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PAST AND RECENT COPPICE FOREST MANAGEMENT IN SOME REGIONS OF SOUTH EASTERN EUROPE

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Abstract

High diversity of site conditions and vegetation patterns in South Eastern Europe (SEE), accompanied by different socio-cultural background of countries, has produced a wealth of diverse coppice stands and a variety of management practices. The paper provides an overview on past and recent coppice forest management in four selected countries in SEE: Bulgaria, Croatia, Macedonia and Serbia, in which coppice forestry has been of significant importance. The following main coppice forest types have been recognised in respect to their past management and current condition: (i) traditional coppice forests; (ii) 'high coppice' forests; (iii) coppice forests for transformation and reconstruction; (iv) coppice forests with standards and 'middle-aged' forests; (v) pollarding forests; (vi) selection coppice forests; (vii) shelterbelts (windbreaks, erosion shelterbelts, etc); (viii) oak coppices for shelling; and (ix) coppice forests subjected to no management. The paper emphasizes the contribution of sustainable management of coppice forest resources to ecological stability and economic development of SEE, which could be achieved by both considering the traditional management concepts and introducing new ecologically, economically and socially sound management practices.

Key words: coppice forests, management concepts, South-Eastern Europe, historical review

INTRODUCTION

Shifts in forest management from maintaining timber production to management for sustainable multi-functional forests have induced changes in forest policy, forestry legislation and forest management concepts in many countries. The challenge to forest management to satisfy multiple services and functions demanded by society is amplified by the potential adverse effects of a changing climate (IPCC, 2007; EEA, 2005). On the other hand, in current European forests, the objective to increase the share of wood resources allocated to the production of green energy for mitigation of climate change may be in conflict with demand for secure timber supply for bio-based industries of the forest sector (Jürgens et al., 2004). In order to respond to new circumstances and larger pressures from society, the forestry sector in general is looking for new ways of efficient forest resources management.

High diversity of site conditions and vegetation patterns in South Eastern Europe (SEE), accompanied by different socio-cultural background of countries, has produced a wealth of diverse coppice stands and a variety of management practices. Despite the significant economical, ecological and social importance of these forests for SEE countries, the knowledge required for their sustainable management is generally fragmented and needs to be re-discovered and scientifically scrutinized.

Coppice forests management in SEE has been developed in consideration with the following characteristic issues: (i) coppice forests mostly represent a degraded form of high forests, originated by exaggerated forests exploitation and affected by different negative biotic and abiotic factors; (ii) their present condition is not satisfactory, i.e. with regard to production capacity, species composition, quality, stability, vitality, health, unfavourable age structure etc.; (iii) in most cases, attempts to improve the condition of these forests and timber assortments produced have not been successful in the past; (iv) coppice forests frequently occupy high-quality sites with higher potential productivity; (v) according to current ownership structure, coppices are mostly state owned in Bulgaria and Macedonia and private owned in Croatia and Serbia. Coppices in private ownership are usually small in area, on parcels less than 1 ha on average.

Despite the intensive research experience in coppice forests management in SEE, many professional and scientific fragments of this complex issue have not been completely solved. Taking into account today's large area of coppice forests, their current state and management significance the regional analysis of status, problems and prospects of coppice forest management can enhance the understanding of existing issues, accelerate future exchange of knowledge and increase the opportunities of discussing and exchanging the experiences of individual management models.

Consequently, the objective of the current manuscript is to review the differences and similarities of past and present coppice forests management for substantial parts of the coppice area in SEE by: (i) analysing past and recent human interventions in coppice forests. Reconsideration of past management and relating it to stands current condition would help ecologists and managers to improve the future management concepts; (ii) presenting and clarifying specific issues in multifunctional coppice forest management in the SEE region; and (iii) establishing priorities according to major risks and problem issues in coppice forests management and determining consequences of various management concepts.

REVIEW APPROACH

The current paper is an attempt to raise awareness among researchers and decision makers in SEE regarding problems of coppice forest management and therefore can be considered as action-taking research. The character is exploratory-descriptive with introduction of basic facts and concerns, formulation of main questions for future research and reporting on the background of past and present coppice forests management in the selected countries.

Content analysis, historical-comparative analysis and background data collection (Neuman, 2006) regarding past and recent coppice forest management in the SEE region were research techniques used in this paper. The background information was collected from scientific and professional articles, project reports and personal experiences. The main study approach was adopted for selected countries – Bulgaria, Croatia, Macedonia and Serbia.

RESULTS

Coppice forestry in general, with all its variants, is still a widespread management system in Europe, especially in the Mediterranean and South-Eastern region. According to UN-ECE/FAO (2000) the coppice area in France alone is almost 7 million ha, followed by Italy (3.4 million ha). Share of coppice forests in some countries of SEE is also substantial, being as high as 48% of total forest area in Bulgaria, 59% in Macedonia and 65% in Serbia (Table 1).

Historical information about establishment of coppice forestry in SEE

Due to the specific geographic location of the studied region – at the crossroad of three continents and ancient civilizations – utilization of forest resources began as early as several thousands of years ago (Simeunović, 1957; Nedyalkov et al., 1961). Despite that, numerous travellers who visited the Balkans in the XVI – XVIII centuries, reported

Table 1
Area and share of coppice forests in some Mediterranean and SEE countries

Country	Total forested area (ha)	Coppice forests	
		Area (ha)	Share (%)
Albania	942 000	405 000	43
Austria	3 992 000	70 000	2
Bulgaria	3 700 000	1 750 000	47
Croatia	2 403 000	512 000	21
France	14 470 000	6 822 000	47
Macedonia	948 000	557 000	59
Greece	2 512 000	1 640 000	65
Hungary	1 702 000	501 000	29
Italy	6 013 000	3 397 000	56
Montenegro	543 000	298 000	55
Romania	5 617 000	369 000	7
Serbia (without Kosovo)	2 252 000	1 456 000	65

Sources: SFA (2005); Bankovic et al. (2008); Toromani, Jupe (2007); Barbu, Barbu (2005); UN–ECE/FAO (2000); Chatziphilippidis, Spyroglou (2004); Glavonjic et al. (2005)

on the presence of extensive areas of primary forests (Simeunović, 1957; Nedyalkov et al., 1961; Stoyanov, 1968).

The intense exploitation of forest resources in prevailing parts of the SEE began in the XVIII and especially in the XIX century. This was a result of social, economic and political changes in all countries in the region. These changes included: (1) development of commodity-and-monetary relationships, which gradually destroyed the enclosed natural economy; (2) changes in land ownership resulted in the formation of considerable areas of private land which was then included in free trade circulation; (3) development of agriculture, handicrafts, civil and military industry, and stock-breeding; and (4) population growth followed by enlargement of existing settlements and formation of new ones (Nedyalkov et al., 1961; Stoyanov, 1968). As a result of these changes, significant areas of primary forests were partially or entirely transformed into coppice stands through the intensive firewood, timber and charcoal production. Other forests were burned and converted to pasture land (Nedyalkov et al., 1961).

In the past, inefficient forestry legislation, illegal logging, large forest fires, raise of railroads as well as lack of well qualified foresters resulted in an accelerated process of forest degradation (Simeunović, 1957). This processes triggered the development of legislative and political mechanisms aiming at the definition of guidelines for management, exploitation and protection of forests and forests products. The first forestry laws, established in Croatia (1769), Bulgaria (1870) and Serbia (1891), were also the first guidelines on forest management and emphasized the principle of sustainable wood production. Although these first regulations were scarcely implemented into real forestry practice they contributed to the improvement in legal and normative aspects related to forests. The most important reasons for the failure of regulations were the population poverty and devastating wars in the region, which took place during the end of XIX century and beginning of XX century. The wars became a reason for even increased exploitation of forests in the economically and technically underdeveloped countries of the region.

Extensive and uncontrolled exploitation of forests in the whole region resulted in the following negative consequences at the beginning of the XX century: reduction of the total forested area (in Serbia and Bulgaria to 30-35%, from about 80% back in history, Jekić, 1928, Jovanović, 1954; Stoyanov, 1968); partial fragmentation of previously continuous forest cover; and change in species composition as well as drastic shifts from high forests to coppice forests (Simeunovic, 1957; Nedyalkov et al., 1961). The typical degradation process followed the pattern less-stocked forests, irregular coppice forests, shrubs, brushes, and finally bare land (Šafar, 1963).

Despite the fact that guidelines on afforestation, silviculture and harvesting had already been published, until the beginning of the XX century forest management in the Balkan region was carried out without any professional guidance. The proposed transformation of coppice forests into high forests was either a chaotic process or was not conducted at al (Bonchev, 1902; Nedyalkov et al., 1961, Simeunovic, 1957). Organized transformation of coppice forests in the region started after the 1960s. It was estimated

that transformation into high forests would be achieved in relatively short periods (i.e. several decades). However, this turned out as unfeasible in practice in the majority of countries mostly due to the social and economical conditions in the region (Mircevski, 1998, Nedyalkov et al., 1961). Today the total coppice forest area in the Balkan countries is either relatively unchanged (Bulgaria, from 1.69 mill ha to 1.75 mill ha; Macedonia, from 0.54 mill ha to 0.56 mill ha); increased (Serbia, from about 1.00 mill ha to about 1.45 mill ha) or decreased (Croatia, from about 0.83 mill ha to 0.53 mill ha).

Management systems for coppice forests in SEE

Management systems in coppice forests are among the oldest forestry practices, used to provide regular supplies small sized wood. Advantages and disadvantages of coppice management system in general regarding to other management systems are described precisely and in details by Matthews (1996), Hatzistathis, Hatzistathis (2003), Marañón et al. (1999), Chatziphilippidis, Spyroglou (2004), Klepac (1994), etc. Acording to management objectives and silvicultural methods management systems for coppice forests used throughout history of studied region could be divided into several main groups:

Simple (traditional) coppice forests management

Trees are cut in short rotations to ensure regeneration from stem sprouts or root suckers. Sustainability of wood supply is achieved by dividing the total area of coppice forest in number of compartments in accordance with the duration of rotation period. Rotation period depends on the management objectives and can be from one year in willow coppices up to 20 or 40 (50) years in coppices for fuel wood or saw logs. In this system, it is important that rotation period does not exceed the age in which particular tree species ceases to produce healthy stump sprouts. Sometimes it is possible to combine wood production from coppice forests with cattle grazing.

In studied region, simple (traditional) coppice forests management has been practically abandoned. It was common in Bulgaria until the fifties of XX century with rotation periods of 15–30 years (Nedyalkov et al., 1961). During the sixties of the last century clearcutting in Serbia was also abandoned, with the exception mainly for black locust (*Robinia pseudoacacia* L.) forests (Jeftić, 1967). In Croatia clear cutting as a method of regeneration of even-aged forests is forbidden, except in cases of black alder, willows and poplars where clear cutting and regeneration by vegetative resprouting is still allowed. In Macedonia this system still exists. Rotation is up to 50 years for oaks (*Quercus* sp.) and European beech (*Fagus silvatica* L.), up to 30 years for black locust and up to 20 years for soft deciduous.

'High coppice' forests

This term can be used for coppice stands managed by a silvicultural system typical for high forests such as longer rotation periods and an objective of producing large dimension trees with good quality stems (Markovic, Petrovic, 1960). This management system developed as a result of efforts to convert coppices into high forests. Transformation into high forests, however, was not as successful as expected, the period of transformation

being excessively prolonged. Best coppice forests (well stocked and healthy) composed predominantly of economically valuable species (beech, oaks, scattered broadleaves etc) on good-quality sites were included in this forest type. Consequently, such stands are to be considered as coppices in process of transformation.

'High coppice' forest systems have been applied in all countries in the region. For example, for a short period (the 80s and 90s of the last century) the best quality coppice stands in Bulgaria were designated for production of saw-timber by management at higher rotations – 80–100 years (Nedyalkov et al., 1961). Such forests have become more and more representative in Serbia since the sixties of the last century, when clear cutting and the vegetative reproduction of coppice forests were almost completely abandoned, except for some black locust forests (Jeftić, 1967).

Coppice forests for transformation and reconstruction

Coppices for transformation into stands with trees from seed origin include stands dominated mainly by different oak species and European beech on good sites, in good health condition and with relatively high productivity. Transformation by means of natural regeneration was set as the main approach of their management. In the 60s of the last century it was expected that transformation would be achieved in relatively short periods (several decades). Despite the initial expectations, the area of coppice forests for transformation into seed ones gradually increased during next decades mainly due to unsuccessful regeneration activities.

The least productive tree and shrub communities on poor and degraded sites, mainly in the lowest vegetation zone, were set aside for reconstruction. In this case, the purpose was transformation of low-productive coppice stands into more productive ones through clear cutting and substitution of the main tree species. In most cases, however, forestations were unsuccessful. Despite cleaning activities, planted seedlings were suppressed by the coppice/sacker shoots of the local tree and shrub vegetation. Currently forests for reconstruction in some countries in the region have been officially abolished as a forest type. They were mainly transferred into the other coppice forest types: coppice forests for transformation and forests for coppice management.

Coppice forests with standards and 'middle-aged' forests

The term 'coppice with standards' is often assimilated with the term 'middle-aged forest'. However, these terms will be separated in this paper due to the differences in their implementation in some countries in SEE.

Coppice with standards are usually formed from regular coppice forests by retaining a certain number of trees after the periodic clear cut (20–30 trees per ha). Aim of this kind of management is to produce larger trees able to produce valuable sawlogs by the end of the next rotation cycle. This kind of management is also of interest when the transformation of coppice into high forest is targeted: standards are usually characterized by better seed-bearing potential. In case of this paper, 'middle-aged forest' is considered as a step between coppice with standards and high forest. It has coppice forest in the middle story, and trees of seed origin in the upper story. This forest type is suitable for

small sized private forests. It gives the forest owner fuel wood, sticks, poles, small sawlogs and litter. There is also possibility to organize cattle grazing in the middle forest, usually 3 to 5 years after cutting.

Pollarding forests

Pollarding is an almost forgotten art of coppicing in SEE. However, in some rare cases, it is still used in all countries – to obtain shoots for basket and furniture production as well as for cattle feeding during the winter in areas with very extensive cattle breeding. For example, the pollarding coppice forests in Serbia cover about 0.5 % of total forested area, mostly in private forests (Krstic, 2006). Farmers in Istria and on island of Cres in Croatia used to cut trees of pubescent oak and chestnut at 2 or 3 meters above ground to obtain fuel wood, sticks and food for cattle (Klepac, 1994). In this management regime grazing is permanently allowed, since cattle can not reach new sprouts at 2 or 3 meters above ground. Some key characteristics of the so-called low and high pollarding in Macedonia were presented by Mircevski (1995). Years ago in Serbia, so-called 'fur hat' forests were separated as a special kind of pollarding coppice forests, which main product were sticks. (Markovic, Petrovic, 1960).

Selection coppice forests

This coppice management concept is very similar to a selection system in high forests. Trees from largest diameter classes being harvested and tendings performed in lower diameter classes. Target diameters are set with regard to age and resprouting ability of the tree species as well as according to the aimed wood products. Selection cutting in coppices is considered as more appropriate way of forest regeneration than clearcutting, especially when copses grow in undesirable climate conditions or on les favourable sites with extreme slope (Jovanovic, 1988). In this kind of management the soil remains continuously covered with forest which makes it especially appropriate in erosion and water protection areas. At present this management concept is rarely used in the studied region. Back in 1937, however, Šenšin (1937) recommended it as one of the most appropriate management systems for private forests in Yugoslavia of that time.

Shelterbelts (windbreaks, erosion shelterbelts, etc)

Shelterbelts and windbreaks are important tools in protecting agricultural crops from impact of strong wind and other negative weathering. If coppice forests are used for that purpose, farmers can also obtain fuel wood and in some cases even sawlogs. Tree species used are usually poplars and in some cases oaks. Due to arid climatic conditions in Macedonia, more drought resistant species such as black locust, honey locust, almond-tree, etc are used.

Oak coppices for shelling

According to Burschel, Huss (1987), since XV and XVI centuries a special form of coppice forest had become important in Central Europe. It was the so called 'oak forest for shelling'. In this case the product is not just wood, but the bark as well

(tanbark). This management system in coppice forests was also operational in SEE. Beside oak, sweet chestnut was also used. Toward the end XIX and the beginning of XX century this management practice was almost completely abandoned due to tannic producing becoming les rentable.

'No management' concept

Due to increase in harvesting costs, some forest owners deliberately decided not to manage their coppice forests. It was explicitly pronounced on poor and inaccessible sites. The absence of elementary conditions for a profitable forestry resulted in exclusion of such stands from regular management. According to Krstic, Stojanovic (1998) such forests should be treated as protection forests. In some SEE countries, coppices that were abandoned after World War II developed towards naturally structured forests (Nedyalkov at al., 1961, Chatziphilippidis, Spyroglou, 2004).

DISCUSSION AND CONCLUSIONS

Coppice forests are a significant component of SEE woodland resources (compare Table 1). The most important common characteristics in their establishment were the absence of any silvicultural measures in early ages and very weak and inadequate silviculture treatments in later stages (Nedyalkov et al., 1961; Mircevski, 1998; Dubravac, Krejči, 2001; Bobinac, 2003; Bobinac, Aleksic, 2007; Krstic, 2006). Most coppice forests in which management activities aiming for transformation into high forests had started were sooner or later left to spontaneous development. It was mostly due to lack of financial resources or adequate knowledge. Some coppice forests were simply left to grow. These circumstances, combined with the influence of different social, economical and biological factors, as well as with erroneous scientific and expert management approach, caused the development of a diverse range of coppice forest types with heterogeneous structural, productive and qualitative characteristics. This variety is also a result of different management systems that have been developed in the region throughout history. Although formally adhering to the concept of 'multifunctional forest use', some of these practices should be re-discovered and tested against ecological, economical and social indicators of sustainable forest management such as the PEOLG of the MCPFE (Ministerial Conference for the Protection of Forests in Europe) (Vacik et al., 2007) and updated with new and improved management concepts.

For successful introduction and implementation of new and improved coppice forests management concepts and practices, it is necessary to consider the main problems and knowledge gaps according to past and recent coppice management. The following issues have to be taken into account:

(i) There are clear functional interactions between past management and the current state of coppice forests. It is not the role of woodland history studies to prescribe future management strategies but history can certainly stimulate debates about future management directions (Stewart, 2005);

(ii) All management systems described in this paper cover some criteria of sustainable development but they differ in the fulfilment of economical, ecological and social criteria of sustainability. Some of these practices should be rediscovered and tested against ecological, economical and social sustainability indicators of maintainable forest management frameworks such as the PEOLG of the MCPFE (1998, Vacik et al. 2007), and updated with new, improved management concepts.

(iii) Coppice silviculture is fairly simple thus being appropriate for small private forest property. Professional and financial support to private owners as well as adequate forest policy can improve the state of these forests and promote development of rural areas.

(iv) Involvement of all stakeholders in coppice forestry into decision making will produce tangible improvement in whole forestry sector and contribute to more sustainable utilisation of wood and non-wood products from coppice forests.

(v) In most cases, coppice forests in SEE have been managed with rotation periods ranging from 10 to 80 (100) years. The prolongation of the rotation cycle generally ensures a richer return of organic matter to soil and reduces the negative effects of the short rotations upon site fertility as well as concentrate higher standing volumes (Amorini, Fabio, 1992). On the other hand, some authors find that too long rotations result in loss of growth potential and lower tree vitality, and therefore do not recommend them from economical, ecological and biological aspects (Vuckovic et al., 2000; Dubravac, Krejči, 2004).

(vi) Transformation of coppice forests into high forests by means of natural regeneration has proven to be the most appropriate and effective management practices. Its main advantages are that it gradually improves ecosystems stability, stem quality and value as well as increase in aesthetic features of forested landscapes (Hatzistathis, Hatzistathis, 2003).

(vii) Due to the substantial share of coppice forests in SEE and their unfavourable age structure (stands between 50 and 70 years dominate) the possibility of introduction of some additional management concepts, such as coppice with standards or coppice with reserves should be considered in particular countries in the region. In this case, additional knowledge is necessary in order to assure appropriate implementation of these techniques.

(viii) Improved coppice management in SEE countries would also be an important contribution in climate change mitigation, modern bioenergy industry promotion, sustainable social development and poverty alleviation (Jurgens et al., 2004).

(ix) Additional considerations concerning possible enlargement of protected coppice forests area in SEE in accordance with implementation of EU directives regarding to biological diversity, water quality, recreation etc. are necessary.

It can be concluded that sustainable management of coppice forest resources can contribute to ecological stability and economic development of the SEE region. This could be achieved by both considering the traditional management concepts and introduction of new management practices which are scientifically sound with regard to ecological, economic and social concerns.

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