Coppice Products

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Introduction

Coppice is a traditional form of forest management that has been widely practiced in Europe since ancient times. Some studies quoted that, in the Mediterranean area, coppiced forests were already established in the Etruscan-Roman period (Matthews 1989, Gabbrielli 2006).

The management system relies on the ability of broadleaved tree species to regenerate quickly from cut stumps and root systems following felling. Both the size of felled area and periods between felling vary depending on the silvicultural needs of different species and local economic factors.

Typical rotation lengths and species in different countries are detailed in the table below.

Coppice management usually provides a regular supply of small dimension material after just a few years of growth. The continued popularity of this type of forest management may be attributed to a relative ease of management and the fact that it is still possible to practice coppicing satisfactorily without large capital investment. Farmers and loggers can cut stools with simple and affordable tools, obtaining products that can serve multiple purposes. The felled stems are often small enough to be easy

Table 1. Most common rotation ages and species in some European Countries (compiled based on the experience of report authors)

Country	Rotation (Years)	Species
Finland	5 - 6	Willows
Slovakia	10 - 30	Birch, Oak spp.
Portugal	12 - 30	Chestnut, Eucalypt, Oak spp.
Italy	12 - 40	Beech, Chestnut, Oak spp., Hornbeam
Spain	15 - 30	Beech, Chestnut, Oak spp.
United Kingdom	10 - 50	Ash, Birch, Chestnut, Hornbeam
Greece	10 - 50	Beech, Chestnut, Oak spp.
Albania	10 - 60	Arbutus, Oak spp.
France	10 - 60	Beech, Chestnut, Hornbeam, Oak spp.
Macedonia	30 - 60	Ash, Beech, Oak spp., Hornbeam
Slovenia	30 - 60	Beech, Chestnut, Robinia
Ukraine	30 - 60	Ash, Alder, Beech, Birch, Oak spp.
Poland	60	Alder

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to handle manually, with simple/low specification mechanized forestry systems or with tools already in use on the farm or for other purposes (i.e tractors, trailers, horses, etc.). Furthermore, coppiced forests are usually harvested during winter and this fits well with the work timetable of farmers.

The final harvest of a mature coppice forest commonly yields between 90 and 200 m^3/ha, depending on species, age and site productivity. Stems cut in coppice stands are generally transformed into small-size assortments. Average stem size varies between 0.05 and 0.25 m^3.

Historical and Current Trends

Coppice forest management increased with demographic growth during the 17th-19th centuries and with early industrialization (iron industry, glass factories, tile and lime kilns) which created high demand for firewood and charcoal, especially if coal was not locally available (Parde 1991, Woronoff 1990).

In the past century, with the widespread use of other energy sources such as gas and oil and the use of posts and poles made of concrete or from coniferous species, coppicing entered a period of decline and many coppiced forests became neglected. Furthermore, the migration of people from villages to towns contributed to the abandonment of rural areas and consequently also of the forests.

Now, due to higher fossil fuel prices and efforts to replace fossil fuels by CO_2 neutral renewable energy, there is once again a strong demand for relatively cheap fuel wood. However, this increase is only in part a demand for traditional small-scale firewood; it also includes large commercial operations that supply both domestic and industrial biomass markets.

There is also an increasing demand for 'environmentally friendly' materials for use in agriculture, horticulture and in bioengineering, such as soil and bank protection, which means that coppice products have a 'second chance' to satisfy these needs.

The general trends of coppice over the past centuries can be summarised as long-term growth, a period of short-term decline and, currently, recent revival.

Wood Products

Firewood

Firewood was the first source of fuel and has always been used for heating, cooking and lighting. Historically, small diameter trees were cut for fuelwood and species more useful for building purposes were conserved. Firewood was never completely surplanted by fossil fuels and it enjoyed a revival in recent years with the increasingly severe oil crisis (Warsco 1994). In fact, Europe still uses more traditional firewood than any other industrial energy wood product (Nybakk et al. 2003). In total, Europe consumes over 100 million solid m^3 of firewood per year, about twice as much as US and Canada put together (FAO 2007).

The production of firewood exceeds 17% of the total wood production in Norway, whereas in Finland and Sweden the level is nearer 10%. In Central Europe, firewood production reaches up to 50% of the total wood production (e.g. Hungary 52%) and in some Southern European countries it reaches more than 70% (e.g. Italy 70%, Greece 72%) (EUROSTAT 2015).

Firewood consumption reached 22 million m^3 solid in France (Elyakime and Cabanettes 2013), about 2.5 million m^3 in Spain, 18 million m^3 in Italy (Caserini et al. 2008) and Slovenian households used about 1.1 million m^3 of firewood every year (Čebul et al. 2011).

Figure 1. Firewood from coppice: piled at the roadside, near the forest and ready for transport (on the left) and split thereafter (right) (Photos: Ivalsa)

Firewood (Figure 1) is extracted from the forest in different lengths, from 2 to 6 m in northern Europe, and from 1 to 2 m in southern Europe, due to the different extraction methods (Magagnotti et al. 2012, Zimbalatti and Proto 2009). It is sold to consumers both as round-wood and as split logs in different lengths (typically 25-30-50 cm or 1-2 m billets).

Most common species used for firewood are beech, oak spp., black locust, hornbeam, ash and alder. Traditionally, chestnut has not been popular as firewood for an open fire because of its tendency to crack and spit during the burning process. Nowadays, with the modern enclosed fireplaces and downdraft boilers, these disadvantages are not as relevant; chestnut has become more widely used, especially since it is more readily available and the price is lower compared to other species.

Firewood has a strong presence in today's markets. In the future a possible slow decline is predicted due to wood stoves and boilers with high energy efficiency and the replacement of solid wood with the new technologically-advanced user-friendly wood-based fuels, namely wood chips and pellets.

Charcoal

Charcoal is produced from hardwoods, such as oak, beech, birch, hornbeam, by pyrolysis and is a porous solid fuel having a high calorific value (31MJ/kg). Therefore, the combustion of charcoal gives off high heat, without flames. The main advantage of the product is that the combustion emits no harmful emissions (tar, tannins, methane, etc.). These qualities have led to the product being widely used for domestic purposes: charcoal is popular choice for outdoor cooking.

In former times, charcoal was produced directly in the forest and you can still find small flat spaces in coppice forests where the simple earth kilns were operated. It is suitable for a large variety of domestic and industrial uses. As "active coal" it is also used as an absorbent material in filters and as a reducing agent in metallurgy. It can easily be transported and stored.

Nowadays charcoal represents a minor market in the EU, although there are exceptions. In the Carpathian mountains of Ukraine, there are notable examples of industrial charcoal-making operations, developed for the export markets over the past 5 years, and currently turning over 0.5 million m^3 of wood into charcoal. Traditional production methods can also be revived to link cultural heritage with tourism; in Slovenia, for example, a private forest owner cooperative successfully markets traditionally produced charcoal as a cultural product, for use in outdoor cooking, while the local municipality offers tourists the opportunity to experience this traditional activity.

Chips

Wood chips are wood particles with a length of 2-5 cm, a width of 2-3 cm and a thickness of few millimetres (Figure 2). Chipping is a common way to process woody biomass from coppice woodland, mainly processing the residues and non-firewood species. The efficiency of the operations is determined by appropriate chipper selection and work techniques (Figure 3). Generally, chips are obtained from forest residues like branches and tops while trunks are used for firewood or poles. This holds true as long as the prices for firewood or poles are higher than the price for chips.

Species such as poplar or willow from short rotation coppice that do not have an alternative market are ideal for chip production.

Figure 2. Example of wood chips

Figure 3. Chipper working at the landing, chipping coppice wood

Figure 4. Chestnut poles that have been debarked and sharpened (Photos: Ivalsa)

Chipping has the potential not only to increase the total harvest through a better utilization of the available above ground biomass, but also gives a solution to the problem of residue management (Pottie and Guimier 1985, Asikainen and Pulkkinen 1998). The demand for chips is linked to the uptake of modern boilers and power stations that are more efficient and have lower emission rates than traditional stoves (Strehler 2000).

Industrial Roundwood

Coppiced beech and chestnut from France and Spain is used in industries producing paper, board and panel materials. In 2014, approximately 4.4 million m^3 of industrial hardwood was used in France (two pulpwood factories in France, as well as one in Belgium, plus about 10 panel and board factories) (Agreste 2014). Eucalypt from Spain, Portugal and South Africa is used in many pulp and paper mills.

Poles, Posts and Other Fencing Assortments

Traditionally, the three coppice species chestnut, oak and black locust have been preferred to produce posts and poles because of their natural resistance to decay, which is particularly important for materials that have contact with the ground. With increasing environmental awareness and concerns regarding the use of chemicals for preserving softwood species, these coppiced alternatives are becoming popular once more (Figure 4).

Larger diameter poles are used in land consolidation works, such as revetments and can be durable for up to 50 years, while small diameter poles are used for gardens and small holdings. Chestnut poles have been used in vineyards since ancient time.

Even today there is an industrial scale production of vineyard poles in Italy, regionally concentrated close to wine-producing areas. It is heavily modernised to remain competitive

with alternatives such as concrete, steel and impregnated softwood.

UK and France have extensive experience in splitting bigger coppice boles to produce fencing materials, but many other types of fencing also exist (Figure 5).

Production of oak poles and similar assortments is limited because the price for firewood from oaks is high compared to other species.

Construction, Furniture and Flooring

Boles of larger dimension from oak and black locust are used as sawnwood for the production of outdoor furniture and solid wood for indoor furniture. A new development is the production of parquet flooring (Fonti and Giudici, 2002) with high resistance and beautiful colour in two main products: the so-called "mosaic" and "laminated, ready to lay". Chestnut wood is also used for outside decking thanks to its resistance to weather conditions.

In Austria, cherry from 40 year old coppice forests is used to make high value furniture. In Poland, long rotation coppice alder is used to produce high quality plywood.

Craft Products

A number of other wooden objects can be obtained by material from coppice forests. In most cases they are made by artisans as locally produced handicraft souvenirs and include items such as baskets, walking sticks, carvings, sculptures, toys and eating utensils (plates, spoons, etc).

Figure 5. Example of fencing in the field (Photo: Ivalsa)

Non Wood Products

Coppice forests can provide many non wood forest products with great potential and market. For extensive research on non wood forest products in general, see COST Action FP1203 "European non-wood forest products" (www.nwfps.eu).

Some examples of non wood products from coppice forests are:

Honey and Beeswax

Honey (Figure 6) is used as sweetener in many recipes and as a spread, but also in medical traditions to treat wounds and coughs. Honey is also the main ingredient in an alcoholic beverage called mead. Honey is mainly from chestnut, black locust, eucalypt and linden. Honey and beeswax are used in the cosmetic and pharmaceutical industries as well.

Mushrooms and Truffles

Many edible mushrooms grow in association with chestnut or oaks – including truffles (*Tuber* spp.) and porcinis (*Boletus edulis*), both highly prized in many countries as side dish, or with rice, pasta and meat. Truffle oil is a delicacy made from high quality olive oil infused with concentrated truffles (mainly black winter truffles).

Figure 6. Honey produced in *Salix* coppice stands; prepared as a taste-testing to compare different honey types (Photo: D. Lazdina)

Fruit

Local fruits and nuts are harvested from coppice woodland on a small local scale and can be important to some communities.

Traditional Medical Herbs

Some non wood products are used as medicinal herbs in the Ukraine and the Republic of Macedonia.

Game

The habitats provided by managed coppice forests are ideal for many animal and plant species that are adapted to particular levels of open space and shade. Some game species also find the habitats suitable, so coppice is often exploited for rearing and hunting.

Biochemicals

Tannin is utilized mainly from chestnut and oaks. It is prepared by hot water extraction of the bark and timber, followed by spray-drying of the solution. Vegetable tannin was used for leather production, but its use has decreased since the 1950s because of synthetic tannins. Nowadays its characteristics are appreciated for premium quality leather.

New Products and their Promotion in the Framework of a Green Economy

The demand for coppice products has recently been increasing, mainly for energy purposes. This trend is in part influenced by the recent developments of management techniques, both in harvesting and processing technology. For example, it is quite common to have integrated recovery of logs for firewood and poles, and branches and tops for chips. It is likely that in many countries the use of wood chips will increase.

The trend of the increasing demand is not homogenous in all regions due to different forest, economic, cultural and social aspects. For example, chestnut demand for furniture production is higher in central Italy, while the production of chestnut laminated beams and panels is increasing in north-eastern Italy (Pettenella 2001).

The development of new markets and green economies can be supported by new management and marketing instruments, such as new approaches in the selling system, efficient promotion and certification.

It is not easy to find the right "recipe" for promoting the use of coppiced products in the framework of a possible green economy. These trends and markets are at different levels in different countries, according to economic, environmental and social conditions and to species composition.

There are some instruments that can promote and boost the market chances:

- **Networking, association and promotion:** reinforcement of the producers' market power.
- **New selling system:** small local markets, which permit the local producers to sell directly to consumers; E-business; Business to business with the sales of semi-finished products and DIY (do it yourself) products.
- **Promotion of legal labour:** because of less taxes and minor costs, companies with illegal workers can sell products – especially firewood – at lower price, causing a distorted market.
- **New developments in harvesting and processing technologies:** in recent years, new technologies that require different levels

of power and investment have arrived on the market. There is a wide choice of tractors, trailers, winches, cable-yarders, fire-wood processors, chippers and many more. Public administration should control and promote training courses in safety and technical matters. Short and practical training courses could help logging companies in increasing their competitiveness and productivity.

- **Promotion by public authorities:** the use of coppiced products could be encouraged through regulations, public investments and promoting programs. For example, a municipality could use benches made from chestnut wood in public parks, or stimulate the use of chestnut poles in vineyards and when installing wooden highway barriers. Cooperation between public authorities and producers could be one success factor in promoting and developing coppiced products. Another is increasing the coordination between local producers.
- **Diversification of products:** to enter and/or develop profitable markets and empower forest owners and operators. In many situations, high firewood prices discourage the production of other assortments, such as poles. However, the economic benefit of good firewood prices can be uncertain since it can change under many circumstances, such as new products, warm winters or regulations on the air quality allowed in old stoves. A possible addition could be, for example, pellets and microchips; the market is currently booming and the products are easier to manage and more suitable to modern life style. Operators should try to diversify their production with a wide range of valuable assortments.

Conclusions

In the past, vast areas of coppice forest in Europe supplied the local population with products such as firewood, charcoal, tannin, and fodder, as well as shelter for animals and a large variety of poles used in agriculture and construction.

Despite some decades of decline, the current economic trends point to a good future for coppice management. It has the potential to gain importance again locally, strengthen rural communities and help avoid the depopulation of mountainous regions and other rural areas.

The current danger is that neglective or disruptive management activities can have more serious silvicultural and ecological consequences than in more 'natural' forest systems. Thus, abandoning coppice forests may not only lead to to an impoverishment of rural communities, but also to environmental degradation and ecological catastrophes.

Without active management there will be no coppice and without income from coppice, there will be no management. Therefore, rural development policies should encourage and promote the diversification of rural activities and multi-functional models that are suitable for coppice forests.

In addition to the traditional products already mentioned, there are new products that are valuable in the context of the green economy, particularly in the area of energy. One priority should be to promote the efficiency of coppiced forests and to pursue this management as a system. It is not seen to be viable to create more coppice from high forest, but to try to dissuade foresters from trying to convert more coppice to high forest. Coppice forest will only be able enjoy the benefits of the modern green economy if coppice management is modernized.

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