Estonian Journal of Archaeology, 2020, **24**, 2, 89–140
https://doi.org/10.3176/arch.2020.2.01

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# ENVIRONMENT AND SETTLEMENT LOCATION CHOICE IN STONE AGE ESTONIA

The location choice of Stone Age settlements has been long considered to be influenced by environmental conditions. Proximity to water and sandy soils are most typical examples of those conditions. The notion of the influence resulted from the evidence from a relatively small amount of sites. During the recent decades the number of known settlements has increased to a level where statistical assessment of relation between environmental characteristics and settlement location choice is possible.

To undertake this task we collected data about known Estonian Stone Age settlements and acquired environmental data of their locations using publicly available geological datasets. We provide univariate descriptive statistics of the distributions of variables describing site conditions and compare them to characteristics generally present in the environment. We experiment with a set of environmental variables including soil type, distance to water and a selection of geomorphometry derivatives of the digital elevation model.

Quantitative assessment confirmed previous observations showing a significant effect towards the choice of sandy, dry location close to water bodies. The statistical analysis allowed us to assess the effect size of different characteristics. Proximity to water had the largest effect on settlement choice, while soil type was also of considerable importance. Abstract geomorphological variables such as Topographic Position Index and Topographic Wetness index also inform us about significant effects of surface forms.

Differences of settlement locations during stages of the Stone Age are well observable. The environmental conditions of sites from the pre-pottery Mesolithic follow the general pattern but with the greater variation. Narva and Comb Ware stage settlement locations preferences are nearly identical to each other showing preference of sandy higher areas near the shoreline and indicating increased site investment. For Corded Ware period a new settlement mode is observable which is no longer directly related to water bodies and can be explained by semi-agrarian subsistence and decreasing dependence on aquatic resources.

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## Introduction

It has long been assumed that locations of Stone Age settlements are to a large extent determined by environmental conditions. Already in the mid-19th century, geologist and archaeologist Constantin Grewingk (1865, 110) claimed that in Stone Age Estonia people lived by the sea and rivers, before any of the sites from the period had actually been discovered in the area. Over time archaeological finds confirmed this idea and it has become so convincing that archaeological sites are used as proxy data for geological shoreline reconstructions (e.g. Veski et al. 2005; Rosentau et al. 2013). Proximity to shoreline (e.g. Jochim 1976, 55) is not the only environmental characteristic of a suitable site location; sandy soil (e.g. Kriiska & Tvauri 2002, 56; Huurre 1983, 41) and the position in the local landscape (e.g. Plog & Hill 1971; Jochim 1976; Kvamme & Jochim 1990) are also considered important. Those environmental features are also present in an implicit mind model, often described as a “gut feeling” that guides archaeologists during the search for sites in the landscape.

Currently no statistical analysis has been made to quantitatively assess the influence of environmental features on Stone Age settlement site locations in Estonia. In this paper we undertake this task, analysing the features of site locations and exploring regularities appearing at the level of the whole settlement pattern.

Environmental statistical (locational) analysis of archaeological sites has been a common practice for decades, involving research on several periods and regions (e.g. Hahn 1983; Jochim 1976; Kvamme & Jochim 1990; Kvamme 2005) including the studies of Bronze Age and Iron Age sites in various regions of Estonia (Haav 2014; Kimber 2016). The purpose of most of these studies has been to develop inductive models for predicting the archaeological potential of certain regions and finding new sites. As results have shown, predicting variables vary depending on both area and research period, although the most significant tend to be proximity to water, soil type and geomorphological features (e.g. Kvamme & Jochim 1990).

In this study we analyse Stone Age settlement site locations in Estonia and their environmental conditions. Recent research has significantly widened our knowledge with the addition of new site locations and dates. We statistically describe the accumulated data and study the relationship between currently observable geological variables and past settlement choice. By comparing statistics for different stages of the Stone Age we explore how the site selection principle changed over time and re-evaluate the existing qualitative explanations for settlement location choice in a quantitative context. The methodological goal of the paper is to study the usefulness of environmental variables for describing the Stone Age settlement choice. Exploring the relationships between variables is outside the scope of this paper.

To achieve our aim we collect available data about the geological characteristics of the environment, including soil type, approximate distance to shoreline and geomorphological variables derived from the digital elevation model (DEM). We perform univariate statistical analyses of the environmental variables of site locations and compare them for the different stages of the Stone Age. We group the variables of sites by their stages of the Stone Age and compare the statistical distribution of environmental variables of the groups and assess how they differ from environmental data and each other. For variables with a significant impact on settlement choice we provide descriptive statistics and use them in archaeological interpretations.

## Materials and methods

### *The history of the discovery of Estonian Stone Age settlements*

The first Stone Age site was found in Estonia in the year 1886. The discovery of the Kunda Lammasmäe settlement by Grewingk was methodologically effective even in the modern sense. Finds collected over more than a decade, the palaeogeographic reconstruction of the ancient lake, landscape analysis and skilled fieldwork all played a role in the discovery (Grewingk 1882; 1884; 1887). After that, no Stone Age settlements were found for half a century. This was due to the fact that the study of the Stone Age declined after Grewink's death, and work focused on the Iron Age. The only place where attempts were made to find settlements in the concentration area of Stone Age finds was the lower reaches of the Pärnu River, but the fieldwork did not yield results (Frank 1906; Glück 1906; see also Kriiska 2000).

In the early 1920s, the first new discovery of a Stone Age settlement was made during the excavation of a Metal Age site (Spreckelsen 1925). Several Stone Age settlements have been found while studying settlements from other periods, including a significant number for the Corded Ware stage in particular. The number of found settlements gradually grew only in the 1930s and 1940s, when Richard Indreko began to study locations with many stray finds (Indreko 1932; 1948a). The sites he methodically discovered, together with others found accidentally in construction and excavation works since the 1950s (e.g. Gurina 1967; Jaanits 1979) or in other searches (e.g. Jaanits & Jaanits 1975), became the main focus of research for decades. Long-term and large-scale excavations of the sites were carried out (mainly by Lembit and then also by Kaarel Jaanits) but settlements were not systematically searched (with a few exceptions), not even those in the immediate vicinity of excavated settlements (for a more detailed discussion of Estonian Stone

Age history, see Kriiska 2006). The lack of surveys for finding new sites seems to have been rooted in the belief that Stone Age settlements are very scarce. Jaanits justified the lack of Mesolithic settlements in Estonia in the book "Prehistory of Estonia" (Jaanits et al. 1982, 48), saying "If this can be partly explained by the fact that the cultural layers of settlements have not been discovered, the main reason must be the sparseness of the settlement at that time." The work reflected the state of the late 1970s and presented all the known Stone Age settlements, including 10 Mesolithic (pre-pottery), 7 Narva, 16 Comb Ware and 19 Corded Ware stage settlements.

The situation changed only in the mid-1990s as a result of contacts with Finnish archaeology. Participating in and studying archaeological fieldwork in Finland provided both the methodological skills necessary for organising fieldwork and, above all, the knowledge that the current source base in Estonia was not sufficient for further research. From 1994 the systematic identification of settlements began in Hiiumaa and the Narva region (e.g. Kriiska 1995b; Kriiska & Lõugas 1999) and then continued in many other places in Estonia (Vedru 1996; 1997; 1998). The main basis for this was simple (often unwritten) palaeoreconstructions based on already known settlements on the ancient shores of the Baltic Sea and Lake Võrtsjärv. Intensive landscape surveys were carried out, during which open land sites (fields, forest roads, etc.) were inspected and test pits were dug either at selected locations or en masse on prehistoric coastal and shore formations. Exploration trips often took place in parallel with excavations (e.g. Kriiska 1998; Kriiska & Lõugas 1999; Kriiska & Saluäär 2000a), but special expeditions of different lengths were also organised (e.g. Kriiska et al. 2004). Most settlements were discovered during such expeditions, including the sites found in ploughed fields in central and southern Estonia as a result of surface clearing. A number of settlements were also found through the examination of excavated material from previously excavated antiquities (e.g. Kriiska et al. 2004, 36; Jussila & Kriiska 2006, 44).

In addition to sites found close to large bodies of water, Mesolithic settlements gradually began to be found on the banks of small rivers and lakes (for a discussion, see Kriiska & Kihno 2006, 46), and a few settlements with no relation to water bodies at all were also found (Jussila & Kriiska 2006).

On the whole, the sites have been found using different sources and methodologies: reports from the public, archaeological research of later Prehistoric periods, surveys based on stray finds and surveys based on former shorelines using both fieldwalking and bulk digging of test-pits in prospective areas.

In all thoroughly studied regions (Estonian islands, northern and north-eastern coastal area and former shorelines of Lake Võrtsjärv) a large amount of locations with different environmental conditions have also been surveyed. Usually only some of the surveyed areas include finds from the Stone Age. During archaeological fieldworks of the last two decades it has been a standard practice to survey the region surrounding the area of research including locations outside the observable pattern of sites. This all provides confirmation that the observed pattern is not only the result of a search pattern but is grounded in empirical reality.

In addition to the "negative sample" other types of sites like Iron Age sites and burials have been systematically surveyed (results of the surveys have been regularly published since 1996 in the *Archaeological Fieldwork in Estonia*). Recently large-scale surveys of natural flint stone have provided comparative reference material to the Stone Age archaeological site distribution (Kriiska et al. 2018).

### *Dataset*

The dataset presented here is based on the previously described Stone Age research and includes data (Appendix 1) from recent systematic surveys conducted until 2017 (some sites discovered later were included as well). The sites are classified into four stages of the Stone Age: pre-pottery Mesolithic (9000–5200 cal BC), Narva (5200–3900 cal BC), Comb Ware (3900–1800 cal BC) and Corded Ware (2800–2000 cal BC). The classification of the sites is based on finds and related typo-chronology using the existing radiocarbon and other dating methods, if possible. The last two stages have significant overlap in time and are distinguished by pottery types. The number of sites included is 410, with 244 pre-pottery Mesolithic sites, 39 sites with Narva pottery, 60 sites with Comb Ware and 67 sites with Corded Ware.

Only the sites with known exact locations were incorporated into the database. The locational data was then used to retrieve environmental information corresponding to each site forming an environmental database of the Stone Age settlement. As sources we used available spatial environmental data sets including soil and current water bodies data as vector layers and DEM as raster layers, all of which have been made available by the Estonian Land Board (2018). Because of the large area covered we used raster layers with the resolution of 5 m.

### *Proximity to water*

We preprocessed all the data sources for the purposes of our research. Because of the significant change in water levels during the long period from the Stone Age to the present, site distances to water could not be directly derived from contemporary maps. The area under study has been affected by the changing water level in the Baltic Sea and the post-glacial land uplift, which has "tilted" it. Erosion and local hydrological changes have modified the environmental conditions as compared to the period of habitation, especially for sites from the oldest Mesolithic period.

The shoreline configurations of water bodies have changed over time for various reasons. Their unique histories require individual approaches to assess the placement of sites related to each body of water. The Baltic Sea, whose shoreline has changed significantly and which is closely linked to past settlements, has been thoroughly researched in Estonia (e.g. Jussila & Kriiska 2004), mostly focusing on local areas like Pärnu bay (Veski et al. 2005; Rosentau et al. 2011; Habicht et al. 2017; Nirgi et al. 2020), Tallinn Bay (Muru et al. 2017), Narva Bay (Rosentau et al. 2013; Ryabchuk et al. 2019), Hiiumaa (Lõugas et al. 1996; Kriiska 2004, 107 ff.) and Ruhnu Island (Muru et al. 2018).

The shores of bigger lakes have also shifted because of the water level change and land uplift. While the Holocene history of Lake Võrtsjärv (e.g. Moora et al. 2002; Moora & Raukas 2003) has been studied relatively thoroughly from the perspective of the Stone Age settlement (e.g. Tallgren 1922, 31 ff., figs 4, 5; Indreko 1934; Moora 1990; Kriiska & Johanson 2003), less research has been conducted on the hydrological history in relation to human habitation by Lake Peipsi (e.g. Yanits 1959b, 18 ff.; Roio et al. 2016, 225). Although rivers are contained in riverbeds and are thus easier to trace, their courses often change and their banks are often dynamic. In several cases they flow in valleys created by much older (glacial) geological conditions.

For this reason we estimated the distance to past shorelines using data from the current shoreline, palaeoshoreline reconstructions, DEMs and also archaeological interpretation of the sites, employing different strategies for different contexts. For rivers we were able to measure the distance to the current riverbank or a historical riverbank in the event of an existing palaeoreconstruction of a connected lake or coastal region. For lakes we measured the distance to the current shoreline or a clearly observable palaeoshoreline. For sites connected to the Baltic Sea and Lake Võrtsjärv we measured site distances using palaeoreconstruction of their shorelines.

Because settlement locations are defined by just one point and we do not know the size of the site, we rounded the distances to the closest 50 m. The resulting estimation is of limited accuracy but is sufficient to assess shoreline connectedness in general. We were only able to include larger bodies of water, and small streams were excluded as no reliant information on their past hydrological conditions could be found. This means that sites distant from the shoreline did not necessarily lack natural drinking water sources, but they did not have close access to water providing aquatic resources and the possibility of boat use.

### *Geomorphological variables*

Available DEMs of settlement areas open up opportunities for further exploration of settlement choice in relation to the geomorphology of site locations. This can be studied through geomorphometry – the measurement and mathematical analysis of the configuration of the earth's surface. The analysis is then based on quantified geomorphological characteristics of site locations and comparisons with overall environmental characteristics.

We used a set of variables that have been already tested in archaeological research (e.g. Kvamme & Jochim 1990; Kvamme 2005) to describe settlement locations in relation to the environment. We also included a set of variables used in ecological models (Amatulli et al. 2018). Those variables include simple local DEM derivatives describing the morphology of a location such as slope, aspect and various measures of surface curvature.

We also included several more complex DEM derivatives that are linked with the elements (water, wind, earth, sunshine) of the environment. The Topographic Wetness Index (TWI) is used to describe topographical control of hydrological processes and is calculated as a function of the slope and the upstream catchment area (Sörensen et al. 2006). Wetness has been shown to be related to many natural processes such as soil formation (Moore et al. 1993), and it has also been used in archaeological research to assess historical agricultural land use (Andresen 2008).

The Convergence Index (Köthe & Lehmeier 1993; Kiss 2004) describes the hydrological convergence of a location, often used in hydrological calculations. A lower location in comparison to the surrounding areas draws in flows, while a location with a higher Convergence Index is a starting point for flows and a Convergence Index of 0 describes locations where flows pass through.

Although the Convergence Index is mostly useful for hydrological research, the variable might describe influences on human perception of the location. A similar measure, the Topographic Position Index (TPI; Guisan et al. 1999), describes the prominence of a location in the surrounding area and is thus often used in landform classification algorithms. A higher TPI indicates a higher elevation in relation to the surrounding environment, and vice versa. The measure has been used in archaeological research to show the prominent locations of Bronze Age graves (De Reu et al. 2011), among other research. As TPI measures prominence within a certain radius, we experimented with different radiuses of 50, 250, 500 and 1500 m. The statistical effect size measures of the TPI with different radiuses can give us information about the range in which topographic prominence was most important for settlement location choice.

The Morphometric Protection Index (MPI), also termed positive openness, expresses the degree of dominance or enclosure of a location in the surrounding landscape. It is an angular measure of the relationship between relief and horizontal distance and incorporates the viewshed concept. It is calculated from multiple zenith and nadir angles – here along eight azimuths (Yokoyama et al. 2002). Higher locations with better views have a higher MPI, while locations hidden in the valleys have a lower MPI.

To explore the terrain ruggedness of the site locations we experimented with three measures: the Vector Ruggedness Measure (VRM; Hobson 1972), the Terrain Ruggedness Index (TRI) and the Surface Roughness Index (LSRI; Beasom et al. 1983).

The wind exposition index (Böhner & Antonić 2009; Gerlitz et al. 2015) expresses how open a location is to wind, taking into account all directions cumulatively using angular steps. Potential incoming solar radiation (Insolation Index; Böhner & Antonić 2009) describes the yearly solar radiation to which a location is exposed. The index could give an indication of past preferences: did Stone Age people prefer settlement locations in direct sunshine or in the shade?

It must be kept in mind that these variables are not statistically independent since they are derived from the same data source. To derive the geomorphological variables from the DEM we used SAGA GIS 7 (Conrad et al. 2015). Appendix 2 contains a full list of variables used with further details.

### *Variables describing soil*

Suitable soils are essential for an agrarian economy, but soil also determines the local vegetation and habitat of other organisms influencing hunter-gatherer subsistence. Soil is also closely related to the water regime of the location: sandier soils drain away water but soils with a high clay consistency collect water. To acquire data about the soil characteristics in settlement locations we used contemporary soil data provided by the Estonian Land Board (2018). The data covering the whole country contains classifications and information about soil texture. Although the data resolution is uneven, it provides enough information to give meaningful insights into the relationship between soil characteristics and site selection. For this research the distribution of soil types from archaeological sites was compared to the overall distribution of soil types in the whole country.

Because of the large number of soil classes in the available soil classification it was generalised using a classification developed to reflect soil genesis, structure and fertility (Astover 2005). It has been argued that a contemporary soil classification might not have a good overlay with concepts of soil as seen in the past (Kvamme 2005, 5; Verhagen & Whitley 2012, 57), so quantifiable variables and more abstract categories are preferable. To overcome this problem we extracted information on the soil texture of each settlement location available in the existing dataset. Using soil texture standards (Astover et al. 2017) we quantified the measures of soil rustiness and clayness, respectively the share of large fractions in the soil and the percentage of clay present in the soil. These new variables enabled us to move from the commonly used soil categories to a quantitative approach that was better suited to statistical analysis.

### *Statistical method*

To evaluate the relationship of each variable with settlement choice we analysed the distributions of the variables. The distributions were compiled using the location of the sites, grouped together according to the stage of the Stone Age in which each site was inhabited. We compared them with each other and with samples taken from the environment.

The goal of the comparison is to check whether the variable values are just random environmental characteristics or whether they contain regularities, implying that they are related to a location choice made by past inhabitants.

To test the existence of non-random differences between the site and environmental samples we used the Kolmogorov–Smirnov (K–S) test. The K–S test measures the divergence between known Stone Age sites and expected cumulative frequency distributions of environmental characteristics (Siegel & Castellan 1956, 47 ff.; Shennan 1988, 53 ff.). The test is an established methodology in archaeology because of its ability to compare distributions with very different sizes (Wheatley & Gillings 2002, 136 ff.) and its suitability for continuously distributed geo-environmental data (Kvamme 1990). The K–S test indicates the statistical significance of the difference between variable distributions, thereby proving the reliability of the result. But to gain insights into causal processes of settlement choice we also needed to evaluate the effect size, especially since the variables used in the current study are not statistically independent.

The effect size was assessed using Vargha and Delaney's A measure (Vargha & Delaney 2000). The A measure estimates the difference between two samples using the probability that a random variable pulled from the first (settlement) distribution is larger than a random variable pulled from the control (environment) distribution. The value of A ranges from 0 to 1, with 0 indicating that all the site values have higher scores than the environmental values, 0.5 that they are the same, and 1 that all the site values have lower scores. The A statistic has been recommended for cases when parametric tests cannot be applied (Li 2016). It has also recently been applied to geomorphological data in archaeology (Weaverdyck 2019).

For the variables which demonstrated statistically significant ($p$ value < 0.05) differences, with A more than 0.647 or less than 0.353, descriptive statistics were calculated and interpreted. The A statistic together with descriptive statistics of variable distributions gave us indications about the size and direction of the effect and was used to interpret the relationships between site selection and environmental preferences during different archaeological periods.

The sample of environmental data was generated by randomly picking 10,000 points from all areas in the used raster data. All of Estonia was not used because of limited computational resources, so overall distributions might have a bias towards the topography of regions with known archaeological sites. We do not consider this to be a problem because the differences discovered between the site and environmental distributions would be even more significant if using data from the whole country.

## Environmental variables and site selection

### *Proximity to water*

The statistical analysis of the distribution of the sites' proximity to water confirmed current knowledge about water connectedness in the Stone Age. The majority of the sites were situated close to water, with a mean distance of 260 m from the centre of the site to the respective shoreline. As compared to the random sample pulled from the environment, the effect size of the closeness to water is significantly large (A statistic = 0.08; K–S $p$ value = 1.35e-187), reflecting the major influence of closeness to water on settlement choice.

There were also significant differences in distance distributions of sites grouped by different typo-chronological classes. The mean distances of the classes are fairly similar (pre-pottery Mesolithic 141 m; Narva stage 51 m; Comb Ware stage 53 m), with the exception of the Corded Ware stage sites (779 m). In Fig. 1 the distances to water are visualised as a box plot. The Narva and Comb Ware stage sites exhibit a very similar tendency towards closeness to water, with almost all sites being less

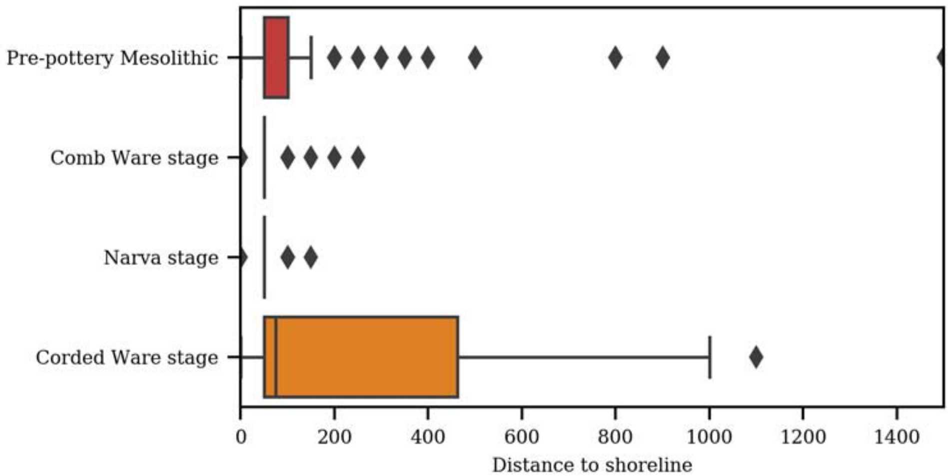


**Fig. 1.** Distribution of sites' proximity to waterfront visualised as a boxplot.

than 100 m from the shoreline and even the outliers being situated less than 250 m from the shoreline.

The pre-pottery Mesolithic sites are also close to water, with 75% of the sites at a distance of less than 100 m. The site distance distribution includes a lot of outliers which could be an indication of higher mobility and varied site functions, e.g. temporary hunting camps (e.g. Jaanits et al. 1982, 40; Kriiska 2004, 21; Jussila & Kriiska 2006, 47).

The sites with Corded Ware pottery show a different relationship with water bodies. The effect of closeness to water is still large but an A statistic of ~0.25 expressed a significantly smaller effect than the values of ~0.03 for other periods. Although most of the sites are on the river bank and lake shores (37 shore sites and 8 shore-connected sites), with a median distance of only 85 m, a new habitation mode which does not seem to be constrained by bodies of water is observable.

*Variables describing soil*

The Estonian Stone Age settlement sites have been described as predominantly situated on sandy soils. This can be explained by the fact that sandy soils drain water, thus providing dry and pleasant locations (e.g. Kriiska 2004, 56). To test the hypothesis with empirical data and analyse the sandiness of the Stone Age sites we used the soil formulas of the site locations from the Estonian Land Board database. We grouped the sites by period and compared their clayness distribution to that of the whole environment.

The results confirm previous observations that the Stone Age sites are situated on more sandy soils (e.g. Kriiska & Tvauri 2002, 56; Huurre 1983, 41). As the soil sandiness effect varied for different stages we considered them separately. Surprisingly, the pre-pottery Mesolithic sites were not significantly different from the environment while the Corded Ware stage sites had a small tendency towards sandiness (A statistic = 0.253, *p* value = 0.0002). Narva stage sites (A statistic = 0.195, *p* value = 3.651e-10) and Comb Ware sites (A statistic = 0.238, *p* value = 2.014e-11) showed a large effect.

Figure 2 illustrates the comparison of site soil clayness with expected clayness. A tendency to select sandy soils is visible, as soils with a clayness of 10% or less are used significantly more than would be expected by random settlement choice. The preference is especially clear for sites from periods with pottery, with almost all Narva stage sites being situated on soils with clayness of less than 20%. Corded Ware stage sites were also found on soils with higher clayness; the tendency towards placement on sandy soils for these sites is less significant than for Narva and Comb Ware stage sites.

For pre-pottery Mesolithic sites, despite the general effect of higher than average clayness, we can still see the importance of sandy soils. Soils with higher than 30% clayness were found in only some instances. For some reason, fewer sites than expected were situated on fine sands, and there are several outliers on soils with high clayness. The sites with Narva and Comb Ware also tend to be situated on soils with lower soil rustiness (Fig. 3), with significant numbers of sites on soils with no stones in them.

The soil types in sites grouped by soil classification (Fig. 4) reveal that Stone Age people preferred locations with albeluvisols and for sites with pottery also podzols.

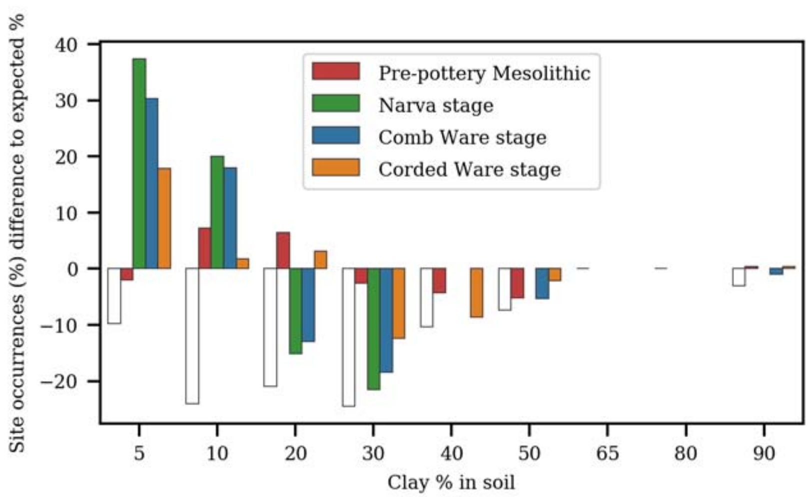


**Fig. 2.** Clayness of soil as a percentage of sites situated on soils with a given clayness. The plot is visualised as a comparison with the number of soils with the same clayness in the environment, thus showing the difference with the expected distribution. The white bars are included to show the percentage of soils of corresponding type in the environment.

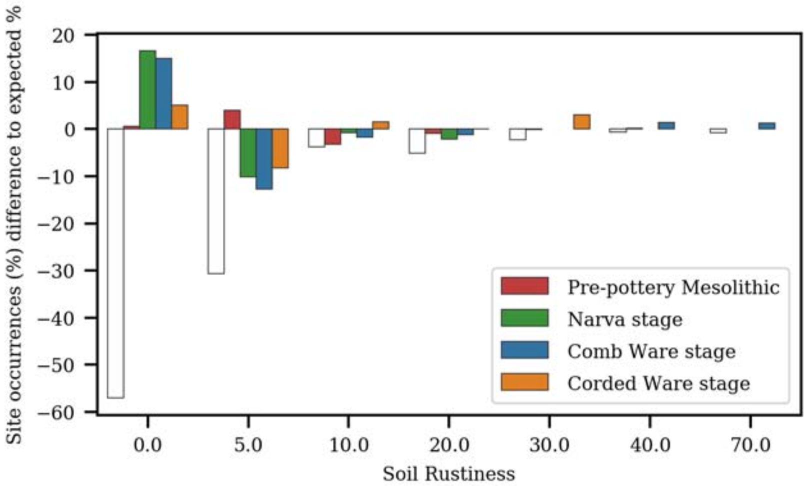


**Fig. 3.** Soil rustiness as a percentage of sites located on soils with a given rustiness. The plot is visualised as a comparison with the number of soils with the same rustiness in the environment, showing the difference with the expected distribution. The white bars are included to show the percentage of soils of corresponding type in the environment.

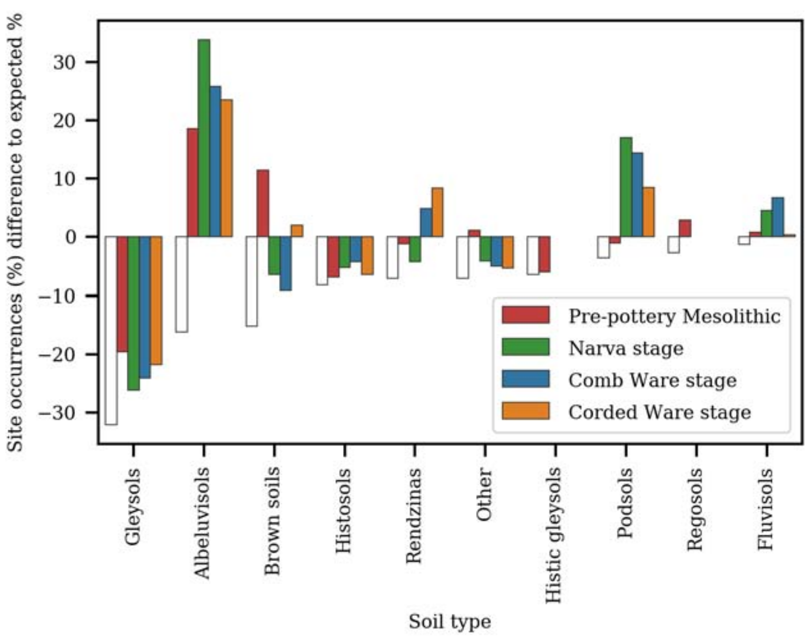


**Fig. 4.** Distribution of soil types compared to distribution of soil types in the environment. The white bars are included to show the percentage of soils of corresponding type in the environment.

Almost no sites are present on gley soils. The Stone Age stages with pottery differ remarkably from the pre-pottery Mesolithic, for which the effects are less pronounced or even opposite, e.g. the high presence of sites on brown soils. Although the aforementioned regularities are significant, site selection principles are in general more effectively described by the clayness of the soil than by the soil classification.

*Variables describing soil*

The Estonian Stone Age settlement sites have been described as predominantly situated on sandy soils. This can be explained by the fact that sandy soils drain water, thus providing dry and pleasant locations (e.g. Kriiska 2004, 56). To test the hypothesis with empirical data and analyse the sandiness of the Stone Age sites we used the soil formulas of the site locations from the Estonian Land Board database. We grouped the sites by period and compared their clayness distribution to that of the whole environment.

*Geomorphological variables*

The relationship of 19 geographical variables to settlement choice was assessed and most of them were found to be significant (Table 1). The variables with a significant effect on settlement choice are described and interpreted below.

The slope of the ground is one of the most easily perceivable geomorphological characteristics for a person at the location. As expected, inhabitants preferred settlement locations on slight slopes. The distribution of slope values at site locations (Fig. 5) shows a significant influence toward a bigger slope (A statistic = 0.671, *p* value = 1.43e-37) in comparison to the environment, reflecting a clear preference in settlement choice. Some differences between slope distributions in different Stone Age stages can also be observed. Sites with Narva-type pottery were situated on the steepest slopes (mean 0.056 radians), and pre-pottery Mesolithic sites were mostly on flatter ground (mean 0.046 radians), but the latter had also more outliers.

Since settlement choice is related to the slope of the environment we also analysed the direction of the slopes. The east-west direction has a small effect (A statistic = 0.625; *p* value = 1.151e-20) towards the east, and the south-north direction has a medium effect (A statistic = 0.665; *p* value = 2.072e-27) towards the north. To explore the directionality we visualised the variable ASPECT as a radial plot (Fig. 6). For the visualisation we only selected sites with a slope greater than 0.07 rad.

For the pre-pottery Mesolithic sites no general preference towards any slope direction is observable but for Narva and Comb Ware stage sites there is a preference towards sites on slopes directed to the south and south-west. Southward and south-east facing slopes can be optimal for more sunshine, but the solar insolation analysis (variable SOLAR) indicates a small negative effect for sites with pottery and a small positive effect for the pre-pottery Mesolithic. The directionality might be influenced by the general topography of the region, e.g. the direction of the water from the site location if the settlement was situated close to the waterfront. A certain skewness

**Table 1.** Used environmental variables

| Variable | Description | A statistic | K–S test *p* value |
|---|---|---|---|
| D_WATER | Distance to water | 0.089; large | 1.356e-187 |
| CLAYNESS | Soil texture as % of clay content | 0.398; small | 8.295e-10 |
| RUSTINESS | Soil rustiness | 0.527; negligible | 0.021 |
| SLOPE | Slope | 0.671; medium | 2.936e-29 |
| C_PROF | Profile curvature | 0.55; negligible | 7.455e-05 |
| C_TANG | Tangential curvature | 0.515; negligible | 0.354 |
| C_MAXI | Maximum curvature | 0.562; small | 9.247e-05 |
| C_MINI | Minimal curvature | 0.503; negligible | 0.489 |
| EAST | Eastness; part of ASPECT | 0.625; small | 1.151e-20 |
| NORTH | Northness; part of ASPECT | 0.665; medium | 2.072e-27 |
| VRM | Vector Ruggedness Measure | 0.707; medium | 7.249e-33 |
| ROU | Terrain Roughness | 0.682; medium | 2.318e-33 |
| TRI | Terrain Ruggedness index | 0.752; large | 8.378e-51 |
| C_INDEX | Convergence index | 0.52; negligible | 1.676e-05 |
| WEXPO | Wind exposition | 0.603; small | 2.238e-12 |
| SOLAR | Solar radiation | 0.466; negligible | 0.004 |
| TWI | Topographic wetness index | 0.321; medium | 3.76e-25 |
| MPI | Morphometric protection index | 0.617; small | 1.842e-10 |
| TPI10 | Topographic position index (50 m) | 0.692; medium | 6.255e-37 |
| TPI50 | Topographic position index (250 m) | 0.676; medium | 8.52e-36 |
| TPI100 | Topographic position index (500 m) | 0.718; medium | 1.539e-50 |
| TPI300 | Topographic position index (1500 m) | 0.691; medium | 3.482e-44 |

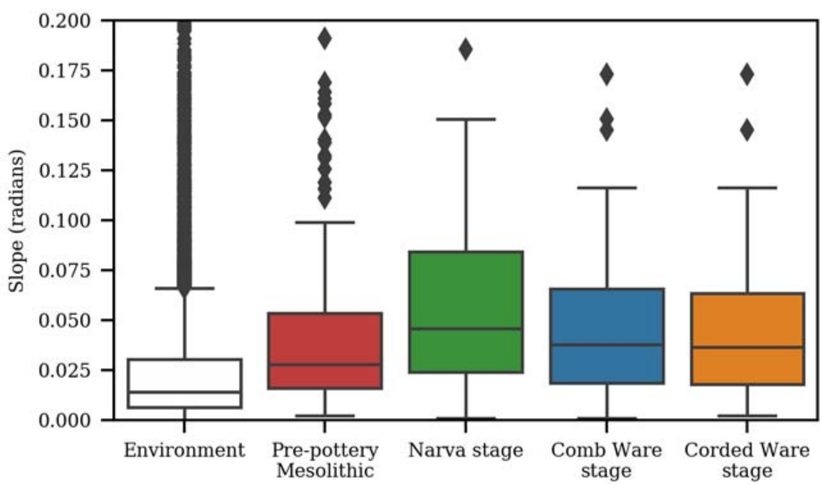


**Fig. 5.** Boxplot illustrating the distribution of slope (in radians) in settlement site locations in comparison with the environmental sample.

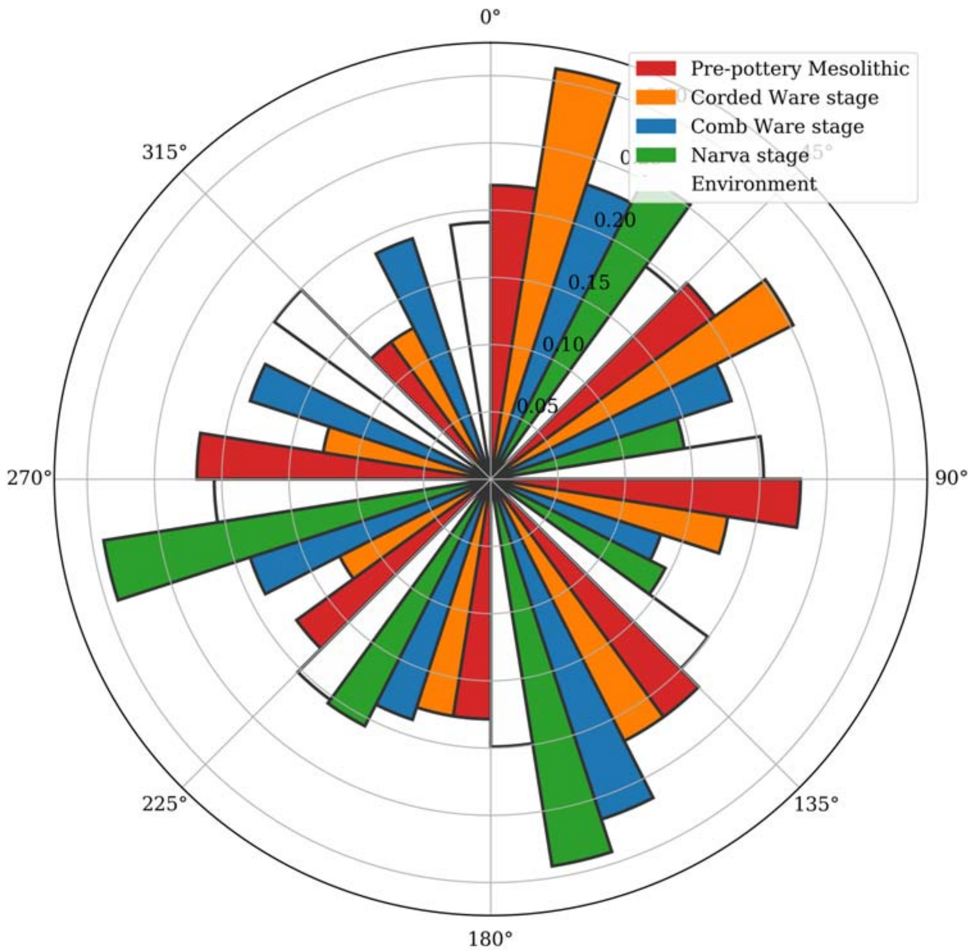


**Fig. 6.** Radial histogram visualising slope direction (aspect) for sites with a slope of more than 0.07 rad compared to that of the environment.

of the data is especially clear for the Narva stage sites, because of the small sample of which 28% (11 sites) are from the same Riigiküla micro-region facing the former lagoon in the south.

Surprisingly, the sites with Corded Ware have a slight tendency to have slopes towards the north and north-west. This might be caused by the fact that the Corded Ware stage site distribution is dominated by inland sites on the Klint plateau of northern Estonia, which slope towards the north.

Variables describing local surface curvature (profile curvature, tangential curvature, minimal and maximal curvature) of the site locations did not show any significant effects.

In contrast with the local surface curvature, the general ruggedness of the environment was found to be strongly related to site location. All of the tested measures give significantly different statistical distributions for sites in comparison to the general environment (VRM: A statistic = 0.707, medium; *p* value = 7.249e-33; TRI: A statistic = 0.752, large; *p* value = 8.378e-51; LSRI: A statistic = 0.682; medium, *p* value = 2.318e-33). All measures clearly indicate that the settlement sites are situated on a more rugged landscape than the environment in general, with TRI (Fig. 7) expressing the strongest effect. The sites with pottery tend to be situated in a more rugged environment than the pre-pottery Mesolithic sites, probably as a result of the different nature of the observable sites.

Wind exposure (Fig. 8) was calculated with the Wind Exposition Index tool and it showed that Stone Age sites are more exposed to the wind than the overall environment (A statistic= 0.603; small; *p* value = 2.238e-12). Pre-pottery Mesolithic sites are more sheltered than sites with pottery. Corded Ware stage sites were found to be in significantly windier locations (A statistic = 0.682, medium; *p* value = 4.88e-07). It is possible that these results do not reflect the effect of wind on settlement location choice but rather the fact that sites were situated on shorelines which are more exposed to wind. The pre-pottery Mesolithic sites have less wind exposure because past water bodies have retreated and they are no longer directly on the shoreline.

A similar tendency appeared when analysing the topographic openness of the location. The variable was calculated using the Morphometric Protection Index Model in SAGA GIS. Again, the distribution of settlement site locations showed a tendency towards openness as compared with the surrounding environment (A statistic = 0.617, small; *p* value = 1.842e-10), with sites with Narva-type pottery being in the most open places and pre-pottery Mesolithic sites being in the least open places. As with WEXPO, the variable is probably related to the closeness to water, but the relationship between both variables has yet to be statistically proven.

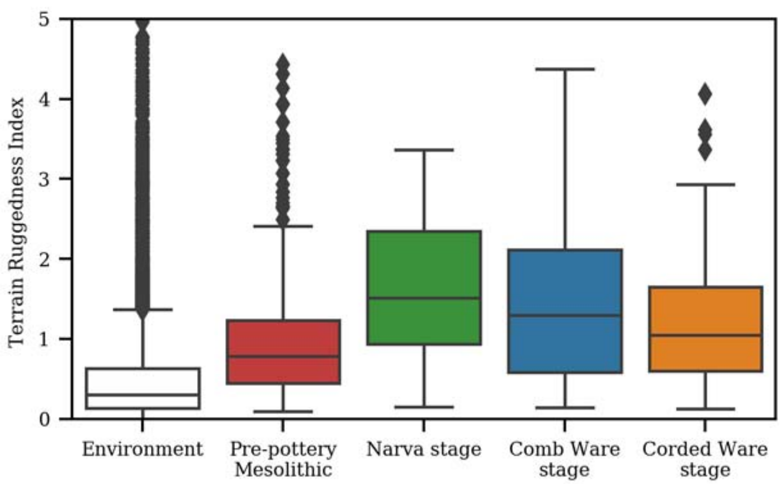


**Fig. 7.** Box plot of Terrain Ruggedness Index (TRI) values of the site locations grouped by period and compared to the environment.

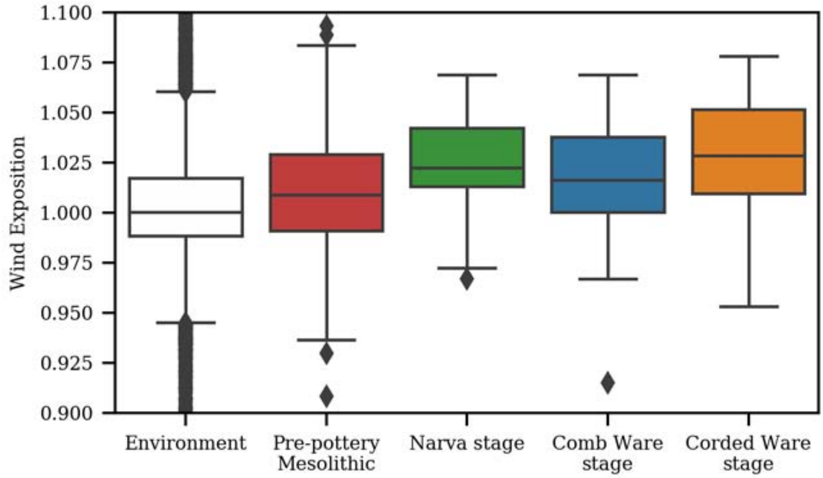


**Fig. 8.** Box plot of Wind Exposition Index (WEXPO) values of the site locations grouped by period and compared to the environment.

One of the reasons that has been used to explain the choice of sandy areas for settlements is their dry nature, since the water drains away through the sand. To check the importance of the dryness of the location we used the Topographic Wetness Index (TWI; Fig. 9). The TWI of locations chosen for settlement sites appears to be considerably lower than the environmental location sample (A statistic = 0.321; medium; *p* value=3.76e-25), confirming the importance of dryness for

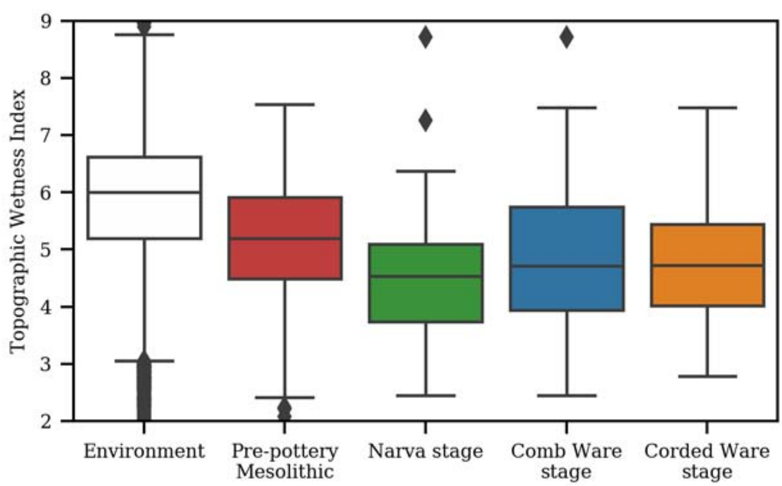


**Fig. 9.** Box plot of the distribution of Topographic Wetness Index (TWI) values in site locations in comparison to the environmental sample.

location choice. The result is especially meaningful given that most of the sites are close to water bodies or wetlands. It clearly shows the principle of choosing a settlement close to water but in a dry place, avoiding any water flowing to the site from surrounding higher areas.

To analyse regularities in the prominence of site locations in the landscape we calculated the Topographic Position Index (TPI) with Saga GIS. The TPI is an algorithm used to measure the topographic slope positions of locations in relation to their surrounding environments. The TPI is a zonal statistic and operates in the context of the surrounding environment. As experimental tests showed that the TPI had a considerable effect on settlement choice we experimented with different ranges to identify the spatial context in which the variable had the greatest effect. We calculated the TPI with 50 m, 250 m, 500 m and 1500 m surrounding ranges. The biggest difference between sites and environment was seen in the 500 m range (Fig. 10; A statistic = 0.718; medium, *p* value=1.539e-50), showing the importance of higher location in relation to quite a large area. The greatest tendency towards selecting higher locations was observed for Comb Ware and Corded Ware stage sites. But the meaning of the tendency still needs to be studied because for some shore-bound sites it might be also influenced by the closeness to water, as the water level is always lower than the site on the land.

Overall geomorphological statistics informed us that Stone Age sites were situated in rugged environments and in high, dry positions on a slight slope. The distributions of geomorphometric variables might also be influenced by the locations' proximity to shorelines, which might cause certain regularities in the geomorphology of the locations, but this effect has not yet been studied.

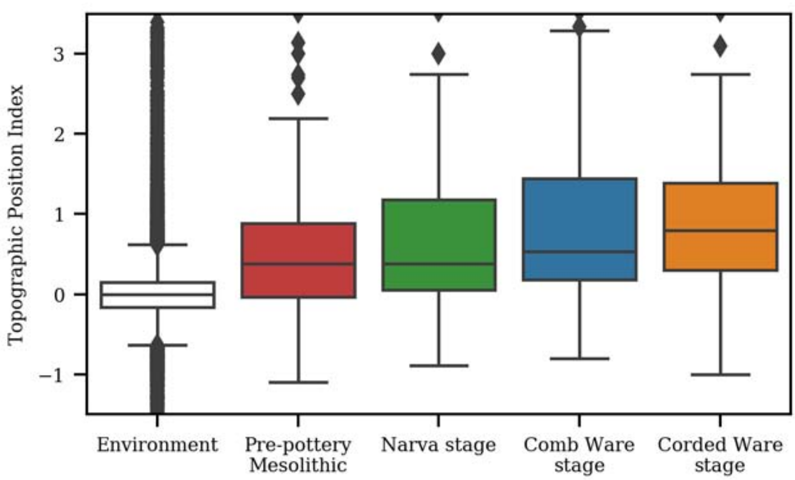


**Fig. 10.** Box plot of the distribution of Topographic Position Index (TPI) values using a context range of 500 m. The box plot visualises the comparison between values in site locations and the environmental sample.

## Changing settlement choice

### *General observations*

It has long been assumed that water bodies were the main determining factor in the location choice of Stone Age settlements. By the beginning of the 21st century, there was enough reference material in Estonia for empirical conclusions to be drawn. Although the tendency of settlements to be located close to shorelines had been mentioned before, the only paper focusing on the issue is by Jussila and Kriiska (2006). The study explores hunter-fisher-gatherer sites in Estonia and Finland and focuses on exceptional sites situated further away from shorelines. In the paper, Jussila and Kriiska (2006, 46) propose a site classification based on distances to water (D): shore-bound sites (D < 150 m), shore-facing sites (D < 300 m), inland forest sites (D < 1 km) and inland "deep forest" sites ( D > 1 km). According to this classification, 333 of the sites in the dataset used in our study are shore-bound sites, 40 are shore-facing sites, 21 are inland forest sites and 17 are inland "deep forest" sites. But it should be borne in mind that the categories were developed for hunter-fisher-gatherer sites and are not optimal for Neolithic (semi-)agrarian sites.

According to the classification, most of the sites are very closely connected to water, with only rare cases being qualified as inland sites. The majority of the inland sites belong to the Corded Ware stage, where hunting, fishing and gathering might have not been the main subsistence mode.

The results indicate very strong water connectedness for the pre-pottery Mesolithic, Narva and Comb Ware stages. This does not necessarily imply a lack of land use away from the water; it may simply be that we lack information on these sites. Shore sites are often found while prospecting past shorelines, but there is no methodology to find inland Stone Age sites and they are usually found while exploring sites from later periods. Still, the lack of data does not refute the general tendency of settling close to water. During archaeological surveys, areas close to the shoreline are also routinely checked and the findings cease when surveying further away from the past shoreline.

Another very clear indication is that Stone Age sites tend to be on high, dry and sandy locations, as seen in the soil type, higher TPI and lower TWI of the site locations. These environmental influences were expected and are intuitive when observing landscape; they generate a certain gut feeling as to suitable locations for settling or camping. Nevertheless, the magnitude of the influence when expressed quantitatively was even clearer than expected.

### *Pre-pottery Mesolithic*

Pre-pottery Mesolithic sites followed aforementioned tendencies but compared to later periods had greater variation. The difference in variation was observable for all significant measures including distance to water, TWI, TPI and most surprisingly clayness, as several sites were situated on soil with high clayness.

The reasons for the variation in general are manifold and relate to the nature of available data about the oldest period of habitation. As the find material is the oldest there has been the most significant environmental change, including hydrological regime change during the period. So the information about the distance to water is less accurate, and also soils might have been modified by changing water levels and flows.

The time period is multiple times longer than the later Stone Age stages, with no significant markers that recognise relevant sub-periods. In most cases the functions of the sites have not been distinguished from each other because of a lack of required markers.

Apart from explanations based on data, the variation can also partly be explained by the nature of the settlement choice for the period. Requirements for environmental conditions might be influenced by a lower selectivity regarding settlement locations. The lack of selectivity may in turn be caused by lower requirements and effort put into site investment, which can be considered as an indication of the short-term use of settlements (Sahlins 1972, 11 f.). The temporary nature of sites is typical for hunter-fisher-gatherers who moved around a lot. It is probable that a lot of sites were temporary sites for highly mobile hunter-gatherers, while those from later periods used their camps for longer.

The hypothesis of higher mobility is backed up by the number of sites situated on flat land and soil of high clayness, which do not usually provide good conditions for long-term habitation, especially with wet weather. Those sites might be used by groups seeking temporary shelter and not planning for significant site investment at the location.

Given the nature of the dataset we can safely assume that it contains information about site selection for multiple settlement modes used in accordance with varying subsistence systems, site functions and mobility strategies. The settlement choice behind this dataset might contain both mobile temporary habitation and permanent settlement sites. The sample probably also includes later Mesolithic periods with a habitation mode similar or identical to the Final Mesolithic Narva and Neolithic Comb Ware stage modes. Isolating those modes is not in the scope of the current research.

### *Narva and Comb Ware stage*

The known Narva and Comb Ware stage sites are situated in environmentally very similar settings, with Narva stage sites having more pronounced environmental influences on settlement choice. The difference between them is not statistically significant because of the small sample of Narva stage sites. The sample from the Narva period is also skewed towards characteristics of a certain region as nearly 28% of the sites are from the same micro-region on the shores of one palaeo lagoon. For this reason we decided to consider Narva and Comb Ware stage sites together.

The vast majority of the sites are situated close to the shoreline on sandy, dry, high, open areas on rugged terrain. The site locations imply careful selection that might indicate a greater emphasis on site investment. Find material contains pottery, which is considered to be an indication of more permanent settlement (Marshall

2006). In comparison with pre-pottery Mesolithic periods, a clearly defined method of permanent settlement choice is observable in archaeological records.

We assume that there were also temporary sites which have not been found or might be hard to distinguish from the pre-pottery Mesolithic period. The data might be skewed because most of the sites were found during archaeological field surveys using methodology targeted for such sites.

### *Corded Ware stage*

The statistical analysis showed that although partly contemporaneous with Comb Ware stage habitation, a completely different settlement location choice system emerged during the Corded Ware stage. Corded Ware stage settlement location choice can be divided into two different models. The environmental conditions of the first are similar to the Comb Ware stage and in several cases the sites have both Comb Ware and Corded Ware pottery, either the latter replacing the former or the two existing together. However, their coexistence has not been proven in any case, while metachronic habitation is visible in radiocarbon dates in several Estonian settlement sites.

As best seen in the box plot (Fig. 1), the placement logic of the second model of Corded Ware stage sites differs significantly from cases where Corded Ware is present on sites with Comb Ware. In several cases Corded Ware stage habitation existed on previously inhabited sites despite the shoreline having receded kilometres away from the time of previous habitation (Kriiska 2003, 19). Such sites are observable on the islands and also at the shores of Lake Võrtsjärv, while the southern and eastern Estonian settlements seem to remain mostly connected to rivers (Kriiska 2000, 72; 2003, 19).

In northern Estonia new sites emerged in a completely different topographical setting. The sites are situated on the limestone rendzina (Klint) (Lang 1996, figs 101 and 120; Lang & Konsa 1998; Kriiska 2003, 19; Paavel et al. 2016, 56). They have distinct environmental conditions including different soils which often have a higher clay content and higher wetness. TPI values inform us that these sites tend to be situated in more prominent positions in the landscape than previously.

The position of the sites implies that their subsistence was not based on an aquatic economy; instead it might suggest the importance of an agrarian economy. Lang (1996, 444) and Kriiska (2000, 74) have suggested the introduction of a sedentary lifestyle and single-family households that continued on to the Early Metal Age. Although Bronze Age settlements are not included in the current study, the change in settlement choice method certainly confirms this hypothesis. However, it must be emphasised that later Bronze or Iron Age settlement or burial sites were located on many Corded Ware stage settlement sites (e.g. Lang & Konsa 1998; Ots et al. 2003; Paavel et al. 2016).

Dating from the sites indicates that hunter-fisher-gatherer and (semi-)agricultural settlements existed contemporaneously and formed distinct cultures that we can currently distinguish by different pottery, in addition to other parameters (e.g.

Kriiska 2019, 15, 22). Therefore it is also possible that some sites classified as Corded Ware stage by fragments of pottery were not the living places of the bearers of this culture, but that the pots were brought to Comb Ware stage settlement sites as a result of exchanges of goods (Jaanits 1955, 186).

As with earlier periods with pottery, archaeological material does not inform us about temporary settlements or hunting camps. In earlier periods the main source of information is flint and quartz, but the find material associated with the Corded Ware stage in Estonia contains almost no lithic material (Paavel et al. 2016, 53; Kriiska et al. 2019, 44), meaning that there is currently no methodology to find traces of temporary Corded Ware stage camps.

## Methodological discussion

### *Survey bias*

As described in the "Materials and methods" the survey methodology might have introduced bias into the statistical analysis and interpretation of settlement choice. While certain bias is inherent for any archaeological research as used samples are influenced both by conditions of preservation and researchers' presumptions, we argue that the existing sample is representative of past settlement choice.

In the current study the main problem could be the overemphasis of the sites' proximity to shorelines. As this is a known issue the former shoreline based surveys have recently included searches in the areas further away from coastal areas. Although often undocumented or documented only in unpublished archaeological reports these results have shown quite clear-cut habitation area as archaeological finds have ceased to be found while moving further away from the shorelines. It shows that there is no continuous habitation spanning towards the inland.

There also exists quite a big sample of non-survey and negative results coming from research of other periods and large-scale surveys. While several sites of the Corded Ware period found from research of later sites (e.g. Jõuga and Soodevahe sites; Lõugas & Selirand 1989, 241; Paavel et al. 2016) are further away from the past shorelines, Narva and Comb Ware sites found while studying later sites have been situated close to the former shoreline (e.g. Kaseküla site).

The statistical difference between the environmental variables of sites of Corded Ware and other stages which have all been found by identical process is in itself an indication of differing logic behind the settlement placement. Indeed this does not preclude certain statistical bias, studying it further would require quantitative research of negative results of archaeological survey.

As is often the case in archaeological research there also remains a possibility of the existence of a currently unobservable mode of habitation, e.g. inland base settlements or hunting camps. In this case their settlement choice logic needs to be described based on isolated set of sites as they do not form a spatial continuum with the current water connected settlement pattern. From current research it appeared that similar situation seems to be true for the Corded Ware settlements that can be described as two separate modes of habitation.

### *Environmental variables and settlement choice*

The statistical analysis presented in this paper indicates that settlement locations in Stone Age Estonia were strongly linked to the environmental conditions of the site locations. In the current case the dominant variables are closeness to water and clayness of the soil, but geomorphological variables also have a considerable effect.

It is worth mentioning that simple DEM derivatives such as surface curvatures did not show a significant relationship with site selection, as opposed to more complex topographic variables, e.g. TPI and TWI. These results might give insights into the settlement choice model from a human perspective, but they require further study.

Although proven to work successfully for predictive models (for a discussion see: Kvamme 2005), the causality of the effects of individual factors presented by variables still needs to be researched. For example, closeness to water may have been required for direct access to aquatic resources, transportation and communications. Water is also required as a complex ecosystem service providing drinking water, hygiene, water for agricultural use, etc. Geomorphological variables are not statistically independent and several of these factors may be influenced by the nature of landscapes close to water.

Archaeological research looks for causal explanations for different phenomena, and statistical models are expected to provide such explanations. But the relationship between observable variables and a possible choice model explaining the residential decisions of Stone Age people needs study. For example, we can observe that a degree of surface slope is preferred for site location, but does that mean that it was required for the people in the past, or does it just describe the sloping ground near the shoreline? Although the issue could be further explored with a statistical analysis of the relationship between the variables, offering archaeological interpretations for questions like these requires a conceptual model of settlement choice.

The geographical scope of settlement choice needs further clarification. It needs to be assessed to what extent environmental correlates arise from the fact that general regions (e.g. big lakes, lagoons, river estuaries) providing necessary resources have similar topographies, as opposed to the fact that they may meet the requirements of a specific location. In the current study we performed a statistical experiment measuring the range in which the TPI variable has the most effect. We found it to be an area with a 500 m radius. Similar statistical experiments of other variables could also be carried out.

Another topic that needs to be researched is the reuse of archaeological sites: were the sites inhabited based on continuous knowledge, were they continuously the "best" locations in the environment, or had previous habitation modified the environment in a favourable way? An interesting example is the Kivisaare site, which was inhabited during all periods despite being situated on an island during the Mesolithic and in an inland forest during the Corded Ware period.

## Conclusion

The goal of the current study was to give a statistical overview of the settlement pattern of the Estonian Stone Age and to analyse the influence of the environment on settlement choice in the period. To this end we compiled a list of archaeological sites ($n$ = 410) that can be categorised as belonging to one of the stages of the Estonian Stone Age. We extracted environmental variables for the settlement site locations and compared their distribution to the distribution of the variables in the environment overall. For distributions with significant differences (K–S $p$ value < 0.05), we quantified them with Vargha and Delaney's A measure and provided descriptive statistics.

Quantitative assessment confirmed previous observations that proximity to water had the most significant effect on settlement choice, while soil type was also of considerable importance. To measure settlement choice we quantified soil types by the percentage of clay content. There was a clear link between sites' suitability for habitation and higher sandiness (meaning lower clayness).

We assessed several geomorphological variables for their impact on settlement choice and concluded that while simple DEM derivatives have no links with settlement choice, more abstract topographical variables such as TPI and TWI have strong effects. For all stages studied, most of the sites are situated close to water, on dry, sandy areas avoiding water flows on a gentle slope in slightly more prominent locations.

There are some differences between settlement patterns for the different stages of the Stone Age. Site locations from the pre-pottery Mesolithic have greater environmental variation. This suggests that archaeological material reflects several different modes of habitation caused by environmental changes during the period, multiple site functions and variable levels of site investment by hunter-fisher-gatherer groups practising differing modes of mobility.

Both the Narva and Comb Ware stage sites followed a very clearly defined pattern, with the majority of the sites being situated close to the shoreline on sandy, dry, high, open areas on rugged terrains. The site locations indicate strong site investment with higher sedentism.

During the Corded Ware stage a new settlement mode emerged; some sites were not situated close to water and were placed on different soils. The sites were situated on higher locations on older shoreline formations or cliffs which were no longer close to the shoreline. Settlements emerged on the Klint in northern Estonia and on old shore formations far from the sea and Lake Võrtsjärv. On the islands and in central Estonia this corresponds closely to Bronze and Iron Age settlement patterns.

New environmental characteristics affecting settlement choice indicate new agrarian or semi-agrarian subsistence and decreasing dependence on aquatic resources. At the same time, several sites were used during both Comb Ware and Corded Ware stages, even though the previously adjacent shorelines had receded by the latter period. Most of the sites still continued to follow the previous placement logic of the partly contemporaneous Comb Ware stage.

**Acknowledgements**

This research was supported by the Luxembourg National Research Fund (FNR) (10929115), the Estonian Research Council project PRG243, and Arheograator Ltd. We are grateful to all the people who took part in our archaeological expeditions over the years. The publication costs of this article were covered by the Estonian Academy of Sciences, the Institute of History and Archaeology at the University of Tartu, and the Institute of History, Archaeology and Art History of Tallinn University.

APPENDIX 1

List of Stone Age settlement sites

* Column 1 – site location number. Locations which were inhabited during several periods have the same number while appearing number of rows corresponding ton number of habitation phases.
* Column 1 – period number, the field is filled if the location was inhabited during several periods and is used to distinguish between the periods.
* X, Y – the coordinates of the estimated centre of the site in L-EST97 coordinate system (EPSG:3301).
* SITE NAME – name given to the site.
* STONE AGE STAGE – the name of the Stone Age stage where the site belongs to. If a location was inhabited during several periods, a separate record is created for each of the habitation phases.

Pre-pottery Mesolithic sites

| | | X | Y | Site name | References |
|---|---|---|---|---|---|
| 1 | | 6475587 | 539466 | Pulli | Jaanits & Jaanits 1975 |
| 2 | 1 | 6594258 | 643993 | Kunda Lammasmägi | Indreko1948b; Grewingk 1887 |
| 3 | 1 | 6478700 | 688748 | Akali | Jaanits 1955; Jaanits et al. 1982 |
| 9 | | 6530238 | 396949 | Kõpu II | Lõugas et al. 1996 |
| 10 | 1 | 6588896 | 739099 | Narva-Joaorg | Yanits 1966 |
| 12 | | 6602195 | 601481 | Vihasoo I | Kriiska 1997a |
| 13 | | 6602498 | 601126 | Vihasoo II | Kriiska 1997a |
| 14 | | 6551725 | 492892 | Valgeristi I | Kriiska 2001b |
| 15 | | 6458488 | 540074 | Metsaääre I | Kriiska 2001a |
| 16 | | 6458315 | 540316 | Metsaääre II | Kriiska 2001a |
| 17 | | 6587738 | 528300 | Liikva I | Unpublished |
| 18 | | 6587206 | 523679 | Liikva II | Unpublished |

*Continued on the next page*

APPENDIX 1. *Continued*

| | | X | Y | Site name | References |
|---|---|---|---|---|---|
| 19 | | 6587420 | 523622 | Liikva III | Unpublished |
| 20 | | 6488965 | 404713 | Võhma I | Kriiska 1998 |
| 22 | | 6487269 | 404531 | Võhma II | Kriiska 1998 |
| 23 | | 6486928 | 404388 | Võhma III | Kriiska 1998 |
| 24 | | 6489519 | 405881 | Võhma IV | Kriiska 1998 |
| 25 | | 6489123 | 405777 | Võhma V | Kriiska 1998 |
| 26 | | 6489881 | 405811 | Võhma VI | Kriiska 1998 |
| 27 | | 6489818 | 405628 | Võhma VII | Kriiska 1998 |
| 28 | | 6492210 | 407598 | Pahapilli I | Kriiska 1998 |
| 29 | | 6492126 | 407603 | Pahapilli II | Kriiska 1998 |
| 30 | | 6530549 | 397091 | Kõpu III | Lõugas et al. 1996 |
| 31 | | 6530753 | 397191 | Kõpu IV/V | Lõugas et al. 1996 |
| 32 | | 6530891 | 397264 | Kõpu VI | Lõugas et al. 1996 |
| 33 | | 6531014 | 397264 | Kõpu VII/VIII | Lõugas et al. 1996 |
| 34 | | 6531314 | 397653 | Kõpu IX | Lõugas et al. 1996 |
| 36 | | 6531821 | 396097 | Kõpu XVII | Kiristaja et al. 1998 |
| 37 | | 6407314 | 455192 | Ruhnu I | Kriiska & Tamla 1998; Kriiska & Saluäär 2000a |
| 38 | 1 | 6407664 | 455335 | Ruhnu II | Kriiska & Saluäär 2000a |
| 39 | | 6407844 | 455780 | Ruhnu III | Kriiska & Saluäär 2000a |
| 40 | 1 | 6406579 | 456063 | Ruhnu IV | Kriiska & Saluäär 2000a |
| 41 | | 6406747 | 455477 | Ruhnu VI | Kriiska & Saluäär 2000a |
| 42 | | 6494208 | 578009 | Lepakose | Yanits 1975 |
| 43 | | 6407852 | 455457 | Ruhnu V | Kriiska & Saluäär 2000a |
| 44 | | 6494357 | 579407 | Tamme | Jaanits et al. 1982 |
| 45 | | 6495036 | 579361 | Maltsaare | Unpublished |
| 46 | | 6496189 | 582258 | Jälevere | Jaanits 1981 |
| 47 | 1 | 6480655 | 621509 | Siimusaare | Jaanits 1965 |
| 48 | | 6478272 | 618536 | Leie I | Kiristaja et al. 1998; Kriiska et al. 2004 |
| 49 | | 6479560 | 620791 | Moksi | Indreko 1932 |
| 50 | | 6482078 | 620243 | Lalsi I | Kiristaja et al. 1998; Kriiska et al. 2004 |

*Continued on the next page*

APPENDIX 1. *Continued*

| | | X | Y | Site name | References |
|---|---|---|---|---|---|
| 51 | | 6482375 | 620087 | Lalsi II | Kiristaja et al. 1998; Kriiska et al. 2004 |
| 52 | 1 | 6481455 | 621840 | Kivisaare | Kriiska & Johanson 2003 |
| 53 | | 6492681 | 622558 | Umbusi | Yanits 1977; Jaanits & Ilomets 1988 |
| 54 | 1 | 6483984 | 637510 | Valmaotsa II | Kriiska & Tvauri 2002 |
| 55 | | 6482747 | 637493 | Valmaotsa I | Kriiska & Tvauri 2002 |
| 56 | | 6471027 | 661958 | Ihaste | Kiristaja et al. 1998; Johanson & Kriiska 2007 |
| 57 | | 6470688 | 662081 | Ihaste II | Johanson & Kriiska 2007 |
| 58 | | 6469949 | 534838 | Sindi-Lodja I | Kriiska 2001a |
| 59 | | 6470142 | 535085 | Sindi-Lodja II | Kriiska 2001a |
| 61 | | 6467729 | 644963 | Keeri I | Kriiska & Tvauri 2002 |
| 62 | | 6467344 | 645009 | Keeri II | Kriiska & Tvauri 2002 |
| 63 | 1 | 6467926 | 644648 | Keeri III | Kriiska & Tvauri 2002 |
| 64 | | 6467955 | 642366 | Võsivere I | Kriiska & Tvauri 2002 |
| 65 | | 6467759 | 642283 | Võsivere II | Kriiska & Tvauri 2002 |
| 66 | | 6466393 | 644250 | Nurmeotsa | Kriiska & Tvauri 2002 |
| 67 | | 6440591 | 620261 | Pikasilla I | Kriiska et al. 2004 |
| 68 | | 6439918 | 621647 | Pikasilla II | Kriiska & Tvauri 2002 |
| 69 | | 6441211 | 622486 | Purtsi Voore | Kriiska & Tvauri 2002 |
| 70 | | 6495683 | 597349 | Maalasti | Kriiska & Tvauri 2002 |
| 71 | | 6493346 | 632782 | Jüriküla | Kriiska & Tvauri 2002 |
| 72 | | 6476595 | 615539 | Oiu I | Kriiska et al. 2004 |
| 73 | | 6476254 | 615428 | Oiu II | Kriiska et al. 2004 |
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| 98 | | 6478650 | 618365 | Leie II | Kriiska et al. 2004 |
| 99 | | 6477695 | 618690 | Leie III | Kriiska et al. 2004 |
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| 101 | | 6489175 | 633855 | Altnurga | Konsa & Ots 2004 |
| 102 | | 6497190 | 637125 | Kursi | Konsa & Ots 2004 |
| 103 | | 6486829 | 634757 | Siniküla Kodasmäe I | Konsa & Ots 2004 |
| 104 | | 6487494 | 634826 | Siniküla Vati I | Konsa & Ots 2004 |
| 105 | 1 | 6487674 | 634480 | Siniküla Vati II | Konsa & Ots 2004 |
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| 107 | | 6498555 | 638400 | Tõrve | Konsa & Ots 2004 |
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| 129 | 6467665 | 604660 | Vasara I | Kriiska et al. 2004 |
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| 131 | 6499420 | 566825 | Lüüste I | Konsa & Ots 2004 |
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| 134 | 6492295 | 652410 | Tabivere II | Konsa & Ots 2004 |
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| 149 | 6443250 | 587035 | Póögle | Konsa & Ots 2005 |
| 150 | 6497108 | 636281 | Kursi kirik | Konsa & Ots 2005 |
| 152 | 6494040 | 589030 | Navesti | Konsa & Ots 2005 |
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| 156 | 6477215 | 385758 | Kehila | Konsa & Ots 2006 |
| 157 | 6592715 | 577213 | Valkla-tagune II | Konsa & Ots 2006 |
| 158 | 6493930 | 624970 | Umbusi Soo | Konsa & Ots 2006 |
| 159 | 6442111 | 622773 | Pühaste | Konsa & Ots 2006 |
| 160 | 6475049 | 625331 | Vaibla Kaabe kenk | Konsa & Ots 2007 |
| 161 | 6513003 | 646022 | Kuremaa II | Konsa & Ots 2007 |
| 162 | 6404729 | 703692 | Kalatsova II | Konsa & Ots 2007 |
| 163 | 6474454 | 627878 | Verevi | Konsa & Ots 2007 |
| 164 | 6591555 | 581143 | Kuusalu IV | Konsa & Ots 2008 |
| 165 | 6589790 | 574540 | Kivisilla | Konsa & Ots 2008 |
| 166 | 6405612 | 705848 | Meremäe II | Konsa & Ots 2008 |
| 167 | 6471598 | 661763 | Jummisaare II | Konsa & Ots 2008 |
| 168 | 6475681 | 540167 | Aluste | Konsa & Ots 2008 |
| 169 | 6592376 | 566336 | Jägala Jõesuu III | Kriiska et al. 2009 |
| 170 | 6486081 | 560958 | Aesoo I | Konsa & Ots 2009 |
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| 178 | | 6486412 | 634956 | Siniküla II | Konsa & Ots 2009 |
| 179 | | 6486596 | 634612 | Siniküla Kodasmäe II | Konsa & Ots 2009 |
| 180 | | 6483250 | 637341 | Valmaotsa Hendriku | Konsa & Ots 2009 |
| 181 | | 6421283 | 621848 | Ransi (Metsaääre talu) | Unpublished |
| 182 | | 6482250 | 531057 | Kurena | Konsa & Ots 2010 |
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| 184 | | 6484654 | 636858 | Siniküla Mukdeni | Konsa & Ots 2010 |
| 185 | | 6472974 | 631512 | Saare | Lõhmus & Ots 2011 |
| 186 | | 6479204 | 635923 | Valmaotsa Sooküla I | Lõhmus & Ots 2011 |
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| 188 | 1 | 6390767 | 702858 | Toodsi Liidva | Lõhmus & Ots 2011 |
| 189 | | 6527223 | 627522 | Kärde II | Tõrv & Ots 2012 |
| 190 | 1 | 6529027 | 624499 | Tooma | Tõrv & Ots 2012 |
| 191 | | 6485724 | 637387 | Laeva | Kiristaja et al. 1998 |
| 192 | | 6482919 | 637712 | Valmaotsa Lubjaahju | Unpublished |
| 193 | | 6502782 | 652464 | Ehavere | Ots & Rammo 2013 |
| 194 | | 6504996 | 626990 | Pudivere | Ots & Rammo 2013 |
| 195 | | 6466894 | 643045 | Härjanurme | Ots & Rammo 2013 |
| 196 | | 6464003 | 642225 | Külaaseme I | Ots & Rammo 2013 |
| 197 | | 6464006 | 642800 | Külaaseme II | Ots & Rammo 2013 |
| 198 | | 6464098 | 643134 | Meeri Tabuli | Ots & Rammo 2013 |
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| 202 | | 6435975 | 645300 | Pühajärve Sõsarsaar | Ots & Rammo 2013 |
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| 213 | 6482352 | 637204 | Valmaotsa Valmaotsa | Unpublished |
| 214 | 6442483 | 654474 | Puugi | Unpublished |
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| 221 | 6403720 | 700207 | Vastseliina linnus | Unpublished |
| 222 | 6433947 | 672370 | Tilleoru Kantsimägi | Unpublished |
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| 229 | 6478503 | 621576 | Meleski III | Unpublished |
| 230 | 6479737 | 621840 | Meleski IV | Unpublished |
| 231 | 6592280 | 566521 | Jägala Joa IV | Tõrv & Ots 2012 |
| 232 1 | 6441347 | 622174 | Vooremägi | Veldi & Valk 2010 |
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| 330 | | 6595355 | 643245 | Jaanimäe | Sander & Kriiska 2018 |
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| 332 | | 6595570 | 643415 | Järvepõhja II | Sander & Kriiska 2018 |
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| 336 | | 6596350 | 643300 | Miili | Sander & Kriiska 2018 |
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| 6 | 1 | 6419057 | 684848 | Kääpa | Jaanits 1955 |
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| 35 | | 6530589 | 396103 | Kõpu XIV | Kiristaja et al. 1998 |
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| 40 | 2 | 6406579 | 456063 | Ruhnu IV | Kriiska & Saluäär 2000a |
| 52 | 2 | 6481455 | 621840 | Kivisaare | Kriiska & Johanson 2003 |
| 60 | 1 | 6470435 | 535312 | Sindi-Lodja III | Kriiska & Lõugas 2009 |
| 238 | | 6602569 | 601104 | Vihasoo III | Kriiska 1997a; 1997b |
| 239 | | 6592531 | 555802 | Kroodi | Jaanits 1968 |
| 240 | | 6530531 | 396045 | Kõpu XIII | Jussila & Kriiska 2004 |
| 241 | | 6531214 | 397531 | Kõpu XVI | Jussila & Kriiska 2004 |
| 242 | 1 | 6595404 | 734049 | Riigiküla I | Gurina 1967 |
| 243 | 1 | 6595572 | 733908 | Riigiküla II | Gurina 1967 |
| 244 | 1 | 6595243 | 734088 | Riigiküla III | Gurina 1967 |
| 245 | 1 | 6595124 | 734009 | Riigiküla IV | Kriiska 1995b; 1996 |
| 246 | | 6595091 | 733962 | Riigiküla V | Kriiska 1999 |
| 247 | | 6595055 | 733900 | Riigiküla VI | Kriiska 1999 |
| 248 | | 6594958 | 733851 | Riigiküla VII | Kriiska 1999 |
| 249 | | 6594912 | 733811 | Riigiküla VIII | Kriiska 1999 |
| 250 | | 6594697 | 733714 | Riigiküla IX | Kriiska 1999 |
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| 253 | | 6594477 | 733595 | Riigiküla XII | Kriiska 1999 |
| 254 | | 6594054 | 733484 | Riigiküla XIII | Unpublished |
| 255 | | 6593937 | 733375 | Riigiküla XV | Unpublished |
| 256 | | 6504737 | 664138 | Pedassaare III | Konsa & Ots 2009 |
| 281 | 1 | 6417994 | 680342 | Villa II | Kriiska & Tvauri 2002 |
| 285 | 1 | 6542222 | 682594 | Rannapungerja I | Roio et al. 2016 |
| 317 | 1 | 6531865 | 670601 | Kalmaküla I | Unpublished |
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| 327 | 1 | 6542216 | 683005 | Rannapungerja III | Roio et al. 2016 |

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| | | X | Y | Site name | References |
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| 190 | 2 | 6529027 | 624499 | Tooma | Tõrv & Ots 2012 |
| 232 | 2 | 6441276 | 622116 | Vooremägi | Veldi & Valk 2010 |
| 242 | 2 | 6595404 | 734049 | Riigiküla I | Gurina 1967 |
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| 287 | 1 | 6597220 | 730725 | Narva Jõesuu IIB | Kriiska et al. 2016 |
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| 323 | 2 | 6519092 | 672388 | Omedu Jõekääru | Roio et al. 2016 |
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| 326 | 3 | 6542115 | 682668 | Rannapungerja II | Roio et al. 2016 |
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| 3 | 1 | 6478700 | 688748 | Akali | Jaanits 1955 |
| 4 | 2 | 6479341 | 686642 | Kullamägi | Yanits 1959b |
| 6 | 3 | 6419057 | 684848 | Kääpa | Jaanits 1966 |
| 7 | 2 | 6530122 | 396945 | Kõpu IA | Kriiska 2004 |
| 10 | 4 | 6588896 | 739099 | Narva-Joaorg | Jaanits 1966 |
| 11 | 2 | 6459163 | 396666 | Naakamägi | Jaanits 1966 |
| 21 | | 6488965 | 404713 | Võhma I | Kriiska 1998 |
| 47 | 2 | 6480655 | 621509 | Siimusaare | Yanits 1959b |
| 52 | 4 | 6481455 | 621840 | Kivisaare | Kriiska & Johanson 2003 |
| 54 | 2 | 6483984 | 637510 | Valmaotsa II | Kriiska & Tvauri 2002 |
| 60 | 3 | 6470435 | 535312 | Sindi-Lodja III | Kriiska & Tvauri 2002 |
| 63 | 2 | 6467926 | 644648 | Keeri III | Johanson et al. 2014 |
| 77 | | 6544856 | 690988 | Uusküla | Roio et al. 2016 |
| 97 | | 6593762 | 734983 | Vasa | Kriiska et al. 2019 |
| 105 | 2 | 6487674 | 634480 | Siniküla Vati II | Konsa & Ots 2004 |
| 106 | 2 | 6500200 | 635175 | Tammiku | Kriiska & Tvauri 2002 |
| 133 | | 6591357 | 699549 | Toila | Unpublished |
| 151 | | 6515566 | 668171 | Küti Viidike | Unpublished |
| 188 | 2 | 6390767 | 702858 | Toodsi Liidva | Lõhmus & Ots 2011 |
| 190 | 3 | 6529027 | 624499 | Tooma | Tõrv & Ots 2012 |

*Continued on the next page*

APPENDIX 1. *Continued*

| | | X | Y | Site name | References |
|---|---|---|---|---|---|
| 242 | 3 | 6595404 | 734049 | Riigiküla I | Gurina 1967 |
| 243 | 3 | 6595572 | 733908 | Riigiküla II | Gurina 1967 |
| 245 | 3 | 6595124 | 734009 | Riigiküla IV | Kriiska 1995b; 1996 |
| 257 | 2 | 6597383 | 730937 | Narva-Jõesuu I | Kriiska & Nordqvist 2010 |
| 270 | 2 | 6497751 | 475290 | Kaseküla | Kriiska et al. 1998 |
| 273 | 2 | 6475900 | 518861 | Lemmetsa I | Kriiska & Saluäär 2000b |
| 277 | 2 | 6468836 | 614734 | Valma | Yanits 1959a |
| 278 | 2 | 6415426 | 676915 | Tamula I | Jaanits 1966 |
| 280 | 2 | 6418068 | 680665 | Villa I | Yanits 1959b |
| 283 | 2 | 6588628 | 542279 | Tallinna Vabaduse väljak | Kadakas et al. 2010 |
| 286 | 2 | 6597310 | 730821 | Narva Jõesuu IIA | Kriiska & Nordqvist 2012 |
| 287 | 2 | 6597227 | 730725 | Narva Jõesuu IIB | Kriiska et al. 2015 |
| 288 | 2 | 6597154 | 730700 | Narva Jõesuu III | Kriiska et al. 2015 |
| 289 | 2 | 6597382 | 731006 | Narva- Jõesuu IV | Kriiska et al. 2015 |
| 290 | | 6474562 | 442589 | Asva | Indreko 1939; Jaanits 1966 |
| 291 | | 6486400 | 436732 | Kuninguste | Lõugas 1974 |
| 292 | | 6478380 | 587893 | Madi | Kriiska & Tvauri 2002 |
| 293 | | 6545463 | 680732 | Lemmaku | Kriiska & Tvauri 2002 |
| 294 | | 6561845 | 693306 | Jõuga | Lõugas & Selirand 1989 |
| 295 | | 6594023 | 733388 | Riigiküla XIV | Kriiska 2000 |
| 296 | | 6600650 | 606135 | Kadrina Võhma I | Ots et al. 2003 |
| 297 | | 6600729 | 607148 | Ilumäe II | Lang & Konsa 1998 |
| 298 | | 6600997 | 606733 | Ilumäe IV | Lang & Konsa 1998 |
| 299 | | 6597198 | 586530 | Muuksi I | Vedru 1996 |
| 300 | | 6597252 | 585969 | Muuksi II | Vedru 1996 |
| 301 | 2 | 6592625 | 582237 | Kuusalu Oduli | Vedru 1999 |
| 302 | | 6591561 | 560910 | Võerdla I | Lõugas & Selirand 1989 |
| 303 | | 6593052 | 562209 | Rebala | Lang et al. 2001 |
| 304 | | 6586362 | 553872 | Lagedi | Lang 1996 |
| 305 | | 6591338 | 551268 | Iru | Vassar 1939; Lang 1996 |
| 307 | | 6434453 | 644970 | Kloostrisaar | Johanson et al. 2014 |
| 308 | 2 | 6451657 | 589658 | Kaarli | Unpublished |
| 309 | | 6433818 | 644783 | Pühajärve Lepassaar | Johanson et al. 2014 |

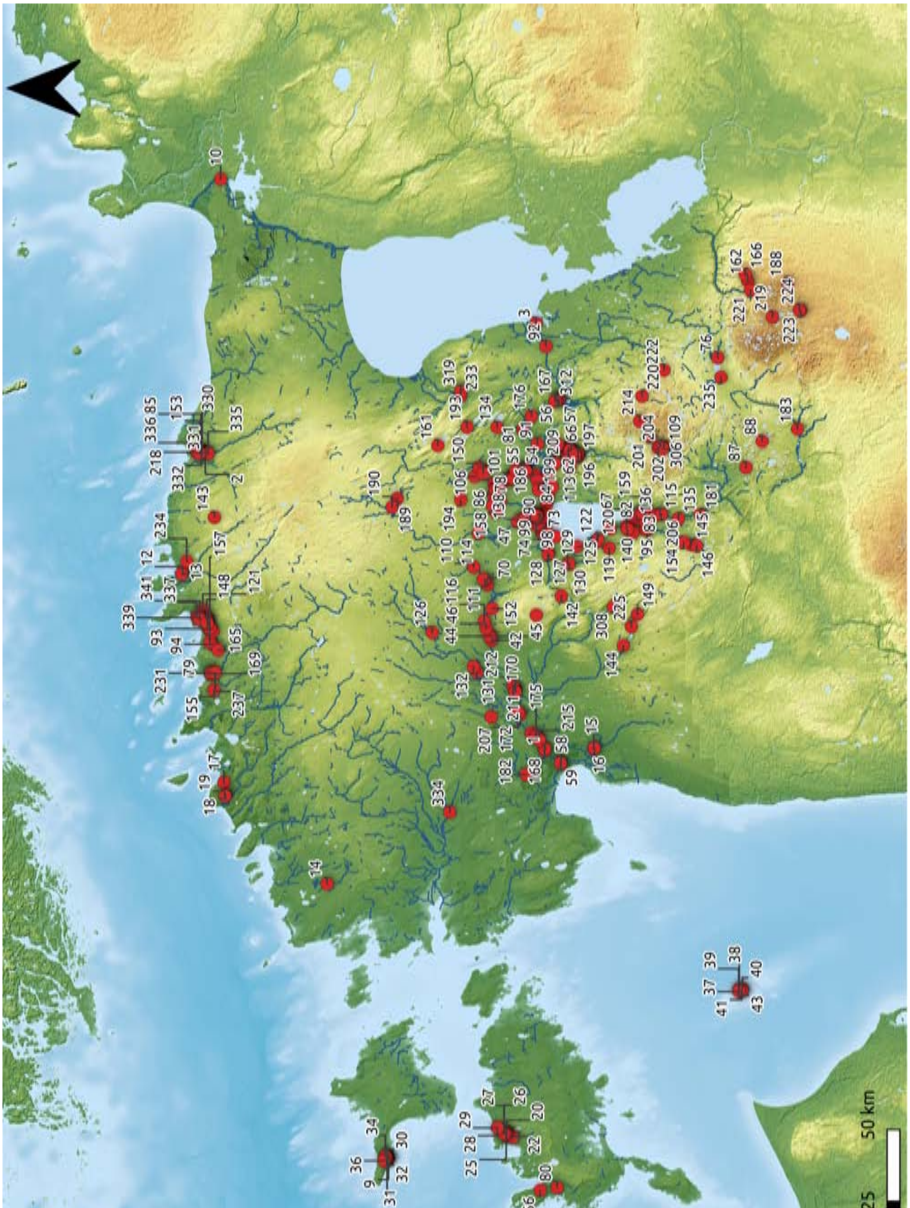
*Continued on the next page*

APPENDIX 1. *Continued*

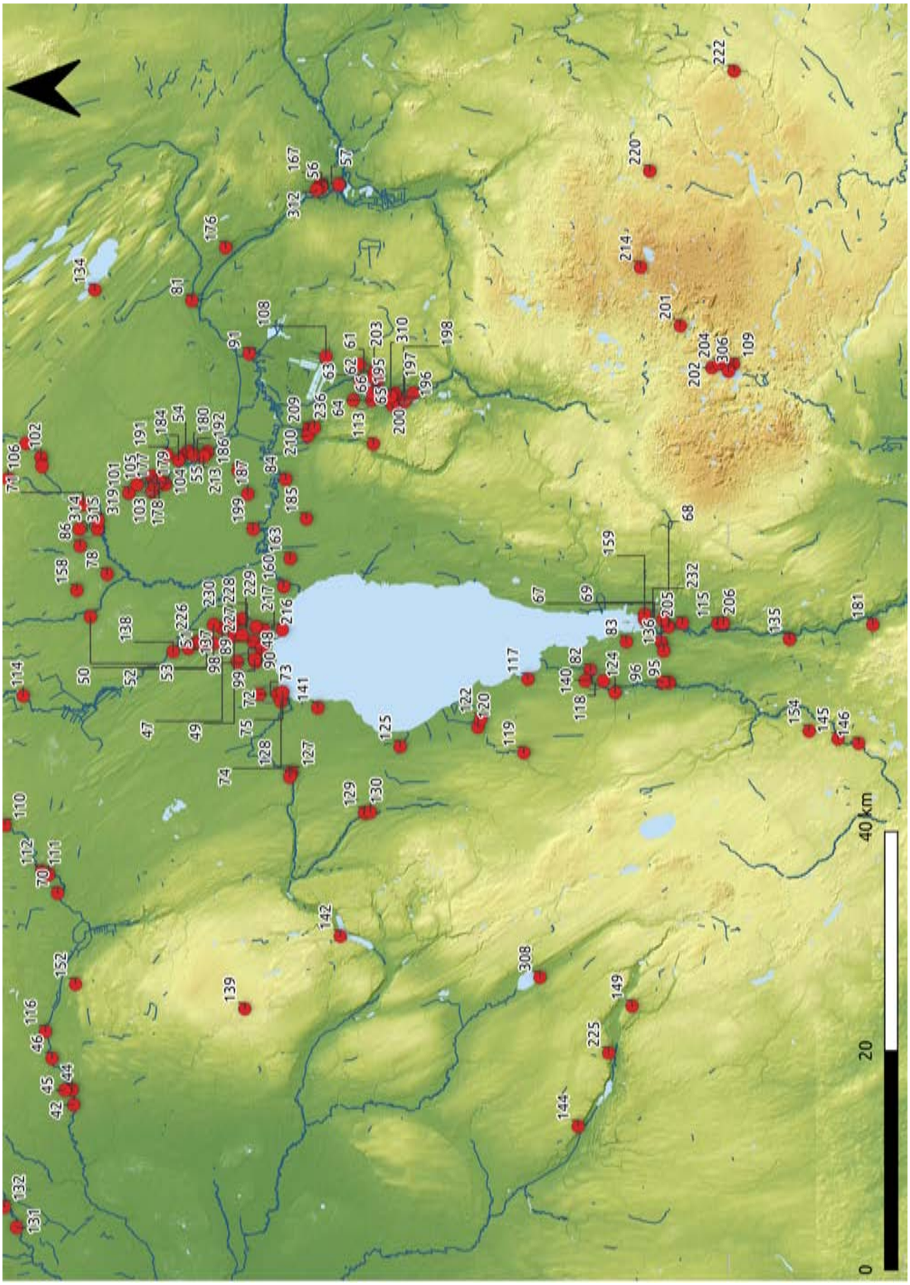
| | | X | Y | Site name | References |
|---|---|---|---|---|---|
| 310 | 2 | 6465277 | 642680 | Karijärve saar II | Ots & Rammo 2013 |
| 311 | | 6588216 | 542263 | Tallinna Mülleri Põld | Bernotas et al. 2017 |
| 312 | 2 | 6472085 | 661527 | Jummissaare I | Konsa & Ots 2008 |
| 313 | | 6407063 | 456188 | Ruhnu Valgi | Konsa & Ots 2009 |
| 314 | 2 | 6492745 | 630715 | Palu I | Unpublished |
| 316 | | 6469842 | 662660 | Veibri | Kriiska & Tvauri 2002 |
| 321 | 2 | 6510413 | 514989 | Ojapere II | Unpublished |
| 322 | 2 | 6510056 | 515507 | Ojapere III | Unpublished |
| 323 | 3 | 6519046 | 672520 | Omedu Jõekääru | Roio et al. 2016 |
| 326 | 4 | 6542115 | 682668 | Rannapungerja II | Roio et al. 2016 |
| 333 | | 6470303 | 665713 | Kabina II | Konsa & Ots 2007 |
| 338 | | 6457413 | 582218 | Sammaste | Unpublished |
| 340 | | 6587377 | 549331 | Soodevahe | Paavel et al. 2016 |
| 343 | | 6519938 | 512153 | Teenuse IX | Unpublished |

# APPENDIX 2

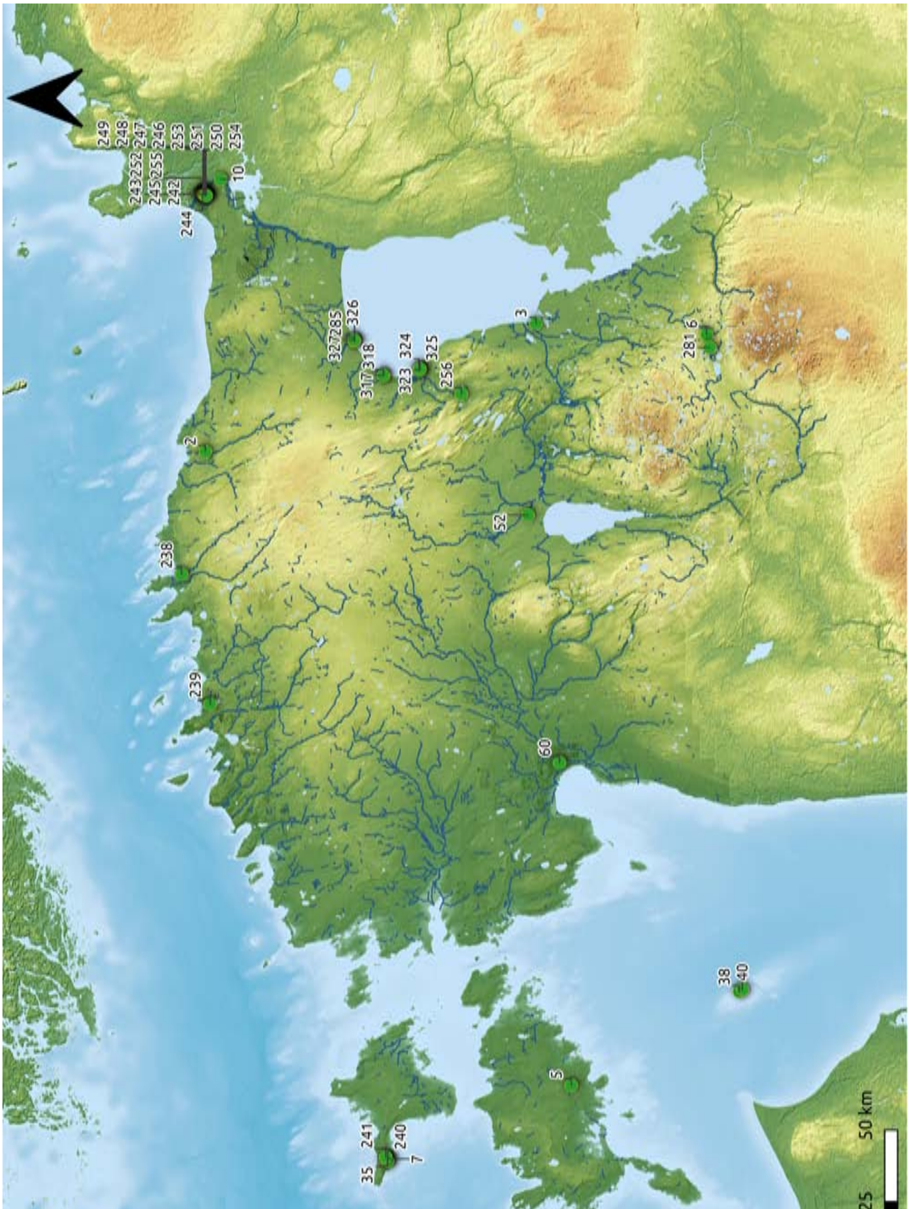
Settlement pattern maps



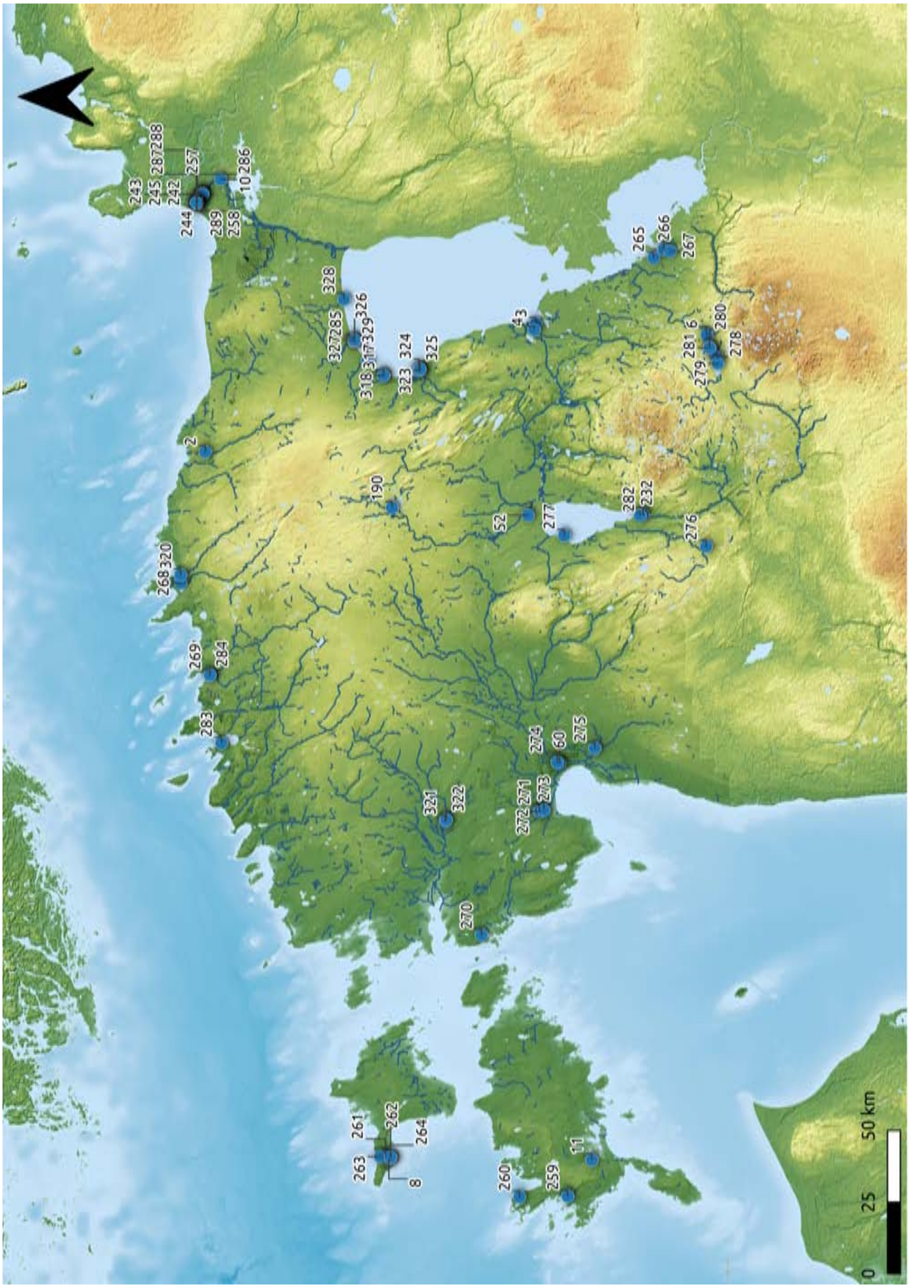

Pre-pottery Mesolithic settlement pattern. Author: Kaarel Sikk. Topographic map: Estonian Land Board 2020.



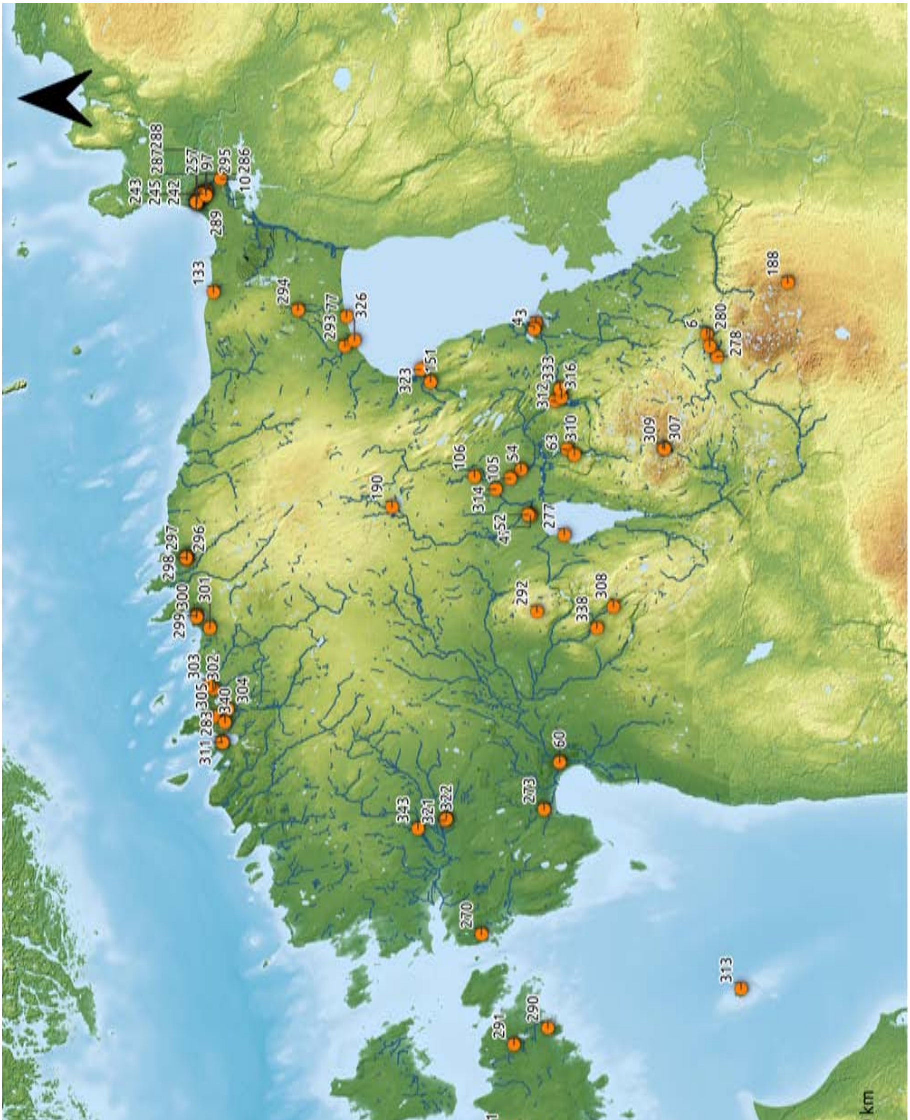

Pre-pottery Mesolithic settlement pattern in the region close to Lake Võrtsjärv. Author: Kaarel Sikk. Topographic map: Estonian Land Board 2020.




Narva stage settlement pattern. Author: Kaarel Sikk. Topographic map: Estonian Land Board 2020.




Comb Ware stage settlement pattern. Author: Kaarel Sikk. Topographic map: Estonian Land Board 2020.




Corded Ware stage settlement pattern. Author: Kaarel Sikk. Topographic map: Estonian Land Board 2020.

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## EESTI KIVIAEGSETE ASULATE KOHAVALIK JA SELLE SEOSED LOODUSKESKKONNAGA

### *Resümee*

Kiviaja asulate kohavaliku seost looduskeskkonna ja topograafiaga on oletatud ja seejärel võetud Eestis tõsiasjana juba teadusliku arheoloogia algusest peale alates 19. sajandi teisest poolest ning seda teadmist on kasutatud ka asulakohtade otsingutel. Kõige olulisemaks on peetud asukohtade lähedust veekogudele ja eriti suureks on nende leidumise potentsiaali hinnatud liivastel küngastel.

Kirjeldatud arusaam kiviaegsete asulakohtade paiknemisest on ühelt poolt intuitiivselt mõistetav, kuid see on ajapikku ka arheoloogiliste uurimistööde kogemusega kinnistunud. Siiani pole aga kõiki asulakohti hõlmavaid uurimisi läbi

viidud. Viimastel aastakümnetel on avastatud asulakohti sedavõrd palju, et nüüdseks on kohavaliku ja keskkonna vahelisi seoseid võimalik ka kvantitatiivselt uurida.

Käesoleva uurimuse läbiviimiseks koguti kokku andmed Eesti teadaolevate kiviaja asulate kohta ja need seoti Maa-ameti jagatavate avaandmetega. Kokku saadi andmeid 410 muistise kohta, neist 244 keraamikaeelsest mesoliitikumist (umbes 9000–5200 aastat eKr), 39 Narva staadiumist (5200–3900 aastat eKr), 60 kammkeraamika staadiumist (3900–1800 aastat eKr) ja 67 nöörkeraamika staadiumist (2800–2000 aastat eKr).

Iga muistis seoti mullastikukaardiga ja määrati selle kaugus mineviku veekogudest. Lisaks tuletati digitaalselt kõrgusmudelilt potentsiaalselt asulakohtadega seostuv valik geomorfomeetrilisi muutujaid. Nende põhjal viidi läbi statistiline analüüs ja uurimaks keskkonna mõju asukoha valikule võrreldi erinevate perioodide muutujate jaotust keskkonnas üldiselt esinevate jaotustega.

Analüüsi tulemusel selgus, et enamiku kasutatud muutujate puhul võis kiviaja asulakohtades keskkonnaga võrreldes täheldada statistiliselt olulisi erinevusi. Lihtsamate geomorfomeetriliste muutujate puhul oli mõju üldjoontes väiksem (v.a pinna kallak), abstraktsete muutujate puhul oli mõju selgelt suurem. Viimaste hulka kuuluvad näiteks topograafilise positsiooni indeks ja märguse indeks, mis näitavad, et asulakohad paiknevad ümbritsevast pigem kõrgematel, kuivadel ning vetevooludest kõrvalejäävatel aladel.

Statistiliselt hinnati samuti mõju ulatust ja tulemused kinnitasid varasemaid tähelepanekuid, et asulakohad paiknevad üldjuhul veekogude lähistel, liivastel ning kuivadel ümbritsevast pigem kõrgematel kohtadel. Mullastik osutus kohavalikul väga oluliseks teguriks, kõige selgemalt ilmnes selle mõju, kui muutujana eraldati mulla savisuse määr. Enamikul asulakohtadel oli pinnase savisisaldus väga väike.

Erinevate kiviaja staadiumide vahel võis märgata mitmeid erinevusi. Vanima ja pikima staadiumi, keraamikaeelse mesoliitikumi puhul võis oodatult täheldada keskkonnamuutujate suuremat varieeruvust. Ajavahemiku pikkuse tõttu on selle jooksul toimunud enim keskkonnamuutusi, samuti on võimalik, et selle perioodi jooksul on korduvalt muutunud inimeste majanduse ja mobiilsuse süsteem.

Kontrastina on peaaegu identsed Narva ja kammkeraamika staadiumi asulakohtade keskkonna karakteristikud väga selgelt piiritletud, asudes liivastel küngastel veekogude randadel ning kallastel. Selline asulakoha valik viitab suurele panustamisele asulakohta investeerimisse ja eelnevast väiksemale mobiilsusele. Nöörkeraamika staadiumi puhul on ühelt poolt jälgitav eelnevale sarnane asulate kohavaliku muster, kuid lisandus hulk veekogudest eemal olevaid asulakohti peamiselt Põhja-Eesti klindil. Teistes Eesti piirkondades kasutati mitmel juhul kohti, kus oli ka mõne varasema staadiumi asula, kuid nöörkeraamika staadiumis ei paiknenud need kohad enam vahetult veekogude kallastel või randadel. Muude keskkonnamuutujate varieeruvus on nöörkeraamika staadiumi asulakohtade puhul samuti suurem, elupaigad asetsesid mitmel juhul ka savisel pinnasel. Võimalik, et sellise asukoha valiku tingis viljelusmajandus, mille tõttu veest elatise hankimine oli väiksema tähtsusega.