

Marčeta, M., Keča, Lj. (2024). *The role of forest resources in the development of Southeastern Serbia: Market analysis and perspectives*. *Agriculture and Forestry*, 70 (4): 137-145. <https://doi.org/10.17707/AgricultForest.70.4.10>

DOI: 10.17707/AgricultForest.70.4.10

Milica MARČETA^{*1}, *Ljiljana Keča*²

THE ROLE OF FOREST RESOURCES IN THE DEVELOPMENT OF SOUTHEASTERN SERBIA: MARKET ANALYSIS AND PERSPECTIVES

SUMMARY

The global wood trade is important for the world economy and significantly impacts the construction, paper, and bioenergy industries. Growing demand comes from industrialized countries and developing economies, which invest in urbanization and infrastructure development. As a large consumer and wood exporter, Europe is influenced by climate change, geopolitics, and energy crises. On the other hand, Serbia has a long tradition in wood export, but at the same time faces challenges in modernization and sustainable forest management. In such circumstances, this research aims to analyze the market trends in wood assortments in the Southeastern Forest Area of Serbia in the period 2008-2017. The purpose of the research is to identify the main trends in the field of logging, processing, and sales of wood assortments in the analyzed area. The subject of the research includes state forests, Public Enterprise (PE) "Srbijašume", forest estates in the Southeastern Forest Area, the volume of logging, production, and sales of wood assortments, as well as their price.

The data were collected from the databases of the PE "Srbijašume" and included annual sales and prices of beech, oak, and poplar, which were adjusted according to annual price indices to calculate their real prices. The methods used in the analysis include descriptive statistics, the Mann-Kendall test for trend detection, and autocorrelation of time series.

The results indicate a statistically significant increase in the volume of felling, sales, average prices, and gross revenues during the analyzed period. Beech and oak dominate the sales, reflecting their importance in the regional forest inventory. This data confirms the steady growth of the wood industry sector in the South East region and underlines the importance of responsible resource management and adaptability to market dynamics.

Keywords: wood market, Southeast Serbia, PE "Srbijašume", logging, sales

¹Milica Marčeta, (corresponding author: milica.marceta@sfb.bg.ac.rs), University of Belgrade, Faculty of Forestry, SERBIA.

²Ljiljana Keča, University of Belgrade, Faculty of Forestry, SERBIA.

Notes: The authors declare that they have no conflicts of interest. Authorship Form signed online.

Received: 02/09/2024

Accepted: 28/11/2024

INTRODUCTION

In general, the wood trade is an important component of the world economy and has a significant impact on industrial sectors such as construction, furniture, paper, and bioenergy. The growing demand for wood and wood products comes from economically developed and developing countries that are intensively investing in urbanization and infrastructure.

Changes strongly influence global wood markets in a wide range of regulatory and market factors (Latta *et al.*, 2016), in particular: population, economic growth, technological changes, the environment, etc. (de Fégely 2005; 2009). The main exporters of wood products are Canada, Russia, the USA, and the Scandinavian countries, which have large forest resources and developed infrastructure for processing and export. On the other hand, importers are often from countries with high urbanization levels and construction activity, such as China, Japan, and India. Sustainable forest management has become key to regulating trade and protecting forests, and some countries are implementing eco-labeling and certification to meet environmental standards.

The European wood market and wood trade are affected by several major factors, such as global climate change – through the increasing volume of sanitary logging, the global economic crisis manifested in the reduction of wood product consumption, fossil fuel prices, the geopolitical situation, the volume of wood supply on the market, etc. (Gejdoš, Potkány, 2017; Stare, Ščap, 2019).

In Serbia, the wood trade has a long tradition with a significant share in the national economy and an important role in rural areas. Serbia's main export partners in this area are European Union countries, including Germany, Italy, Slovenia, and Romania. The European Union already plays a vital role in trade with the Western Balkans and in further integrating the Western Balkans into the economic and political structures of the European region (Zdrahal *et al.*, 2024).

Problems with illegal logging and the need to modernize the processing sector and forest management pose challenges to sustainable development and wood trade in Serbia. The focus is increasingly on the implementation of sustainability certifications (such as FSC and PEFC) to encourage environmentally responsible production and increase export competitiveness. These standards have become the most diffused standards at the global level (Lombardo, 2024).

Based on the situation in Serbia, where supply and demand for raw materials are not matched, public enterprises (PEs) play an important role in their distribution (Prašćević, 2015). In this sense, the pre-defined criteria for priority purchases are respected, which are, in the case of technical wood:

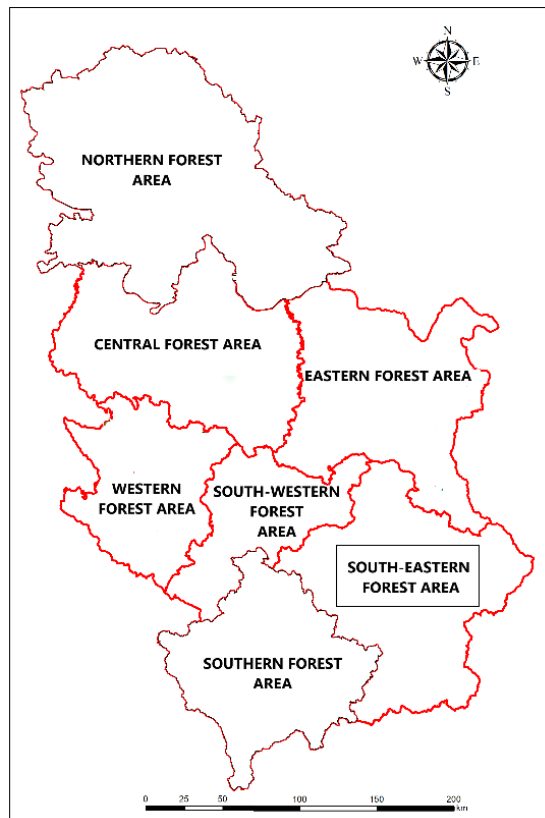
- buyers who have their own installed wood processing capacities;
- number of wood processing stages performed by the buyer;
- compliance with previous contractual obligations, a buyer who has complied with contractual obligations in the current year will be offered approximately the same quantity in the following year as he took over in the previous year;

-level of development of the buyer's municipality, i.e. processing plants with the majority of employees (Glavonjić *et al.*, 2016).

The aim of the research is to examine market trends and potential in the Southeastern Forest Area. The purpose is to identify trends in logging, production, and sale of wood assortments in the analyzed area. The subject of the research is state forests, PE "Srbijašume" and forest estates in the Southeastern Forest Area, the volume of logging (production), sale of wood assortments, and their prices.

MATERIAL AND METHODS

The data used in this article were generated from internal databases and reports of the PE "Srbijašume". Specifically, the annual data on sales (in m³) and wood prices (in dinars) for beech, oak, and poplar in the Southeastern Forest Area were analyzed. Nominal wood prices were adjusted using annual price indices to achieve comparability over the observed period. This calculated the real price of wood. Based on the real price and sales volume, the annual gross income for each of the three wood types was calculated (Marčeta, Keča, 2024).



Map 1. Research area

The research area refers to the Southeastern Forest Area, which includes the forest estates of Leskovac, Niš, Vranje, Kuršumljia, and Pirot (Map 1). The period analyzed is 2008-2017.

Based on the data, time series were formed and in the first phase, significant autocorrelations (dependence within the data) were examined using the autocorrelation coefficient graph (Wang, 2008). Autocorrelation was calculated in two steps. In the first step, the dependence between data of consecutive years was examined, for step 2, the dependence between data every two years, etc. For the autocorrelation coefficients, the confidence interval (95%) is indicated on the graph. If the autocorrelation coefficient for any of the steps is outside the confidence interval, it is considered that there is a statistically significant dependence of the data with that step. The significance of the trend was tested using the Mann-Kendall test (Mann, 1945; Kendall, 1975; Kulkarni, von Storch, 1995; Yue, Wang, 2004). This method is most commonly used for trend detection, the non-parametric Mann-Kendall test (Hamed, Rao, 1998; Ghalharia *et al.*, 2012; Guhathakurta *et al.*, 2010), which assumes the independence of data in the time series (Yue, Wang 2004; Pohlert, 2016).

RESULTS AND DISCUSSION

Table 1 presents total logging, sales, gross revenue, as well as the average price and standard deviation of the price in the Southeastern Forest Area, in the period 2008-2017.

Table 1. Descriptive statistics

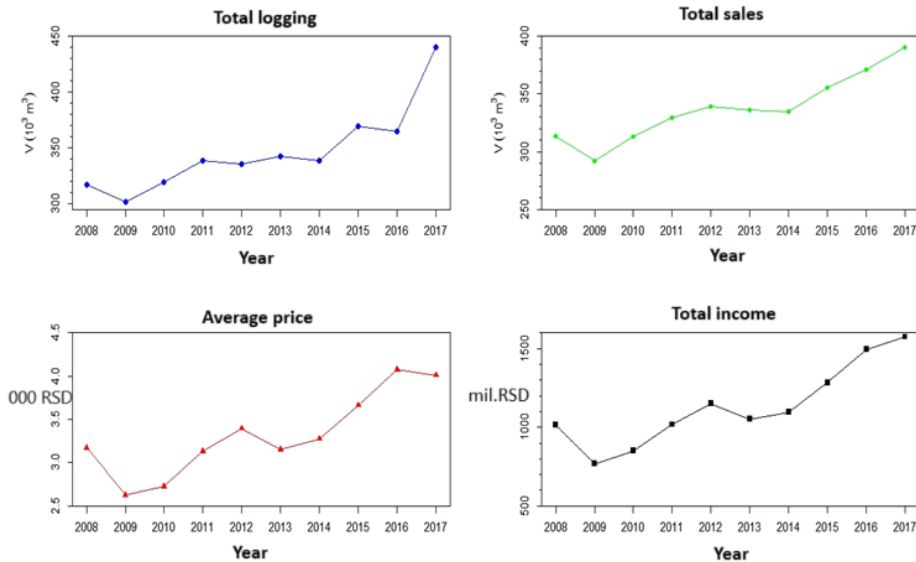
YEAR	LOGGING		SALES		PRICE		GROSS INCOME	
	TOTAL (m ³)	%	TOTAL (m ³)	%	Average value (RSD)	Standard deviation	TOTAL (RSD)	%
2008	316,795	28.1	313,422	28.8	3,172.2	636.9	1,013,365,655	33.8
2009	301,703	27.3	292,039	27.4	2,622.4	344.0	768,532,387	25.8
2010	319,199	27.3	313,185	27.4	2,722.2	309.6	850,522,283	23.8
2011	338,912	27.9	329,268	28.5	3,130.0	286.9	1,018,114,760	26.3
2012	335,603	27.8	339,235	27.4	3,395.0	305.0	1,149,924,878	24.7
2013	342,684	26.7	335,937	26.4	3,148.8	119.9	1,051,785,283	24.6
2014	338,623	26.4	334,928	26.7	3,274.8	134.4	1,095,801,468	24.0
2015	369,240	27.4	355,391	26.3	3,662.0	332.6	1,282,196,262	24.2
2016	365,022	27.2	370,935	27.7	4,071.8	433.6	1,494,055,348	26.2
2017	440,432	28.1	390,265	28.3	4,007.6	437.7	1,574,491,214	26.4

Source: Original

In the Southeastern Forest Area, the volume of felling, in the analyzed period, was in the interval 301,703-440,432 m³, where the placement followed the felling dynamics. The highest average price was formed in 2016, influenced by the sale of more valuable assortments, while the most significant gross income was achieved in 2017 (Table 1).

In general, the availability and supply of technical wood affects the supply and demand of the wood industry. This can be explained by the fact that an increased supply of technical wood results in its lower price, and thus lower costs, better competitiveness, and higher demand for wood industry products (Trømborg *et al.*, 2000). In those circumstances, the forestry sector is undergoing a transition towards a “circular bioeconomy” (Michal *et al.*, 2021), and the complex interaction between economic and environmental forces is common in most European countries (Lombardo, 2024).

Graph 1. Trends in total logging, total sales, average price, and total income



Source: Original

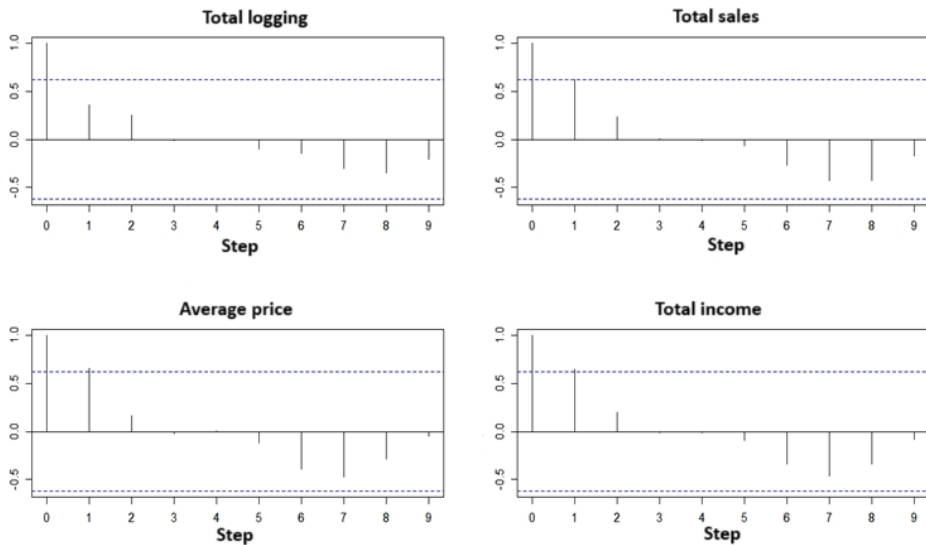
Graph 1 shows total logging (in thousands of cubic meters), total sales (in thousands of cubic meters), the average price of wood (in thousands of dinars), and total gross revenue (in millions of dinars) in the Southeastern Forest Area during the observed period.

In all analyzed cases, shown in Graph 1, an increasing trend can be observed in the categories: total logging, total sales, average price, and total revenue). This indicates the absence of extreme deviations from the trend line, except for 2017, when more intensive logging occurred.

Unlike the formation of prices based on market power and the strength of market participants (Brkić *et al.*, 2017), the realization of wood assortments is carried out according to the current price list of the PE for the current year. This is done according to the sales model on the forest-truck road, where “the wood is cut to a certain length, classified and stacked on the forest road awaiting shipment” (Delić, 2011). This method of sales is “...a variant of free sales, when forest enterprises determine in advance, based on production costs and the market situation, the prices of forest assortments for a certain period, after which they must be revised” (Ranković, Keča, 2011).

In practice, prices are formed under market conditions, primarily the supply and demand ratio and the costs that arise from the moment of felling and processing of trees to the point of delivery (Keča *et al.*, 2015).

Graph 2. Autocorrelation coefficients



Source: Original

Graph 2 presents the autocorrelation coefficients of total felling, sales and gross revenue, and the average price in the Southeastern Forest Area. The autocorrelation coefficient with step 1 is significant for total sales, average price, and total revenue. In these cases, the modified Mann-Kendall test was applied.

Table 2. Mann-Kendall test

SOUTHEASTERN FOREST AREA				
Variable	Test	Statistics	<i>p</i> -value	Trend
Total logging	Mann-Kendall	3.041	0.002	Yes
Total sales	Modif. Mann-Kendall	3.041	0.002	Yes
Average price	Modif. Mann-Kendall	2.683	0.007	Yes
Total gross income	Modif. Mann-Kendall	3.220	0.001	Yes

Source: Original

Based on the results (Table 2), it was determined that there is a statistically significant increasing trend in total felling, sales, average price, and total revenue in the Southeastern Forest Area in the period 2008-2017.

For the reason of comparison with other forest areas, Table 3 shows the sales and revenue shares for beech, oak, and poplar in 2017. For beech, the percentage of sales and gross income was calculated in relation to the total sales and the income from beech in all forest estates (Marčeta, 2023).

Table 3. Sales and gross income from beech, oak, and poplar in 5 forest areas in 2017

	FOREST AREA				
	Central (%)	Eastern (%)	Western (%)	Southwestern (%)	Southeastern (%)
SALES					
1.Beech <i>Fagus</i>	2.47	28.68	10.40	24.55	31.67
2.Oak <i>Quercus</i>					
Turkey oak <i>Quercus cerris</i>	3.70	2.54	2.42	16.76	11.35
English oak <i>Quercus robur</i>	1.13	-	0.16	-	-
Sessile oak <i>Quercus petraea</i>	2.71	4.03	6.99	12.28	13.68
Italian oak <i>Quercus frainetto</i>	0.30	0.41	0.29	2.02	9.13
3.Poplar <i>Populus</i>	62.24	19.20	3.55	0.01	0.09
INCOME					
1.Beech <i>Fagus</i>	2.50	27.71	10.98	25.87	31.92
2. Oak <i>Quercus</i>					
Turkey oak <i>Quercus cerris</i>	4.07	2.54	2.47	14.62	10.70
English oak <i>Quercus robur</i>	3.04	-	0.39	-	-
Sessile oak <i>Quercus petraea</i>	3.24	6.79	6.32	10.63	11.61
Italian oak <i>Quercus frainetto</i>	0.23	0.33	0.35	1.51	9.01
3. Poplar <i>Populus</i>	67.71	22.70	3.54	0	0.05

Source: Original

The results show that the share of beech sales is the highest in the Southeastern Forest Area (31.67%). This is expected, given the dominance of beech in the forest fund of this region. At the republic level, beech makes up about 30% of the forest fund of Serbia, while in state forests it occupies 31%

(2008). In a slightly smaller percentage, beech is represented in sales in Eastern and Southeastern Serbia. In addition, the Southeastern Forest Area has the largest share in the sale of Sessile oak and Italian oak, 13.68% and 9.13%, respectively, while the sale of Turkey oak has the largest share in the Southwest Forest Area (Table 3).

CONCLUSIONS

Based on the research results, the following conclusions can be highlighted:

-in the period 2008-2017, a constant increase in logging and wood sales was recorded in the Southeastern Forest Area;

-average wood prices increased, with a sharp increase in prices in 2016 when more valuable wood assortments were sold;

-Sessile oak and Italian oak represent a significant share of oak sales and are most represented in the Southeastern Forest Area;

-seasonal fluctuations in wood prices and supply were determined, depending on demand and production in individual years;

-the highest gross revenues were achieved in 2017, which is the result of a larger sales volume and increased average price;

-beech had the largest share in sales in the Southeastern Forest Area, which is in line with its dominance in the forest fund;

-seasonal changes in the price and supply of wood were observed, which depended on market trends and production;

-the results of the Mann-Kendall test confirmed the existence of a statistically significant increase in the volume of felling, sales, prices, and gross income;

-the important role of the PE "Srbijašume" in the context of defining the criteria for the allocation of raw materials is emphasized, thereby affecting the balance between supply and demand on the local market.

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