

CHARACTERISTICS OF LAND AND CLIMATE INDICATORS AS THE BASIS FOR AGRICULTURAL PRODUCTION PLANNING IN THE MUNICIPALITY OF VLASOTINCE¹

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Abstract

This study explores the characteristics of land and climate indicators as a basis for planning agricultural production in the municipality of Vlasotince. Aim of the research was to provide concise information about agricultural land, relief, pedological characteristics, and basic climate indicators in this area. Data were collected from relevant strategic documents and scientific papers that address similar topics.

In the field of agricultural land, the analysis encompassed the scope and structure of agricultural land use, agricultural land used by agricultural households, land consolidation, and agricultural land in state ownership within the territory of the municipality of Vlasotince. The relief analysis included the identification of key relief characteristics in municipality, which have a significant impact on microclimate conditions and agricultural production possibilities in mentioned area.

The results of the pedological characteristics of the land indicate the occurrence of various types of soil, such as humus-silicate soils (rankers), eutric brown soils (cambisol), alluvial or fluvial soils, and pseudogleys. The obtained results offer insight into soil fertility and its capability to support growing of various crops. Analysis of basic climate indicators in the municipality of Vlasotince includes temperature, precipitation, and the length of the vegetation period. According to research results and discussion, this study provides a comprehensive overview of the characteristics of land and climate indicators in observed municipality that are of essential importance for agricultural production planning.

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Key words: Agricultural land, relief, pedological characteristics, climate indicators.

JEL⁵: Q15, Q54, O13

Introduction

Agriculture is a key sector for the development of rural areas in the Republic of Serbia. However, climate change poses a significant challenge to this branch of the economy. In line to data from the Republic Hydrometeorological Service of Serbia (RHMS), there has been an increase in the average annual temperature in Serbia by 1.2 °C from 1961 to 2017, while the annual precipitation in this period has decreased by 6.2% (RHMSS, 2023).

At the same time, soil characteristics are of great importance for agricultural production. According to the Development Plan of the Municipality of Vlasotince 2022-2029, the most prevalent soil types in this municipality are humus-silicate soils (rankers), eutric brown soils (cambisol), alluvial or fluvio-glacial soils, and pseudogley (OGCL, 2021).

In order to achieve maximum yields, it is necessary to dispose with the soil of good quality, with sufficient organic matter and nutrients. Agricultural land is one of the most important natural resources of any country and fundamental factor in agricultural production, as provides income for the majority of rural population, ensuring food security for the nation, while its responsible management contributes to the preservation of environment (Zubović et al., 2017).

The agricultural sector in the municipality of Vlasotince plays a significant role within the local economy, providing the basic food needs for population. However, in line to increasingly pronounced climate changes and their impact on agricultural production, it is necessary to thoroughly investigate soil characteristics and climate indicators in order to properly plan and manage agricultural production.

On the other hand, the productive capacity of the land is diminished by processes of continuous reduction and degradation of agricultural surfaces (Kljajić et al., 2012). Numerous natural and anthropogenic influences that lead to threats and changes in the use of agricultural land must be therefore understood, anticipated, and, if possible, directed (Dabović, 2022). Due to its significance for ensuring food security for the nation, the agricultural sector is subject to specific legal and institutional regulation compared to other economic activities (Zubović et al., 2016).

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The aim of presented research is to provide a comprehensive overview of soil characteristics and climate indicators as a basis for agricultural production planning in the municipality of Vlasotince. Recognizing the significance of agriculture for the local community, this research aims to identify key factors that affects the success of agricultural production, providing the guidelines for adjustment to changing production conditions. Special attention will be given to agricultural land, topography, pedological characteristics, and basic climate indicators.

Agricultural land represents a fundamental resource for food production and sustainability of agricultural sector, while topography and pedological characteristics have a significant impact on soil fertility and agricultural production possibilities. Significant change in land-use was within basin of the Južna Morava river comprising the abandonment of agricultural land towards the intensive depopulation processes, certain negative economic and social trends that indirectly affects soil degradation and sediment transport (Manojlović et al., 2021). Key morphological characteristic of Serbian relief is in its progressive rising from the north and Pannonian Plain to the south and southeast of Serbia, and the Šar-Prokletije Mountains (Đurović, 2022).

Several studies have been focused on determining the yield of various corn (*Zea mays L.*) hybrids in line to used soil type and its compaction. Field experiment has been performed during the 2016-2017 within the municipality of Leskovac, at the 3 types of soil: alluvium, chernozem, and parapodzol (Biberdžić et al., 2018). The highest average yield for all soil types was obtained by growing hybrids from the FAO-500 maturity group, while the lowest yield was gained with hybrids from the FAO-400 maturity group (Biberdžić et al., 2018). In the area of Vlasotince, various soil types can be found. The dominant are humus-silicate soils (rankers), eutric brown soils (cambisols), alluvial or fluviate soils, or pseudogleys (OGCL, 2021).

Climate extremes, as are drought and heat waves could drive to large decline in yields, i.e. to jeopardize life support of agricultural producers, or even to endanger the global food security (Vogel et al., 2019). Climate indicators, such as temperature, precipitation, and length of the growing season, also play a crucial role in determining the potential for successful agricultural production. Analyzing these indicators allows understanding of climate trends, including changes in temperature and rainfalls patterns, and their impact on available agricultural conditions. In recent decades, due to increase in air temperature, prolonged growing seasons, and variable precipitation levels, grassland areas such as meadows and pastures are experiencing more frequently water deficits, what hinders their regeneration (Stričević et al., 2021).

The main goal of study is to gain a comprehensive insight into the characteristics of soil and climate indicators in mentioned municipality, trying to identify key factors

for successful agricultural production, as to provide support in planning appropriate agronomic measures in line to adaptation to changing climate conditions.

Used Materials and Methods

In this study, the Descriptive Statistics (DESK) approach is used to analyze the soil characteristics and climate indicators in the municipality of Vlasotince. The DESK approach is a statistical method used for describing and analyzing data from available literature sources.

During the study development, available strategic documents of the municipality of Vlasotince and the Republic of Serbia, as well as adequate scientific papers in this field was analyzed. So, valuable support for research task is provided by the local and national strategic documents, such as the Spatial Plan of the Vlasotince Municipality, the Development Plan of the Vlasotince Municipality for 2022-2029, the Strategic Development Plan of the Vlasotince Municipality for the period 2021-2030, the National Action Plan for Mitigating the Consequences of Drought and Soil Degradation, and the Amendments to the General Regulation Plan of Vlasotince Municipality in 2020.

These documents provide required information on dominant soil types, humus content, basic climate indicators, and other relevant parameters. As was previously mentioned, relevant scientific papers are also used, providing additional information on soil characteristics and impact of climate change on agricultural production.

The collected data allows identification of dominant soil types, fertility assessment, and later understanding of their potential for agricultural production. Furthermore, the analysis of available climate data, such as temperature and precipitation, enables understanding of climate change impact on the agricultural sector in the municipality of Vlasotince. Used methodological approach contributes to obtaine comprehensive insight into the soil characteristics and climate indicators in observed municipality through the description and analysis of available data from strategic documents and literature.

These results better understanding the state of soil, the impact of climate change on agricultural production, and identification of potential approaches for adaptation to these changes.

Research Results with Discussion

This section presents a concise summary of information and discussion of results related to agricultural land, relief, pedological characteristics, and basic climate indicators.

Agricultural land

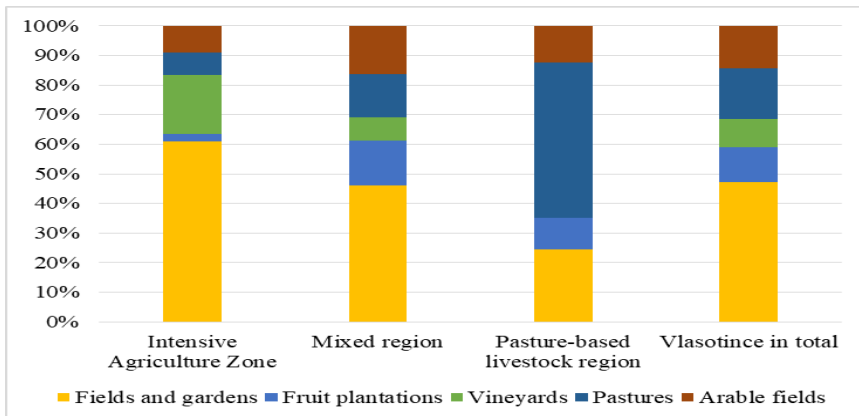
Extent and structure of agricultural land use - According to the data from the Annual Program for Protection, Development, and Use of Agricultural Land in the Municipality of Vlasotince for the agroeconomic year 2023 (AAL, 2023), agricultural land covers 15,638 ha, what represents half of the municipality's territory (50.8%).

The predominant land use types are arable land and gardens, 47.2%, followed by meadows, 17.1%, pastures, 14.3%, orchards, 11.7%, and vineyards, 9.8%.

Development and spatial planning documents⁶ have been defined the use, management, and protection of agricultural land in accordance to available natural and economic preconditions for production as like:

- intensive agricultural area, occupying 23.1% of the overall agricultural land areas in municipality, mainly consisting of arable land and vineyards located in valley and basin areas, ranging from 200-350 m.a.s.l.;
- mixed area, covering 65.9% of the total agricultural land surfaces that is mainly consists of arable land, pastures, orchards, and meadows in hilly areas (350-600 m.a.s.l.) and hilly-mountainous regions (600-800 m.a.s.l.);
- pasture livestock area, encompassing 10.9% of the total agricultural land surfaces is located in mountainous areas (above 800 m.a.s.l.), with the meadows as the dominant land use form (Chart 1.).

Chart 1. Structure of the land use in agricultural areas of the Vlasotince municipality (for 2023, in %)



Source: Authors' calculation according to AAL, 2023.

6 The Regional Spatial Plan of the South Pomoravlje Region (OGRS, 2010), Spatial Plan of the Municipality of Vlasotince (Municipality of Vlasotince, 2011), and Development Plan of the Municipality of Vlasotince 2022-2029 (OGCL, 2021).

The best-quality arable land, suitable for intensive crop and vegetable production is mostly located in the valleys of South Morava and Vlasina rivers at the area of Vlasotince up to 350 m.a.s.l., and partly on the slopes of Kruševica, ranging from 350-600 m.a.s.l.

Slight slopes of the Leskovac Basin on the right side of the South Morava, western slopes of Kruševica, and northwest branches of Ostruznica, up to and above 350 m.a.s.l., with well-drained soils and favorable sun exposures, constitute the well-known Vlasotince vineyards as a part of the Leskovac viticultural region (MAFWM, 2013). The vineyards of Vlasotince have gained a reputation towards the exceptional wines, recognized as integral part of the Leskovac viticultural region. The region's rich winemaking tradition, coupled with the unique terroir of Vlasotince, imparts distinct flavors and aroma to the produced wines.

The vineyards in Vlasotince municipality showcase a diverse range of grape varieties, carefully selected to thrive in mentioned microclimate. From robust red to crisp white, the produced wines reflect the passion and expertise of the local winemakers. Visitors can explore the vineyards, indulge in wine tasting, and immerse themselves in rich winemaking heritage of the Leskovac viticultural region.

Higher terrains of the basins and peripheral hills in the elevation zone from 350-800 m.a.s.l. are particularly suitable for establishing orchards. There is concentrated 84.6% of the total orchards area in municipality, as well as the majority of pastures (75.7%), fields and gardens (64.5%), meadows (56.2%), and vineyards (53.2%), (AAL, 2023). In the mountainous zone, above 800 m.a.s.l., in the southern part of the municipality, forests and natural grasslands dominate, which, together with orchards and pastures, provide significant opportunities for the development of pastoral farming, organic agriculture, and agroforestry.

Indigenous fruit varieties have good yield even at higher altitudes, while the production volume and economic potential of fields and grasslands, especially meadows, significantly decline above 600 m.a.s.l., requiring implementation of adequate land improvement and agroecological measures, including partial afforestation. A significant constraint for the successful implementation of mentioned activities is the pronounced depopulation processes (SORS, 2022).

The utilized agricultural land of agricultural holdings. According to data from the Farm Structure Survey in 2018, there are 3,666 agricultural holdings that had in total 6,595 ha of utilized agricultural land (UAL).

Table 1. Available agricultural land of agricultural holdings (in 2018)

Element	Available agricultural land of agricultural holdings (AALAH), (in ha)				
	Total	Utilized agricultural land (UAL)	Unused agricultural land	Forest	Other
Area	14,052	6,595	1,739	5,543	174
Share in AALAH (in %)	100.0	46.9	12.4	39.4	1.2
Number of holdings	3,680	3,666	1,717	3,478	3,645

Source: SORS, 2018.

The share of UAL within the available agricultural land of agricultural holdings (AH) is 46.9%. The uncultivated agricultural land occupies 1,739 ha (12.4% of AH), while it is owned by 1,717 holdings. This land remained unused due to certain economic, social, and other reasons, but it can be reintegrated into the cultivation process by utilizing the resources available to the holdings or by its lease (Table 1.).

In the structure of utilized agricultural land in 2018, the most prevalent were arable land and gardens (57.1%), followed by meadows and pastures (21.9%), orchards (13.6%), and vineyards (6.6%).

Compared to data obtained from the Agricultural Census in 2012 (SORS, 2012), the area under-utilized agricultural land (UAL) have been decreased for 0.4%, while the share of arable land and gardens, orchards, and vineyards have been increased at the expense of permanent grasslands (Table 2.).

Table 2. Structure of utilized agricultural land in 2012 and 2018

Element	Utilized agricultural land (UAL), (in ha)					
	Total	Household plot	Arable land and gardens	Orchards*	Vineyards	Meadows and pastures
2018	6,595	49	3,763	898	437	1,445
2012	6,623	54	3,753	718	411	1,686
2018/2012 (%)	-0.4	-9.3	+0.3	+25.1	+6.3	-14.3
Share in UAL, 2018	100.0	0.7	57.1	13.6	6.6	21.9
Share in UAL, 2012	100.0	0.8	56.7	10.8	6.2	25.5

Note: * Perennial fruit and berry plantations.

Source: SORS, 2018; SORS, 2012.

The average size of UAL per farm was 1.8 ha, while at the level of Jablanica Region it was 2.7 ha, Region of South and East Serbia, 4.4 ha, or Republic of Serbia, 6.2 ha. This indicator had a value of 1.6 ha in 2012, while the increase in last 6 years was mainly the result of decrease in number of farms (Table 3.).

Table 3. Organizational and legal forms of land ownership of UAL and average land size

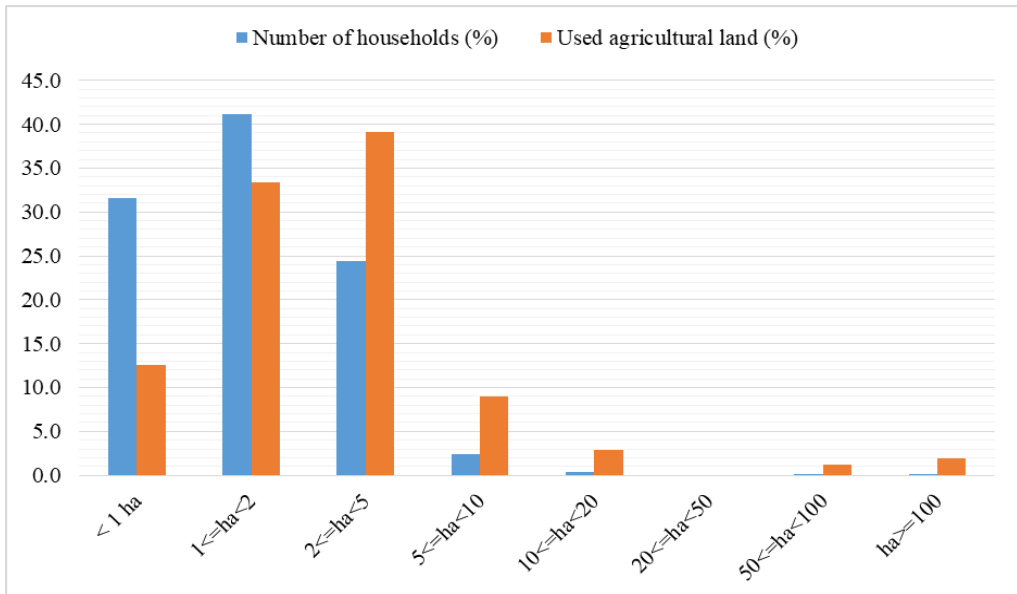
Element	2018.			2012.		
	Number of households	UAL (ha)	UAL per household (ha)	Number of households	UAL (ha)	UAL per household (ha)
Family agricultural households	3,678	6,470	1.76	4,126	6,510	1.58
Agricultural households of legal entities and entrepreneurs	1	125	125.00	4	114	28.50
Total	3,680	6,595	1.79	4,130	6,623	1.60

Source: SORS, 2018; SORS, 2012.

The ownership structure is highly unfavorable. In 2018, as much as 97.2% of farms with utilized agricultural land (UAL) had estates smaller than 5 ha, while these farms occupy 85.0% of the total UAL (Chart 2.).

Considering farms smaller than 10 ha, in mentioned structure they have reached 99.6% and 93.9%, respectively. Medium size farms are extremely scarce, with only one registered with size within the 50-100 ha, or one in category above 100 ha (Chart 2.).

The farm fragmentation is additional constraint for sustainable utilization of agricultural land. According to Agricultural Census from 2012, farms had in average 8 separate parcels of UAL, with average size of each parcel around 0.2 ha (SORS, 2012).

Chart 2. Ownership structure of agricultural holdings (in 2018)

Source: SORS, 2018.

Consolidation. Consolidation has been carried out in multiple cadasters, in total 157 ha, and according to the Spatial Plan of the municipality of Vlasotince, there are areas that need further consolidation, approximately 100 ha (Municipality of Vlasotince, 2011). Meanwhile, measures for the regulation of agricultural land, prescribed by the annual programs for protection, regulation, and utilization of agricultural land, are limited just to the regulation of field roads (AAL, 2023).

Agricultural land in state ownership. According to the data from the Annual Program for Protection, Regulation, and Utilization of Agricultural Land in the Municipality of Vlasotince for the 2023 (November 1st 2022 - October 31st 2023), the total area of agricultural land in state ownership is 668 ha. Currently there are 177 ha under lease contracts, while 198 ha are planned to be leased and later utilized. Remaining 293 ha are excluded due to the discrepancy between the legal and actual status, meaning that instead of agricultural land there are forests, naturally and artificially created infertile land, or land of special purpose (AAL, 2023).

Relief and pedological characteristics

The area of the Vlasotince municipality is clearly divided into the two parts, flatland and hilly-mountainous part, which differ in their geomorphological, climate, hydrogeological, and biogeographical characteristics. From the aspect of morphology there are two main areas: the valley-basin region, which is the most fertile part of the

municipality, and the hilly-mountainous region, which has a complex and diverse relief (Municipality of Vlasotince, 2020). The basin region is located on the eastern side of the Leskovac - Vlasotince basin, on the western slopes of Kruševica and the northwestern foothills of Oštrazub. The hilly-mountainous relief is highly developed, dissected, and covers over 80% of municipal territory. The lowest point is at the confluence of the Vlasina River and the South Morava River, with an elevation of 230 m.a.s.l., while the highest peak, Raskrsje, reaches 1,433 m.a.s.l. (Municipality of Vlasotince, 2021). Soil formation in nature is the result of pedogenetic factors: relief, parent material, climate, organic matter, and the age of the terrain. Mentioned factors affect the direction and intensity of pedogenetic processes occurring in the soil, resulting in the formation of more or less fertile soils (Hadžić et al., 2002). Soil is highly diverse and characterized by different types depending on the observed region. Within the territory of Vlasotince municipality, three main types of soil can be distinguished: meadow soils, forest soils, and mountain soils (Municipality of Vlasotince, 2021). Meadow soils are predominantly used for livestock production, while they are characterized by good structure and fertility. Forest soils are rich in humus and highly fertile, while in this areas forests of oak, beech, and pine are most commonly found. Mountain soils are very poor and infertile but play a significant role in preserving biodiversity (Municipality of Vlasotince, 2021). In observed territory, there are different types of soils, with the most prevalent being humus-silicate soils (rankers), eutric brown soils (cambisols), alluvial or fluvial soils, and pseudogleys (OGCL, 2021).

1. Humus-silicate soils (rankers) are characterized by uneven natural fertility, making them suitable for use as arable land in lower areas, while they are alternated with meadows, pastures, and forests in higher areas. However, this type of soil is sensitive to erosion, so it needs appliance of erosion protection measures such as crop rotation, use of cover crops, and protective walls. Additionally, these soils can be enriched with organic matter to improve fertility.
2. Eutric brown soils (cambisols) are potential soils that can be easily converted into high-quality soils suitable for various purposes, such as agriculture, fruit growing, viticulture, or forestry. However, these soils often require improvement of physical properties and protection against erosion, especially in the case of crop production and vineyards. Protective measures can include implementation of irrigation systems, agrotechnical measures such are crop rotation, use of cover crops, and application of fertilizers and pesticides.
3. Alluvial or fluvial soils are found in the floodplains, where dominantly maize is cultivated. They have high production value, particularly for cash crops. This type of soil is also susceptible to erosion, so there are certain implementations

for protective measures, such as stream regulation, irrigation systems implementation, deep soil cultivation, and application of fertilizers.

4. Pseudogleys can be found on alluvial terraces in the Vlasina valley and in some hilly-mountainous areas of the Vlasotince municipality. These areas have been often exposed to high precipitation, while due to low temperatures and lack of sunlight, water cannot penetrate deeply into the soil, resulting in formation of pseudogleys. They represent soils with high moisture content and low aeration, which make them less suitable for plant growth compared to other soils. However, they are important for environmental preservation, functioning as natural water filter, preventing groundwater pollution, etc. This type of soil also has potential for organic production, considering the low level of pollution. However, due to low fertility, additional investments in fertilization and soil maintenance are required in order to achieve good productivity.

The Municipality of Vlasotince has a good potential for organic agriculture (OGCL, 2021), what is based on natural production approach that avoids the use of synthetic fertilizers and pesticides. This type of agriculture has a long history in Serbia, especially in rural areas. Organic production in this region could be supported due to proximity of urban markets, which are increasingly interested in healthier and natural produced food. Additionally, the preserved nature of this region, along with a relatively low level of air, water, and soil pollution, makes it ideal for the production of healthy food without harmful chemicals. Land, as a natural resource have to be observed as non-renewable resource, as it takes thousands of years for its formation and regeneration on a geological substrate, while its degradation or loss could be sometimes extremely quick, even in several seconds or minutes (e.g. erosion and other natural or anthropogenic accidents), (MAEPRS, 2015).

Basic climate indicators

Basic climate indicators and pedological characteristics significantly affect agricultural production. Specifically, natural changes and anomalies in weather, water and soil conditions affect all production systems in agriculture (Stričević et al., 2020). For this reason, the analysis of climate and pedological conditions represents an important support in determining the scope and structure of plant and animal production. In altered climate conditions, there often comes to reduction in yield and quality of agro-products (Ilić, Milenković, 2022). Priority should be given to the development of production systems that improve water use efficiency, while they are adapted to warm and dry weather conditions (Ilić, Milenković, 2022). The changing climate is a huge challenge for agriculture within the process of shaping agricultural policies (Marković, 2020). Accordingly, it is important to determine an adequate strategy

for climate change adaptation to ensure stable development of plant production (Prodanović et al., 2023). This includes ensuring and favoring conventional practices, early sowing, timing of sowing, seed stocking, use of growth regulators, use of winter crops and more resilient varieties, which farmers have partially practiced (Prodanović et al., 2023).

The municipality of Vlasotince has a moderately continental climate, with an average annual temperature of 11°C in the plains and 6.7°C in mountainous areas. In average, annual precipitation ranges 600-700 mm, while snow typically persists from November to March, with the highest number of snowy days in January (Municipality of Vlasotince 2021). The coldest month is January, with an average minimum temperature of -5°C, while the warmest are July and August, with an average maximum temperature around 28°C (Municipality of Vlasotince, 2021). The seasons are well pronounced and influence the climate conditions and vegetation. Winter is characterized by cold weather, snow, and frost, while the spring is characterized by warmer weather and frequent rains. Summer brings high temperatures and dry weather, while autumns have shorter days and sharper temperature drops.

The seasons represent an important climate indicator in observed municipality, as they affect crops production and animal life, overall agriculture, and other aspects of human life. Moreover, these periods play a significant role in tourism, as tourists often choose destinations according to specific seasonality and characteristic weather conditions. In past few decades, climate conditions in Vlasotince and wider region have been changing under the influence of global climate change. This is manifested through the more frequent and intensified extremes in weather conditions, such are drought, floods, and storms. Therefore, monitoring the change in seasons' conditions and other climate indicators can be useful in adapting to new climate conditions. Precipitation in observed area is uneven throughout the year, with the highest rainfalls in spring and autumn. According to data from the Republic Hydrometeorological Service of Serbia (RHMSS) for the period 1981-2010, the average annual precipitation in the municipality of Vlasotince was around 750 mm. However, data from the last few years show significant deviations related to average. For example, in 2021, in Vlasotince was recorded in total 624 mm of precipitation, what is about 17% less than the average for the observed period. Similarly, in 2020 is showed a total precipitation 739 mm, what is also less than the average. This information indicates that precipitation in Vlasotince municipality has been less frequent and more intense in the last few years compared to observed period. This could be a consequence of global climate change. More detailed analysis of basic climate indicators requires their monitoring over a longer period. Therefore, in Table 4. are presented the average monthly, annual, and extreme values of temperature and precipitation for the last 30 years.

Table 4. Average monthly, annual, and extreme values of weather indicators in last 30 years

Month	Absolute maximum (°C)	Mean maximum (°C)	Mean minimum (°C)	Absolute minimum (°C)	Precipitation - average monthly sum (mm)
January	21.1	4.6	-2.1	-18.3	45.2
February	25.6	7.1	-0.6	-19.4	43.8
March	28.9	11.7	2.1	-10.0	42.8
April	32.2	16.0	6.0	-3.3	52.1
May	36.7	20.8	10.1	1.1	62.8
June	40.0	24.8	13.9	4.4	60.4
July	42.8	27.4	15.6	6.7	50.6
August	41.7	27.0	15.3	6.1	53.6
September	40.0	23.6	12.7	1.1	39.8
October	35.0	18.9	7.9	-4.4	37.3
November	27.2	12.2	2.9	-13.3	49.7
December	24.4	7.1	-0.7	-20.0	53.0

Note: The values are average values recorded over the last 30 years.

Source: RHMSS, 2023.

It is noticeable that the largest temperature fluctuations are observed during the period from December to March, while temperatures are most stable during the summer months, from June to September. The highest average monthly precipitation occurs in May, 62.8 mm, while the lowest are recorded in September, 39.8 mm. This information can be of great use to farmers in Vlasotince, in line to planning and adjusting their activities according to the prevailing climate conditions in the region. For example, information about average precipitation can help farmers to implement irrigation for crops during periods with lower rainfalls, while information about temperatures can be useful in selecting crop varieties resilient to specific climate conditions. Based on analyzed climate and pedological characteristics, agricultural production suitable for this territory includes:

1. Fruit cultivation - Vlasotince and its surrounding offer favorable conditions for growing fruits, especially apples, pears, plums, and cherries. These areas are already known for fruit production, and there are significant areas under orchards that can be further improved with the use of modern technologies and varieties.
2. Vegetable growing - Favorable climate conditions, sufficient rainfall, and fertile soil make this region suitable for growing various types of vegetables. The most common are tomatoes, peppers, potatoes, cabbage, cucumbers, and watermelons.

3. Livestock production - This region has a long tradition in livestock farming, particularly sheep breeding. Mountain pastures provide excellent grazing potential for sheep breeding, while there are also good conditions for raising pigs and cattle.
4. Viticulture - Vlasotince area has an abundance of sunny days and favorable climate conditions for growing grapevines. Region is known for wine production, with the most common varieties being Prokupac, Tamjanika, and Župljanka.
5. Beekeeping - Region has a well-established tradition in beekeeping, while the mountainous areas provide suitable conditions for beekeeping (honey production and other bee-related products).

Agricultural production is largely influenced by climate factors (Popović et al., 2023). With proper organization and the use of modern technologies, agricultural productions can ensure high yields and support the development of entire local economy. Agricultural production should be developed in line with sustainable principles, respecting environmental protection and utilizing available resources in sustainable manner. Adequate infrastructure, such as roads, water supply systems, and irrigation systems, should be also reconsidered to ensure optimal growth and development of agriculture. Generally, agriculture can be a significant factor for the development of Vlasotince municipality, utilizing its natural resources and cultural heritage. There is a need to establish cooperation among local producers, institutions, and enterprises, while supporting the development of rural tourism and markets for agro-products, in order to increase economic benefits and improve quality of life in observed area.

Conclusion

Analyzed information linked to soil pedological characteristics and climate indicators in the municipality of Vlasotince could provide valuable guidance for farmers during planning and adapting their activities towards local climate conditions. Based on derived results it could be concluded that exists favorable preconditions for establishing various lines of agricultural production in observed area. So, available areas are particularly suitable for fruit and vegetable growing, livestock farming, viticulture, and beekeeping.

These areas already have developed production capacities and possess good tradition in many branches of agriculture, while with adequate organization and appliance of contemporary technologies all of them could provide high yields, contributing to local economy. In Vlasotince municipality it will be highly important for agriculture to continue its development in accordance to sustainability principles, including

environmental protection and sustainable resource use. In addition, it is necessary to provide adequate infrastructure, such as roads, water supply, and irrigation systems, to ensure optimal growth and development of all agricultural sectors. Achieving full potential of agricultural production requires establishment of cooperation among local producers, institutions, and companies. It is also essential to support the development of rural tourism and create a market for local agricultural products, which will contribute increase in economic benefits and improving of quality of life in entire municipality.

Generally, agriculture can be a significant factor for the development of the municipality of Vlasotince, utilizing available natural resources and rich cultural heritage recognized in this region. Comprehensive approach that includes sustainable production, infrastructure and market conditions, as well as cooperation among all relevant stakeholders, is crucial for achieving successful and sustainable agriculture in observed area.

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