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THE DYNAMICS OF THE EARLY MEDIEVAL SETTLEMENT DEVELOPMENT IN THE DRAVA PLAIN IN CONNECTION WITH THE PEDOLOGICAL ANALYSIS OF ARABLE LAND

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Abstract

This study investigates the Early Medieval settlement dynamics of the Drava Plain through a comparative analysis of settlement patterns and pedological data on arable land. Utilizing a dataset of 18 rural archaeological sites, the research examines the spatial and temporal distribution of settlements, soil classifications, and their suitability for agriculture. The findings reveal that initial settlers from the late 6th century prefered locations with automorphic soils at the base of hills, which were fertile and easily cultivated with simple tools. By the late 7th century, settlements expanded to hydromorphic soils, necessitating advanced plough technology. This shift enabled efficient use of the Drava River's alluvial plains. The study concludes that the choice of settlement sites was closely linked to the agricultural potential of the land, demonstrating a significant adaptation to environmental conditions and technological capabilities.

Keywords: landscape archaeology, Early Medieval archaeology, GIS, site catchment, agriculture, soil analysis

1. INTRODUCTION

The article deals with the settlement dynamics of the Drava Plain (Dravsko polje) in the Early Middle Ages, focusing on the comparison between the spatio-temporal development of the Early Medieval settlement and the results of the pedological analysis of the potential arable land of the individual settlements, dated by the archaeological method.

The beginnings of the Early Medieval settlement of the Drava Plain date back to the end of the 6th or the beginning of the 7th century (Magdič 2021, 136). The previous Roman settlement ended in the course of the first half of the 5th century, when most of the population left the area (Horvat 1999, 255). This was confirmed by the recent analysis of 1105 relevant sites, which validated that the newcomers colonised an all but completely abandoned landscape (Štular et al. 2022). In temperate climates, the overgrowth of abandoned arable land is usually completed after a maximum of 150–200 years, when a dynamic equilibrium is reached and one can speak of a fully formed forest (Cojzer 2011, 12–14). Therefore, the first Early Medieval communities settling the Drava Plain area were not limited by the choice between cleared and overgrown space when selecting the location for their settlements, as the area was predominantly covered with mature forest.

The results of the comparative analysis of spatio-temporal settlement dynamics and pedological analysis of potential arable land were confronted in the discussion with the generally accepted conclusion, further substantiated by Pleterski (2008, 17), that the primary economic activity of the Early Medieval inhabitants of the present-day Slovenian territory was agriculture, with emphasis on arable farming. The most important result of the research is the conclusion that the first Early Medieval settlers of the Drava Plain chose for their settlement the environments that best suited their specific, technology- and culture-determined farming practices.

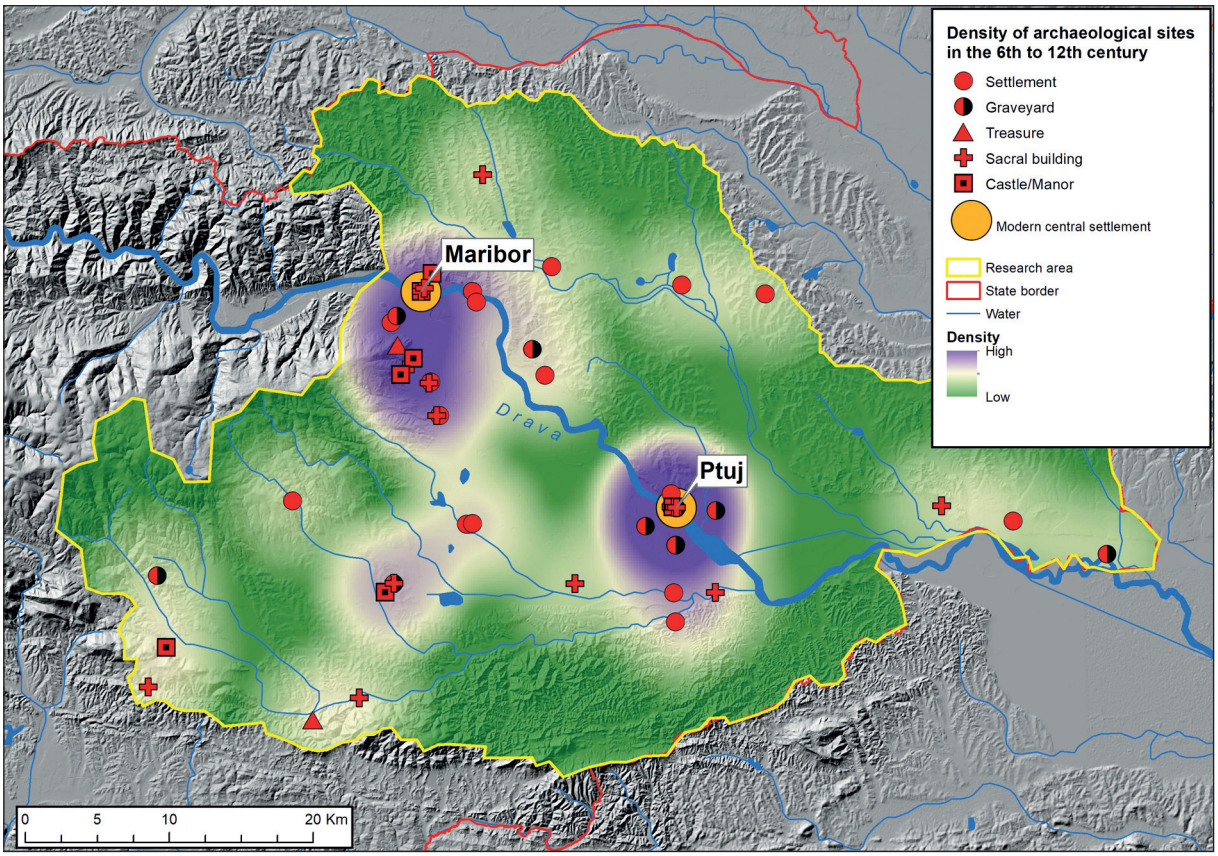


Fig. 1: Density of archaeological sites in the 6th–12th centuries period. Site density is interpreted from point data using the ArcGIS tool Kernel Density, whereas each point is representing an individual archaeological site.

One of the goals of the analysis of potential arable land is to determine whether the area of arable land in the Early Middle Ages was a factor that people took into account when choosing where to settle.

2. MATERIALS, METHODS AND RESULTS

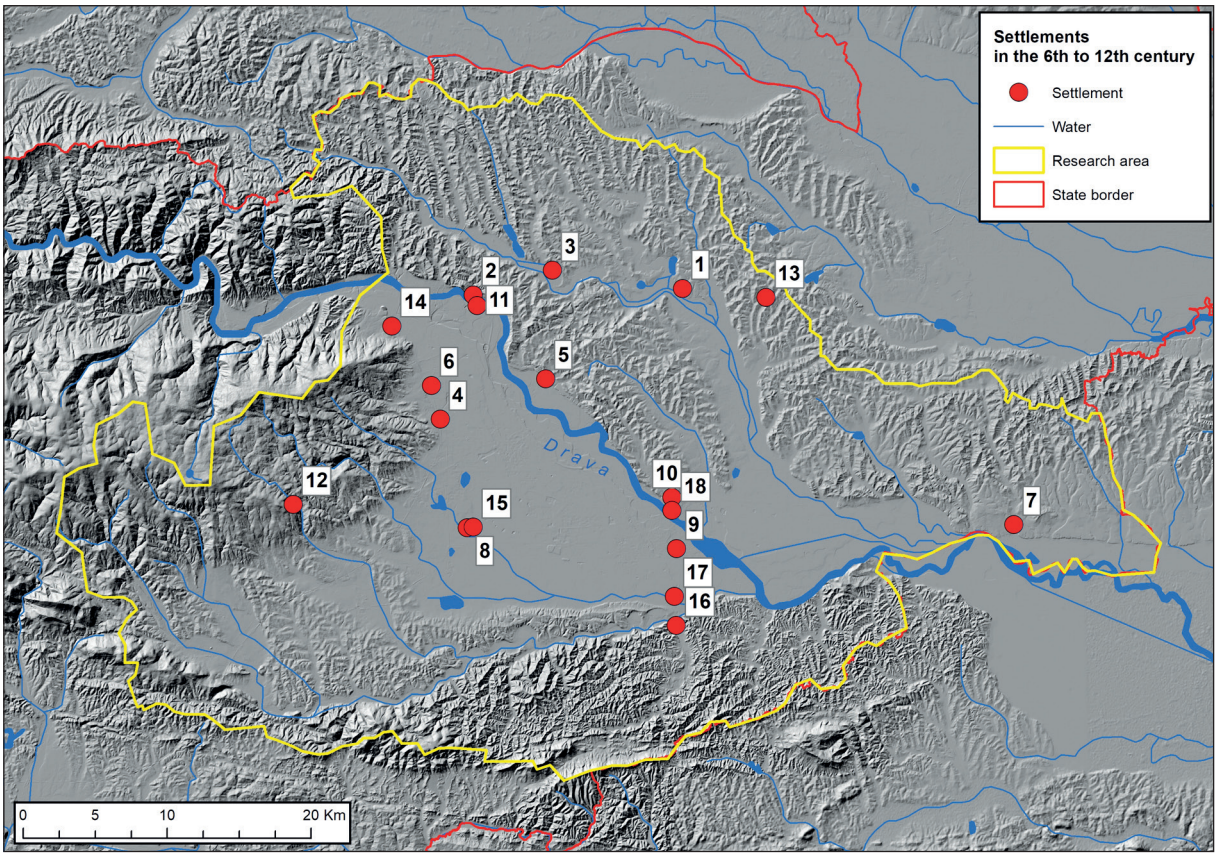
2.1 ARCHAEOLOGICAL DATA SET

The data basis for the present study is a comprehensive study of the Early Mediaeval archaeological data of the Drava Plain and the surrounding hills (Magdič 2021), in conjunction with the Zbiva database (relevant here: Štular 2019; Štular et al. 2021; 2023; Štular, Belak 2022). The most important result of the study of the archaeological data of the considered area is the finding that the Early Mediaeval settlement took place in two distinct concentrations, one in the wider area of today's Maribor, the other in the wider area of today's Ptuj (*Fig. 1*).

The present study focuses on archaeological sites identified as rural settlements on the basis of material remains found during archaeological excavations. Spatial and chronological data from 18 settlements were included in the study. The time span and formation moment, listed in *Fig. 2*, were determined by a combination of analytical methods based on a typo-chronological analysis of pottery and C14 dating of individual settlements (Magdič 2021, 65–137). The time span represents the time frame within which a settlement certainly existed, but not necessarily during the entire period. The formation moment represents the moment when an individual settlement existed with certainty, but it is also possible that it existed some time earlier as well.

The earliest Early Medieval settlement in the area is Spodnja Senarska, which dates back to before the end of the 6th century. According to the found pottery, the settlement is a remnant of the original settlement, which in the observed area was abandoned before the middle of the 7th century. At the same time as the settlement in Spodnja Senarska, or directly after its decline, new settlements appeared in the area, the first harbingers of a new settlement. The earliest of these settlements, established before 658, are Malečnik – Pod Meljskim hribom, Močna – Vaški trg, Slivnica – Srednji travniki, Spodnji Duplek – Srednje polje and Spodnje Hoče – Pod cerkvijo.

The settlement of the area continues in the second half of the 7th century and the first half of the 8th cen-



No.	ZBIVA ID	Settlement – site name	Time span	Formation (at the latest)
1	10002902	Spodnja Senarska – Zgornje polje	550–650	600
2	10002669	Malečnik – Pod Meljskim hribom	542–764	634
3	10002840	Močna – Vaški trg	630–1050	634
4	10003694	Slivnica – Srednji travniki	640–888	640
5	10002904	Spodnji Duplek – Srednje polje	630–642	642
6	10002298	Spodnje Hoče – Pod cerkvijo	630–1050	658
7	10003693	Pušenci – Cerkvišče	630–1300	764
8	10003280	Spodnja Gorica – Cediljeki	630–764	764
9	10003692	Ptuj – Turnišče	630–925	764
10	10000052	Ptuj – Štuki-Marof	640–800	764
11	10002535	Maribor – Pobrežje	642–764	764
12	10002536	Jurišna vas – Ančnikovo gradišče	630–833	833
13	10002371	Andrenci – Police	630–880	860
14	10003687	Maribor – Zgornje Radvanje	630–880	860
15	10002670	Spodnja Gorica – Gmajna	630–888	875
16	10003276	Podlehnik – Murko	764–1025	888
17	10003684	Lancova vas – Na pukli	764–888	888
18	10003690	Ptuj – Grad*	660–800	800

Fig. 2: Farming settlements in the Drava Plain, dated between the 6th and 12th centuries, based on archaeological evidence.

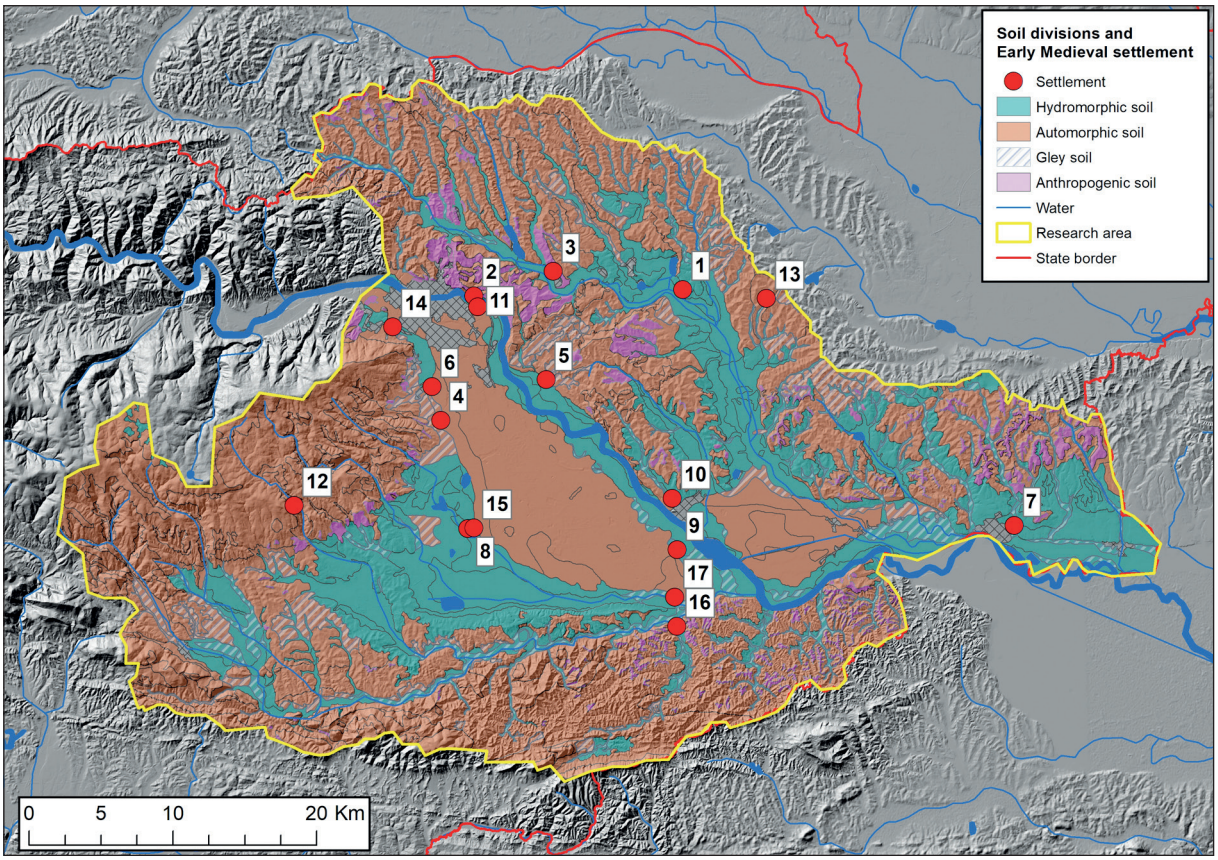


Fig. 3: Pedological map of the Early Medieval settlement, based on soil divisions.

tury. The settlements of Ptuj - Štuki-Marof and Ptuj - Turnišče, Maribor – Pobrežje, Pušenci – Cerkvišče, Jurišna vas – Ančnikovo gradišče and Spodnja Gorica – Cediljeki can be dated to the period before 764. So far, no settlement remains have been discovered in Ptuj that could provide a "link" between the decline of the Roman town in the 5th century and Slavic settlement in the 7th century. However, there are traces that indicate the presence of an indigenous population even in the 6th century. These include a deer-shaped clasp discovered in one of the local inhabitants' graves on the top of Panorama Hill, which, according to Slavko Ciglenečki, belongs to the group of the latest animal brooches, with good comparisons in the 6th and 7th centuries (Ciglenečki 1993, 512, Pl. 2: 9).

The latest phase of Early Medieval settlement begins after 764, with the settlements of Ptuj – Grad, Spodnja Gorica – Gmajna, Lancova vas – Na pukli and Podlehnik – Murko founded towards the end of the 8th or in the 9th century. The settlement Andrenci – Police can also be dated to this period at the latest, although it cannot be excluded that it was founded as early as in the 7th century.

2.2 PEDOLOGICAL DATA SET

The pedological data for the study were taken from the 1:25,000 scale pedological map of the Republic of Slovenia (Repe 2010). An in-depth analysis of the soil (Magdič 2021, 245–253) revealed that the classification of soils, of primary importance for landscape archaeology, is the classification of soil divisions. The soils in the study area can be classified into two basic divisions: automorphic and hydromorphic soils (*Fig. 3*). The automorphic soils of the area include undeveloped soils, humus-accumulating soils and cambic soils. The most important common characteristic of automorphic soils is that they do not retain rainwater permanently or temporarily in any part of the profile, making flooding extremely rare. The water table is deep, so it never rises to the surface. Hydromorphic soils in the area studied include riverine soils, pseudogley soils and gley soils. The most important common characteristic of the hydromorphic soils is that they are directly and visibly influenced by at least one form of water, that is temporarily or permanently stagnant in at least part of the profile. The profile is either heavily soaked or contains water itself. Flooding is common in this type of soil.

During the analysis, I observed the distribution of soil types in the potential fields of each settlement. From a quality-of-life perspective, soil characteristics related to the ability to drain water are of particular importance. Automorphic soils form a drier space, while hydromorphic soils form a wetter space. In addition to the soil division, I have also observed other characteristics such as the gleying factor of the horizon, which is an indicator of water retention (Vidic et al. 2015, 30). As it turns out, gleying can also be present in cambic soils, which can have a very positive effect on yields per hectare.

2.3 EARLY MEDIEVAL FIELDS (SITE CATCHMENT ANALYSIS)

2.3.1 IDENTIFICATION AND AREA OF ARABLE LAND

The identification of potential Early Medieval arable land is based on the theory of central land cores, according to which the farming settlements of the period had their arable land in close proximity, usually on particularly favourable soils (Lozić 2024a in this volume with references). The input data of 'arable land' come from early 19th century cadastral maps, the so called Franciscean Cadastre, which are a reliable representation of the agricultural landscape not only in the pre-industrial period, but also before the land expropriation of 1848. They maps depict the last phase of the development of the feudal landscape, which by definition is feudal in origin and whose origins must be traced back to the Early Middle Ages (Štular 2011, 123). For the situation as depicted on the maps of the Franciscean Cadastre, we can speak of the achieved carrying capacity of the economic hinterland of a given village parcel (e.g., Zimmermann et al. 2009, 11). Thus, all land that was suitable for plowing and growing crops with the technical means available at that time is marked as fields. Land that is not marked as arable land is therefore generally not suitable as arable land. It follows that land not marked as arable land was not used as arable land in the Early Middle Ages either. The opposite is not the case (Lozić 2024b in this volume).

Štular (2006, 202–203, 207–209), in his study of the economic hinterland of the Early Medieval settlement of the Bled area, reviewed the results of previously established models for determining the economic hinterland of settlements. He compared them with his own measurements of the time it takes a person to walk from an Early Medieval settlement to the adjacent field. The reconstruction of the Early Medieval landscape of the Bled area with the field locations of each Early Medieval settlement was based on a multidisciplinary historical study by Pleterski (2013). He found that the field of each Early Medieval settlement in the Bled area was no more than a 6–7 minutes' walk away (Štular 2006, 207–209).

The similarity of contemporary agricultural implements in Central Europe suggests very similar basic agricultural practices, which were merely adapted to the specific physiographic characteristics. On this basis, we can assume that the distance from the settlement to the arable land was not more than 7 minutes even in the fertile Drava Plain.

To illustrate the arable areas of each of the Early Medieval settlements studied, polygons with a perimeter that can be reached within a seven-minute walk. The 'within a seven-minute walk' area were created using the Path Distance tool.[1] The basis for using this tool is a DEM, which is used to simulate the relief of the considered spaces. The DEM was created from a georeferenced ground point cloud, based on publicly available data (public data from the Slovenian Environment Agency: http://gis.arso.gov.si/evode/profile.aspx?id=atlas_voda_Lidar@Arso).

The interpolation of the points used to create the digital elevation model (hereafter DEM) was performed using the Natural Neighbour algorithm, which has proven to be very suitable for interpolating data points with irregular spacing. The DEM with a resolution of 10 × 10 meters proved to be the most efficient.

The slope walk exponent function (Tobler 1993) was used to calculate the difficulty of walking up and down the slope. The polygons generated reflect the distances from the centre of gravity of each of the Early Medieval settlements that can be reached within a seven-minute walk. The intersection of the arable areas on the Franciscean Cadastre maps and the areas within the '7-minutes' walk polygons' represents the potential arable areas of each of the Early Medieval settlements.

In the case of the settlements Malečnik – Pod Meljskim hribom, Maribor – Pobrežje, Močna – Vaški trg, Ptuj – Štuki-Marof and Pušenci – Cerkvišče, where the soils are now altered due to intensive human activities, The original soil divisions were reconstructed based on an analogy in the geology of the surroundings and relief. The numerical values of the analysis correspond to the corrected situations. The pedological map could not be reconstructed in the case of the settlement Ptuj – Grad, because the area is highly urbanised and extends over different geological substrates. Therefore, the settlement was excluded from the study.

The results of the analysis of the potential arable areas of the Early Mediaeval settlements showed significant differences (*Fig. 4*). From the smallest arable areas with only 7.6 ha (Malečnik – Pod Meljskim hribom), to 66.8 ha (Lancova vas – Na Pukli). In order to facilitate the analysis and evaluation of the data, The values for the arable area of each settlement were devided into

[1] All GIS operations in the study where performed with ArcGIS 10.6, ESRI, Redlands CA, USA.

No.	Settlement – site nane	Area of arable land (ha)
2	Malečnik – Pod Meljskim hribom	7.6
12	Jurišna vas – Ančnikovo gradišče	13.2
4	Slivnica – Srednji travniki	13.4
9	Ptuj – Turnišče	22.8
3	Močna – Vaški trg	23.3
16	Podlehnik – Murko	23.8
8	Spodnja Gorica – Cediljeki	24.3
13	Andrenci – Police	26.3
5	Spodnji Duplek – Srednje polje	30.5
15	Spodnja Gorica – Gmajna	35.5
7	Pušenci – Cerkvišče	38.4
6	Spodnje Hoče – Pod cerkvijo	44.7
1	Spodnja Senarska – Zgornje polje	46.6
10	Ptuj – Štuki-Marof	48.9
14	Maribor – Zgornje Radvanje	49
11	Maribor – Pobrežje	59.5
17	Lancova vas – Na pukli	66.8
	Average	**29.6**
	Median	**30.5**

Fig. 4: Arable land of the Early Medieval settlements, listed by area of arable land, from the smallest to the largest.

classes of 10 hectares. The result of this classification is shown in *Fig. 5*.

The study also examined the possible relationship between the size of arable land and the formation time of each settlement. The comparative graph shows that the differences in the size of arable land are not related to the time of the formation of each settlement (*Fig. 6*).

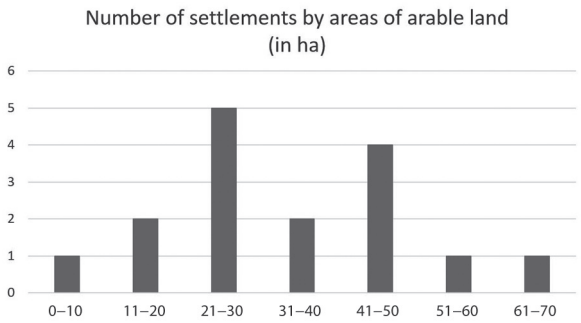


Fig. 5: Number of Early Medieval settlements and areas of belonging arable land, in classes of 10 ha.

2.3.2 THE SOILS OF THE SETTLEMENT AREAS

An analysis of the relationship between settlement sites and local soils showed that Early Medieval settlements were located on both automorphic and hydromorphic soils (*Fig. 7*). The study also focused on the possible relationship between the soil substrate and the dating of each settlement. It was found that, with the exception of Spodnja Senarska – Zgornje polje, all four settlements, which certainly date back to before the middle of the 7th century, were located on automorphic soils. However, the automorphic soils in the arable areas of Spodnje Hoče – Pod Cerkvijo, Slivnica – Srednji travniki and Spodnji Duplek – Srednje polje are partially gleyed, which has a positive effect on their fertility. It is only towards the end of the 7th century that settlements also appear more frequently on hydromorphic soils.

It can be seen that most of the settlements are located in the border area of pedological divisions: automorphic and hydromorphic soils (*Fig. 8*).

Considering the positioning of the fields in relation to the presence/absence of soils of a particular division, the following picture emerges: 15 of the 17 settlements are positioned in such a way that at least part of their

No.	Settlement – site name	Area of arable land (ha)	Formation (at the latest)
1	Spodnja Senarska – Zgornje polje	46.6	600
2	Malečnik – Pod Meljskim hribom	7.6	634
3	Močna – Vaški trg	23.3	634
4	Slivnica – Srednji travniki	13.4	640
5	Spodnji Duplek – Srednje polje	30.5	642
6	Spodnje Hoče – Pod cerkvijo	44.7	658
7	Pušenci – Cerkvišče	38.4	764
8	Spodnja Gorica – Cediljeki	24.3	764
9	Ptuj – Turnišče	22.8	764
10	Ptuj – Štuki-Marof	48.9	764
11	Maribor – Pobrežje	59.5	764
12	Jurišna vas – Ančnikovo gradišče	13.2	833
13	Andrenci – Police	26.3	860
14	Maribor – Zgornje Radvanje	49	860
15	Spodnja Gorica – Gmajna	35.5	875
16	Podlehnik – Murko	23.8	888
17	Lancova vas – Na pukli	66.8	888
	AVG	**29.6**	
	Median	**30.5**	

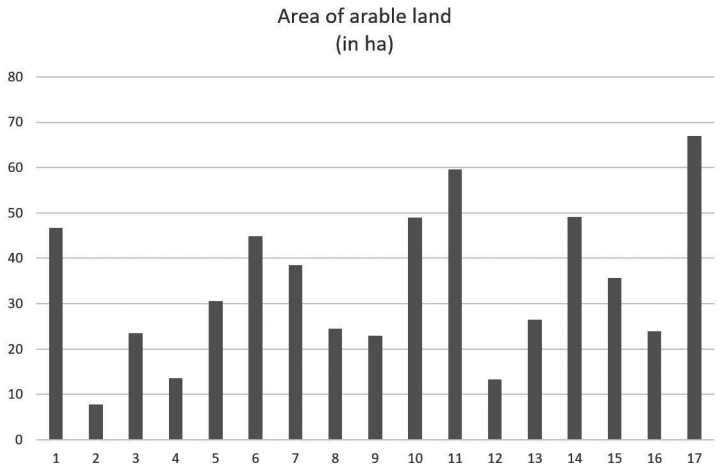


Fig. 6: Arable land size, compared to the time of the foundation of the settlement. In the graph, the size of the arable land is shown on the y-axis, the settlements are sorted from left to right, according to the time of the settlement formation time.

fields are located on hydromorphic soils. However, it should be noted that although all the arable areas of Slivnica – Srednji travniki are located on cambic soil, i.e., automorphic soil, a large part of the area is heavily gleyed (up to 50%) at least in part of the profile. Thus, it is a soil type that is a mixture of automorphic and hydromorphic soils. As for the soil type, the settlement Jurišna vas – Ančnikovo gradišče with fields on automorphic soils is an exception among the Early Mediaeval settlements of the considered area. It is located within the walls of a Late Roman fortress on the fringe of the Pohorje Mountains, at an altitude of 750 m above sea level. The choice of the location for this settlement was obviously not due to the selection of the most suitable soils for agriculture, but to other characteristics, where the factor of safety played a predominant role. It is likely that it was a settlement of indigenous people who moved to the Pohorje Mountains at the time of the collapse of the Roman state organisation and built their own self-sufficient economy, probably based mainly on animal breeding.

3. DISCUSSION

Paul the Deacon (c. 720–c. 799) notes in his writings that the area between Avaria (i.e., Pannonia) and Italy, where the Slavs lived, was still largely covered with "impenetrable forests" in the first half of the 7th century and the settlements were several days' march apart. According to Štih, the use of the term *saltus* suggests that Paul the Deacon is referring to an uncultivated forest (Štih 2015, 127). It is certainly worth taking a closer look at this statement of Pavel Diakon that the area of present-day Slovenia, including the considered area of the Drava Plain, was still mostly forested in the first half of the 7th century, because the statement also coincides with the results of archaeological research. As far as can be deduced from the analysis of archaeological sources, the area in question was most densely populated in the Roman period. Archaeological sites from this period account for about half of all known archaeological sites in the area (Magdič 2014, Fig. 5). The highest settlement density dates from the 2nd and 3rd centuries. For various reasons that historians have not yet been able to satisfactorily determine, people began to leave the area during the 3rd century, so most rural settlements were abandoned by the 3rd century (Horvat 1999, 255). The urban centre of the region, Colonia Ulpia Traiana Poetovio, also underwent far-reaching demographic changes during this period. The extensive urban settlement, which in the 2nd and 3rd centuries encompassed almost the entire area of present-day Ptuj and beyond, was transformed into a collection of small hamlets during the 4th century, undoubtedly losing its urban character. Before the middle of the 5th century, the town was practically abandoned (Horvat et al. 2003, 182–183).

It can be concluded that most of the considered area was forested from the end of the 3rd century. In temperate climates, the forestation of abandoned arable land is usually completed after a maximum of 150–200 years, when a dynamic equilibrium is reached and one can speak of a fully formed forest (Cojzer 2011, 12–14). Thus, the communities that began to settle the area in question towards the end of the 6th or beginning of the 7th century encountered a fully overgrown, forested landscape. From this we conclude that the former fields (dating back to the Roman period) were covered by a mature forest at that time. Thus, the first Early Medieval communities that settled the Drava Plain were not limited by the choice between cleared and forested areas when selecting the location for their settlements. An analysis of the potential fields of the Early Medieval settlements revealed that the majority of the studied settlements had available land, suitable for arable cultivation, ranging in size from 21 to 30 hectares (*Fig. 4*).

Settlement – site name	Formation (At the lastest)	Soil division
Spodnja Senarska – Zgornje polje	600	Hydromorphic soil
Malečnik – Pod Meljskim hribom	634	Automorphic soil
Močna – Vaški trg	634	Automorphic soil
Slivnica – Srednji travniki	640	Automorphic soil
Spodnji Duplek – Srednje polje	642	Automorphic soil
Spodnje Hoče – Pod cerkvijo	658	Hydromorphic soil
Pušenci – Cerkvišče	764	Hydromorphic soil
Spodnja Gorica – Cediljeki	764	Hydromorphic soil
Ptuj – Turnišče	764	Hydromorphic soil
Ptuj – Štuki-Marof	764	Hydromorphic soil
Maribor – Pobrežje	764	Automorphic soil
Jurišna vas – Ančnikovo gradišče	833	Automorphic soil
Andrenci – Police	860	Automorphic soil
Maribor – Zgornje Radvanje	860	Hydromorphic soil
Spodnja Gorica – Gmajna	875	Hydromorphic soil
Podlehnik – Murko	888	Hydromorphic soil
Lancova vas – Na pukli	888	Automorphic soil

Fig. 7: Soils at the individual settlement sites, according to pedological divisions. The settlements are arranged according to the time of their formation, from the oldest to the youngest.

No.	Settlement – site name	Formation (at the latest)	Automorphic soil	Hydromorphic soil	SUM (ha)
1	Spodnja Senarska – Zgornje polje	600	0	59.5	**59.5**
2	Malečnik – Pod Meljskim hribom	634	5.1	2.5	**7.6**
3	Močna – Vaški trg	634	19.4	3.8	**23.2**
4	Slivnica – Srednji travniki	640	13.4	0	**13.4**
5	Spodnji Duplek – Srednje polje	642	22.5	12.5	**35**
6	Spodnje Hoče – Pod cerkvijo	658	44.4	0.3	**44.7**
7	Pušenci – Cerkvišče	764	0	38.4	**38.4**
8	Spodnja Gorica – Cediljeki	764	0	7.5	**7.5**
9	Ptuj – Turnišče	764	22.4	0.5	**22.9**
10	Ptuj – Štuki-Marof	764	5.7	43.1	**48.8**
11	Maribor – Pobrežje	764	47.3	12.2	**59.5**
12	Jurišna vas – Ančnikovo gradišče	833	13.2	0	**13.2**
13	Andrenci – Police	860	23.7	2.6	**26.3**
14	Maribor – Zgornje Radvanje	860	25.7	23.3	**49**
15	Spodnja Gorica – Gmajna	875	17.1	26.2	**43.3**
16	Podlehnik – Murko	888	6.3	17.5	**23.8**
17	Lancova vas – Na pukli	888	48.9	17.9	**66.8**
	SUM (ha		315.1	267.8	582.9

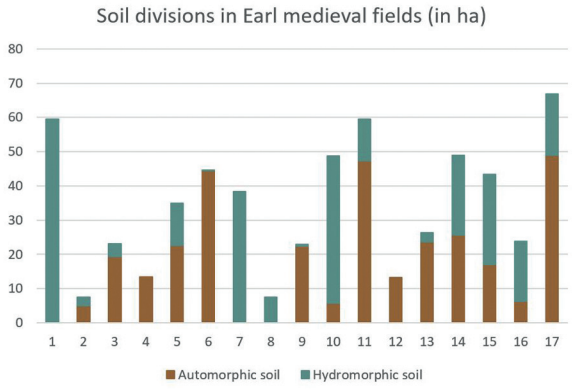


Fig. 8: Table and graph on the areas of the soil divisions in the fields of the Early Medieval settlements. The settlements are arranged according to the time of their formation.

This indicates that the average Early Mediaeval community living in a single settlement did not need more than 30 ha of land for its agriculture. However, with the method used, it was not possible to determine more precisely how large the actual fields of each community were. If we compare the size of the arable land of each settlement with the time of its formation, we can see that the size of the arable land did not depend on the time of the formation of each settlement (*Fig. 6*).

The soil characteristics of the potential fields were analysed to evaluate its arable potential. It was found that the Early Medieval inhabitants of the considered area settled on both drier and wetter soils. However, the factors that influenced the choice of settlement areas clearly varied over time. In the first phase, before the middle of the 7th century, sites with very specific environmental characteristics were selected for settlement. All of the settlements found in the first phase of occupation were located at the base of hills with loose, sandy, automorphic soils that were partially gleyed. With the sufficiently high moisture provided by the gleyed soils just below the slopes of the hills, from which rain water drained, the farmlands of the first Early Mediaeval farmers were among the most fertile arable lands in the area (see Repe 2010, 148). The first settlers therefore chose loose sandy soils for their fields, which could be cultivated by simple

agricultural tools, taking care to choose micro-locations where plants had sufficient moisture to grow.

The locations of the settlements from the late 7th century onwards indicate the introduction of a different agricultural tactic, in which the hydromorphic soils of the alluvial plains of the Drava River were also cultivated. These soils tend to be clayed and therefore can only be effectively cultivated with a plough, which not only cuts and crushes the soil but also turns it (on the use of the plough in the Early Middle Ages, see Pleterski 1987). Ploughshares with signs of wear (disproportionate wear), that occur in this type of use were found in treasure finds at the Razvanje – Poštela (Pahič 1985, 295–296) and Zbelovska gora – Gradišče (Bitenc, Knific 2015, fig. 17) sites. This type of ploughshares with enlarged leaf is typical for the area of western Pannonia between the 8th and 10th centuries (Henning 1987, 51, Fig. 21). Thus, the above-mentioned data can be interpreted as the introduction of a new cultivation technique in the second half of the 7th century, which includes the use of the plough, with which not only cuts and crushes the soil but also turns it. So to speak, an early example of the heavy plough. However, it is characteristic for the entire Early Middle Ages that the sites chosen for the settlements were located near the border between automorphic and hydromorphic soils, i.e., near the border between the dry and the wet world. This choice of settlement location made it possible to adapt agriculture to changing weather conditions, cultivating drier or wetter fields, depending on weather conditions. This tactic minimised the risk of total crop failure that could be caused by extreme drought or extreme humidity.

CONCLUSION

The first Early Medieval communities that began to settle in the area around the end of the 6th or the beginning of the 7th century were not limited by the choice between cleared and overgrown space when selecting the location for their settlements, because the arable land from the Roman period had been abandoned for more than two centuries and completely overgrown by mature forest. The present study has shown that settlement dynamics in the Drava Plain in the Early Middle Ages was significantly related to environmental factors, among which the pedological substrate in relation to the relief played a primary role. The main result of the study is the conclusion that the Early Medieval settlers of the Drava Plain chose as settlement sites the environments that best suited their specific technological and cultural agricultural practises at that time. In the first phase of settlement, they chose for their settlements dry areas at the foot of lower hills with loose sandy soils that could be cultivated by hand with a hoe or with a simple plough. Rainwater flowing down from the hills provided sufficient moisture for crops to grow. Before the end of the 7th century, however, people settled also wetter areas with clay soils, the cultivation of which required the use of more advanced agricultural technology, especially a type of plough, which as well as cutting and crushing the soil also turned it over. Only the introduction of this type of plough made it possible to use the vast river plains of the Pannonian world, now known as the 'granary of Slovenia', in an economically efficient way.

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