Agroforestry Guidance

Note 1: Introduction to cricket bat willow silvopastoral systems.

HAMPSHIRE FOREST PARTNERSHIP

ABACUS AGRICULTURE

BioDiversity International Ltd

Hampshire Forest Partnership was established by Hampshire County Council in 2022 with a goal to plant one million trees by 2050. The vision for the partnership is to facilitate tree planting by working with communities, landowners, businesses, and organisations across Hampshire.

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Any financial information presented should be checked in relation to local costs, yield potentials and sales process.

Introduction

Hampshire Forest Partnership will seek to provide opportunities for and deliver projects that meet six strategic priorities, shown below:-

1. Public benefit, amenity value, health and wellbeing
2. Climate change mitigation and resilience
3. Biodiversity and local nature recovery
4. Landscape character, cultural and heritage development
5. Learning, awareness, and educational opportunities
6. Sustainable development of the rural economy.

Hampshire Forest Partnership recognises that there are many opportunities for tree planting on farmland and to help farmers reach net zero, improve soils, and enhance biodiversity. Agroforestry has seen a recent surge in interest amongst farmers, yet there remains confusion about how best to integrate tree planting within farming systems. These guidance notes will aim to break down the barriers and improve understanding of how tree planting can be developed on farms.

Agroforestry

Agroforestry can be defined as "a collective name for land use systems and technologies where woody perennials (trees, shrubs, etc.) are deliberately used on the same land management unit as agricultural crops and/or animals, either in some form of spatial arrangement or temporal sequence."

In agroforestry systems, there are both ecological and economic interactions between the different components. In many cases agroforestry is a profitable activity even in the absence of subsidies or grants. The major agroforestry sub-types in the UK can include:

Silvopastoral systems (livestock component linked to pasture or swards)

Silvoarable systems (arable component)

Environmental agroforestry e.g., riparian strips or buffer areas

Food forests (large garden forms for food production in the urban or peri-urban context)

Forest farming e.g. wood pasture in the New Forest

Orchard intercropping

Agroforestry is an old practice recently developed in the UK after 40 years of intensive research based on national network trials. It has only recently been recognised by agricultural and forestry policy in the UK.

The **main advantage** of agroforestry compared to conventional forestry is that it can be highly profitable even in the absence of subsidy.

Agroforestry

The **main disadvantage** is that like many multi-component agricultural systems it is complicated.

In the past there have been too few competent advisors. The situation is improving however and there is a new breed of partner advisors with key value chain knowledge/contacts and an incentive to make the system work.

Suggested Agroforestry species

Tree species	Key management suggestion	Products and markets	Site notes/ preferences
Cricket Bat Willow *Salix alba "Caerulea"*	Plant large high-quality sets	Timber for production of cricket bats for domestic use and export	Will tolerate short term flooding
Hazel *Corylus avellana*	Manage as single stem tree for mechanical harvesting	Hazel nut flour, nuts, nut milk, oil etc	Shelter is important.
Walnut *Juglans regia*	Use late flowering (spring frost avoiding) lateral bearing grafted trees.	Nuts, nut oils, walnut flour, walnut butter	Prefers deep sandy loams and shelter, but will grow in many local soil types with proper drainage
Quince *Cydonia oblonga*	Needs special processing equipment	Preserves, beverages and membrillo	Will tolerate short term flooding and is also drought tolerant
Mulberry *Morus nigra*	Use named varieties selected for flavour and precocity (early bearing) e.g., at 1-3 years old	Preserves, and beverages	Prefers shelter and deep, moisture-retentive but well-drained soil.
Stone pine *Pinus pinea*	Requires specialised processing equipment.	Nut kernels	Shelter is important
Chestnut *Castanea sativa*	Use named varieties	Nuts, flour, and milks	pH less than 7
Oak *Quercus spp*	Use varieties with improved precocity as acorns are the economic product	Acorn flour	Shelter is important
Elder *Sambucus spp*	Use a mixture of species and varieties for elderflowers and berry products	Elder flowers/berries for beverages	Shelter is important
Hawthorn *Crataegus spp*	Use species with large fruit and good juicing properties	Beverages and health products (e.g. hawthorn tincture)	Shelter is important

Setting objectives and a rule of thumb

Before establishing agroforestry there is a need to set objectives and timescales for achieving a return on investment. This will depend on land tenure and if the intention is to grow for wholesale or localised value-added markets. In general, a site of greater than 10 acres is required for a commercial agroforestry operation.

For many UK agroforestry systems trees occupy c. 10-20% of a land parcel spatially arranged in groups, rows, or as individual trees. Agroforestry is dynamic and as trees grow, management will need to adapt.

As a rule of thumb shade levels below 50% will not have a major effect on the growth of an understorey and late leafing trees are preferred to allow an understorey to obtain some light early in the season.

Livestock benefits in a silvopastoral system

For livestock, the provision of shade and shelter from extreme heat and cold is becoming increasingly important with climate shifts. If livestock experience extreme heat or cold, the live weight gain will be adversely affected. In dairy cattle, milk production is affected. As the ambient temperature increases above the Upper Critical Temperature (UCT) which is 25 degrees Celsius, milk yields can fall by as much as 20%. There will also be a reduction in fertility, including an increase in embryonic loss (sheep are also affected by this). There is also evidence of an increase in the risk of clinical mastitis.

There are many nutritional and health benefits from providing browse and fodder from trees and hedges. The figure below shows the nutritional profile of a range of tree species. This can be comparable or better than meadow hay and red clover silage.

Leaf nutrition in tree species compared to herbaceous fodder (%). Taken from Birks *et al* 1989.

Species	Moisture	Ash	Fat	Sugar	Protein	Fibre
Rowan	11.9	5.9	6.5	50.4	9.9	15.4
Goat willow	11.5	6.1	3.8	50.3	11.6	16.7
Aspen	10.8	8.5	6.0	43.5	13.3	20.9
Grey alder	11.9	3.9	5.9	43.6	17.6	17.4
Birch	11.7	3.9	7.0	49.2	12.0	16.2
Meadow hay	15.0	5.4	2.2	44.4	8.5	24.6
Red clover	15.7	5.1	1.9	35.8	11.0	28.6

Impact of silvopastoral systems

Environmental impacts include land and water decontamination, increased biodiversity, and reduced flooding. Social benefits especially in peri-urban areas include increased access to green space and educational benefits.

Grants for silvopastoral systems

Given the low planting density, most Forestry Commission tree establishment grants would not currently be appropriate.

Hampshire Forest Partnership have several funding schemes for farmers and landowners, please visit the website for further information **Farmers and landowners | Hampshire County Council (hants.gov.uk)**

If your project involves the local community, Hampshire Forest Partnership have several schemes available. Visit **People and communities | Hampshire County Council (hants.gov.uk)** for further details.

The Woodland Trust is supporting agroforestry establishment and will cover most costs. This is available on a first come first served basis.

Many Environmental Land Management **(ELM)** payments can be appropriate and if stacked could be attractive. Agroforestry payments will be available as part of the **Sustainable Farming Incentive (SFI)**. These may require Environmental Impact Assessments (EIA). Cricket bat willow agroforestry may be eligible if it's a part of meadow habitat creation under the **Biodiversity Net Gain** scheme.

Hampshire Forest Partnership may also be able to provide funding support e.g. in relation to their programme "Shoots Along the Routes". **Shoots Along the Routes | Hampshire County Council (hants.gov.uk)** They can also supply free elm trees as part of a scheme to reintroduce disease resistant hybrids to Hampshire to benefit nature recovery (available each year on a first come first served basis).

Cricket bat willow silvopastoral systems

Cricket bats are made from a very special tree; the cricket bat willow *Salix alba* "Caerulea". Trees are planted at 100 stems per hectare on average and harvested after 12-20 years. The game of cricket is gaining popularity in India and the USA and now women's cricket is expanding rapidly. The demand for the bat blanks or clefts is constantly increasing. UK exports to India of English willow, which is bought by Indian companies to make bats used by players at all levels of the game, were worth over £6 million annually between 2018 and 2020, and are currently subject to a tariff of 10%. A Free Trade Agreement (FTA) could see these taxes cut or even removed entirely, along with a range of duties on other exports that would help UK firms expand into an economy due to become the world's third largest by 2050.

Site requirements and critical management

Cricket bat willows appear to grow best next to running water (e.g., river plains, water meadows by streams and rivers) but it is not essential. A site where the water table is about 1m below the surface which does not dry out will help them grow just as well. Soil type is not critical, but they do grow more vigorously on clay soils. Areas of mature trees e.g., oak with a high incidence of honey fungus should be avoided as this can spread to the willow. Planting within 9m of a river may need permission from the Environment Agency. In addition, habitat and wildlife considerations may mean that trees are not appropriate for the site, so carry out appropriate checks prior to planting.

Lighter soils are suitable if the water table stays constant and does not dry out in the summer. Wet field corners are excellent prospects although bat willows do like field drains so care must be taken. As with most trees, planting areas where overhead telephone/electric cables exist should be avoided. Planting in areas near to older native broadleaves, particularly oaks can significantly raise the risk of honey fungus.

The picture on the cover of this guidance note shows a typical planting that has been managed well in terms of removing side shoots. **This is a critical management issue**. It also shows the moderate shade created which can reduce heat stress in any livestock.

Establishment and Management

Planting is done using a straight crowbar or post hole borer to make a hole. The set is pushed 0.5m into the bottom of the hole, the ground is then firmed up around the stem. If it is done properly there is no need to stake the tree but individual guard protection against rabbits and deer is essential.

Protection from livestock damage must be in place and maintained. Guards should be perforated / holed type to prevent water retention thus alleviating aerial root growth on stem and they should be pushed about 1 inch into the ground to prevent voles and mice causing damage.

It is important that the guards can be slid up and down the set, to allow removal of side shoots as shown in the plate below. Failure to remove side shoots would render the timber virtually worthless.

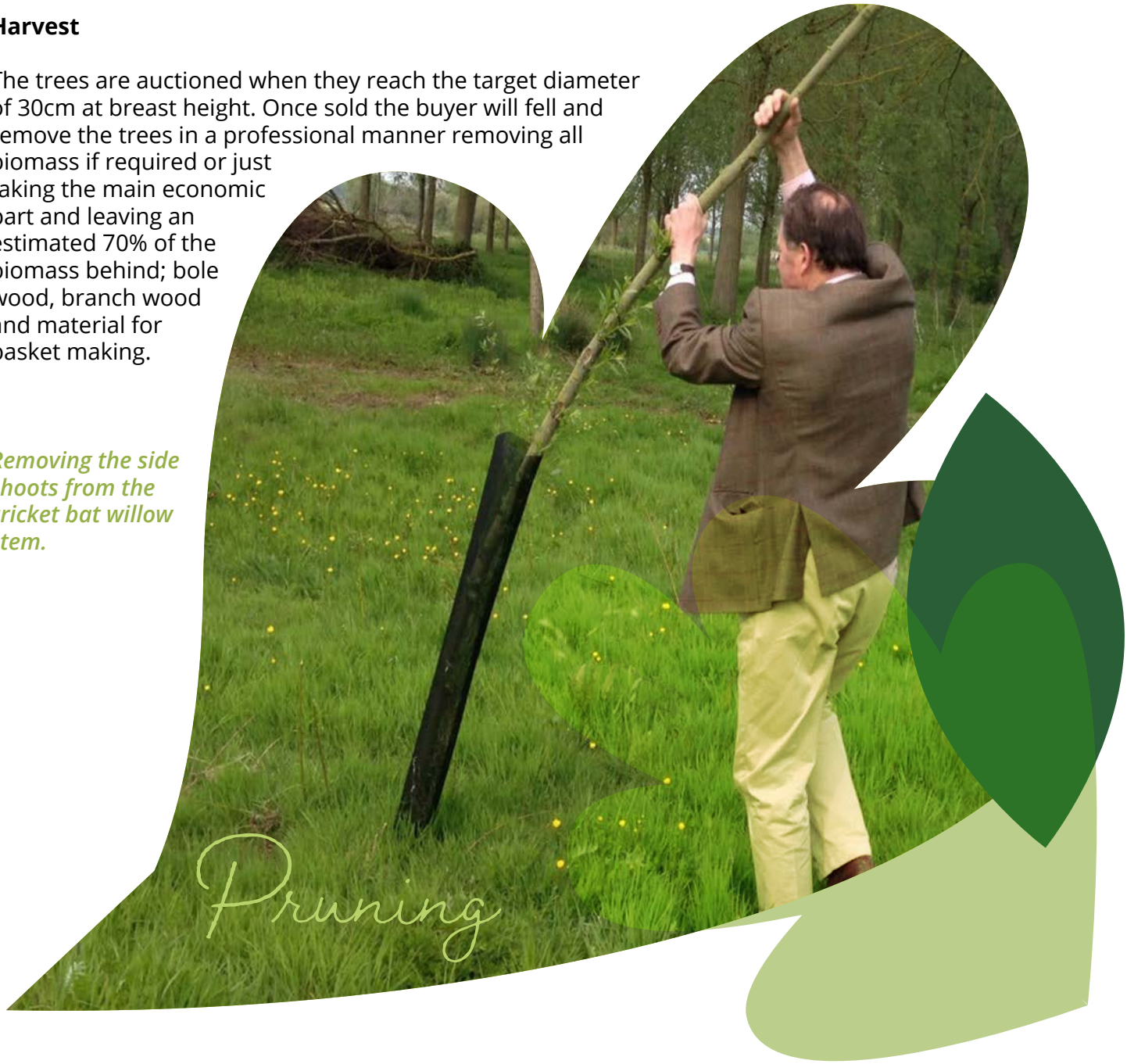
Mulching around the base of the tree for the first 2 years would dramatically improve establishment and growth.

Diseases

There are two main diseases affecting cricket bat willows, watermark disease (*Erwinia salicis*) and honey fungus (*Armillaria mellea*). In both cases any tree becoming infected should be felled and removed immediately to prevent the disease spreading. Watermark disease is a bacterial disease, and the infection occurs via leaves and leaf scars resulting in leaves appearing shrivelled and scorched, and the timber to have a black watery stain rendering it worthless. Honey fungus attacks the root system and quickly can kill the tree, turning the wood into a grey mass with no value. Presence of mature native broadleaf species in a location, particularly oaks are thought to significantly increase the chances of *Armillaria* infection.

Harvest

The trees are auctioned when they reach the target diameter of 30cm at breast height. Once sold the buyer will fell and remove the trees in a professional manner removing all biomass if required or just taking the main economic part and leaving an estimated 70% of the biomass behind; bole wood, branch wood and material for basket making.



Removing the side shoots from the cricket bat willow stem.

Pruning

Outcomes at plot and landscape scale

Most growers would see income from the trees as the main purpose of the venture and this can be substantial. A target income of £70,000 per hectare after 12 years is not unreasonable on a good site with good management. Additional income streams are possible from the grazing, environmental stewardship, and any remaining tree biomass.

Experience shows that 100% grazing income is possible for the whole rotation as at 100 stems per ha, shading is minimal. Benefits to livestock include medicinal effects of using fresh prunings as a fodder and microclimate benefits (shade and shelter).

Willows contain salicylic acid, which is a natural anti-inflammatory. This compound, and tannins found in tree bark and leaves, can significantly help with animal pain relief, tooth, and gut health. It can reduce their internal parasite burdens and new evidence suggests that selenium (from willow) and copper (from hazel) can help with resistance to bovine tuberculosis.

Working at the landscape scale offers the greatest potential for the delivery of optimised ecosystem services. Areas of cricket bat willow agroforestry can be augmented with quince agroforestry and reedbeds to give a more diverse river buffer zone. Conversion of arable areas into silvopastoral systems linked to blocking land drains could help decontaminate land (nitrate and phosphate), increase carbon sequestration, and improve biodiversity linked with meadows and wetlands. Riparian planting could also serve to reduce river pollution. At this scale it is very appropriate to consider forming a tripartite environmental partnership consisting of (1) a grower, (2) a government agency or utility and (3) a private sector philanthropic entrepreneur/broker. A 25-year environmental stewardship contract could deliver decontamination, biodiversity, carbon offsetting, and/or green infrastructure benefits (e.g. reduced flooding).

Simple Gross Margin Model, assuming no grant, with labour as a fixed cost

Variable	Amount £ per tree
% top grade trees at 100 stems per hectare	90%
Price per tree after 12 years	£730
Cost per set	-£10
Grant per tree	£0
Tree protection per tree	-£20
Labour for tree establishment	£0
Mulch cost per tree	-£5
Net income per tree	£695
Net income per ha	£69,500

Advice on cricket bat willow

Several companies advertise in farming and landowners' journals. They can provide sets, advice, annual maintenance services and provide buy back contracts. It is up to the grower to decide what services they require and if they want to sell the final crop to the highest bidder and not be limited by a contract.

Services available from Hampshire County Council can be found at **Agroforestry | Hampshire County Council (hants.gov.uk).**

Hampshire County Council have created a new Facebook group, **The Hampshire Agroforestry Forum**, to enable farmers, growers, and food entrepreneurs to link with each other to facilitate new markets for tree products. **Hampshire Agroforestry Forum | Facebook**. If you have products to sell or you are looking for products produced from trees, please add your details to the group. You could also pose any questions and queries about agroforestry for others to answer.

Sources of information

Birks et al. (1989) 'The Cultural Landscape: Past, Present and Future, Cambridge University Press.

Crawford M (2016) How to grow your own nuts. Green Books

Temperate agroforestry systems | CABI Books (cabidigitallibrary.org)

soilassociation.org/media/19141/the-agroforestry-handbook.pdf

HAMPSHIRE FOREST PARTNERSHIP
a legacy in leaves