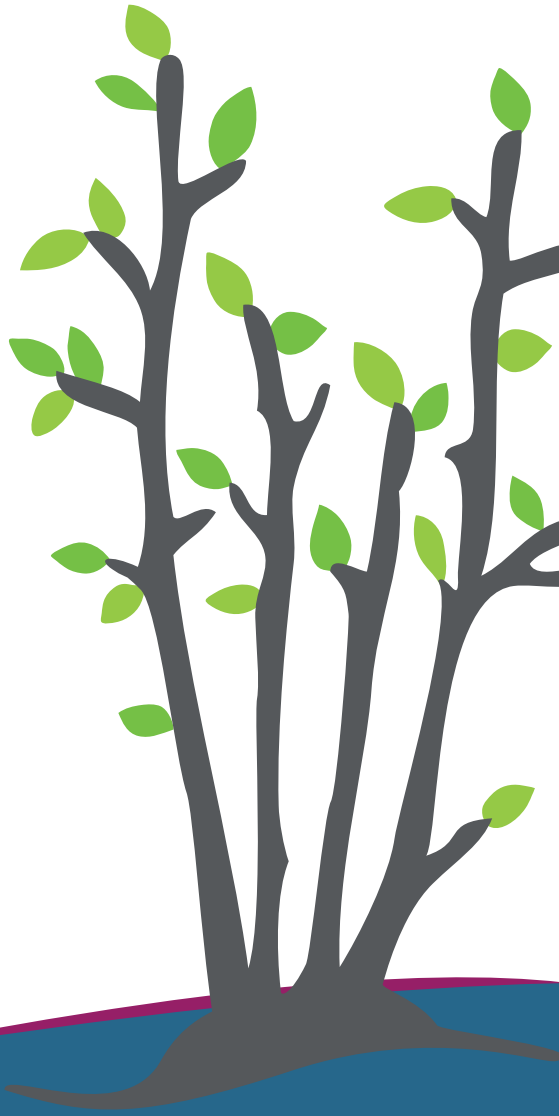
COST Action FP1301 EuroCoppice

Innovative management and multifunctional utilisation of traditional coppice forests – an answer to future ecological, economic and social challenges in the European forestry sector



Coppice in Brief

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COPPICE (NOUN): AN AREA OF [WOOD]LAND (ON FOREST OR AGRICULTURAL LAND) THAT HAS BEEN REGENERATED FROM SHOOTS AND/OR ROOT SUCKERS FORMED AT THE STUMPS OF PREVIOUSLY FELLED TREES OR SHRUBS. [ADAPTED FROM IUFRO SILVA TERM DATABASE 1995]

Coppice is a word that is used to cover many things, including: a type of woodland consisting of trees that are periodically cut; the multi-stemmed trees that occur in such woodlands; the process of felling (i.e. coppicing) the trees; and the production of new shoots by recently-cut stools. The principle of coppicing is simple: it is the ability of many woody plants (trees and shrubs) to regrow from cut or damaged stems or roots. At its simplest, a single-stemmed tree that has grown from a seed or a sucker is cut down and allowed to regrow: several shoots will sprout. Repeated felling at multi-annual intervals will produce a multi-stemmed tree, growing from a base called a stool. A group of such multi-stemmed stools in one site are what then form a coppice i.e. coppiced woodland.

In some regions/countries, elaborate forms of coppice management have evolved over centuries, designed to produce specific resources from coppice systems of selected species cut on strict rotational cycles. Sweet chestnut (*Castanea sativa*) has been managed in single species coppices for poles; likewise sessile oak (*Quercus petraea*) for tanbark and charcoal; and hazel (*Corylus avellana*) for poles and split-wood products. Coppiced woodlands supplied the needs of rural and urban communities for millennia, in a relatively sustainable way, until the Industrial Revolution, the growing population and the demand for fuels and materials exceeded the capacities of the coppices to supply, requiring importation of fossil fuels and wood products. 'Traditional' coppice management declined during the past century and many coppices were abandoned or converted to high forest, plantations or other land uses.

There is currently a resurgence of interest in coppicing, for intensive production of wood for energy or manufactured products; and for ecological and cultural objectives. Newly planted short rotation coppices (SRCs) typically rely on species (such as *Eucalyptus* or *Robinia*) or vigorous hybrids of poplar, willow or alder; and may be classed as an agricultural land use rather than as forestry.

Restoration of former coppice woodlands may attempt to replicate a traditional system, or adapt management to meet modern requirements for wood production and other societal and environmental benefits. Food production from coppices can be locally important (e.g. fungi, nuts, berries, honey); and artisanal products can also be of local economic interest (e.g. hazel thatching spars, chestnut fencing, limewood turnery, willow basketry).

Silviculture and Tree Management Systems

Two basic systems of coppice woodland management are recognised: **simple coppice**; and **coppice with standards**. A third, rarer system is **selection coppice**. In addition, there are two management systems that apply coppicing principles of vegetative regrowth to individual trees, rather than to woods: these are termed **pollarding** and **shredding**. Figure 1 illustrates five applications of coppicing and the typical landscapes that result from them.

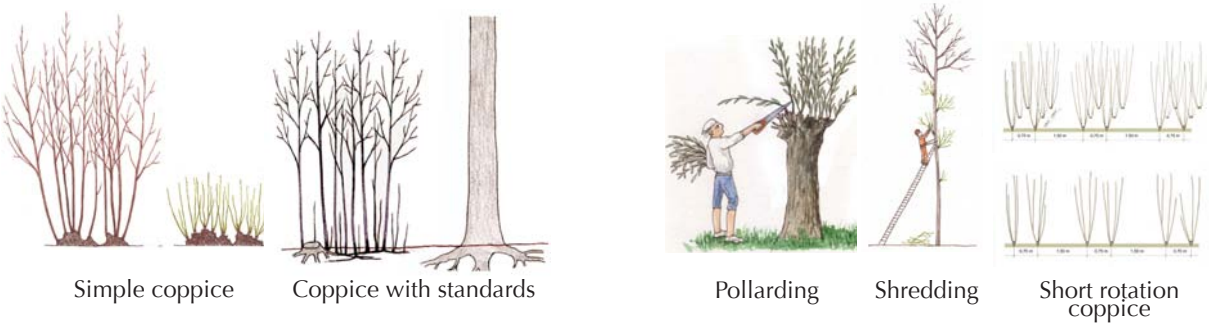
Simple coppice

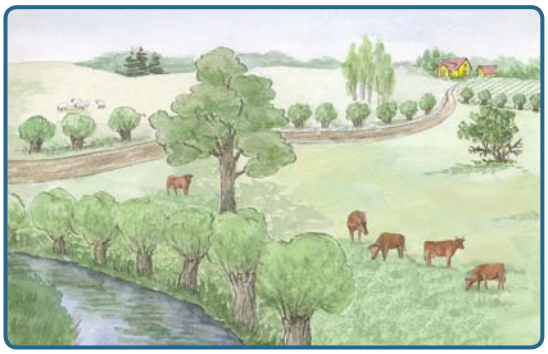
This is woodland managed as an even-aged, single-storey structure, typically producing small/medium-sized roundwood for poles or fuelwood. The coppice is cut on a regular rotation, the length of which depends on the product required and also on species, location, rate of growth and environmental/societal interests (though usually between 10 and 30 years). Theoretically, the coppice is managed by sequential cutting of 'coupes' (definition = compartments, see Glossary for alternative names) throughout the woodland, with the woodland divided into the number of 'coupes' equal to the number of years in the planned rotation: one coupe is then cut each year. Coppice woodlands managed in this way, are described as 'in-cycle', or 'in-rotation'.

'Short rotation coppice (SRC)' is a special example of 'simple coppice' that is mainly on agricultural land. The lifespan of any shoots is short compared with those of traditional coppice woodlands (typically between 1 and 3 years); the stools may need to be replanted after only 5 to 7 rotations to maintain site productivity.

Coppice with standards

In this method, the woodland is multi-storied, with an even-aged understorey of coppice underwood cut regularly to produce small material; and with a partial overstorey of uneven-aged standard trees, that can be grown from seed or from selected stems on stools and allowed to grow to a sufficient size for timber or tree products. Coppice with standards is more difficult to manage than simple coppice as it is necessary to manage the species, number, age and location of the large overstorey trees, as they will affect the growth of the understorey crop. The underwood is managed as simple coppice; after cutting each coupe, the number and distribution of the standards is adjusted. Over time, some of the oldest trees may be retained for veteran tree interests, whilst younger generations of standards need to be recruited, but at a density that avoids over-shading that would degrade the coppice.





Coppice in forest landscapes

Coppice in agricultural landscapes

Figure 1. Types of coppice management and typical landscapes that result from them (Illustrations: Ruta Kazaka)

Selection coppice

Two or three age classes of stems are rotated on the same coppice stool, to provide specific sizes or shapes of poles for particular purposes, e.g. in some of the mountain beechwoods and holm oaks of Europe. Hazel coppice is sometimes cut in this way, to provide thin straight rods for thatching spars; and later, larger poles for fence hurdles or building.

Pollarding

A pollard is a tree that is cut like a coppice stool, but at a height above the ground intended to be out of reach of browsing animals (typically more than one to two metres). New shoots grow from the decapitated trunk and can be harvested periodically in just the same way as from a coppice stool, whilst grazing animals can use the land beneath the tree – multi-purpose land use. Willow and poplar pollards are also widely used to stabilise banks of water courses.

Pollards can grow for centuries whilst being repeatedly cropped for shoots, used for livestock fodder, for poles, firewood or even for small timber. Some of the most ancient trees in Europe are pollards. In many regions, pollarding for production purposes has died out, but may be continued for ancient tree management objectives or for landscaping reasons. In some regions, pollarding for firewood and fodder is still practised e.g. on Ash (*Fraxinus*), Lime (*Tilia*) and Elm (*Ulmus*).

Shredding

This is the practice of cutting side branches from the main trunk of a tree while retaining the crown, typically to provide wood and fodder for livestock. Unlike pollarding, the tree is not decapitated and continues to grow upwards as a single stem tree, ultimately able to provide large dimension timber. Shredded trees are typically found alongside tracks or field boundaries and also in some pasture-woodland systems.

Biology of Coppice Shoots

The ability of woody plants to re-sprout is a natural adaptation that enables survival after damage to the tree/shrub from animals, fire, storm or pathogens. Not all tree species can produce coppice shoots – most conifers (gymnosperms) cannot, whilst most broad-leaved trees (angiosperms) can. Table 1 provides an illustrative list of some species that can produce coppice shoots. Some species regenerate more readily from stumps, some from root suckers: over centuries, some individual plants can spread to a considerable area in their above ground stool or underground root structures, creating clonal structures covering hundreds of square metres.

Origins of coppice shoots

There are three ways in which coppice shoots form:

- **'Stump shoots'**, that originate from dormant buds suppressed in the bark;
- **'Stool shoots'**, that originate from adventitious buds in callus tissue following cutting or wounding;
- **'Suckers'**, that originate from adventitious buds along a tree's roots.

'Stump shoots' are the usual response of a broadleaved tree to cutting, when dormant buds buried in the bark are stimulated to break dormancy and sprout: dormant buds are the primary source of most coppice (and pollard) shoots and they should be favoured after cutting, as they will form the strongest shoots.

'Stool shoots' grow from adventitious buds that develop from plant tissue growing in the callus wound at the cut wood surface. These buds develop into shoots in the same season as the cut, but, unlike dormant buds, they are not directly connected to the plants vascular system, so have to make a new vascular link. As a result these shoots are often short-lived; and if they survive, they only form weakly attached shoots, so are not desired as coppice shoots.

'Suckers' grow from adventitious buds on the roots: they may be stimulated to sprout from below ground by the cutting of the above ground plant, or by disturbance of the ground, or simply as a natural vegetative reproduction process.

Regeneration of coppice shoots and longevity of stools

The probable number of shoots that will be produced from any one species of tree when coppiced depends on many factors, including stump size, age, condition, site parameters, competition from other plants, etc. It is certainly possible for coppice stools several hundred years old to continue to produce abundant shoots when routinely coppiced, even though the centre of the stool may have completely died out leaving a ring of productive stems some tens of metres in circumference.

It is quite possible that some stools of long-lived species such as *Tilia* and *Castanea* are more than a thousand years old. These species are particularly successful at vegetative reproduction through layering, which is the rooting of stems that are in direct contact with the soil. Layering to produce genetically identical clonal offspring may take place either naturally following collapse of a tree's stem, or as part of a deliberate management procedure to generate new stools within a coppice.

If the rotational cutting of coppice is neglected for a long period, then it is possible that the sprouting response to the next cutting will be poor. Neglected stools can survive for many years, attaining large dimension stems, but they can become increasingly unstable and vulnerable to windthrow, when entire root plates can be uplifted due to the top-heavy growth of stems, or the stool can be destroyed because it is split into many pieces.

Browsing animals

Coppice stools, being close to the ground, are very vulnerable to herbivore damage – new shoots are highly palatable and young bark is easily stripped. Deer, grey squirrels, rabbits, hares and voles can severely restrict coppice regrowth after cutting and also degrade standing coppice: they require strict control. Livestock (cattle, sheep, goats, pigs and horses) should be excluded from coppices, preferably permanently, although some coppice woodlands were traditionally opened for grazing for the final years of the coppice cycle. It is possible for coppices to be managed as a resource for grazing animals and for game, but the strict control of browsing in the first few years after coppicing is crucial and often very costly.

Coppice management

Most coppice woodlands have been intensively managed over several centuries to achieve a high density of stools and a few selected species. Typical coppices are monocultures of hazel or oak, lime, sweet chestnut, or black locust specially selected to meet industrial needs such as bark for tanning, wood for charcoal, poles for fencing and building. Ageing stools would be cut back and replaced with a new plant, by layering from an adjacent stool or by seeding or planting. Deadwood would be cut out and only the favoured species retained. Today, after perhaps decades of neglect, reinstating coppice management can be difficult, especially in view of the modern requirement for larger dimension poles for fuelwood. The method of cutting the stool, the type of tool/machine used and the height,

angle and season of cut are all factors influencing stool vitality and ecological interest.

One aspect of modern management that should be given more attention is the effect of mechanised cutting and harvesting on the woodland soil and its essential life-support role for the ecosystem. Compaction of soil is highly damaging to root systems and to the mycorrhizal fungi that are essential in nutrient transport for the trees and shrubs. It is also very damaging to surface and buried archaeology. Timing of operations and selection of appropriate machinery are crucial in the management of sensitive sites.

Coppices that have been neglected or their rotation cycles abandoned are termed 'overstood', 'stored coppice' or 'over-aged coppice'. This cannot be a long-term strategy for coppice – such woods will inevitably become high forest. There is also a risk of damage to any archaeological features present by stems and root plates being thrown over in high winds.

In modern short rotation coppice, stool management might be very different, with the need to maintain production and tree vigour. Mechanically harvested coppice may require more frequent replanting, at intervals of 12-20 years.

Biodiversity and Cultural Heritage

Coppices of all kinds and ages are of interest for their associated wildlife and for their cultural heritage. The management system of rotational cutting creates structural heterogeneity across a woodland area, providing a range of age-classes and space for a high diversity of plants and animals that prefer open spaces and edge habitats and alternate light and shade conditions. Continuation of coppicing is essential for many species – they cannot tolerate the denser shade of high forest or the lack of spatial diversity therein. Ecological management of coppice can increase the extent of old trees and dead-wood habitats beyond that normally found in intensive coppice systems, for example by retaining some trees and shrubs beyond their normal rotation and broadening the diversity of tree/shrub species. Retaining ancient trees in the landscape, as coppice stools (especially the high-cut stools known as 'stubs') in the forest and as pollards and shreds in pasture-woodlands and along watercourses and roads, adds considerably to the flora and fauna.

Cultural heritage interests are found in ancient coppices, where thousands of years of woodland management have created features such as banks and ditches, hollow ways, timber slides, boundary markers, charcoal-making platforms, pollards and veteran trees, often with archaeological artefacts dating back to the prehistoric period. More recent coppice woods may contain pre-woodland features of field systems, habitation sites and other archaeological structures. Both old and new coppices require sensitive management to protect these cultural and ecological interests.

Other aspects of cultural heritage associated with coppices include the food and artisanal products mentioned in the introduction; and also the social history and art/literature and language so inextricably tied up with coppicing as a long-established practice in most rural communities. The evident popular interest across many European regions in community woodlands, woodland crafts, use of wood instead of artificial materials, switching to woodfuel, local food festivals etc. is highly encouraging – woods will survive if their products are in demand.

Conclusions

Coppicing is a venerable practice – it can, when practised ecologically, be a very effective way of managing trees and shrubs to produce wood and food required by society, in a repetitive manner without undue depletion of natural resources. It creates valuable habitats for many species of plants, fungi and animals; and safeguards and perpetuates landscapes and aspects of high cultural importance.

The long-established coppices hold some of Europe's most ancient trees and archaeology. Conservation of semi-natural ancient woodland and continuation of coppicing is one way to protect and promote these assets, provided that management objectives are widened to encompass these less-productive features.

Traditional coppicing can be promoted for multi-purpose production and conservation objectives, whilst new wooded areas on agricultural land managed as short rotation coppices can be designed and managed to replicate some of the most important elements of traditional coppice. They have the potential to produce large volumes of wood for energy in a short time, whilst diversifying the landscape and creating habitats supporting wildlife and game of high value.

Conversion of ancient coppices to high forest or non-wooded land should be avoided wherever possible. The task for all of us is to ensure that we can manage woodlands (old and new) to integrate all of society's needs, within the capacity of the environment (economical, natural and cultural) to supply them.

Acknowledgments

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EuroCoppice - COST Action FP1301 2013 - 2017

Over 150 experts, researchers and practitioners from **35 European and partner countries** came together to collect and analyse information on coppice forests and their management. A broad range of topics were addressed in five **Working Groups**: (1) Definitions, History and Typology, (2) Ecology and Silvicultural Management, (3) Utilisation and Products, (4) Services, Protection and Nature Conservation, and (5) Ownership and Governance.

Action Members have produced reports and publications for science, policy and practice, raised awareness for important coppice-related issues, highlighted findings at numerous conferences and supported the careers of young researchers. Further information can be found at: www.eurocoppice.uni-freiburg.de

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Further Contacts: EuroCoppice initiated a long-term platform for coppice-related topics within IUFRO (www.iufro.org), the global organisation for forest research: Working Party 01.03.01 "Traditional coppice: ecology, silviculture and socio-economic aspects". Coordinator: Valeriu-Norocel Nicolescu, nvnicolescu@unitbv.ro