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OVERVIEW OF HISTORIC WOOD CHARCOAL MANUFACTURING IN TÜRKIYE

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ABSTRACT

Wood charcoal has a long history in Türkiye, shaping social and industrial dynamics from the Ottoman era until the present day. For instance, charcoal has served household, artisanal, and industrial needs; trade patterns have evolved with energy transitions and regional forest resources. The study brings together historical and contemporary perspectives on the production, use and trade in charcoal in Türkiye from 2010–2023, drawing on the literature and FAO data to provide a concise overview. It also discusses implications for policy and future research. It reviews more than 40 scholarly works, theses, books, and archival sources on charcoal production and charcoal use from Ottoman times to the present. It also offers a conceptual framing of charcoal practices during the Ottoman period and analyses FAO charcoal export/import data (2010–2023) to triangulate historical interpretations with statistics. Charcoal was central to energy for smelting, weapons production, minting, cooking, and heating, with major centres including Salonica, Edirne, Izmit, Teke, and Aydın. Forest resources and urban demand shaped a complex supply network. Ottoman charcoal production lagged behind Europe in transitioning to coal, and reported efficiency varied (estimated productivity debates around 17–20%, depending on archival sources). Charcoal making was labour-intensive, regionally varied, with kilns typically being earth-mound. Modern patterns rely on migrant labour in some provinces. In addition to angiosperm taxa such as oak, beech, hornbeam, chestnut, ash, elm, alder, strawberry tree, and birch, gymnosperm taxa such as spruce, fir, and pine are also used in charcoal production. Türkiye is primarily a net importer of charcoal (2010–2023), with imports exceeding exports; however, the gap narrowed in recent years (2019–2023). The recreational use and expanding industrial applications of charcoal are driving growing demand in cooking, heating, and leisure contexts. There is substantial untapped potential in Türkiye's forest and waste woody biomass to produce cleaner, value-added charcoal that reduces both costs and the environmental impact. Policies should promote sustainable forest management, regional deployment of efficient production technologies, and support for local charcoal supply chains. Future work should evaluate environmental costs of intensified charcoal use and explore cleaner production technologies and lifecycle trade-offs.

Keywords: charcoal, Ottoman Empire, trade, forest, Anatolia

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INTRODUCTION

The oldest known chemical wood processing method, dating back to prehistoric times, is the production of charcoal (Uçar, 1988). For centuries, wood has been transformed into charcoal in almost every part of the world. Forests that provided firewood and charcoal, two basic forms of wood fuel, have been indispensable sources of thermal energy in preindustrial societies (Williams, 2006). These forests supplied the wood necessary for charcoal production, which was needed to melt iron and fuel furnaces in copper production. Charcoal is one of the world's most important energy sources and can be used for various purposes, including household, medical, and industrial applications.

Smelting technology developed in the Old World at the expense of large forests around the Mediterranean, including those in Anatolia (Perlin, 2005). The history of wood charcoal production and use stretches back to ancient times, where it has long been employed for various purposes in Türkiye (Berkel and Huş, 1953; Bozkurt and Göker, 1996; Köprülü, 1948). Before the industrial application of coal, charcoal was a necessary and important material not only for the art of smelting but also for blacksmithing, locksmithing, and other crafts (Köprülü, 1948). Forests continued to provide a significant share of energy to Ottoman households and industries until the end of the empire.

Forests were used to supply large amounts of energy to households and industries in the Ottoman Empire. During this period, charcoal was used for: 1) household consumption (cooking and heating); 2) industrial consumption in the defence industry (iron factories and arsenals, weapons and ammunition manufacturing, gunpowder production),) iron foundries and smelters, and the Imperial Mint; and 3) artisanal consumption (bakers, paint manufacturers, lime, tile and brick manufacturers, blacksmiths, tanners, glass manufacturers, and bath owners) (Tok, 2017). Today, the use of charcoal for grilling and barbecuing is widespread in homes, restaurants, and places of recreation. In addition to its primary use in recreational activities, charcoal also provides input to sectors such as the iron and steel, glass, chemical, and cement industries. Furthermore, the demand for charcoal has increased because it does not contain sulphur and produces less air pollution than other types of coal during combustion. This rising demand has also created more employment opportunities and increased income levels in rural areas, supporting rural development and the regional economy (Günal, 1999; İmren et al., 2019).

During the Ottoman Empire, the production of silver, gold, and copper raw materials required for vital production units, especially the Imperial Mint and the Imperial Foundry continued uninterrupted. However, this continuous production relied on a steady supply of charcoal from nearby forests (Gündoğan, 2023). Similarly, the heating and cooking needs of society in daily life were heavily dependent on charcoal. Additionally, traditional handicrafts and workmanship also required charcoal intensively. This extensive use undoubtedly had a negative impact on forest resources and triggered environmental problems. In response to issues or shortages in the supply of charcoal, some official decisions were made. For example, during the First World War, when there was a shortage of charcoal, all coffee shops in Istanbul were prohibited from burning charcoal in their stoves (Öztel, 2013).

This study aims to bridge the historical significance of charcoal with its contemporary socio-economic relevance, particularly underexplored in the context of Türkiye. To this end, it provides historical and current information on charcoal production and use in Türkiye, as well as focusing on foreign trade in coal, based on the literature.

MATERIAL AND METHODS

The primary material used in our study consists of articles examining the socio-economic dimensions of coal production and use from the Ottoman Empire to the present. First, basic information was obtained by reviewing postgraduate theses, books, and articles published on the production and utilisation of charcoal. The conceptual framework of this study was then established by examining practices related to charcoal, particularly during the Ottoman Empire period. The charcoal export and import data (2010–2023) used in the study were sourced from the FAO. We reviewed more than 40 scholarly works, including Ottoman archival texts, peer-reviewed journals, and FAO datasets (FAO, 2025). Historical interpretations were triangulated with FAO statistical data to explore continuity and change. Studies on charcoal in archaeological sites were excluded if the charcoal resulted from a fire caused by a reason other than charcoal production. Additionally, the environmental impacts of charcoal production are not included in the literature considered here.

RESULTS

Historical charcoal production and use in the Ottoman Empire

Forests were the primary raw material for thermal energy for smelting in Ottoman Anatolia. Most industrial facilities and households in the empire consumed wood and coal, limited to the natural resources available in the vicinity of their settlements (Tok, 2023). The process of procuring wood and then burning it to produce charcoal was an important aspect of mining operations. In the Ottoman Empire, charcoal was produced by melting iron in furnaces and ovens in military facilities during the construction of ships (Kocaoğlu, 2025). The Imperial Arsenal (Tersâne-i Âmire) was one of the city's largest consumers of charcoal, using it to produce iron components for ships (Iwata, 2023).

In the Ottoman period, Salonica, Edirne, Izmit, Teke, and Aydın were the most important centres of charcoal production due to the abundant forests and marketing opportunities (Tok, 2017). In particular, urban residents consumed charcoal from districts in the Thrace region near the Black Sea, including Istranca, Terkos, Çatalca, Vize, Tatarpazarı, Hasköy, and Filibe, as well as from communities on the eastern side of the Sea of Marmara, such as İzmit and Kocaeli (Iwata, 2023). Charcoal was a basic component of gunpowder production (Parry, 1972). During the Ottoman Empire, forests around Istanbul were used to meet the needs of the Tophane Cannon Factory and the Baruthane Gunpowder Factory. Considerable charcoal was needed to melt metals such as iron and copper in the furnaces of the Cannon Factory. The Imperial Mint (Darphane) used charcoal, the most important type of fuel required for its money minting activities (Çiftçi, 2004; Narin, 2018; Yıldırım, 2015).

During the Ottoman period, charcoal was also used for cooking and heating. It was supplied from the regions surrounding Istanbul and the provinces of Anatolia bordering the Black Sea, with sea transportation generally used for shipping these products (Öztel, 2013). Firewood and charcoal were vital in many large industries that required thermal energy. Smelting, ironwork, glassmaking, pottery, and lime production were among the main professions that consumed considerable organic energy sources. In early modern Istanbul, charcoal played a crucial role in the urban economy and the lives of the city's residents (Tok, 2017). It was used in various settings, including the court, private homes, and trade workshops, with hammams, bakeries, and ironware manufacturers consuming particularly large quantities of thermal energy (Iwata, 2023). Charcoal making was a laborious task that required levelling the ground, erecting a central pole, stacking the cut wood, and covering the piles before burning (Tok, 2017). As state policy, the export of timber, firewood, and charcoal was controlled by the Ottoman government (Dursun, 2007).

Efficiency in Charcoal Making During the Ottoman Empire

Excessive use of wood fuel, along with practices such as logging, pastoralism, and clear-cutting, has been a leading cause of global deforestation and forest degradation. The metallurgical industry has significantly impacted forests worldwide, particularly due to its high demand for thermal energy (Williams, 2006). According to Richards (2005), one of the most remarkable transformations in early modern Britain was the shift from wood to coal as the primary fuel. By the mid-eighteenth century, coal had become the predominant source for both household heating and industrial purposes. In England in the 1790s, there were only 25 furnaces using charcoal, compared to 86 furnaces working with coke in the iron smelting industry (Şakul, 2016). However, unlike western Europe, where coal became available in large volumes from the late eighteenth century onwards, the Ottoman mines relied primarily on charcoal as their main fuel source during the same period (Gündoğan, 2024).

In 1855, a French forestry expert prepared a report on the production of wood fuel in Ottoman lands due to fuel shortages and high fuel prices. According to this report, charcoal production was inefficient. The main reasons for the shortages were poor management of the forests and inadequate logging and charcoal-making techniques (Şakul, 2016). It was determined that using an axe instead of a saw for felling was quite inefficient, resulting in a total wood loss of 20%. Additionally, chopping consumed 10% more time than sawing. According to the report, '*In France, 19-22 units of coal could be obtained from 100 units of wood, while in the Ottoman Empire this amount was between 9-11 units*' (Öztel, 2013). In contrast, according to Kocaoğlu (2025), 1 kg of coal can be obtained from 5–10 kg of wood after burning for approximately 10 days in a domed oven called '*Torluk*' under suitable weather conditions.

Tok (2017) argued that this claim has been questioned in many archival documents, suggesting that productivity in the Ottoman charcoal business was around 17%–20%, and that the difference in productivity levels between the French and Ottoman charcoal production industries in the 19th century was not as significant as previously thought. It is understood that technological developments in wood-charcoal production in the Ottoman Empire were not transferred from other countries, low efficiency was discussed, and the transition to coal was delayed (Keskin, 2007; Tok, 2017).

GENERAL CHARACTERISTICS OF WOOD CHARCOAL PRODUCTION IN TÜRKIYE

Terminology and Traditions

Türkiye has a long and complex history of wood charcoal production, traditionally centred in the Anatolia and Thrace regions. The Ottomans referred to the earth pits used in charcoal-making as '*torluk*' (Tok, 2017), a term that continues to be used in Türkiye today. The production of charcoal, which was an important source of income, was known as '*torlukçuluk*'. Individuals engaged in charcoal production were referred to as '*Torlukçu*' in Thrace and '*Torakçı*' *in Anatolia* (Alabaşoğlu, 2022).

Labor and Working Conditions

The use of charcoal is increasing, driven particularly by recreational activities in recent decades. In rural areas, charcoal production serves as a vital livelihood for many (Güvenli and Daşdemir, 2017). Today, charcoal production is undertaken by workers who must endure difficult terrain and prolonged separation from social life. Consequently, it is becoming increasingly challenging to find skilled masters and workers in this field (Aydın and Çalışkan, 2019). Legal permits must be obtained from the forest administration for charcoal production, and there may be difficulties regarding protection in areas within or adjacent to the forest (Menemencioğlu, 2013).

Wood charcoal manufacture is a seasonal, predominantly labour-intensive activity, primarily carried out by households consisting mostly of men. The preparation, production, and delivery of charcoal, which is produced across extensive areas in Türkiye and holds significant economic value, occurs under arduous conditions (Aktaş and Batur, 2019). Güreşir (2020) noted that folk songs are composed (*türkü yakmak*) to commemorate those who lost their lives due to charcoal production (*torlukçuluk*).

Tree Species and Regional Practices

Wood charcoal is still widely produced by migrant charcoal producers using traditional methods with earth-mound kilns. There is a diversity of tree species used for charcoal production in different regions of Türkiye. During the Ottoman period, the charcoal most consumed by the Tophane Cannon Factory and the Baruthane Gunpowder Factory was generally obtained from oak, chestnut, beech, spruce, and fir trees (Koç, 1999). Also known as Erica species, these were used by Tersâne-i Âmire after obtaining charcoal in large quantities (Kocaoğlu, 2025). Berkel (1944) stated that approximately 97% of charcoal is produced from broad-leaved trees, primarily oak, while pine is preferred among coniferous trees. İnal (1955) also noted that oak has great value as firewood and charcoal. Four different oak species are used in Konya province: *Quercus trojana* P.B. Webb, *Quercus ithaburensis* Decne. subsp. *macrolepis* (Kotschy) Hedge, *Quercus pubescens* Willd., and *Quercus cerris* L. (Vural, 2014). In the Tarsus-Karabucak region of southern Turkey, even exotic species such as *Eucalyptus camaldulensis* Dehn and *Eucalyptus grandis* W. Hill are used in charcoal production (Kızılel, 2014). In Çatalca, located to the west of Istanbul, wood obtained from oak species (*Quercus petraea* (Mattuschka) Liebl, *Q. robur* L., *Q. frainetto* Ten, *Q. cerris* L., *Q. pubescens* Willd., *Q. hartwissiana* Stev), oriental beech (*Fagus orientalis* Lipsky), common hornbeam (*Carpinus betulus* L.), elm (*Ulmus minor* Miller), and alder (*Alnus glutinosa* (L.) Gaertn.) found in coppice forests is used in the production of charcoal (Günal, 1999).

Some production patterns from Türkiye

This section provides brief information on charcoal production from four different provinces of Türkiye (Fig. 1a–d). Generally, oak, hornbeam, beech, chestnut, and strawberry tree species are the most suitable for wood charcoal production in Balıkesir (Figure 1a). Due to insufficient local labour and the lack of interest among workers in tree cutting and charcoal production, migrant workers are brought in from outside the province. Workers who come with their families, and are usually relatives, and live in tents set up with their children during summer and winter. Wood cutting begins in Balıkesir in March–April and continues until November–December. Although charcoal production slows down in winter, it continues throughout the year (Aydın and Çalışkan, 2019).

In Çankırı (Fig. 1b), seasonal immigrant charcoal producers come from different regions of the country with their entire families during the charcoal production process. Wood charcoal is still widely produced using traditional methods with earth-mound kilns. Data collected from 44 kilns indicate a mean kiln efficiency of 19%, ranging from 17% to 22% (1 kg of charcoal is produced from 5 to 6 kg of wood) (Menemencioğlu, 2013). In Malatya (Fig. 1c), an average of 6–7 kilns are established in most production areas.

In Malatya province, oak species, which are the main forest trees, are used in charcoal production, which is generally carried out by workers from the surrounding provinces. These workers and their families live in tents set up at the quarries, often residing there from March and April, through the charcoal production period, until November or December. Charcoal production in Malatya province is conducted in vertical kilns. Approximately 0.25 tonnes of charcoal is obtained from 1 ton of oak wood in Malatya (Güvenli and Daşdemir, 2017).

Charcoal production stages in the Kozak Plateau in İzmir, western Türkiye, are illustrated in Fig. 2. This process has its own characteristics and must include several stages. When selecting the location for the coal production kilns, factors taken into consideration typically include the easy and economical supply of wood raw materials, wind conditions, proximity to water resources, sensitivity to forest fires, transportation conditions, and labour supply (Güvenli and Daşdemir, 2017; Menemencioğlu, 2013). The Kozak Plateau is a region known for its production and trade of non-wood forest products, the most significant being pine nut production (Özden et al., 2022). However, charcoal production has traditionally been carried out in this region. Thin and round oak woods are used as raw

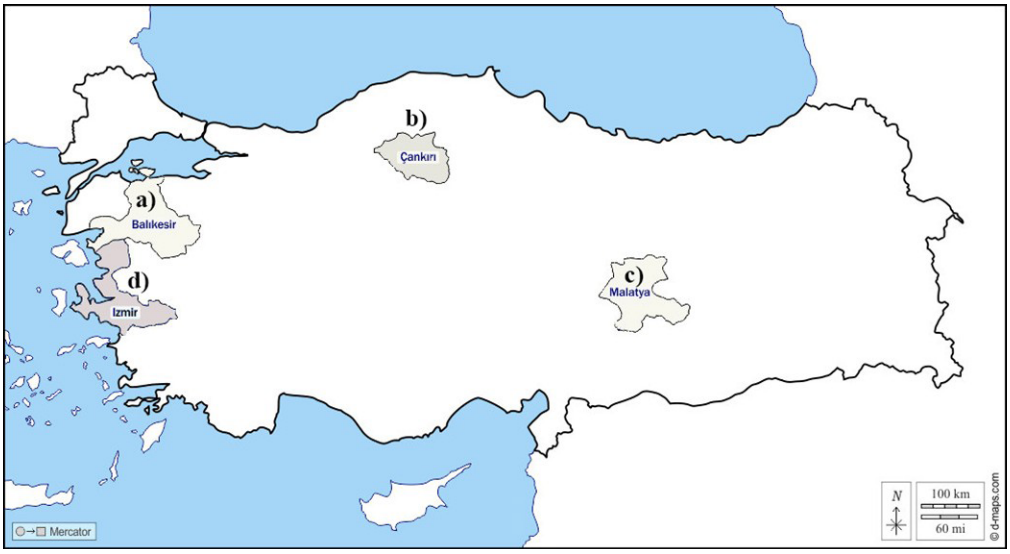

Fig. 1. Charcoal production patterns in different parts of Türkiye
Ryc. 1. Wzorce produkcji węgla drzewnego w różnych częściach Turcji

Fig. 2. Traditional charcoal production steps in Yukarıbey village in the Kozak Plateau (Bergama-İzmir): Supply of raw materials (a); Preparation of kiln site (b); Establishment of kiln (c, d, e, f, h); Stacked wood covered with tree branches and soil (g); Burning and carbonisation (i, j); Extinguishing charcoal and cooling (k, l); Packaging and storage (m, n, o)

Ryc. 2. Tradycyjne etapy produkcji węgla drzewnego w wiosce Yukarıbey na Wyżynie Kozak (Bergama-İzmir): Dostawa surowców (a); Przygotowanie miejsca pod piec (b); Budowa pieca (c, d, e, f, h); Ułożone drewno przykryte gałęziami drzew i ziemią (g); Spalanie i karbonizacja (i, j); Gaszenie węgla drzewnego i chłodzenie (k, l); Pakowanie i przechowywanie (m, n, o) material in charcoal production (Fig. 2a). After the wood required for charcoal production is supplied, the kilns need to be established (Fig. 2b). The wood to be burned must be stacked vertically in the kilns (Fig. 2c, d, e, f, h). During carbonization, the stacked wood is covered with tree branches and soil to prevent direct contact with air (Fig. 2g). Once the kilns are covered, the burning process begins. The next stages involve carbonization and cooling processes (Fig. 2h, i, j, k, l). The kilns are opened after a couple of days, and the charcoal is prepared for collection. The wood charcoal extracted from the 'torluks' is first accumulated around the 'torluk' and then packaged and stored (Fig. 2m–o).

CHARCOAL TRADE IN TÜRKIYE

Türkiye's foreign trade in charcoal, in terms of quantity and monetary values between 2010 and 2023, is presented in Table 1 (FAO, 2025). By comparing the figures for imports and exports during this period, Türkiye's average charcoal exports amounted to 6,050 tonnes, while average imports were significantly higher at 63,544 tonnes. This indicates that average imports were 10.5 times greater than average exports. The average monetary value of exports was 4,014.6 USD, whereas the average value of imports was 28,556.2 USD. Thus, average imports in monetary value were seven times higher than average exports.

Examining the data provided by the FAO for the five years between 2019 and 2023, the average export quantity rose to 13,875 tonnes, while the average import quantity was 59,778 tonnes. In terms of monetary value, the average export value during this period was 10,675 USD, compared to an average import value of 29,969 USD (see Table 1). Between 2019 and 2023, average imports were 4.3 times higher than average exports, while in monetary terms, average imports were 2.8 times greater than average exports. In the same period (2019–2023), there was a 10% increase in wood and coal production in the world (FAO, 2024).

According to FAO data, Türkiye is identified as a charcoal importing country, with a negative foreign trade balance. However, an increase in charcoal exports was observed during the 2019–2023 period.

Table 1. Charcoal exports and imports in Türkiye from 2010 to 2023
Tabela 1. Eksport i import węgla drzewnego w Turcji w latach 2010–2023

Years	Export quantity, t	Export value, 1000 USD	Import quantity, t	Import quantity, 1000 USD
2010	120	67	23,000	7,776
2011	100	92	32,000	10,642
2012	80	57	50,553	17,630
2013	777	335	73,708	32,865
2014	1,250	602	58,467	29,498
2015	900	526	82,000	36,676
2016	1,100	819	89,000	39,065
2017	6,000	2,727	94,000	39,427
2018	5,000	3,097	88,000	36,362
2019	8,000	5,183	81,000	33,178
2020	11,000	7,299	62,000	26,698
2021	19,000	12,266	33,000	20,328
2022	18,000	13,722	57,000	34,927
2023	13,376	9,413	65,892	34,715

DISCUSSION AND CONCLUSION

This article provides a perspective on the production, utilisation, and trade of charcoal in Türkiye. Charcoal has been used extensively in Anatolia for blacksmithing, locksmithing, and other crafts, as well as during the Ottoman Empire to meet the heating and cooking needs of households and the energy requirements of industry (Köprülü, 1948). In the Ottoman Empire, nearly all large-scale production facilities were large public enterprises that relied heavily on energy from fuel wood and coal (Tok, 2017). Therefore, charcoal production was of critical importance. Even after the introduction of coal technology, these organic fuels continued to be used. However, technological developments in wood-charcoal production in the Ottoman Empire were not transferred from other countries, leading to discussions about low efficiency and a delay in the transition to coal (Tok, 2017). The inefficiency not only led to rapid deforestation but also delayed the Ottoman transition to fossil fuels, potentially impacting industrial competitiveness.

Haag et al. (2020) state that, contrary to the international trend, where charcoal is mostly used as an energy source, the European charcoal market focuses on charcoal for barbecuing, which is part of social life. In some industrialised countries, charcoal is used extensively as a leisure fuel (e.g. for barbecues) (Nabukalu and Gieré, 2019). A similar trend is also observed in Türkiye. In recent years, the demand for charcoal has once again surged rapidly. This can be attributed to the use of charcoal for cooking and heating purposes, as well as the rise in nature-oriented recreational activities and the opening of new industrial applications (Göker and Akbulut, 1994). Although firewood and charcoal have lost their central position in the energy composition of the contemporary world, these organic fuels are still commonly used for various purposes in daily life, particularly in developing countries where traditional societies are highly concentrated (Tok, 2017). The use of wood charcoal production is particularly developing today due to recreational activities, and charcoal production in rural areas remains a livelihood for many.

When evaluating the species used in charcoal production in Türkiye, it is evident that there is a greater prevalence of Angiospermae species compared to Gymnospermae species, with the greatest reliance being on oak (*Quercus* sp.) species. In Türkiye, native tree species are predominantly utilised for charcoal production; however, species such as *Eucalyptus camaldulensis* and *Eucalyptus grandis* are also used, especially in regions like Tarsus, where they are cultivated. It is understood that coppice forests are generally used in the production of charcoal.

According to FAO data, Türkiye's wood charcoal exports are at a low level, and it is not a significant exporting country. Türkiye is primarily an importing country in its charcoal foreign trade. However, the difference between exports and imports has been narrowing in recent years. İmren et al. (2019) attribute this development to charcoal being a product that can be used in many areas and its cheaper and easier production compared to fossil fuels.

Considering Türkiye's forest and woody waste biomass, the potential for this is far greater than the current level of foreign trade. Utilizing these woody wastes as wood fuels (pellets, briquettes) and charcoal would reduce environmental costs and contribute significantly to the national economy (Akyüz et al., 2022). Given the growing recreational and industrial demand, future studies should examine the environmental cost of intensified charcoal use and opportunities for cleaner production technologies and lifecycle trade-offs.

This study highlights the enduring historical significance and current relevance of charcoal in Türkiye, while documenting the ongoing trade and regional production practices. By integrating forest governance with technology optimization and market incentives, Türkiye can advance toward cleaner, more sustainable charcoal production and use, while preserving historical knowledge and supporting rural economies.

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PRZEGLĄD HISTORYCZNEJ PRODUKCJI WĘGLA DRZEWNEGO W TURCJI

ABSTRAKT

W niniejszym opracowaniu przeanalizowano historyczne i współczesne znaczenie produkcji węgla drzewnego w Turcji, ze szczególnym uwzględnieniem jej wymiarów społeczno-ekonomicznych oraz zmieniającej się dynamiki handlu. Na podstawie analizy literatury omówiono produkcję i wykorzystanie węgla drzewnego, uwzględniając aspekty społeczne, kulturowe i gospodarcze. Wytwarzanie i stosowanie węgla drzewnego w Turcji, który miał różnorodne zastosowania, sięga czasów starożytnych. Jednym z nich było wytapianie żelaza dla celów przemysłowych w piecach opalanych węglem drzewnym zlokalizowanych w pobliżu lasów. Węgiel drzewny wykorzystywano również do gotowania i ogrzewania. Obecnie produkcja węgla drzewnego rozwija się w związku z rekreacyjnym zapotrzebowaniem na ten surowiec. W obszarach wiejskich stanowi ona źródło utrzymania wielu osób. Produkcja prowadzona jest w trudnych warunkach terenowych, wymaga długiej izolacji od życia społecznego, co powoduje coraz większe trudności w pozyskiwaniu wykwalifikowanych rzemieślników i robotników zajmujących się tym rzemiosłem. Do produkcji węgla drzewnego wykorzystywane są zarówno gatunki liściaste, takie jak dąb, buk, grab, kasztanowiec, jesion, wiąz, olsza, chruścina (*Arbutus unedo*) i brzoza (cechujące się wysoką gęstością drewna), jak i iglaste – świerk, jodła czy sosna. Mimo dużego potencjału produkcji krajowej Turcja pozostaje importerem węgla drzewnego w handlu zagranicznym.

Słowa kluczowe: węgiel drzewny, Imperium Osmańskie, handel, las, Anatolia