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Spatial patterns and transformations of traditional farmsteads: A case study of Vojvodina Province, Serbia

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Abstract

Traditional farmsteads are essential patterns of rural landscapes, reflecting long-term cultural and economic transformations. This study focuses on a traditional farmstead type – *salaš*, in Vojvodina Province, Serbia, aiming to identify and describe historical and contemporary forms, focusing on their development, distribution, concentration and transformation, since the 18th century until today. The methodology combines historical literature review and map analysis with field surveys and geospatial analyses. The broader case study covers Vojvodina, with Čenej as a reference area for spatial analysis. Results show a peak in farmstead number and density during the interwar period, followed by a decline due to socio-economic changes and urbanisation. Spatial analysis revealed that proximity to urban centres and roads supports activity, while fragmentation near motorways contributed to abandonment. The study proposes a typology of four historical and five contemporary farmstead types based on structure, land use, function, and vegetation traces, reflecting distinct phases of transformation. These findings provide a framework for interpreting landscape changes and underline the importance of recognising traditional farmsteads as part of rural heritage and cultural identity.

Keywords: Farmstead, cultural landscape, rural heritage, landscape transformation, typology

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1. Introduction

From a heritage perspective, landscapes are defined besides geographic and environmental characteristics and features also by their historical, cultural, aesthetic and symbolic values (Kupidura, 2017). The cultural significance and heritage of landscapes comprises resources from the past that reflect evolving values, beliefs, knowledge, and traditions, shaped by the interaction between people and places over time (Council of Europe, 2005) and reflected both in tangible and intangible ways (Branduini et al., 2016).

Rural landscapes in this context can be considered a specific and important part of cultural heritage (Wieruszewska, 2016) that has been formed by everyday life, farming practices, local economies, religious beliefs as well as other aspects (Salašová & Fialová, 2023). As heritage, rural landscapes encompass tangible features like productive land, settlements, vegetation, rural buildings and infrastructure, alongside intangible cultural knowledge, traditions, practices and expressions of community identities and belonging. Rural landscapes as heritage embody technical, scientific, and practical knowledge related to the interactions between humans and nature (ICOMOS, 2017). If they have historical origins, rural landscapes can be defined as traditional landscapes, shaped by historical processes of adaptation to their

environment, preserving distinctive traits, land uses, structures, and practices (Santoro, 2024). In some cases, entire traditional landscape structures and systems have been preserved (Hreško & Petluš, 2015), while in many other situations there are only fractions and remnants of traditional landscape structures in rural agricultural landscapes that clearly show or indicate traces of the past in the form of isolated patches and patterns which have been shaped by environmental conditions, socio-economic factors, and farming practices (Antrop, 1997; Kupidura, 2017). On a large scale, they may reflect the historic ownership structure, e.g. expansive farmland (Kupidura, 2017). On a smaller scale, patterns emerge through the arrangement and relationships between architectural elements – both buildings, like farm houses, barns and granaries, and smaller objects, like wells or fences – and natural elements like solitary trees, alleys, orchards, vineyards, hedgerows, or waterways.

As significant patterns of rural agricultural landscapes, farmsteads offer insights that extend beyond just agricultural activities on individual farms; they serve as indicators of broader cultural and economic changes across geographic regions. Farmsteads are clusters of buildings and associated farmland used for agricultural purposes that combine food production with residential structures, typically including a farmhouse (the main residential building)

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and buildings of specific functions (barns, stables and granaries) (Raie & Kamrani, 2021). Traditional farmlands usually integrate woody vegetation elements and structures (Supuka et al., 2020) and/or woody vegetation accompanies rural roads leading to farms (Kuczman et al., 2024).

Farmsteads vary in historical context, scale, level of self-sufficiency, economic importance, and societal role. Found in various geographical regions – from the Hungarian *tanya*, Serbian *salaš*, Russian *hutor*, to the Polish *zagroda*. The typology of these is very diverse and variable, for instance in Slovak and Czech Republic, there is a wide range of different terms that refer to dispersed agricultural settlements and indicate their geographical, spatial, morphological and functional differences and nuances, e.g. *laz*, *kopanica*, *štál*, *majer*, *dvor* and other. The typological richness varies across countries and regions, which is very well reflected mainly by those well spread throughout continents, such as the Hispanic *haciendas* and Anglo Saxon *farms* and *farmsteads*. Each type of farmsteads reflects the unique agricultural practices, cultural history, and geographical conditions of a region and forms its landscape character (Lake & Edwards, 2006).

This study can be geographically contextualised within the broader historical region of former Austro-Hungarian Monarchy, while highlighting the focusing on a less researched landscape pattern of a Serbian *salaš*, a traditional farmstead – household which has historically shaped the character of the rural landscape of Vojvodina (northern Serbia), as well as parts of Slavonija (Croatia) and Hungary.

Although derived from the Hungarian word *szállás*, meaning lodging or dwelling, the term *salaš* appears in several Slavic countries with varying meanings. In Ukraine, it refers to a new settlement; in Poland, Slovakia and the Czech Republic, it is associated with seasonal pastoral settlements linked to transhumance (Janto, 2016); while in Serbia, it denotes a permanent or semi-permanent farmstead with residential and agricultural functions such as crop and livestock farming (Košić et al., 2014).

In Serbia, a *salaš* refers to a traditional type of individual farmstead located outside the village, typically surrounded by agricultural fields. Originally established as seasonal shelters for farmers and livestock herders, these farmsteads later developed into permanent agricultural homesteads where people lived and worked. They consist of a residential house and various outbuildings used for storing crops, housing livestock, and keeping agricultural tools and machinery (Čupurdija, 1993; Gajinov, 1994; Klajn & Šipka, 2007; Nedeljković Angelovska, 2014). Residents live on the *salaš* permanently or seasonally, and their livelihoods are generally based on their own agricultural production (Nedeljković Angelovska, 2014). Today, the term *salaš* also carries an additional meaning, often referring to modern farms or rural hospitality facilities that are part of, or associated with, former historical or traditional farmsteads that still preserve elements of local cultural heritage.

Vojvodina Province is an agricultural region in Serbia where the *salaš* has historically been a defining element of the rural landscape. Dating back to the 18th century, a Serbian *salaš* is a self-sufficient family-operated rural estate characterised by the synergy of three elements – labour, housing, and land, encompassing residential and economic buildings, arable land, livestock, cultivation tools, and farm storage facilities (Košić et al., 2014). Representing harmonious, functional units, economically, architecturally and aesthetically suited to the conditions in which they were created (Katić, 1986), these farmsteads contribute to the rich cultural landscape of Vojvodina with their unique architectural and agricultural features (Vidović & Beriša, 2018). Within the Vojvodina region, Čenej, a rural settlement and cadastral unit within the

administrative area of Novi Sad, is notable for having a large number of remaining authentic *salaš* farmsteads. However, due to transformations over time, most traditional Serbian farmsteads have been abandoned or vanished, leaving only traces in the landscape and facing the risk of being forgotten (Čović, 2002). A smaller number of them has been reconstructed and is actively used for private or public purposes (Košić et al., 2014) – mainly rural tourism (Vidović & Beriša, 2018; Đerčan et al., 2023), while others, still awaiting revitalisation, remain endangered and neglected, at risk of being forgotten and lost to time. While past structures cannot be fully restored, in the era of constant change it is crucial to identify patterns like traditional farmsteads that serve as traces of the past, preserve and integrate them functionally into modern society (Antrop, 2005).

The study aims to identify and describe historical and contemporary types of *salaš* farmsteads in Vojvodina, Serbia, focusing on their development, distribution, concentration and transformation of landscape pattern in the countryside.

To achieve this aim goals were determined:

- Analyses of the origins and historical development of *salaš* farmsteads in Vojvodina from the 18th to the 21st century.
- Tracing the transformation patterns of farmsteads in Vojvodina in terms of changes in areal structure, function and spatial distribution.
- Identification and categorisation of the past and current forms of *salaš* farmsteads in Vojvodina and Čenej as representative samples, based on their functional and structural characteristics.
- Determination of the spatial distribution, number and concentration of *salaš* farmsteads, as well as spatial factors that influence their abandonment in the study area of Čenej.

2. Theoretical background

Rural landscapes are continuously being transformed (Jaszczak et al., 2018; Lugo-Espinosa et al., 2024). Different periods in history have created distinct visible patterns that reflect the historical development of a region (Palang et al., 2006). From vineyards (Štefunková & Hanušin, 2019) and woody vegetation (Supuka et al., 2020; Kuczman et al., 2024), man-made ponds (Frajer et al., 2021) and waterbodies (Frajer & Fiedor, 2018), to settlements (Stober et al., 2018; Górká, 2024), haylofts (Baránková et al., 2024), farms and farmsteads (Kovács & Farkas, 2011; Cillis et al., 2019), many authors have focused on different spatial patterns that are part of the agricultural landscape. In this study, we will explore the spatial patterns of traditional farmsteads and their transformations across space and time, with a particular focus on the Serbian *salaš*.

Research on the historical development of farmsteads and similar structures has been conducted by authors at both regional (e.g. Vojvodina, Baranja, Kiskunság region) and international (e.g. Europe, North America, Latin America, Iran) levels, providing a broad context for understanding their evolution since changes, particularly in farmland landscapes, reflect socioeconomic development occurring in rural areas (Liang et al., 2020). Farmsteads throughout Europe followed a similar path of development and change, influenced not only by nature but also by the socioeconomic and political conditions of their regions (Fig. 1).

The first farmsteads were built during feudal periods when rural economies relied heavily on agriculture and livestock production. In the Habsburg Monarchy, later Austria-Hungary, where *salaš* farmsteads occurred, feudalism was the dominant socio-economic system until the second half of the 19th century (Makkai, 1980). In the southern regions of the Monarchy, such as Vojvodina, the development of feudalism was slowed by Ottoman conquests and

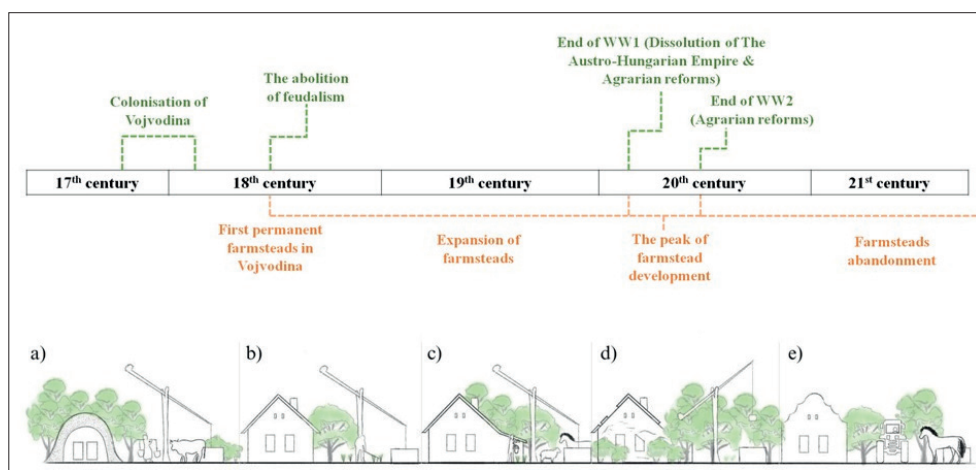


Fig. 1: Socio-economic factors and historical development of farmsteads in Vojvodina: a) Mid-18th century; b) Late 18th and 19th century; c) Late 19th and early 20th century; d) After WW2; e) 21st century

Source: Authors' interpretation

prolonged wars, leaving the area sparsely populated and mostly uncultivated by the late 17th century. Following the withdrawal of the Ottoman Empire, colonisation efforts in the late 17th and early 18th centuries transformed these floodplain-dominated regions, initially characterised by small villages, into areas suitable for establishing new feudal structures (Ćurčić, 1994). By the mid 18th century, the settlement of Vojvodina began, and since it was also a predominantly pasture area (Parabučki & Janković, 1978), the first *salaš* settlements were built, as temporary shelters for farmers grazing livestock with simple accommodations like tents, huts (Ćurčić, 1994), or dugouts (serb. zemunice) as a precaution against Turkish invasions (Lazić, 1984) (Fig. 1a).

In the mid-18th century, the abolition of feudal social relations in Vojvodina (Subić, 1994), and increased demand for grain in Europe, led to the conversion of pastures into arable land (Sabadoš et al., 2019) and establishment of permanent settlements (Subić, 1994). Farmsteads transitioned from extensive livestock breeding to intensive farming, combining crop cultivation (Fig. 1b) with stall-based livestock farming (Fig. 1c), eliminating the need for seasonal migration. After the dissolution of Austria-Hungary, the agrarian reform following World War I redistributed large estates owned by Austro-Hungarian nobles and landowners, granting land to poor peasants and colonists (Kiss, 1942). This reform facilitated the widespread establishment of farmsteads in Vojvodina during the late 19th and early 20th centuries, enabling rural households to adopt the *salaš* way of life and production (Litavsky, 1994; Stojanov, 1994).

After World War II, demographic and economic changes led to the widespread abandonment and destruction of farmsteads across Europe, particularly in Eastern Europe and Vojvodina (Stojanov, 1994; Pándi, 2014) (Fig. 1d). Factors such as the shift of the German population by colonists and the redistribution of land played a significant role (Gajinov, 1994). The Agrarian reform limited land ownership was restricted to 10 hectares of arable land, and large estates were confiscated and nationalised. The Communist land consolidation policies in Eastern European countries led to the collectivisation of farmland, often allocating land to cooperatives and collective farms (Tóth et al., 2016; Navrátil et al., 2019). While these initiatives aimed to increase agricultural efficiency, they frequently disrupted traditional agricultural practices, reduced the autonomy of individual farmsteads, and sparked resistance among farmers. Additionally, the transition from planned to free-market economies further accelerated the decline of farmsteads, as traditional farms became less competitive (Stober et al., 2018). Advances in agricultural machinery and techniques further reduced the need for dispersed farmsteads,

while industrialisation, urbanisation and rural depopulation further contributed to their transformation and disappearance (Stober et al., 2018; Sabadoš et al., 2019). Today many traditional farmsteads are abandoned or endangered, replaced by modern farming enterprises, or lost to urban sprawl. A smaller number has been adapted for commercial use, often retaining visible traces of their historical character (Fig. 1e).

In addition to historical factors, contemporary changes in infrastructure and land use play a decisive role in shaping the current state of traditional farmsteads. In the case of Čenej (Fig. 2), a *salaš*-based settlement located approximately 10 km north of Novi Sad, rapid urban expansion, the construction of the A1 motorway, and the development of road networks have fragmented the once-continuous agricultural landscape. These contemporary infrastructural developments have led to the abandonment of numerous farmsteads due to land expropriation, reduced accessibility, and declining agricultural viability. At the same time, suburbanisation and the growing trend of rural tourism have contributed to the functional transformation of active farmsteads, altering their spatial structure and diminishing their authenticity. According to the General Urban Plan of Novi Sad for the period up to 2030 (Skupština Grada Novog Sada, 2022), further urban and infrastructural development is foreseen for this area, posing an additional threat to the preservation of farmsteads as cultural and landscape heritage. These trends reflect broader pressures visible across Eastern Europe, where traditional rural landscapes are increasingly reshaped by urbanisation and infrastructure projects, and where farmsteads are either repurposed or abandoned altogether (Navarro & Pereira, 2012; Prokopová et al., 2018), leading thereby to a loss of identity and heritage.

Beyond their historical development, farmsteads have been studied for their ecological, cultural, architectural, and socio-economic significance, including their roles as biodiversity centres (Yahner, 1983; Hiron et al., 2013; Pándi et al., 2014; Rosin et al., 2016; Šálek et al., 2018), tourism resources (Čomić, 2002; Santucci, 2013; Košić et al., 2014; Vidović & Beriša, 2018; Đerčan et al., 2023), and heritage sites (Stober et al., 2018; Raie et al., 2024). Previous research has examined factors influencing their sustainability (Cillis et al., 2019; Kovács & Farkas, 2011), abandonment (Pándi et al., 2014; Jaszczak et al., 2018; Navrátil et al., 2020), transformation (Górka, 2024), architectural value (Milošev & Vujanić, 1994; Raie & Kamrani, 2021), preservation and reuse (Ziemelniece, 2016), as well as their integration into rural heritage management strategies across various countries (Lake & Edwards, 2006). However, research gaps remain,

particularly in Eastern Europe, where studies on cultural heritage values of agricultural landscapes are scarce (Mitchell & Barrett, 2019). Specifically, *salaš* farmsteads of the Pannonian Plain in Vojvodina, Serbia, are underexplored in terms of heritage value, distribution, typology, historical development, current state, and transformation, with most research focusing only on their role in rural tourism (Košić et al., 2014; Vidović & Beriša, 2018; Đerčan et al., 2023), neglecting their broader geographical and historical significance.

This research addresses these gaps by providing a comprehensive analysis of traditional *salaš* farmsteads, focusing on their historical development from the 18th to the 21st century, spatial distribution, concentration, typological diversity, and patterns of transformation. By doing so, it contributes to a deeper understanding of farmsteads' roles in rural landscapes and expands the knowledge base in this field.

3. Data and methods

3.1 Study area

The northern part of Serbia, Vojvodina Province is known for its rural character, being the centre of agriculture for centuries. Mosaic-like landscape, featuring plains, meadows, cultivated fields, and scattered *salaš* settlements (Sabadoš et al., 2019) are part of Vojvodina's identity. Bačka, a subregion in Vojvodina, historically had the biggest number of *salaš* settlements. In southern Bačka, some of the oldest and most preserved farmsteads are located in Čenej, a traditional *salaš* settlement within Novi Sad municipality (Fig. 2). Čenej's history dates back to the 13th century, with the emergence of farmsteads beginning in the early 17th century (Zavod za zaštitu spomenika kulture Grada Novog Sada, 2002).

The study is structured around two interconnected spatial levels. The broader study area is the region of Vojvodina, where the historical development, transformations patterns and typology of *salaš* farmsteads were examined from the 18th to the 21st century. Within this context, the case study of Čenej – located in southern Vojvodina and representing a characteristic *salaš*-based settlement – was selected as a detailed local example for analysing the spatial distribution, number, and concentration of farmsteads over the period of four centuries. Additionally, Čenej, served as the basis for developing a typology of 21st-century farmsteads, supported by field observations and photographic documentation. For the spatial analysis of proximity to urban

centres, nearby settlements such as Novi Sad, Rumenka, Stepanovićevo, Kisač, Sirig and Budisava, were also included, as they are functionally and geographically connected to Čenej and influence its transformation dynamics.

Čenej is recognised for its rich cultural and natural heritage. Its cultural significance lies in its protected farmsteads listed as immovable cultural assets, valued for their traditional and vernacular architecture (Zavod za zaštitu spomenika kulture Grada Novog Sada, 2002). Čenej was selected as a representative case study for its diverse farmsteads in various stages of transformation (Fig. 3), some of which have preserved their original form since the earliest settlements (Lazić, 1984; Zavod za zaštitu spomenika kulture Grada Novog Sada, 2002), providing valuable insights into the landscape patterns and processes shaping the rural character of Vojvodina.

Its natural heritage includes the 'Mulberry Tree on the Čenej Farmstead', a third-category natural monument (Gradske info, 2022). This protected natural asset, an ancient tree between 180 and 200 years old and the oldest mulberry tree in Serbia, is located on an abandoned farmstead. In addition, Čenej hosts four habitats of protected and strictly protected species of national importance. The Rumenka Canal, a local ecological corridor, connects the regional ecological corridor of the DTD canal with the protected Jegrička Nature Park (General Regulation Plan of Čenej, 2014).

As a historically significant area, Čenej is rich also in archaeological heritage documenting 27 sites with archaeological content and two monumental structures known as the 'Small' and 'Large Roman Trenches'. Covering an area of 85.87 square kilometres (General Regulation Plan of Čenej, 2014), Čenej had a population of 1,942 residents according to the 2022 census (Statistical Office of the Republic of Serbia, 2022). Today, while Čenej retains the physiognomy of a *salaš* settlement, modernisation and depopulation have significantly reshaped its landscape (see Appendix 1). Abandoned farmsteads, particularly remote ones, and the development of new residential buildings along main roads have altered its traditional character. Despite these changes Čenej remains a testament to Vojvodina's rich agricultural heritage and historical legacy.

3.2 Research methodology

The methodological approach applied in this study is summarised in Table 1 and is structured into three sections (A–C): literature review and map interpretation, identification

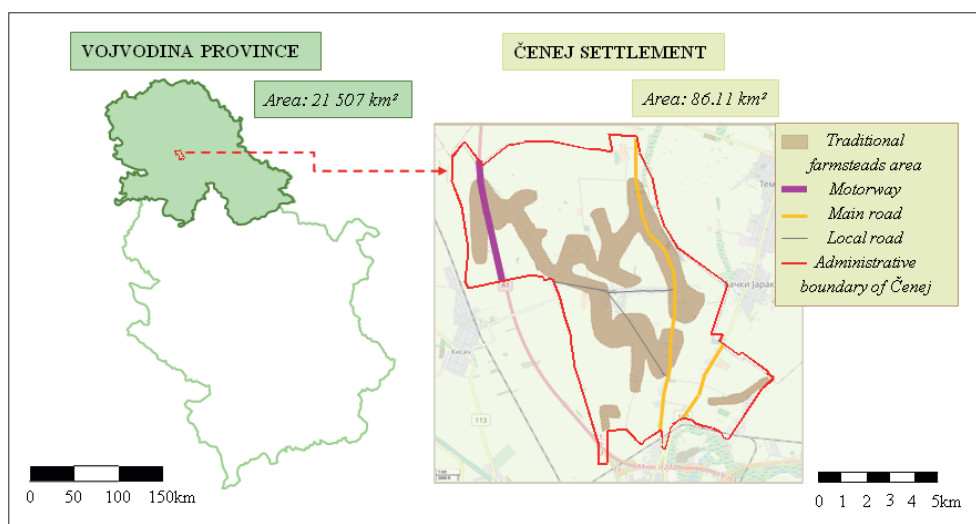


Fig. 2: Location of the study area of Vojvodina and case study of Čenej
Source: Authors' elaboration based on OpenStreetMap database, 2025



Fig. 3: Various transformation phases of traditional farmsteads in Čenej: a) Functioning traditional farmstead with preserved residential and agricultural buildings, b) Partially preserved farmstead with renovated structures, c) Transformed farmstead with modernised residential units, d) Isolated abandoned farmstead surrounded by cultivated land, e) Abandoned farmstead overgrown with vegetation, f) Former farmstead site marked only by surrounding vegetation. Source: Authors' photographs

Research methodology on farmsteads (<i>salaš</i>)				
Methodology	Explanation	Time scope	Study area	Materials and tools
A) Literature review and map interpretation				
A.1 Definition of the historical development	Systematic review	18 th –21 st century	Vojvodina	Historical literature
A.2 Map Interpretation	Interpreting map symbols and land use indicators in historical maps	18 th –20 th century	Vojvodina	Historical maps, supported by archival literature, Sketchbook
B) Identification of farmsteads				
B.1 Identification of farmsteads	Recognising farmsteads based on map symbols and the structural and spatial features described in step A.2.	18 th –20 th century	Čenej	Historical maps
B.2 Digitisation and vectorisation	Converting identified symbols into point features	18 th –20 th century	Čenej	Historical maps, AutoCAD
B.3 Field documentation	Mapping and documenting current farmsteads	June 2024	Čenej	Samsung Galaxy Tab A9+ tablet with Locus GIS software, OpenStreetMap dataset, Google Earth
B.4 Analysis of transformation patterns	Processing spatio-temporal data on farmsteads distribution	18 th –21 st century	Čenej	Historical research data, field data, OpenStreetMap dataset, AutoCAD, Sketchbook, QGIS, Google Earth
C) Classification of farmsteads				
C.1 Development of a farmstead typology	Classifying historical and current forms of farmsteads based on their functional and spatial characteristics	18 th –21 st century	Vojvodina (historical), Čenej (current)	Historical maps, Bing Aerial imagery, field data, photographic documentation

Tab. 1. Overview of the methodological steps, research areas, and data sources applied in this study

Note: Historical maps – Arcanum (2024); Software tools – Sketchbook (v6.1.1, Autodesk, Inc., 2024), AutoCAD (v2021, Autodesk Inc.), Locus GIS (v1.25.1, Asamm Software, s.r.o., 2024), QGIS (v3.28.2; QGIS Development Team, 2025); Aerial imagery – Bing Aerial imagery (Microsoft Corporation, 2024); Satellite imagery – Google Earth (Google LLC, 2024); Current maps – OpenStreetMap (OpenStreetMap contributors, 2024)

Sources: Authors' elaboration

and classification of farmsteads. Each section outlines the key research steps, temporal and spatial scales, and the data sources and tools used.

A) Literature review and map interpretation

• A.1 Definition of the historical development

This step provides a systematic historical overview serving as the foundation for subsequent analyses. The historical development of *salaš* farmsteads, examined mainly through literature, establishes the temporal, socio-political, and functional context essential for understanding transformation patterns and typology. It involves tracing when and why farmsteads emerged, how they evolved through different historical phases, and which events and processes influenced their development or abandonment. This is addressed in detail in the theoretical background section.

• A.2 Map Interpretation

This step includes interpreting map symbols and land-use indicators on historical maps derived from Arcanum (2024), supported by archival and ethnographic sources provided by the Museum and Archives of Vojvodina (Ćurčić, 1994; Gajinov, 1994; Litavsky, 1994; Milošev & Vujanić, 1994; Stojanov, 1994; Lazić, 2006; Ćurčić et al., 2012). Historical maps used for interpretation included the First Military Mapping of the Habsburg Monarchy – 18th century (1763–1787), the Second Military Mapping of the Habsburg Monarchy – 19th century (1819–1869), and the Military Survey of Hungary (1941) for the 20th century. Cartographic symbols and the level of detailing on the maps evolved across the 18th, 19th, and 20th centuries, yet reflecting not only advances in cartography, but also changes in landscape structure and *salaš* design as supported by literature review (Palang et al., 2006;

Kovács & Farkas, 2011; Cillis et al., 2019; Górká, 2024). Several authors used historical map interpretation for the historical analysis of landscape structure (Kilianová et al., 2017; Tóth et al., 2016; Frajer & Fiedor, 2018; Frajer et al., 2021; Baránková et al., 2024; Mulková & Popelková, 2024), but only a smaller number of authors implemented this approach for farmstead analysis (Čuljak, 2012; Górká, 2024).

The interpretation of land-use indicators on historical maps encompassed the broader landscape settings of *salaš* farmsteads, including observing agricultural areas, forests, water bodies, pastures, vineyards and orchards, along with transportation networks and nearby urban centres depending on the level of detail present in each map. Special attention was given to *salaš* symbols and their spatial and structural characteristics as depicted on different maps. These historical maps were essential for understanding the original layout *salaš* farmsteads and their transformations over time.

The symbols and land use indicators on the maps were interpreted and visually presented using sketches and graphic diagrams. Variations in symbol interpretation were visualised and their evolution graphically represented through sketches in Autodesk SketchBook (v6.1.1; Autodesk, Inc., 2024), with a focus on changes in architecture and land use. Graphic diagrams and historical photographs were also used to provide a clear and efficient visual representation of the farmsteads' historical development. This approach offers both precision and efficiency, making it valuable in disciplines such as landscape architecture (Timpe, 2017; Cala-Riquelme, 2021).

B) Identification of farmsteads

B.1 Identification of farmsteads

Farmsteads on historical maps were identified through symbols, text references, or both, which varied across periods (Fig. 4). Text references often accompanied the *salaš* symbol, with names determined geographically in the 18th and 19th centuries (e.g. 'Szallasen von Neusatz' and 'Neusatz szalase') and later by owners' surnames (e.g. 'Radovanovics-szl') in the 20th century. The symbols and land use indicators on the maps were interpreted and visually presented using sketches in the previous step, providing a basis for their easier identification in this step.

B.2 Digitisation and vectorisation

After identifying farmstead symbols and relevant textual references on all three historical maps, the maps were imported into AutoCAD (v2021, Autodesk Inc.), and georeferenced. The identified symbols were then converted into point features and used for further spatial analysis. This methodological approach was based on the digital spatial research framework developed by Tóth et al. (2016), which involves digitisation, vectorisation, and georeferencing as key steps in preparing the historical data for spatial analysis.

B.3 Field documentation

For the 21st century, a combination of satellite imagery (for a macro, bird's-eye view) and field research (for a micro, eye-level perspective) provided detailed insights into various aspects of farmstead transformation, including architectural condition,

vegetation cover, land use, and spatial isolation. Fieldwork conducted in the Čenej area enabled the mapping of farmsteads as point features and the distinction between active and abandoned categories. Coordinates of both active and abandoned farmsteads were collected using a Samsung Galaxy Tab A9+ tablet and Locus GIS application (v.25.1; Asamm Software, s.r.o., 2024), with farmsteads marked as point features within the software. The ground maps in Locus GIS were Google Earth (Google LLC, 2024) and OpenStreetMap (OpenStreetMap contributors, 2024). Special focus was put on mapping different types of abandoned farmsteads which were explained in section 4.3.2, while for active farmsteads a more generalised mapping was conducted. This generalisation occurred because a detailed mapping based on specific subtypes would have required direct visits and interviews with the owners. Due to time and logistical constraints, the mapping of active farmsteads was limited to identifying them as 'active', without further subdivision in the mapping process. However, in the classification section, active farmsteads were divided into several categories based on different criteria, as further explained in section 3.1. Development of farmstead typology. Photographic documentation was also collected during field visits using a digital camera, capturing the current physical condition and surroundings of each observed farmstead.

B.4 Analysis of transformation patterns

After marking each farmstead from the historical maps as point features, all recorded farmsteads in Čenej were counted for the 18th, 19th and 20th centuries. For the 21st century, field data were also imported into AutoCAD (v2021, Autodesk Inc.) and included in the count. The temporal distribution of farmsteads was initially presented in Microsoft Excel (v2016; Microsoft Corporation). The collected data were used to produce distribution maps for each century.

To evaluate their spatial concentration and identify distribution patterns from the 18th to 21st centuries, a 1 × 1 km grid was overlaid onto the map in AutoCAD (v2021, Autodesk Inc.). Only grid cells covering more than 50% of their area within the study boundary were included in the analysis, to ensure consistency and accuracy in spatial comparison. Based on the number of farmsteads per grid cell, a four-tier scale was established: high concentration (more than 5 farmsteads), medium (3–4), low (1–2), and none (0). This method allowed for a quantitative assessment of farmstead clustering across Čenej.

Furthermore, the spatial distribution of current farmsteads in Čenej was analysed in relation to their proximity to infrastructure such as roads and urban centres. Google Earth (Google LLC, 2024) was used as the base map. According to OpenStreetMap data (OpenStreetMap contributors, 2024), three distinct road types are identifiable in Čenej (Fig. 2): a motorway, a main road (regional, primary), and a local road (secondary). Motorways are paid, high-speed, high-capacity roads designed for long-distance travel. Main roads are significant, regional roads that connect smaller areas to larger routes and allow more frequent access and interaction with other routes. Local roads are smaller, lower-capacity roads that primarily provide direct access to homes, farms, and other local destinations. They support short-distance travel within towns, villages, or rural areas, and typically have lower speed



Fig. 4: Different farmstead symbols on: a) 18th century map b) 18th century map, c) 19th century map and d) 20th century map
Source: Arcanum (2024)

limits. A fourth type, field roads, also exists but is not mapped in Figure 2. Field roads are unpaved agricultural tracks providing access to parcels and farmsteads, usually less accessible and usable only in dry seasons. To evaluate whether proximity to infrastructure influenced farmstead abandonment, a spatial analysis was conducted using the Buffer tool in QGIS (v3.28.2; QGIS Development Team, 2025). Special focus was placed on the distances of *salaš* farmsteads from the motorway and main roads, as these routes now represent the primary infrastructure corridors in the region. Abandoned and active farmsteads located within 1–4 km of urban centres, motorways, and main roads were analysed across four distance zones: 1 km, 1–2 km, 2–3 km, and 3–4 km.

Additional datasets, including OpenStreetMap (OpenStreetMap contributors, 2024), were used to identify land-use patterns in zones with the highest concentrations of both active and abandoned farmsteads, and to compare them with the field data. The land-use categories applied in this analysis were derived from OpenStreetMap's land-use classification, which includes tags such as *landuse = farmyard*, *landuse = farmland*, *landuse = forest*, *landuse = residential*. According to the Law on Agricultural Land of the Republic of Serbia (2006/2022) and the Law on Agriculture and Rural Development (2009/2021), agricultural land includes arable fields, gardens, orchards, vineyards, meadows, pastures, fishponds, reed beds, wetlands and other land that can be rationally used for agricultural production. Agriculture is also carried out within agricultural holdings (serb. *poljoprivredno gazdinstvo*) – a category under which *salaši* can also be understood. These correspond the OpenStreetMap land-use categories *farmland* and *farmyard* thus placing them within the agriculture category.

C) Classification of farmsteads

• C.1 Development of a farmstead typology

The previous steps provided a foundation for the development of a typology of *salaš* farmsteads, incorporating both historical and contemporary forms. Based on historical map interpretation and farmstead symbol identification, in the historical context (18th, 19th, and 20th centuries), the classification of farmsteads resulted from a qualitative comparative analysis of the cartographic symbols which were identified in B.1 to explore the spatial relationships between structure types, land use, and vegetation across different historical periods. This process involved clustering consistent features into distinct typological categories according to their morphological and functional characteristics. The typology was developed using the following criteria: Structure type (temporary/permanent buildings), land use context (pasture/arable land), vegetation presence (dense woody vegetation/absence of vegetation), functional zoning (residential buildings only/combined residential and economic buildings), tree arrangements (tree alleys, clustered groups, or solitary trees), cultivated perennial crops (presence of orchards and/or vineyards).

In the contemporary landscape (21st century), the typology was further refined through in-situ field observation in Čenej, photographic documentation and supporting literature. The classification, based on the works of Nedeljković Angelovska (2014), Baránková et al. (2024) and Górka (2024), focused on present-day use, function, spatial context, connectivity, and preservation state. The classification process began with the identification of current farmstead activity and use, distinguishing between active and abandoned farmsteads. For the function criteria farmsteads were divided based on the adapted Nedeljković Angelovska's (2014) framework of present-day function of farmsteads. The spatial context refers to the spatial arrangement of farmsteads within the landscape, i.e. how they are located in relation to each other. The connectivity refers to accessibility of farmsteads through the transport network and infrastructure.

While active farmsteads were mapped simply as 'active', their further classification into subcategories based on usage and function was defined after the fieldwork. Mapping each subcategory would have required visiting individual farmsteads and direct engagement with their owners, which was beyond the scope of this study. Preservation state refers mostly to abandoned farmsteads which could be identified not only through fieldwork but also using aerial and satellite imagery. Therefore, they were categorised following the approaches of Górka (2024) and Baránková et al. (2024), according to the stages of abandonment: vegetation traces only, ruins overtaken by vegetation, and structural remains without vegetation.

This typological framework captures the diversity of forms and degrees of transformation observed across historical periods and the present day, and serves as a basis for understanding both the evolution and transformation of rural landscape structures.

4. Results

4.1 Map interpretation

In the 18th century, tent-like or dugout symbols suggested the nomadic and temporary nature of early settlements, typically located on pastures with or without woody vegetation. These structures, accompanied by crane wells (*deram*), highlight the reliance on water sources for pastoral and arable farming. Red rectangles on arable land depicted permanent farmsteads built with durable materials, often connected to roads, indicating a shift toward permanent settlement and economic development. By the 19th century, farmsteads exhibited more complex layouts, with rectangular courtyards incorporating residential (red rectangles) and economic buildings (black rectangles). Orchards, vineyards and different tree arrangements reflected integrated natural elements into farmstead layouts and showcased varied agricultural and horticultural activities within the estate. In the 20th century, all buildings, including farmsteads, were shown as black rectangles. These maps reveal variations in the spatial arrangement of farmsteads, such as enclosed and open yards, with square-shaped courtyards formed by buildings that create an enclosed space. However, the detailed depiction of surrounding landscape elements is largely absent. What remains noticeable as symbols of farmsteads are special paths leading to the properties, accompanied by symbols of wells and trees, as well as structured green areas like gardens, orchards, or nearby forests. The use of a uniform colour scheme, especially for the farmstead structures and their surroundings, reflects the military mapping style typical for the time. All three historical maps reveal that in Čenej, the main transportation routes were the current regional and local roads, as the construction of the motorway occurred much later, indicating that the motorway was not a historically significant route.

4.2 Identification of farmsteads

The 18th-century distribution map (Fig. 5) reveals a scattered settlement pattern, reflecting the early stages of farmstead development in Čenej. At this time, Čenej was neither a village nor an urban centre. Farmsteads (76 total) were concentrated in the northern and central parts of Čenej (Fig. 6) near pastures and along main roads which were links to trade and urban centres. The southern areas, closer to the Danube, remained sparsely settled as they were unsuitable for habitation due to frequent flooding and limited well-digging and drainage techniques.

By the 19th century (Fig. 5), their numbers increased (148 farmsteads), with settlements becoming more organised and densely populated. Improved transportation infrastructure and a more extensive road network connected farmsteads to regional trade hubs, such as Novi Sad and trade corridors such as the Danube, facilitating economic growth. A higher concentration of

farmsteads is evident in the central and eastern areas (Fig. 6), and with river regulation, the creation of fertile new land, and the development of the transport network, farmsteads gradually expanded southward, closer to the Danube. Agrarian reforms enabled land redistribution, leading to the establishment of new farmsteads by settlers from southern parts of the Kingdom of Serbs, Croats, and Slovenes.

This is evident in the distribution map from the 20th century (Fig. 5), where these settlements are evenly distributed, with a concentration along main roads, reflecting the importance of accessibility and mobility during a time when horse-drawn carriages and footpaths were the primary transport systems. The

road network remained largely unchanged from the 19th century, characterised by a regular layout, likely influenced by Austrian agrarian reforms of the 18th and 19th centuries, which had a lasting impact on spatial organisation. As the map reflects the year 1941, Čenej was still not urbanised, though signs of higher concentration and clustering of farmsteads were becoming apparent (Fig. 6).

After World War II, the number of farmsteads declined sharply, dropping to 103 today. This reduction resulted from post-war socio-economic changes, including agrarian reforms limiting private land ownership to 10 ha, land consolidation in cooperatives, industrialisation, urbanisation, and migration to developed areas. As seen in Figure 5, the construction of a motorway through Čenej



Fig. 5: Čenej farmsteads in the 18th, 19th, 20th and 21st century. Source: Authors' elaboration



Fig. 6: Concentration of farmsteads in Čenej for over the period of four centuries. Source: Authors' elaboration

significantly altered farmsteads in the west, by isolating and fragmenting them, especially those near the new infrastructure which were affected by expropriation. Throughout Čenej, many traditional farmsteads were abandoned, demolished, or replaced by modern structures, particularly near Čenej village, where urbanisation reshaped their original character. The clustered farmsteads in the central area evolved into the urbanised part of Čenej, depicted as a grey area on the 21st century map (Fig. 5).

The evolution of farmsteads in Čenej with both the expansion and the subsequent decline in farmsteads reflects broader historical and cultural trends in rural Eastern Europe. Their growth during the 18th and 19th centuries underscores their ecological and architectural significance, while the post-WWII decline illustrates the impact of modernisation, urbanisation, and changing agricultural practices. These concentration and distribution trends were summed up in Figure 7.

In the 18th century, over 50% of Čenej area showed no presence of farmsteads, with low concentrations dominating the rest of the area. A notable increase in farmstead numbers and concentration occurred in the 20th century (1941), when 397 farmsteads were recorded and over one-third of the area showed high concentration. This period marks the historical peak in farmstead density.

From 1941 onward, both the number and spatial concentration of farmsteads significantly declined. The downward trend continued into the 21st century, with only 103 farmsteads recorded in 2024. More than 50% of the area now has no active farmsteads, and the share of highly concentrated farmstead zones has dropped sharply, indicating widespread abandonment of farmsteads and urbanisation of the rest of Čenej.

Today, farmsteads in Čenej exhibit two dominant patterns: active farmsteads and abandoned structures. These categories serve as the basis for further subdivisions, which are examined in more detail in Section 4.3 Classification of farmsteads.

Besides by field research, the distribution of active and abandoned farmsteads was also analysed based on land cover categories derived from the OpenStreetMap dataset (OpenStreetMap contributors, 2024) (Tab. 2) aiming to identify areas with the highest concentrations of both active and abandoned farmsteads. Farmyards are the central land type for both active and abandoned farmsteads, while farmland shows mixed trends, with 36 abandoned and 14 active sites. Notably, 13 active farmsteads are located in residential zones, indicating functional transformation into suburban or peri-urban housing. These results show that most farmsteads tend to be located in farmyards and farmlands, areas classified according to the Law on Agricultural Land of the Republic of Serbia (2006/2022) and the Law on Agriculture and Rural Development (2009/2021), as agricultural.

In addition to land use, spatial factors – such as the distance of farmsteads from urban centres, motorway and major roads – were analysed by calculating the percentage distribution of different farmstead types within defined buffer zones (Tab. 3).

Besides the one in Čenej, surrounding urban centres were also taken into account (Fig. 8). Although not all urban centres are cities like Novi Sad; some are smaller settlements such as Kisač, Stepanovićevo and Sirig.

The analysis (Tab. 3) showed that farmsteads closer to urban centres tend to have lower abandonment rates, as their proximity to urban areas often makes them more accessible and economically viable for modern uses, such as residential conversion and tourism. On the other hand, farmsteads further from urban centres are more prone to abandonment due to their isolation, limited infrastructure, and declining economic relevance in remote areas. This trend highlights that while proximity to urban centres offers opportunities for preservation and adaptive reuse, greater distances often result in neglect and decay due to reduced connectivity, accessibility and availability of services.

Farmsteads within a 3 km radius of urban centres show relatively lower abandonment rates, as this distance remained manageable for access by traditional means such as horse-drawn carriages or on foot, which were historically common modes of transport. Beyond 3 km, the number of abandoned farmsteads increases significantly. This pattern reflects the historical reliance

	Land cover	Abandoned farmsteads	Active farmsteads
OpenStreetMap (OpenStreetMap contributors, 2024)	Farmyard	49	76
	Farmland	36	14
	Forest	7	0
	Residential	0	13

Tab. 2: Identification of different land use areas with the highest concentration of farmsteads. Source: Authors' survey

Dist. (km)	Urban centres		Motorway		Main roads	
	Abandoned	Active	Abandoned	Active	Abandoned	Active
<1	1.09%	7.77%	30.43%	6.80%	15.22%	37.86%
1–2	14.13%	17.48%	20.65%	14.56%	20.65%	20.39%
2–3	23.91%	37.86%	16.30%	9.71%	13.04%	18.45%
3–4	40.22%	24.27%	14.13%	28.16%	11.96%	4.85%
>4	20.65%	12.62%	18.48%	40.78%	39.13%	7.77%

Tab. 3: Percentage distribution of abandoned and active farmsteads in relation to distance from urban centres, the motorway, and main roads. Source: Authors' research and calculations

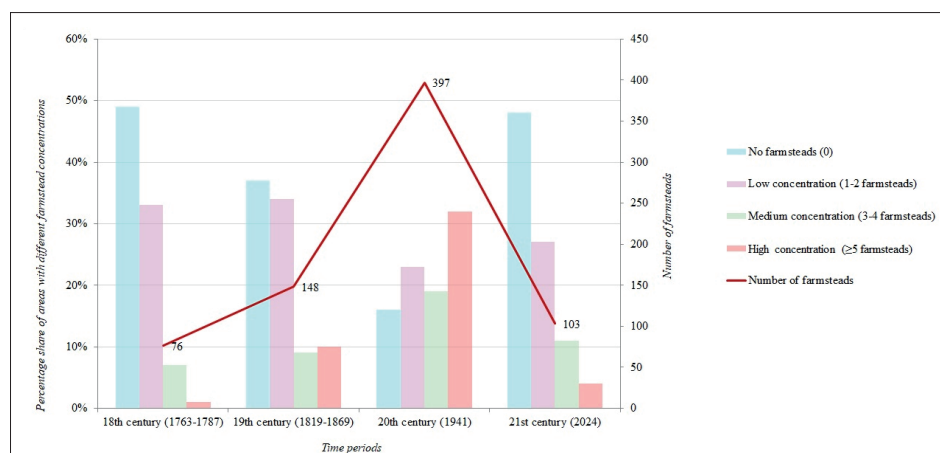


Fig. 7: Temporal changes in the number and spatial concentration of farmsteads in Čenej from the 18th to the 21st century. Source: Authors' elaboration

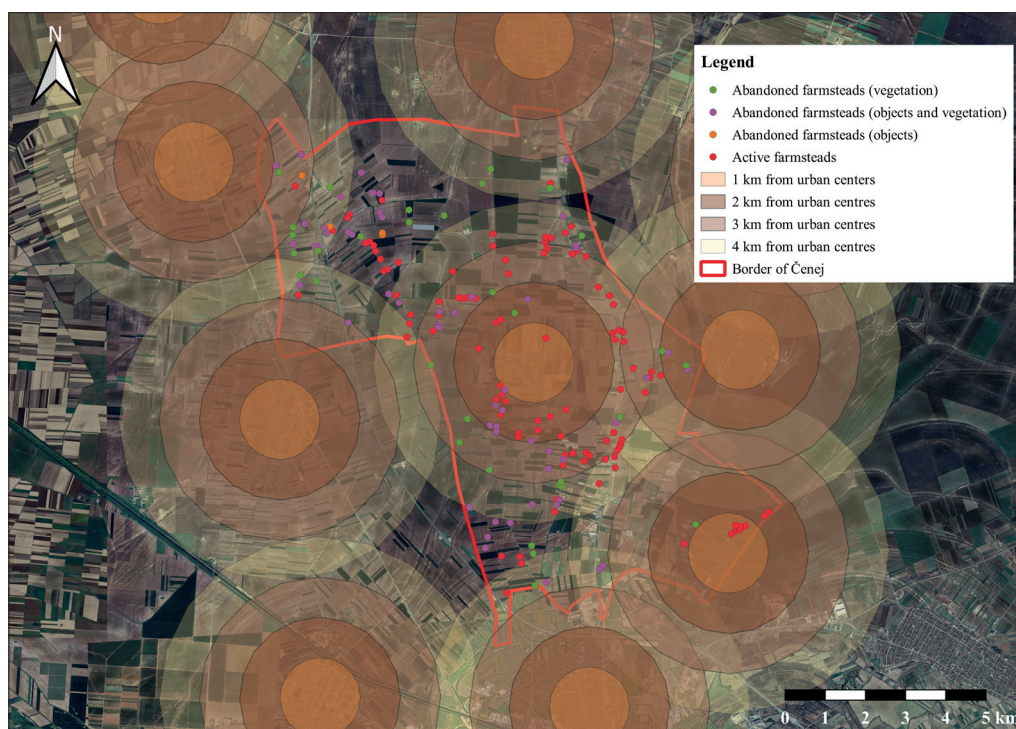


Fig. 8: Distance of farmsteads from urban centres

Source: Authors' elaboration based on Google Earth (Google LLC, 2024, 2025)

on proximity to urban centres for trade, social services, and market access. Greater distances, particularly in the pre-modern era, posed logistical challenges for daily commuting and transport of goods, making remote farmsteads less practical to maintain and more susceptible to abandonment as modernisation and urbanisation progressed. However, it is unclear whether these farmsteads, particularly those with remnants of both structures and vegetation, were abandoned recently or have been in this state for decades.

The results in Table 3 and Appendix 3 show the highest number of abandoned farmsteads (30,43%) is located within 1 km of the motorway, while the number of active farmsteads in this zone is very low (6,80%). This pattern can be attributed to the motorway's planned construction, which likely caused changes to land ownership and land use. The disruption of land ownership may have led many farmsteads to be abandoned. Additionally, the motorway's limited access and lack of direct connectivity to nearby farmsteads may make these areas less practical for maintaining active farming operations, further discouraging activity. As the distance from the motorway increases, the number of abandoned farmsteads decreases, while the number of active farmsteads rises significantly, suggesting that farmsteads further from the motorway are less affected by it, making them more viable for continued agricultural or residential use.

The results in Table 3 and Appendix 3 reveal a varied distribution of abandoned and active farmsteads along main roads, which, unlike the motorway, were established decades ago, as observed in the distribution maps in Figure 5. The highest number of active farmsteads is located within 1 km of the main roads, likely due to proximity to urban centres with established infrastructure. Active farmsteads significantly decrease with increasing distance, indicating that areas further from main roads are less suitable

for maintaining activity. The number of abandoned farmsteads varies inconsistently, indicating that factors such as proximity to urban centres and historical development patterns likely influence abandonment rates. While proximity to main roads promotes higher activity within 1 km, the absence of a clear trend in abandonment suggests that socio-economic and spatial factors, particularly urban centre proximity, play a key role in shaping the distribution of both abandoned and active farmsteads.

The spatial analysis reveals that proximity to urban centres, main roads, and motorways significantly influences the distribution and operational activity of farmsteads. Farmsteads closer to urban centres and main roads generally show lower abandonment rates and higher activity due to better accessibility and economic opportunities, while those near motorways face higher abandonment rates.

4.3 Classification of farmsteads

4.3.1 Historical farmstead types

Based on historical map interpretation, literature review and the typological criteria defined in the methodology, four historical types of *salaš* farmsteads were identified, reflecting variations in land use, structural development, and vegetation patterns. Their classification was guided by the key (Tab. 4), which provides the explanatory criteria used to distinguish between types.

- Type I – Temporary farmsteads (S1-L1/L2-V2-F1-T3-C3): This earliest form corresponds to the unstable socio-political context of the late 17th and early 18th centuries, during the early colonisation of Vojvodina, when Turkish invasions remained a persistent threat. Farmsteads consisted of primitive shelters

S = Structure type	L = Land use context	V = Vegetation presence	F = Functional zoning	T = Tree arrangements	C = Cultivated perennial crops
1. Temporary shelters	1. Pasture	1. Woody vegetation	1. Residential buildings	1. Tree alleys/groups	1. Orchards
2. Permanent buildings	2. Arable land	2. Absence of vegetation	2. Residential and economic	2. Solitary trees	2. Vineyards
				3. Absence of trees	3. Absence of perennial crops

Tab. 4: Key to historical farmstead typology criteria

Source: Authors' interpretation

such as dugouts or simple huts, constructed on both pastures and arable land (Appendix 2a–b). Reflecting the earliest phase of settlement, these temporary structures constructed to shelter farmers tending livestock, were inconspicuous, built low to the ground with thatched roofs, lacked functional zoning or planned vegetation and were situated far from main settlements. An illustrative example of this type is provided in Appendix 2a (S1-L1-V2-F1-T3-C3).

- Type II – Early permanent farmsteads (S2-L2-V1/V2-F1/F2-T1/T2/T3-C3): From the mid-18th century, with the abolition of feudal relations and growing demand for grain, temporary shelters were gradually replaced by permanent structures. This period brought a transition from a nomadic lifestyle to cultivating land and practicing stall-based livestock farming. Pastures were gradually converted to arable land, and temporary shelters evolved into more durable, permanent structures. These included basic residential units and storage buildings, often placed along dirt roads or near wells (Appendix 2c–e). Although structurally more stable, these sites show limited vegetation, mostly simple built residential structures and no clear functional zoning. An illustrative example of this type is provided in Appendix 2c (S2-L2-V2-F1-T3-C3).
- Type III – Semi-structured farmsteads (S2-L2-V1-F2-T1/T2/T3-C1/C2): These farmsteads combined residential and economic buildings, and were frequently accompanied by intentionally planted vegetation elements such as orchards, vineyards, or tree alleys (Appendix 2f–h). Their intentional spatial organisation demonstrates moderate functional complexity, with vegetation serving both practical and structuring roles. Illustrative examples of these types are provided in Appendix 2f (S2-L2-V2-F1-T3-C2) and 2g (S2-L2-V1-F2-T1-C3).
- Type IV – Mature integrated farmsteads (S2-L2-V1-F2-T1 and T2-C1 and C2): The most developed historical form included distinct functional zones, residential and economic buildings, and clearly defined green spaces and elements such as alleys, solitary trees, and ornamental vegetation, orchards and vineyards (Appendix 2i – 1, 7). These farmsteads illustrate full landscape integration, permanence, and clear spatial identity within the agricultural matrix.

4.3.2 Contemporary farmsteads in Čenej

Field research and classification criteria related to current activity, function, spatial context, connectivity and preservation state, resulted in five contemporary types of farmsteads, with a primary focus on their activity and use (two active and three abandoned types). Their classification was guided by the key (Tab. 5), which provides the explanatory criteria used to distinguish between types. This typology reflects the diversity of contemporary farmstead transformation by the example of Čenej and provides a structured basis for assessing their preservation status and future potential.

U1. Active farmsteads (U1-F1/F2/F3-S1/S2/C1/C2/C3/C4-P1): These types are used either on a daily or occasional basis for residential purposes, for combined residential and economic functions, or for tourism and hospitality, or often represent a combination of all these functions

- Type I – Permanently inhabited multifunctional farmsteads (U1-F1/F3-S1/S2-C2/C3/C4-P1): These are the closest successors of traditional *salaš* farmsteads, combining mostly residential and economic functions. They typically include a main residential building, economic buildings such as barns, granaries, corn cribs etc., and adjacent cultivated land. These types are usually privately owned, fully operational and maintained and combine both residential and agricultural or livestock functions. The yards are rectangular, enclosed, often with a windbreak of *Robinia pseudoacacia* L., soliters or groups of *Juglans regia* L., *Morus alba* L., *Populus nigra* ‘Italica’ trees, reflecting both utility and heritage planting. Vegetation is well maintained, and orchards or gardens are commonly present. Such farmsteads embody continuity of rural lifestyle and retain both architectural and ecological values (U1-F3-S1-C4-P1).

A growing number of farmsteads is adapted to non-agricultural purposes such as tourism, hospitality, or events such as weddings and ethno-villages. In these cases, original structures are often renovated or expanded, and traditional architectural elements may be altered for new purposes. The surrounding vegetation is usually restructured into decorative landscapes, with lawns, ornamental species, and sometimes exotic trees replacing traditional utilitarian plantings. Although such sites may lose part of their authenticity, they demonstrate the adaptability of *salaš* farmsteads to contemporary socio-economic trends and their potential role in rural tourism development (U1-F3-S2-C2-P1).

- Type II – Occasionally used farmsteads (U1-F1/F2-S1/S2-C2/C3/C4-P1): This subtype corresponds to secondary residences or weekend houses, where permanent farming activity has largely ceased. Buildings are maintained but show fewer signs of everyday use. Vegetation patterns include ornamental trees and shrubs, sometimes interspersed with remnants of former orchards. These farmsteads represent a transitional form: while they preserve the physical presence of *salaš* farmsteads in the landscape, their function shifts towards occasional leisure and recreation rather than production and permanent residence. In some cases, however, they may still perform a limited economic role, such as seasonal use of orchards or vineyards, beekeeping, or storage of agricultural products, which does not require permanent residence.

U2. Abandoned farmsteads (U2-F4-S1/S2-C1/C2/C3/C4-P2/P3/P4): Abandoned farmsteads are classified into three additional types based on physical remnants and vegetation patterns. Illustrating different stages of degradation, these sites are no longer actively used but remain visible through ruins, traces of planting, or isolated buildings.

- Type I – Ruins with overgrowth (U2-F4-S1/S2-C1/C2/C3/C4-P2): This subtype consists of partially preserved structures – collapsed houses, barns, or foundations – gradually overtaken by spontaneous vegetation. Most commonly observed were pioneer and invasive taxa such as *Robinia pseudoacacia* L., *Sambucus nigra* L., *Ulmus pumila* L. Despite their decay, the spatial layout of the original farmstead can often still be recognised, with tree rows or the remains of an orchard marking boundaries. A notable example is the abandoned

U = Use	F = Function	S = Spatial context	C = Connectivity	P = Preservation state
1. Active	1. Residential	1. Isolated	1. Motorway	1. Preserved
2. Abandoned	2. Economic	2. Grouped	2. Main road	2. Ruins with vegetation
	3. Residential & economic		3. Local road	3. Vegetation remains
	4. None		4. Field road	4. Structure remains

Tab. 5 Key to current farmstead typology criteria
Source: Authors' interpretation

Kuzmanović farmstead (U2-F4-S1-C4-P2), where a centuries-old mulberry tree (*Morus alba* L.) has been preserved as a natural heritage monument protected by law due to its age and imposing dendrological parameters. These types of farmsteads demonstrate how natural succession reclaims abandoned cultural sites, creating patches of cultural ruins and spontaneous woodland, some of which host old and rare tree species that further enhance their ecological and natural heritage value.

- Type II – Vegetation traces only (U2-F4-S1/S2-C1/C2/C3/C4-P3): In this stage, no physical structures remain, but the site is still recognisable through vegetation and territorial features. Linear tree plantings, abandoned orchards, or clusters of spontaneous woody species arranged in rectangular or square formations – reflecting the original parcel layout of the *salaš* – form ‘green imprints’ of past human activity. Such sites are particularly common further from urban centres, where long-term abandonment allowed structures to vanish entirely. While their architectural value is lost, these vegetation remnants serve as elements of landscape memory and provide important ecological functions – offering habitat, melliferous resources, and connectivity within the agricultural matrix. In Čenej, many of these patches are dominated by *Robinia pseudoacacia* L., the most common windbreak species, which has subsequently spread, indicating the former layout of farmsteads (e.g. parcel near Pejičev *salaš*).
- Type III – Structural remains without vegetation (U2-F4-S1/S2-C1/C2/C3/C4-P4): This subtype is characterised by isolated buildings – often a single residential unit or storage house – standing in the middle of cultivated fields. Surrounding vegetation is minimal or absent, as agriculture has reclaimed the space. These farmsteads retain some architectural presence but have lost their ecological and spatial identity, representing the final step before complete disappearance.

Spatial context and connectivity are closely related criteria that apply to both active and abandoned *salaš* farmsteads. Isolated farmsteads are scattered within the agricultural matrix, physically separated and distant from other farmsteads, and can usually be reached only by local or field roads. Grouped farmsteads, as also observed on the example of Čenej, are usually clustered along main or local roads, forming linear patterns. Farmsteads located near motorways rarely have direct access to them, which makes them less accessible and increases their risk of abandonment. Those situated along main roads or regional routes are generally more accessible and therefore more prone to repurposing (e.g. tourism, hospitality). Farmsteads connected by local roads often retain their residential and agricultural functions, while those accessible only by unpaved field roads tend to be more isolated, less accessible, and frequently abandoned.

Active and abandoned farmsteads were mapped across Čenej. Detailed mapping of active farmsteads subtypes was not feasible due to private ownership constraints, but qualitative field observations and supporting literature allowed for their recognition in the classification. Mapping abandoned farmsteads reflected different stages of transformation. The most abundant type is represented by vegetation and structure remains (60,87% of total abandoned farmsteads), suggesting that many farmsteads have reached an intermediate stage of abandonment, retaining both structures and vegetation. This reflects the historical resilience and more or less recent abandonment of these sites, which may still hold cultural and ecological value. Farmstead vegetation patches are moderately abundant (34,78% of total abandoned farmsteads), particularly in areas further from urban centres, indicating that many farmsteads have been abandoned long enough for structures to vanish, leaving only vegetation, which can have an ecological value. The least abundant are

structure remains (4,35% of total abandoned farmsteads), suggesting that remnants of structures alone are rare and may indicate either the impact of motorway construction or recent abandonment.

5. Discussion

5.1 Comparative trends in the decline of European farmsteads

The decline of traditional farming and increasing abandonment of agricultural land are widespread across Europe, particularly in Central and Eastern countries (Pándi et al., 2014; Jaszczak et al., 2018; Stober et al., 2018; Baránková et al., 2024). Political and socio-economic changes, including collectivisation, urban migration, and shifting rural functions have profoundly transformed landscapes in these regions, leaving behind ruins of farm structures and abandoned land (Jaszczak et al., 2018). In Slovakia, for instance, less than 2% of traditional agricultural landscapes survived collectivisation (Baránková et al., 2024). A similar trend is documented in Hungary's Kiskunság region, where scattered farms (*tanyas*) were an important element in the Pannonian Plain's rural landscape. Around 1930, 750,000–800,000 people lived on these farms, but following land consolidation and agrarian reforms after World War II, their number dropped to only 150,000–200,000 – representing a decline of about 75% (Kovács & Farkas, 2011).

The results of this study indicate that traditional farming in Čenej has also declined over the past 83 years, as evidenced by a 74% reduction in the number of farmsteads recorded on historical maps from 1941 compared to the present. A comparable analysis was conducted by Górka (2024) in a 100 km² area of Kashubia, Poland – a region similar in scale to our study area in Čenej (85.87 km²). Despite differences in geographical and cultural contexts, both findings show similar dynamics in farmstead numbers over time, especially around World War II. In the pre-war period, farmstead densities were comparable: Górka recorded 434 farmsteads in Kashubia in 1937, while our mapping identified 397 *salaš* farmsteads in Čenej in 1941. The peak in farmstead numbers during the interwar period in Čenej, reaching 440, is also reported by Lazić (1984) and Košić et al. (2014), confirming our findings. Following World War II, both regions experienced significant declines. By 1983, Kashubia retained 72% (313) of its pre-war farmsteads, while Čenej according to Košić et al. (2014) retained 53.86% (237) by 1984. Our results from the 2024 mapping show a further decrease to 103 active farmsteads (23.4%). However, by 2020 Kashubia retained 67% (291) of its original farmsteads. Although the trends are similar in showing a decline, the percentage of retained farmsteads in Čenej is notably lower, suggesting region-specific dynamics that need further investigation. Although the two regions differ in their geographical and cultural contexts, both reflect a shared pattern of post-war decline of traditional farmstead structures, highlighting the need for further research into the resilience and future of the remaining farmsteads.

5.2 Factors contributing to the abandonment of farmsteads

In Western Europe, farmland abandonment was driven by industrialisation and urbanisation, while in Central and Eastern Europe, it resulted from the collapse of socialism and transition to market-oriented economies (Müller et al., 2009; Baumann et al., 2011). In addition to socio-economic factors influencing agricultural land abandonment (Rey Benayas et al., 2007), spatial factors such as distance from settlements play a significant role in the abandonment rates of farmsteads and similar structures (Shi et al., 2016). Accessibility and isolation also affect the distribution and abandonment of structures like farmsteads and haylofts (Baránková et al., 2024). Proximity to roads and

villages is critical, as these connections have historically been – and remain – vital for economic activity and accessibility of traditional rural structures. Our results indicate that farmsteads located further from urban centres, beyond a 3 km radius, are more prone to abandonment due to their isolation, limited infrastructure, and declining economic relevance in remote areas. This finding aligns with Cillis et al. (2019), who found that active traditional farms in southern Italy, specifically *masserie*, are typically located farther from major agricultural centres, with abandoned *masserie* being even more isolated, reinforcing the link between spatial isolation and abandonment. Similarly, studies in Central and Eastern Europe confirm that remoteness from settlements increases the likelihood of land abandonment (Prishchepov et al., 2013; Lieskovský et al., 2015). However, in Čenej, farmsteads closer to urban centres, within a 3 km radius, tend to have lower abandonment rates, as they have often been urbanised and modernised. In contrast, those located beyond 3 km are significantly more likely to be abandoned, aligning with the findings of several authors (Prishchepov et al., 2013; Lieskovský et al., 2015; Shi et al., 2016; Cillis et al., 2019; Baránková et al., 2024) who highlight how isolation and remoteness contribute to abandonment. Baránková et al. (2024) also studied the influence of distance factors such as accessibility and isolation on the distribution and abandonment of traditional rural structures, using haylofts in Slovakia as a subject study. Their findings – linking greater distance from settlements and primary roads with a higher likelihood of abandonment – are consistent with the spatial patterns identified in our study and further support the idea that remoteness is a key predictor of rural decline.

Even though the geospatial analysis by Cillis et al. (2019) covered an area more than 100 times larger of Čenej, it also demonstrated how distance from infrastructure directly affects the likelihood of abandonment. Their analysis of the road network – focusing on motorways, primary, secondary, and municipal roads – revealed that more isolated farms, located further from main roads, were more likely to be abandoned. Our study supports these findings, as our results show that the highest number of active farmsteads are located within 1 km of the main roads, which correspond to primary roads in Italy. Active farmsteads significantly decrease with increasing distance, indicating that areas further from main roads are less suitable for maintaining activity. This highlights the importance of proximity to infrastructure in sustaining traditional farmsteads in Čenej. However, an interesting exception emerged in the case of motorways: our results show that the highest number of abandoned farmsteads is located within 1 km of the motorway, while the number of active farmsteads in this zone is very low. As the distance from the motorway increases, the number of abandoned farmsteads decreases, while the number of active farmsteads rises significantly. This suggests that farmsteads further from the motorway are less affected by the construction of the motorway – an infrastructure element that was not historically integrated into the rural fabric.

These findings emphasise that while proximity to infrastructure generally promotes continued land use, the type, historical significance, and spatial integration of that infrastructure must also be considered. Historically established roads tend to provide more consistent accessibility and support rural activity, whereas later-developed motorways may introduce new barriers or disturbances, as was the case in Čenej. It is important to note that while infrastructure plays a significant role in abandonment rates, it is just one of many factors influencing the distribution of farmsteads. A comprehensive approach to understanding these patterns requires considering multiple variables, such as socio-economic trends, agricultural practices, and environmental conditions, which can also significantly affect rural land use and farmstead preservation.

5.3 Classification of farmsteads

Nedeljković Angelovska (2014) examined the *salaš* farmsteads of Bačko Petrovo Selo, located 56 km from Čenej, and proposed a classification based on their functional use. She distinguished three categories: *salaš* farmsteads with permanent residential and economic functions, those with occasional residential and economic functions, and those with economic but no residential function. Our typology is largely consistent with hers in terms of active *salaš* farmsteads. However, in Čenej, we identified an additional category – commercially repurposed – reflecting the presence of *salaš* farmsteads engaged in hospitality and tourism, which are absent in Bačko Petrovo Selo. Such multifunctional repurposing of Čenej farmsteads, now serving hospitality, rural tourism or event functions (Đerčan et al., 2023), aligns with broader European trends. For example, in Italy, traditional agricultural estates like the *masseria* and *villa fattoria* have been adapted to combine agricultural production with tourism and heritage preservation (Santucci, 2013; Cillis et al., 2019). Field observations in Čenej indicate that, while these adaptations offer economic benefits, they may sometimes compromise historical authenticity when new constructions are introduced without cultural or historical value. Furthermore, our classification includes permanent residential and economic use, corresponding to Nedeljković Angelovska's (2014) first category, as well as occasional use with seasonal function, which overlaps with her second and third categories.

Górka's study (2024) approached the classification of old farmsteads from a different perspective, focusing on the degree of preservation of the original buildings. His typology distinguished four categories: fully preserved, half-preserved, partially preserved, and transformed. Unlike our function-based typology, which emphasises patterns of use and socio-economic roles of *salaš* farmsteads, Górka's framework highlights their architectural state and material condition. These two perspectives, although developed from different disciplinary angles, are complementary: while functional changes often drive or accompany physical transformations, the state of preservation can also constrain or enable certain uses. Extending the structural perspective to abandoned farmsteads, our study also considered the role of vegetation in indicating stages of decay. In our study, abandoned *salaš* farmsteads were classified according to the presence of vegetation and remaining structures: ruins with overgrowth, vegetation traces only, and structural remains without vegetation. This classification highlights how abandonment in rural landscapes involves both the breakdown of built elements and ecological succession, as vegetation gradually colonises unused spaces. A similar pattern is observed in the Slovak haylofts studied by Baránková et al. (2024), where the majority of structures had collapsed and shrubs or other vegetation had established inside or around them, while only a small proportion (1%) remained preserved and repurposed. Although haylofts in Slovakia – historically used seasonally in mountainous pastures – differ functionally from Vojvodina *salaš* farmsteads, both cases show that the relationship between structural decline and vegetation growth is a key indicator of rural landscape transformation. These insights suggest that combining assessments of building condition and ecological dynamics can provide a more comprehensive understanding of heritage changes across Central and Eastern Europe.

This typology of active and abandoned farmsteads offers valuable insights into the transformation of landscape patterns, particularly the relationship between vegetation and built structures. Even in their decayed state, abandoned farmsteads often retain traces of their original architectural value and traditional function or preserve elements of natural heritage, such as old trees, underscoring their continued significance as cultural and natural heritage within the landscape. In light of these

transformations, it becomes increasingly important to recognise the multifunctional value of traditional rural settlements – not only as heritage assets but also as ecologically significant structures within the agricultural landscape. Small settlements in predominantly agricultural landscapes, with a historical role in traditional agriculture, hold significant potential as agricultural heritage due to their diverse values. In addition to their historical, architectural, and cultural significance, features such as haylofts and farmsteads also provide ecological and biodiversity benefits. For instance, Slovak haylofts, as discussed by Baránková et al. (2024), were integrated into grasslands, supporting species-rich meadows and contributing to biodiversity conservation, making them valuable examples of biocultural heritage. Similarly, farmsteads contribute to ecological value by hosting old orchards, windbreaks, and melliferous plants, which enhance genetic diversity and support pollinator populations. Future research could focus on analysing the biodiversity value of vegetation associated with farmsteads, with a particular focus on woody plants as more permanent features.

Building on their historical, cultural and ecological significance, traditional farmsteads represent a strategic opportunity for shaping future rural development. Our study highlights that traditional farmsteads offer a timely opportunity if not an urging call for Vojvodina and similar regions to recognise, preserve, and meaningfully integrate agricultural heritage into future-oriented rural development strategies – ones that respond to ongoing social, ecological, and climatic changes.

6. Conclusions

This study develops a typology of nine farmstead types, using the example of *salaš* farmsteads, consisting of four historical and five contemporary categories, based on their use, function and preservation. These typologies reflect the spatial and functional transformations of farmsteads over time, offering valuable insights into how rural communities adapted to both socio-economic and environmental changes.

The historical types include: I) temporary farmsteads (dugouts or huts), II) early permanent types with minimal organisation, III) semi-structured types combining residential and economic buildings with functional vegetation, and IV) mature, integrated types with defined zones and ornamental planting. Contemporary types encompass two active – permanently inhabited multifunctional (residential/agricultural/non-agricultural) farmsteads and occasionally used farmsteads; and three abandoned forms (ruins with overgrowth, vegetation traces only, and structural remnants without vegetation).

Additionally, this study tracks the changing distribution and density of farmsteads in Čenej from the 18th to the 21st century, revealing significant transformations in both the number and spatial organisation of these structures. The peak of farmstead development occurred in the interwar period, with a noticeable decline in the post-war years due to socio-political changes, urbanisation, and infrastructural expansion. The typology developed in this study helps to contextualise these shifts, as the various types of farmsteads evolved in response to changing agricultural practices, land use, and the socio-economic conditions.

By examining spatial factors such as proximity to urban centres, main roads, and motorways, the study demonstrates that while these factors significantly influence the activity of farmsteads, they are not the sole determinants. Farmsteads near urban centres and major roads tend to remain active, while those situated near motorways are more likely to be abandoned. Similarly, farmsteads located in more remote, isolated areas, further distanced from infrastructure, are also prone to abandonment, underscoring the complex interplay of various factors driving these changes.

The farmstead typology also draws attention to the importance of recognising abandoned farmsteads, as they continue to hold ecological and architectural value. Even in their decline, many of these structures provide insight into past land use, rural life, and traditional agricultural practices. As such, abandoned farmsteads also play a crucial role in preserving the region's rural heritage. The findings of this study underscore the urgent need to recognise and preserve remaining traditional farmsteads, as they are integral to the identity and character of agricultural landscapes like Vojvodina. Their ongoing disappearance threatens not only vernacular architecture and traditional land-use practices, but also the heritage of several generations and the memory of unique cultural landscapes.

The typology developed in this study lays the groundwork for future research and action, including strategies for protecting vulnerable areas and cultural monuments, as well as innovative models for sustainable rural development and agritourism. Rooted in economic sustainability and resilience, such strategies can ensure the continued preservation of these unique rural forms for future generations.

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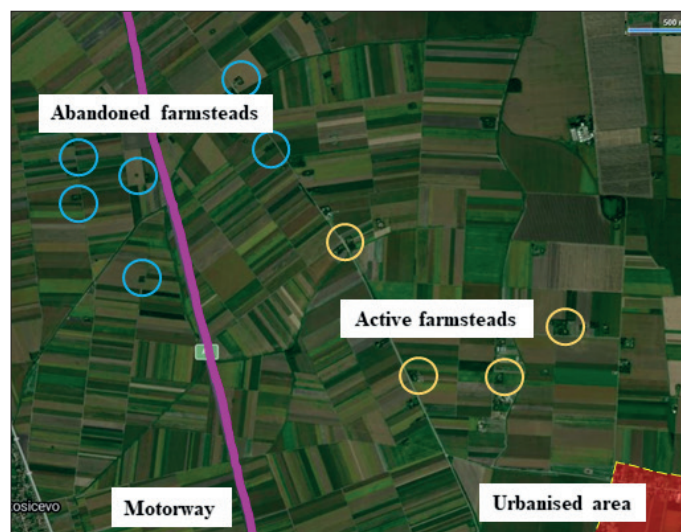
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Appendices

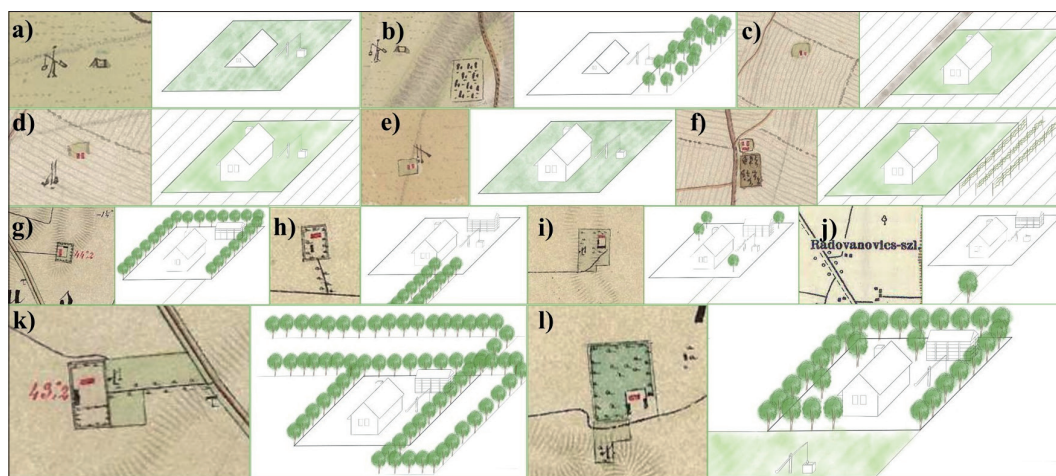
Appendix 1: Representative section of the Čenej area illustrating its landscape character

Source: Authors' elaboration, based on Bing Aerial imagery (Microsoft Corporation, 2024)



Appendix 2: Landscape transformation of the layout and design of a salaš and its surrounding as indicated by historical maps: a) Temporary, dugout farmstead on a pasture with a traditional well, b) Temporary farmstead on a pasture with woody vegetation, c) Built farmstead on arable land with a nearby dirt road, d) Built farmstead on arable land with a traditional well, e) Built farmstead on a pasture with a traditional well, f) Built farmstead on arable land with a vineyard, g) Residential & economic buildings and a tree alley on the farmstead, h) Farmstead with a tree alley by the road that leads to the estate, i) Residential & economic buildings and a group of trees on the farmstead, j) Soliter tree as a landmark in front of the farmstead, k) Farmstead with different green spaces, l) Farmstead with high vegetation and a pasture

Source: Authors' conceptualisation



Appendix 3: Distance of farmsteads from the motorway (left) and main roads (right) in Čenej

Source: Authors' elaboration based on Google Earth (Google LLC, 2024, 2025)

