expert, avoided grazing spaces include area with high quality timber and highly sensitive riparian zones, or with toxic plants
- **Fence to protect woodlands:** Multiple interior fences that separate grazing areas can be used for rotational grazing, which will help to minimize the impact of grazing to the woodland
- **If needed, retain some woodland for grazing:** Select small areas with relatively flat terrain and poor quality or more mature timber that has high wind-block and shade values
- **Reduce grazing intensity:** Reduce animal stocking density and duration of grazing to reduce their bad effect to woodlands
- **Limit access to streams:** Use fencing and large stone to create watering areas that direct livestock to specific portions of streams and other water bodies time limited, or provide a more reliable clean water source
- **Where applicable, utilize cost-share programs**





Extent of Agroforestry in Europe

According to estimates using the LUCAS database, the total area under agroforestry in the EU is about 14.5 million ha; which is equivalent to about 3.6% of the territorial area and 8.8 % of the utilized agricultural area. Of the three studied systems, livestock agroforestry covers about 15.1 million ha which is by far the largest area





Extent of Agroforestry in Europe

- Among European countries, Spain (5.6 million ha), France (1.6 million ha), Greece (1.6 million ha), Italy (1.4 million ha), Portugal (1.2 million ha), Romania (0.9 million ha) and Bulgaria (0.9 million ha) have the largest absolute area of agroforestry
- High value tree agroforestry and arable agroforestry cover 1.1 and 0.3 million ha respectively.
- However the extent of agroforestry, expressed as a proportion of the Utilized Agricultural Area (UAA), is greatest in countries like Cyprus (40% of UAA), Portugal (32% of UAA) and Greece (31% of UAA)

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Extent of Agroforestry in Europe

A cluster analysis revealed that a high abundance of agroforestry areas can be found in the South-West quadrant of the Iberian Peninsula, the South of France, Sardinia, South and Center of Italy, North-East and Center of Greece, South and Center of Bulgaria, and Centre of Romania





Extent of Agroforestry in Hungary

- A study conducted by Varga et al., 2020 regarding woodland grazing in Hungary showed that closed canopy forests still provide a very important resource for livestock grazing. Nevertheless, traditional forest grazing and the knowledge underpinning it has not been sufficiently studied by ecologists, for both are mostly regarded as long lost
- Herder's knowledge was found to cover various aspects of forest grazing (e.g. sustainable management, impact on forest layers, etc.). The unexpected variety and depth of local traditional knowledge and of a long-banned and largely abandoned practice indicate that it would also be worthwhile studying other, similarly lesser-known traditional land-use practices (e.g. wetland grazing, forest-based pig farming, etc.), and carrying out knowledge co-production with their practitioners. In this way, local and traditional knowledge could contribute to the development of more adaptive conservation and land management systems. For example, forest grazing has a noticeable direct effect on herb and shrub layers; this impact could be directed to control invasive species





Extent of Agroforestry in Hungary

Herders reported carrying out forest grazing in native, non-native, and mixed native and non-native forests. Data on sheep grazing in the forest refer mainly to non-native forest (50%), followed by native (33%) and native and non-native mixed (17%). Data on forest grazing of cattle were also obtained for the most part in native forest (55%), as well as in non-native (27%), and native and non-native mixed (18%)

Most herders stated that forest grazing was generally good for livestock, although in many cases forests were only used as supplementary pastures (in most cases it accounted for a maximum of 10–20% of total grazing time, but in some cases, forest grazing represented up to 50% of the activity)





Extent of Agroforestry in Hungary



Have a thorough knowledge of the grazed forest area

Use cowbells in tracking livestock and keeping them together, but it depends on the herder and the type of activities

Pay attention to duration, be calm and careful, change resting place regularly

Setting and maintaining the adequate level of grazing in order to avoid overgrazing and remain "unobserved" (do no harm) in the long term

Herding dogs should be well trained for forest grazing, be calm and have good orientation skills

Do not leave livestock to get bored in the forest, keep moving

Have regular discussions with other related stakeholders (hunters, foresters, conservationists etc)

Graze in forest only when forage is enough, to avoid overgrazing





Extent of Agroforestry in Portugal

In Portugal four major silvopastoral systems are described: two classically Mediterranean systems: the “**Montado**” and “**Olive tree**” systems, and two typically of the transitional environment between Mediterranean and Temperate conditions: “**Pyrenean oak**” and “**Chestnut**” systems

In Portugal, “**Pyrenean oak**” woodlands are traditionally thought of as systems with multiple uses, but Castro (2004 b) considers them as silvopastoral systems because of the important role played by the animals, in providing benefits to the trees and interacting with the trees





Extent of Agroforestry in Portugal

In olive tree system, the use of by-products of this crop (mainly olive leaves) has been part of the farming tradition in the countries of the Mediterranean basin (Sansoucy et al. 1985). In diverse systems, where animals are a component of crop production, pruning provides a useful additional foodstuff of high value, thereby reducing the cost of animal feeds. They consist of about 12% crude protein and 43% digestible organic material. After the commercial collection of olives, sheep and goat flocks feed on the remaining fruit left over on the ground. The understory species are grazed mainly in spring. In ancient times, flocks slept in the olive groves during the summer to help fertilize the trees, as another important component of their multipurpose use





Extent of Agroforestry in Sardinia

Semi-extensive livestock farming occupies about 50% of the total area of Sardinia (24090 km²), and about half of this grazed area belongs to the category “other wooded areas”. In addition, forests occupy about 5800 km² in Sardinia, and about 30% (1800 km²) are considered to be of high nature value. Hence much of the Sardinian rural landscape is characterized by a mosaic of agroforestry systems including grazed forests and wooded grasslands where scattered Quercus species (holm oak, cork oak and deciduous oak trees) are mixed with permanent or temporary pastures or intercropped with cereals and/or fodder crops





Extent of Agroforestry in Sardinia

In the grazed gaps of Mediterranean oak woodlands, complex combinations of negative and positive interactions, operating simultaneously between the oak trees, shrubs and herbaceous plants, under the influence of animals, microorganisms and microhabitat conditions, must be considered to understand the function of the whole ecosystem. The resilient capability of the understorey grasslands in the grazed areas of Monte Pisanu oak woodland, expressed by the composition and the size of the persistent seed bank, can vary according to rainfall variation, grazing management and available phosphorus (P) in the soil. The conservative management of this silvopastoral area can be reached by putting into practice adequate grazing management, by applying specific site-by-site grazing regimes, and P fertilization, as strategies for improving the seed bank of legumes and the overall quality of the pastures into the low tree density or open areas of the Monte Pisanu silvopastoral system





Extent of Agroforestry in USA

Over 177,000 ha of woodlands in Minnesota (USA) are grazed. In general, these woodlands are not managed specifically for timber or cattle benefits

This lack of management often leads to decreased timber value and reduced forage yields

Silvopasture is a potential alternative to overcome this lack of land management on Minnesota woodlots

This three-year study evaluated the potential for silvopasture in Minnesota by comparing the production of unmanaged woodland grazing, silvopastoral, and open pasture systems

The study assessed forage production, forage quality, and livestock performance

Forage production was generally greater in silvopastoral systems compared with unmanaged woodland grazing systems, while forage quality was lower in open pasture systems, at least during the first year

Livestock performance was similar between the grazing systems

Results indicate that silvopasture has potential in Minnesota, but more research studies are required to develop specific management guidelines as well as to monitor silvopasture production systems for longer periods of time (Ford, 2016)





Extent of Agroforestry in USA

In Minnesota there are 6.8 million ha of forestland; of that, 0.81 million ha are on farms and 37% of those are grazed (Garrett et al. 2004). However, passive woodland grazing rarely results in any benefits to the cattle or the trees. Forage re-growth has been shown to be extremely low in woodland grazing systems especially those with hardwood tree species (Johnson 1952). Johnson (1952) found that by the end of the first grazing season the herbaceous forage and much of the hardwood understory had been used

This view that trees and livestock do not mix is still a common view in forestry today (Garrett et al. 2004). However, with the use of 5 intensive management techniques, such as those used in agroforestry, trees, forage and livestock interactions can be manipulated to enhance woodland grazing (Garrett et al. 2004)





Extent of Agroforestry in China

Agroforestry systems in China are classified by system type and system unit as following:

- System type: is defined as a homogenous group whose major components are closely related economically, socially and environmentally
- System unit: is defined as a basic functional unit that reveals the specific biological relationships among the major components and requires similar management strategies and techniques
- In total seven system types and 26 system units are recognized in China, among them, agrosilvofishery, silvomedicinal, and agrosilvomedicinal systems have values unique to Chinese. To note that each system type is discussed according to its geographical extent in China, main species components and system units





Extent of Agroforestry

Management and result of Forest grazing system: Overview and Vision

Management inputs

- Forest stand improvement
- Grazing deferments
- Prescribed fire
- Natural regeneration
- Brush management
- Grazing ecology based on preference values



Results

- Cooler environment for livestock
- Some wind and weather protection
- More diverse understory vegetation
- Reduced probability of catastrophic wildfires
- May receive preferential tax treatment in greenbelt areas
- “Open stand” of timber in grazed forest settings can be more scenic



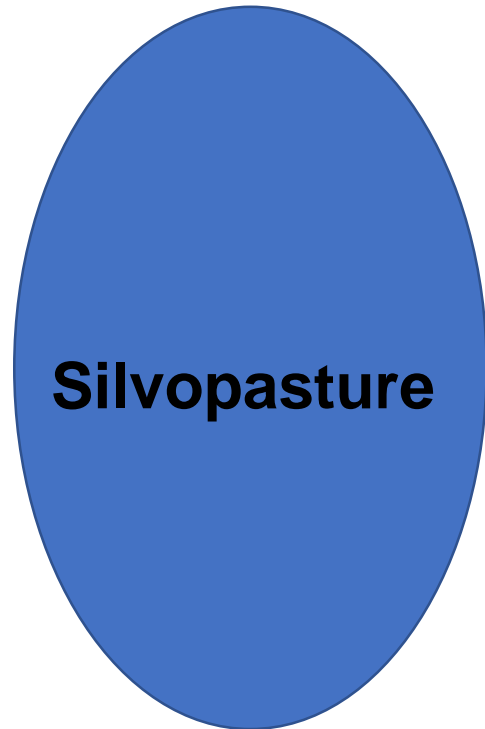


Extent of Agroforestry

Management and result of Forest grazing system: Overview and Vision

Management inputs

- Canopy management
- Tree protection
- Weed control
- Soil amendment
- Hay harvest
- Tree pruning
- Rotational grazing
- Pasture renovation
- Grazing management based on total forage production



Results

- Diversification of income streams
- Shorter forest rotations
- Shaded, cool season forage plants can be more nutritious for livestock
- Improved plant nutrition uptake
- High value woodland products from active limb management
- Cooler environment in summer for livestock
- Some wind and weather protection



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