Changes in the Settlement History of the Late Bronze and Iron Age Körös Region
Hydrology, Reliefs and Settlements

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Keywords: *settlement history, Late Bronze Age - Iron Age, climatic changes, reliefs, hydrology*

1. Introduction

Settlement historical transformations that took place in the Körös Region and the Békés-Csanád alluvial fan in the Late Bronze and Iron ages have already been highlighted in more archaeological studies.[1] Those marginal zones – particularly the flood-free loess ridges/interfluves of unstable water balance in the Great Hungarian Plain (Békés-Csanád alluvial fan) – that had either not been populated or had scarcely been inhabited in former prehistoric ages were 'annexed' in that 800-year-long period (1200-400 BC) by the Gáva and the Vekerzug (and then La Téne) cultures. This tendency might have been stimulated by a complex transformation concerning the lifestyle, economy and environment.[2] Deforestations, which provided – according to pollen analyses likewise – material for constructions of hillforts and fuel for the bronze production implemented by inhabitant cultures of the Carpathian Basin (Urnfield, Kyjatice, Lausitz, and Gáva cultures) at the end of the Late Bronze Age (HB2-HB3, 9-8th centuries BC), might have been a major cause of these irreversible processes. Soil erosion induced by the cutting down of forests in the highlands and lowlands, the reduction of evaporation surface, the increase of river flow rates, and the climate period characterized by a decline in the temperature and a decrease of precipitation that can be dated to the transition period between the Late Bronze and Iron Age concluded a surplus of both the surface and subsurface waters in lower areas of the Great Hungarian Plain; whereas the once flood-free, higher lands were likewise covered or reduced by inundations.[3] As a consequence of the diminishment of quondam residential and economic areas, higher reliefs (loess terraces) of the Körös region and the Békés-Csanád alluvial fan started to be populated at the end of the Late Bronze Age and the Early/Middle Iron Age.

2. Climatic Changes in Europe at the end of the Late Bronze Age and in the Early Iron Age

The „Homeric minimum", „Hallstatt disaster", early Sub-Atlantic climatic deterioration, Little Ice Age. Researchers dealing with the subjects of prehistoric climate and environmental history use numerous terms for the climatic period taking place in the 9-8th centuries BC, and is characterized by the tendencies of significant precipitation and intensive cooling, which can be detected throughout the European continent. On the basis of the pollen analyses conducted on samples taken from marshes and fens, the climatic deterioration can be dated to the period between 900/850-750/700 cal BC: *Engbertsdijksvenen* (Netherland) I.=862 cal BC; VII.=784 cal BC; XIV.=815 cal BC[4], *Pancavská Louka* (Czech Republic) = 858 cal BC[5], *Holzmaar* (Germany) = 800 cal BC[6], *Draved mose* (Denmark) = 848 cal BC[7], *Abbeyknockmoy* (UK) = 750 cal BC, *Moogen* (UK) = 750 cal BC, *Bolton fell moss* (UK) = 900 cal BC, *Walton moss* (UK) = 860 cal BC[8]. A combined investigation involving paleobotanical data and malacofaunal composition and climate model deriving from the analysis accomplished on the Bátorliget Marshland indicate a cooler and wetter climatic period, which could have resulted in 1-2 °C decrease in the temperature during the summer months[9], Glacier analyses accomplished in the French Alps, the

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1 Gyucha 2001, 123–126; V. Szabó 2004, 149–151; Bóka 2008.
2 Bóka 2008, 159.
3 Bóka 2008, 159–160.
4 Kilian et al. 1995; Mauquoy et al. 2004; Barber et al. 2004.
5 Mauquoy et al. 2004.
6 Barber et al. 2004.
7 Kilian et al. 1995.
8 Barber et al. 2004.
9 Sümegi 2004, 327.

Jura Mountains and the Swiss Plateau – analyzing the extensions, fossil soils and dendrochronological features of the wooden remains of the Aletsch, Gorner and Grindelwald glaciers – indicate a maximum extension between 1000 and 600 BC, while a minimum extension between 400 BC and 400 AD[10]. Water levels in the region would change correspondingly with the Holocene glacier fluctuations. Owing to systematic lithostratigraphic analyses, elevated water level was observed in two short episodes 1050-1000 cal BC and 950-900 cal BC, as well as in two longer periods of time, between 1550 and 1150 cal BC, and between 800 and 400 cal BC[11]. On the basis of sedimentation analyses fulfilled in the Lake Jues (Germany), a significant change took place in that area around 2750 cal BC, which concluded a deforestation tendency and the increase of water level[12]. Samples from geoarchaeological drillings and radiocarbon dates of trenches conducted in the southern bank of the Lake Balaton, the Tapolca Basin and the Nagy-berek Marshland, collectively indicated that the lake's water surface level and extension culminated at the end of the Late Bronze Age and in the Early Iron Age[13].

According to analyses on Greenland ice and bores accomplished in the northern Atlantic Ocean, little ice ages followed each other cyclically, at ca. 1470-year intervals in the Holocene (1400, 2800, 4200, etc. cal BP). In the case of both little ice ages assigned to 8100 and 2800 cal BP, dates coincide with the decline of solar activity entailing colder and wetter weather character in Europe[14]. Bore samples taken in the eastern forest-steppe zone also refer to weather conditions characterized by colder temperature and more precipitation in 850 cal BC[15]; correspondingly to areas west of the Carpathian Basin: the so-called Urnfield climate optimum terminated in Moravia and the surrounding territories under HB3, and we can reckon with cold and wet weather already partly in HB3 period and in the HC phase[16].

We can positively ascertain upon the abovementioned results of multidisciplinary researches that such climatic changes happened at the end of the Late Bronze Age and the Early Iron Age, which made an impact throughout Europe, and consequently the Carpathian Basin.

3. Connections between Reliefs and Settlements

The area we involved in the investigation coincided with the territory concerned by the research Archaeological Topography of Békés county (3798.5 km²). It can be divided to two regions, partly the Mezőség – or Békés-Csanád alluvial fan – and the Körös region. These two lands are fundamentally different in terms of geomorphological character. Within the study area we can observe various phenomena of the Quaternary period, which indicate different heights above sea level and reliefs (Fig. 1):

Fluvial sediment (floodplain sediment): Silt and clay are represented significantly in its material. In the case of larger rivers (e.g. the Körös rivers) we distinguish between the floodplains of Early Holocene high (fQh1) and New Holocene shallow (fQh2). The first type of floodplains is not or rarely inundated by recent floods, only in the case of exceedingly high water levels. Inside basins (e.g. the internal Great Hungarian Plain, Körös region), bottomlands surrounded by alluvial fans develop in the floodplain. The enclosing reliefs are composed by silt, clay and rarely sand[17].

Lacustrine sediment: horizontally bedded sediment of fine grains is deposited in the internal portion of lakes (clay: lQh2a and silt: lQh2al), whereas alongshore sand and pebbles can likewise occur[18].

Marsh sediment: this type of sediment is characterized by different organic matter content, which can be clay, silt, peat, muck soil and mould. The marsh sediments on the surface are generally of New Holocene age (bQh2to)[19].

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10 Holzhauser 2005.
11 Holzhauser 2005, 796.
12 Zolitschka et al. 2003, 90–92.
13 Sümegi et al. 2007, 250–251; Sümegi/ Jakab 2007a, 77; Kiss/ Kulcsár 2007, 115–116.
14 Geel et al. 1999, 335–336.
15 Dirksen et al. 2005.
16 Bouzek 1999.
17 Kaiser/ Gyalog 1996, 57–58.
18 Kaiser/ Gyalog 1996, 59.
19 Kaiser/ Gyalog 1996, 59.

Aeolic sediments (loess): superficial loess soils are regularly Upper Pleistocene in origin. Aeolic/ typical loess (eQp3l), infusion loess (hQp3il), clayey loess (hqp3a-l) and loessy sand (eQp3lh) can be found in Hungary. The vast majority of lands is covered with the infusion loess, a.k.a. loess mud. The aeolic dust deposited in water, or it was leached due to later inundations. It occurs on the quondam floodplains of the Great Hungarian Plain rivers[20].

The Great Hungarian Plain's surface is covered by the latest formations of the Earth history: Holocene sediments in the fluvial floodplains, and Upper Pleistocene strata on flood free reliefs[21]. Apart from marginal areas, we distinguish among three height levels: plains adjacent to the rivers (e.g. Körös region), Pleistocene flatlands that surmount floodplains altitudes with a few meters (e.g. Békés-Csanád alluvial fan), and sand hills ascending 20-80 m above the average altitude[22]. Körös region's surface is dominantly a floodplain with plenty of wetlands, marshes, peaty bogs, and divergent, meandering river branches. The surface cover is thick silt in all directions, whereas clay emerges in the margins, and loess ridges alongshore. These islands of loess are Pleistocene relief remnants even in the middle of the depressions[23]. We conduct a comparative analysis of the prehistoric hydrological features capable of reconstruction[24] (Fig. 2), the reliefs appropriate to accommodate human habitations and the settlement locations of those cultures that were involved in the investigation (Gáva, Vekerzug and La-Téne cultures). We assumed that peoples of these cultures adapted themselves to the quondam weather, hydrological and topographical circumstances, and selected the locations of their habitations according to these. We recorded the data of 1177 settlements (processed 90%), among which 365 belonged to the Gáva Culture, 538 to the Scythian Vekerzug Culture, and 274 to La-Téne. Based on the databases that present Quaternary geological formations,[25] we can delineate the pre-regulation state of those low floodplains that can refer to Late Bronze and Iron Age persistently or temporally inundated lower floodplains, marshes and lakes, and the higher plains inundated periodically or in case of significant floods, as well as permanently flood-free islands (loess terraces, Pleistocene sand surfaces) (Fig. 1). By means of comparing these reliefs to the locations of the individual cultures (with the help of geoinformatics (ArcGIS)) we can provide data on the quondam hydrological and climatic relations, as well as their alterations in chronological aspect (Fig. 3).

Low floodplains provide place for 30.4% of the Gáva culture settlements, 17.1% of the Vekerzug and 18.9% of the La-Téne sites. In contrast, we can find 25.6% of the Gáva Culture, 43.7% of the Vekerzúg culture and 37.5% of the La-Téne culture settlements on high floodplains. Whereas on (loess) terraces, which reliefs are considered the highest in altitude, 30.6% of the Gáva culture settlements, 26.3% of the Vekerzug and 28.8% of the La-Téne culture settlements are represented. Sandy surfaces give place to as few as 0.5% of the Gáva, 9.4% of the Vekerzug and 7.2% of the La-Téne cultures' habitations. On lower surfaces covered with lacustrine sediments, which indicate persistently inundated environments, 4.6% of the Gáva Culture and 2.1% of the La-Téne settlements settled down, whereas Vekerzug sites are not represented on this type of sediment. Peat and marsh sediments provide place for 2.1% of the Gáva, 0.5% of the Vekerzug and 0.7% of the La-Téne periods's sites. Finally, on (the separately studied) alkali soils, indicating wet environment, 19.4% of the Gáva settlements, 13.3% of the Vekerzug and 18.2% of the La-Téne cultures' sites are represented (Fig. 4).

The population of Gáva culture did not prefer any of the major relief types (low and high reliefs, terraces), but it rather occupied them in approximately equal distribution. That tendency indicates the predictability and stability of the onetime environment. Reliefs and sediments – e.g. low floodplains, lacustrine sediments, peatbogs and alkali soils –, which can be regarded as „moisture indicators", and the ratios of settlement distributions undoubtedly suggest a drier and warmer climatic period in the era

[20] Kaiser/Gyalog 1996, 60.
[21] Rónai 1985, 87.
[22] Rónai 1985, 89.
[23] Rónai 1985, 367.
[24] Gyucha/ Duffy 2008.
[25] MFT 2005.

of the Gáva culture (12-9th centuries BC) (moisture indicator no.: 37.1). In contrast, the distributions of the Scythian Vekerzug (7-5th centuries) settlement locations present a completely different configuration: they moved from low plains up to those high floodplains that were more protected from floods. They populated terraces in the same distribution as the Gáva culture did, however, a drastic reduction – to less than half – in the number of the moisture indicator (17.6) and a decline in the amount of settlements taking place on alkali soils reflect to a settlement organization that looked for more secure reliefs (loess terraces, high floodplains, sandy surfaces) and such areas that were protected from surface waters and floods to greater degree than in the previous centuries. This tendency can be explained by a rainier and cooler climate and the increasing intensity of inundations. La-Téne people populated the distinct reliefs in a distribution similar to the Vekerzug Culture. Although, slighter distinctions of the ratios, the increase of moisture indicator number (21.7), as well as the repeatedly growing frequency of settlements on alkali soils reflect to more moderate and predictable fluvial activity, and the improvement of the climatic environment.

4. Connection between Hydrology and Settlements

Based on the analysis of the chronological order of populations within a closer area, or region, we can conclude climatic transformations. The investigation of lacustrine and riparian sites (settlements) are particularly appropriate to that, since the distance of population from a shore refer mostly to changes of the water level[26]. The populations of human communities were determined fundamentally by the proximity to watercourses on the Great Hungarian Plain in the past millennia[27]. The hydrological reconstruction of the Holocene surface water system was based on topographical maps, the digitalized georeferenced maps of the Second Military Survey of the Habsburg Empire, the map pages of the First Military Survey of the Habsburg Empire, Gábor Hevenesi, and Mátyás Huszár, as well as on high resolution aerial photos. According to the reconstructed hydrological model of the Holocene Körös Region, the water system of the period's initial phase could have been remarkably stable, and thus had not undergone significant changes in the pre-regulation period (Fig. 2)[28].

We accomplished the analysis of the proximity of the Gáva, Scythian Vekerzug, and La-Téne cultures' settlements to watercourses by means of comparing the settlement database they compose and the above introduced paleohydrological reconstruction (Fig. 5). It can be ascertained conclusively that the vast majority of the settlements of these three cultures located in the zone with the distance range from 50 to 500 m from prehistoric running waters. In areas lying in the distance of 25-50 m – in fact, on the shores –, settlements can be observed in meager distribution, similarly to more distant areas, which accommodated sites in a lot less distribution. The „main population zone", ranging from 50 to 500 m, was inhabited by 76.6% of the Gáva Culture settlements, 60.4% of the Vekerzug settlements, and 67.3% of that of the La-Téne; whereas in the farther outer zones, this distribution is as follows: 18.5%, 34.8% and 28.3% (Fig. 5). We can assert, on the basis of the aforesaid, that people of the Gáva Culture would occupy the main population zone in the neighbourhood or rivers, whereas they used the outer zones scarcely. This ratio had transparently changed by the end of the Early Iron Age and the Middle Iron Age, as besides the main zones, the Scythian Vekerzug culture utilized the outer zones for dwelling purposes more frequently. The tendency transformed in the Late Iron Age again: in contrast to the Vekerzug period, people of La-Téne era moved closer to running waters, and used outer zones more rarely for residential purposes.

With respect to the settlements' proximity to watercourses, we assert that Bronze Age settlements fell close to running waters (low level of floods), whereas the end of the Early Iron Age and the Middle Iron Age can be characterized by a kind of „moving-away" trend of the habitations from watercourses (higher flood levels); and subsequently, the tendency of populations in the Late Iron Age

[26] Horváth 2002.
[27] Gyucha/ Duffy 2008.
[28] Gyucha/ Duffy 2008.

indicate again a proximity to rivers. All these can be correlated with the climatic and paleohydrological changes, and the fluctuations of the water surface level and the intensity of floodings, which might have, by all means, happened in the region.

Similar consequences were drawn from the investigation of settlement ecology conducted at the terraced valley of the Danube between Dunaalmás and Esztergom. As a characteristic of the Urnfield Culture in this area, settlements emerge on both ashore and the islands. As opposed to this, settlements of the consecutive period, the Early Iron Age (800/700-500/400 BC, according to the publications), occupied lands with higher altitude that were situated farther from the Danube. After the so called Urnfield climate optimum, the elevated level of floodings concluded that human habitations „crept upwards" to higher altitudes owing to the 2-300-year-long cool and rainy oscillation of the Early Iron Age; but the intensive emergence of settlements alongshore in the second half of the Late Iron Age already refer to a lower level of rivers[29].

According to the changes in the values of Bog Surface Wetness (BSW hereinafter) in the UK and results of sedimentation analyses conducted on the floodplains, low fluvial activity with warm and dry climate phase can be reconstructed between 1200-850 BC; between 850-550 BC, a more intense fluvial activity with cold and wet climate can be observed, and a short decrease of the BSW values besides higher water levels and stagnating fluvial activity between 550 and 400 BC[30]; whereas cold and wet climate phase and augmenting fluvial activity can be reconstructed between 400 and 100 BC[31].

5. Summary

On the basis of the analyses conducted on reliefs Upper Pleistocene, Early Holocene and New Holocene in origin, which are characterized by different altitudes, the introduced paleo-hydrological reconstructions (Fig. 6), as well as those of the identified locations of the settlements of the cultures discussed above, Gáva Culture occupied all three main reliefs in equal distribution, in areas close to watercourses. In contrast, people of the Vekerzug Culture preferred settling down in higher lands, and moved farther from running waters. La-Téne culture appeared on lower reliefs more frequently than Vekerzug Culture, and pulled closer to rivers coincidentally.

The spatial distribution of settlements may reflect to onetime climatic circumstances, the changes of fluvial activity, the oscillation of water levels, as well as to the intensity and fluctuation of floodings, too. The localization of Gáva Culture settlements refers to a warmer, drier climate and more predictable fluvial activity, which corresponds to the parameters of the so-called Urnfield climate optimum. The settlement structure of the Scythian Vekerzug Culture suggests colder and wetter weather conditions (as discussed above), and the immoderate activity of running waters in its territory during the Early/Middle Iron Age. Under the La-Téne period a kind of consolidation process can be observed. The frequency of settlements in lower areas and riparian plots grew again, referring to a warming process from the Late Iron age onwards, and a more stable, predictable fluvial activity.

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[29] Horváth 2000; 2002.
[30] Brown 2008.
[31] 14 independent flooding episodes are recognized in Great Britain in the Holocene, between 10420 and 400 cal BC. One of these is dated to the period between 2750 and 2350 cal BP (Macklin/ Lewin 2003).

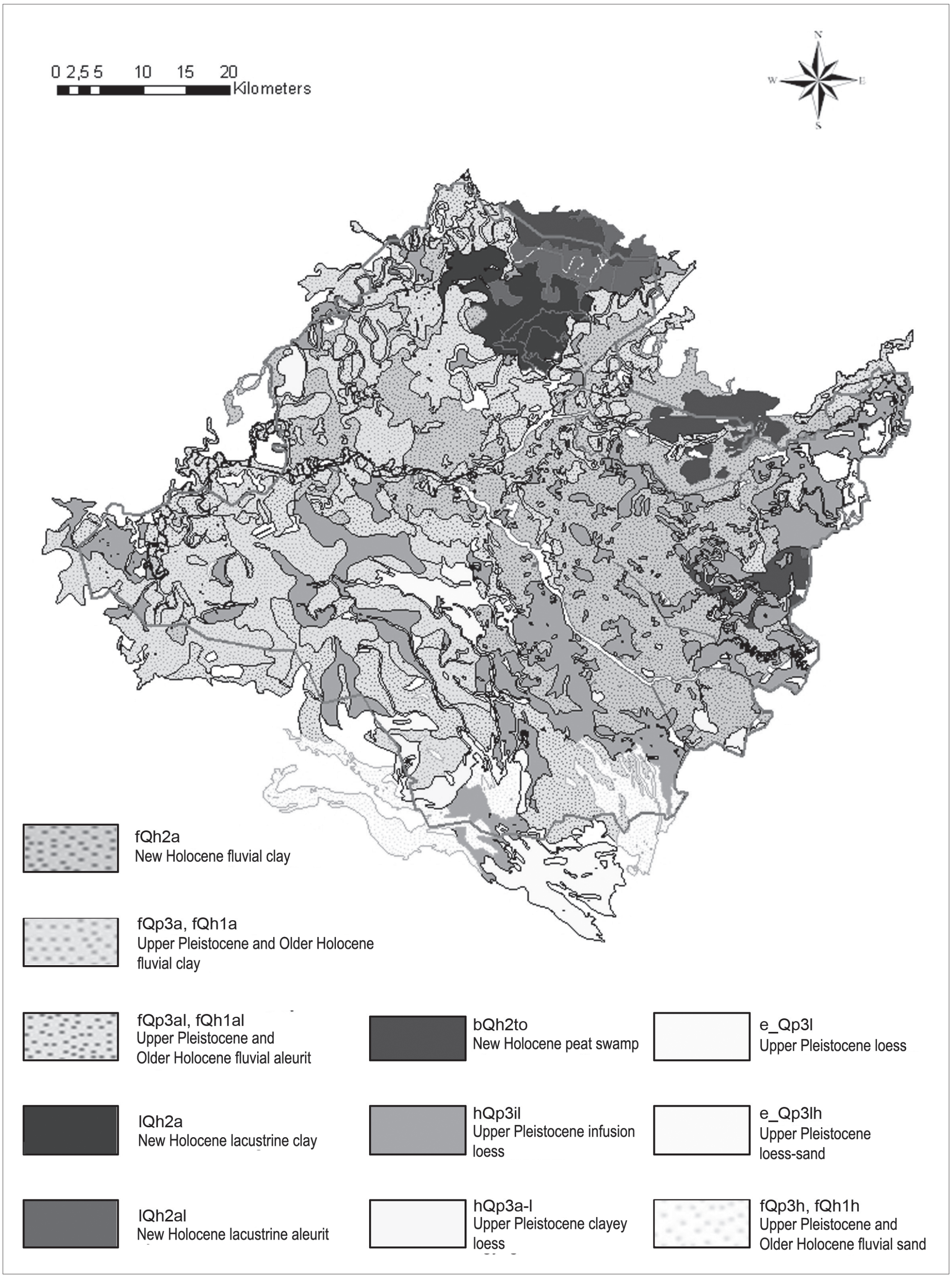


Fig. 1: Quaternary geological (soil) formations within the research area

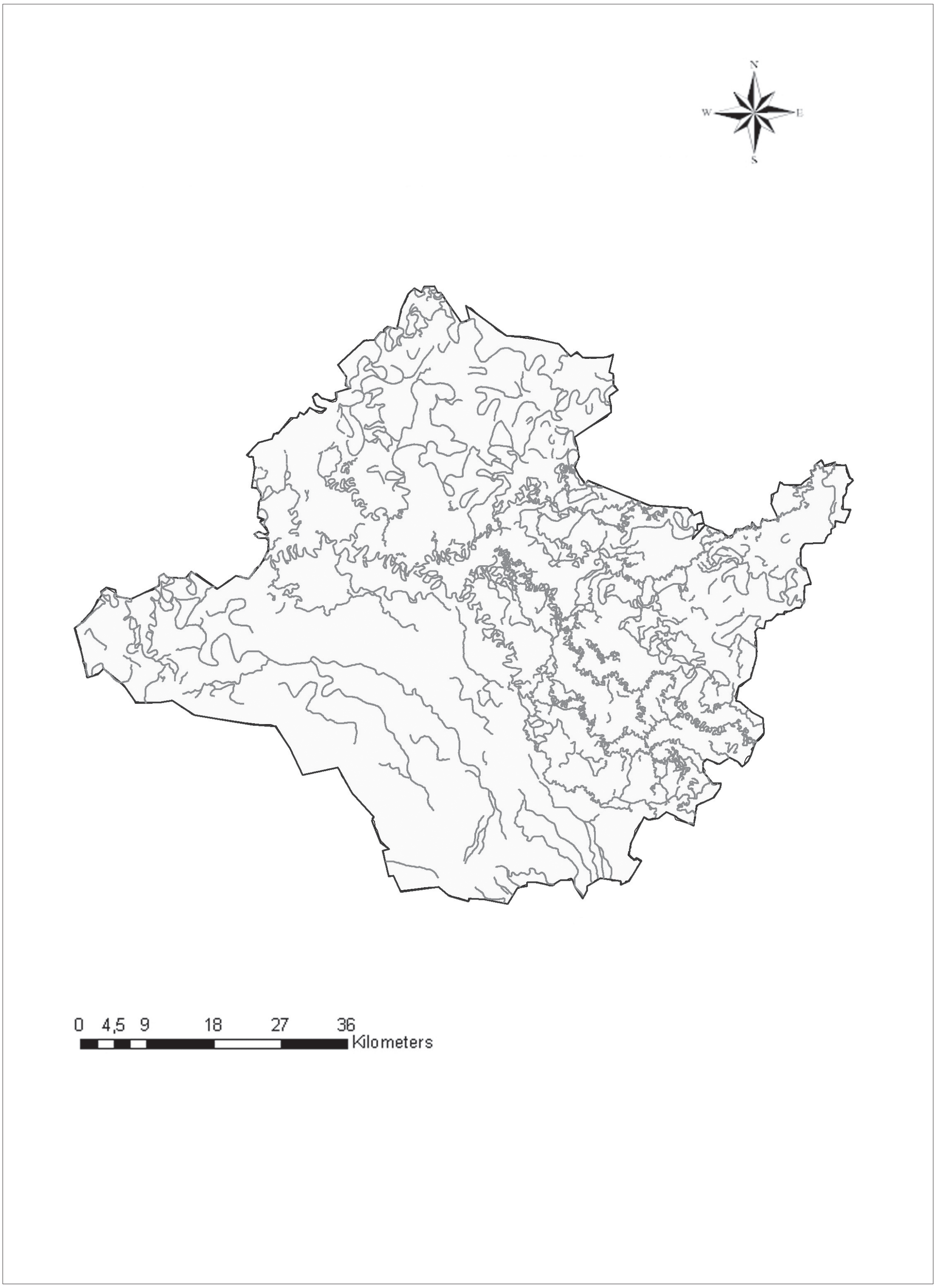


Fig. 2: Paleohydrological reconstruction within the research area (after Gyucha/Duffy 2008)

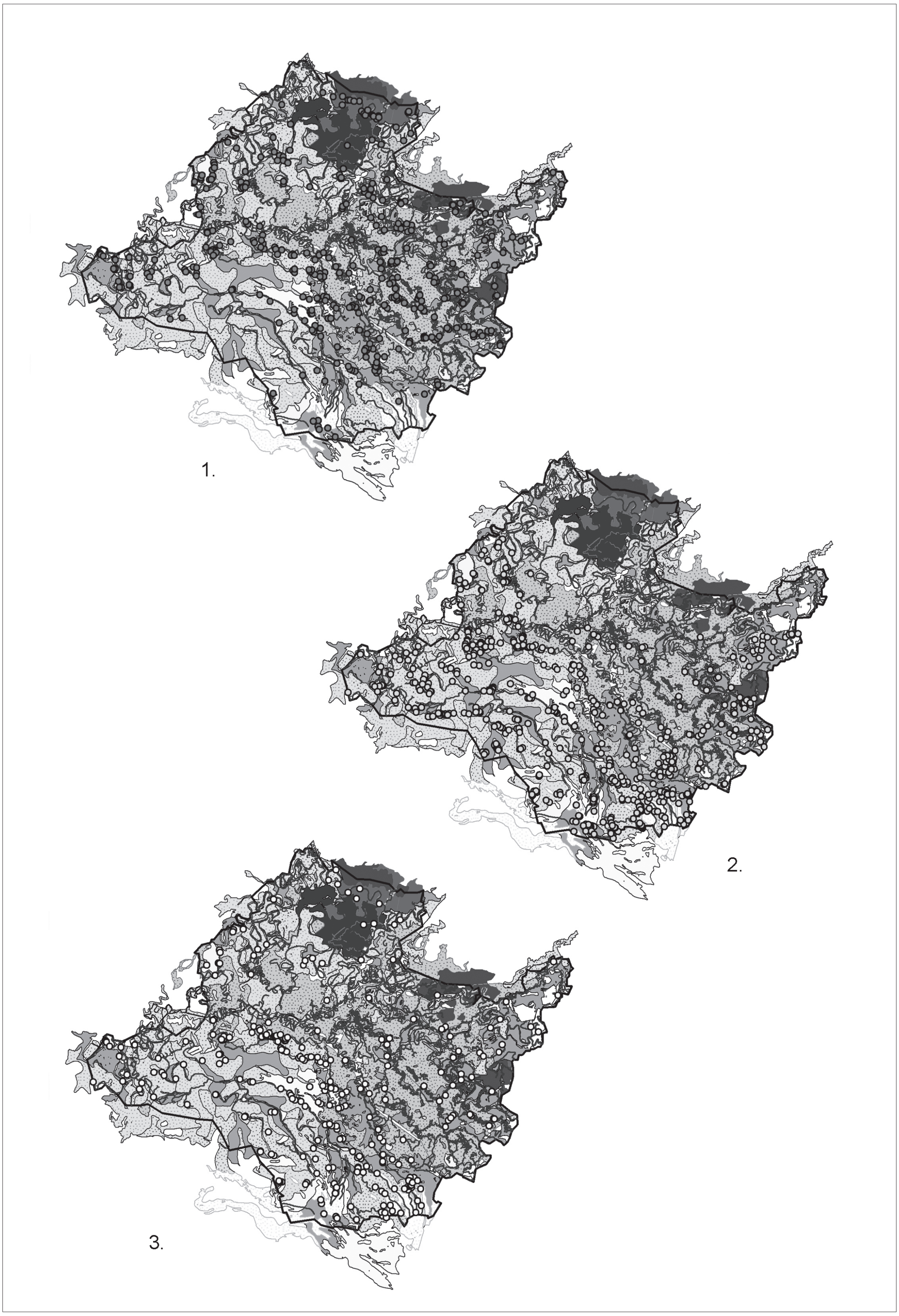
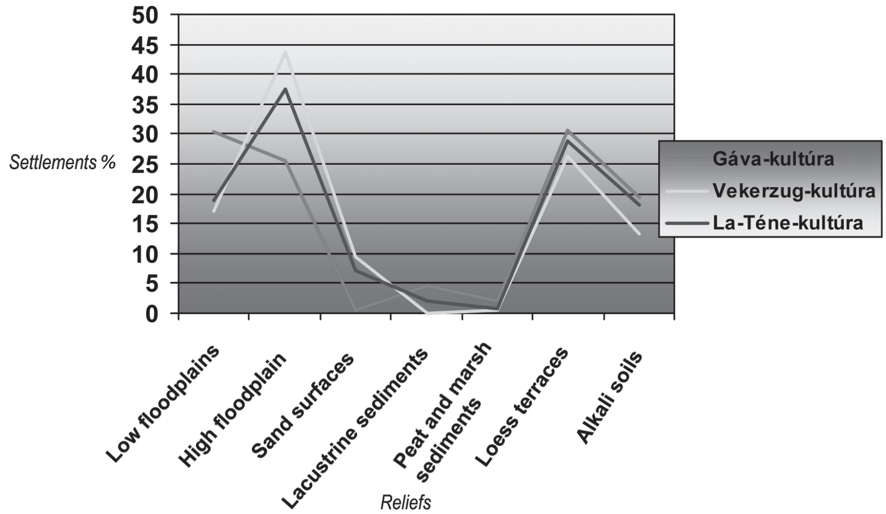


Fig. 3: Connection between the reliefs and settlements: 1. Settlements of the Gáva culture 2. Settlements of the Vekerzug culture 3. Settlements of the La–Téne culture



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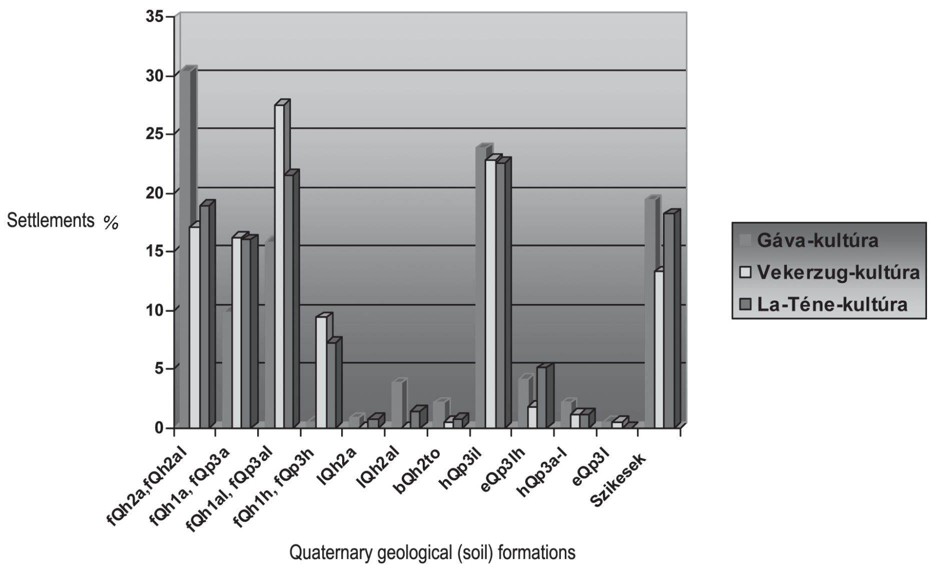

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Fig. 4: 1. Connection between the reliefs and settlements 2. Connection between the Quaternary geological (soil) formations and settlements

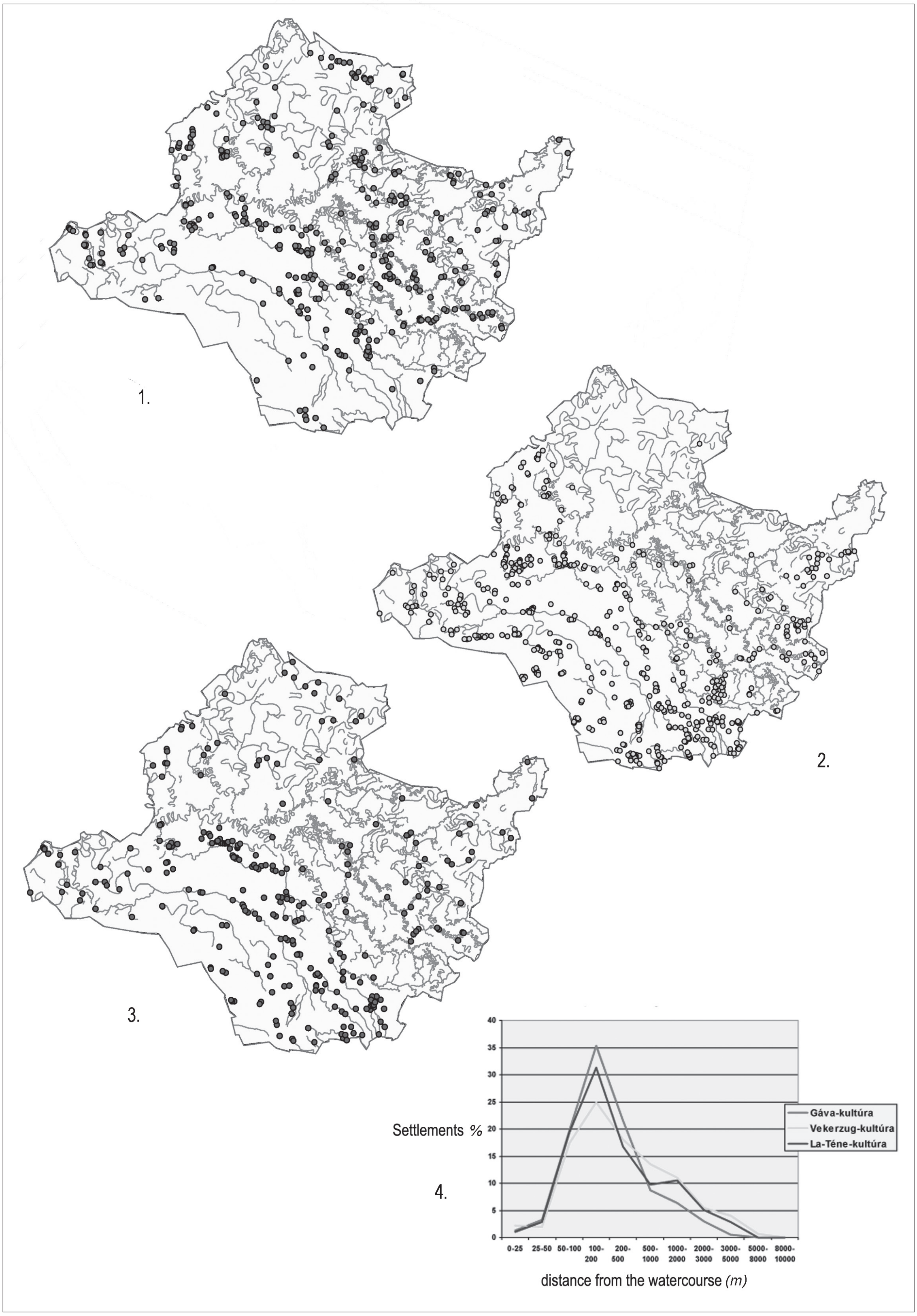

Fig. 5: Connection between the Paleohydrological reconstruction and settlements: 1. Settlements of the Gáva culture 2. Settlements of the Vekerzug culture 3. Settlements of the La–Téne culture 4. Settlement distance from the watercourse

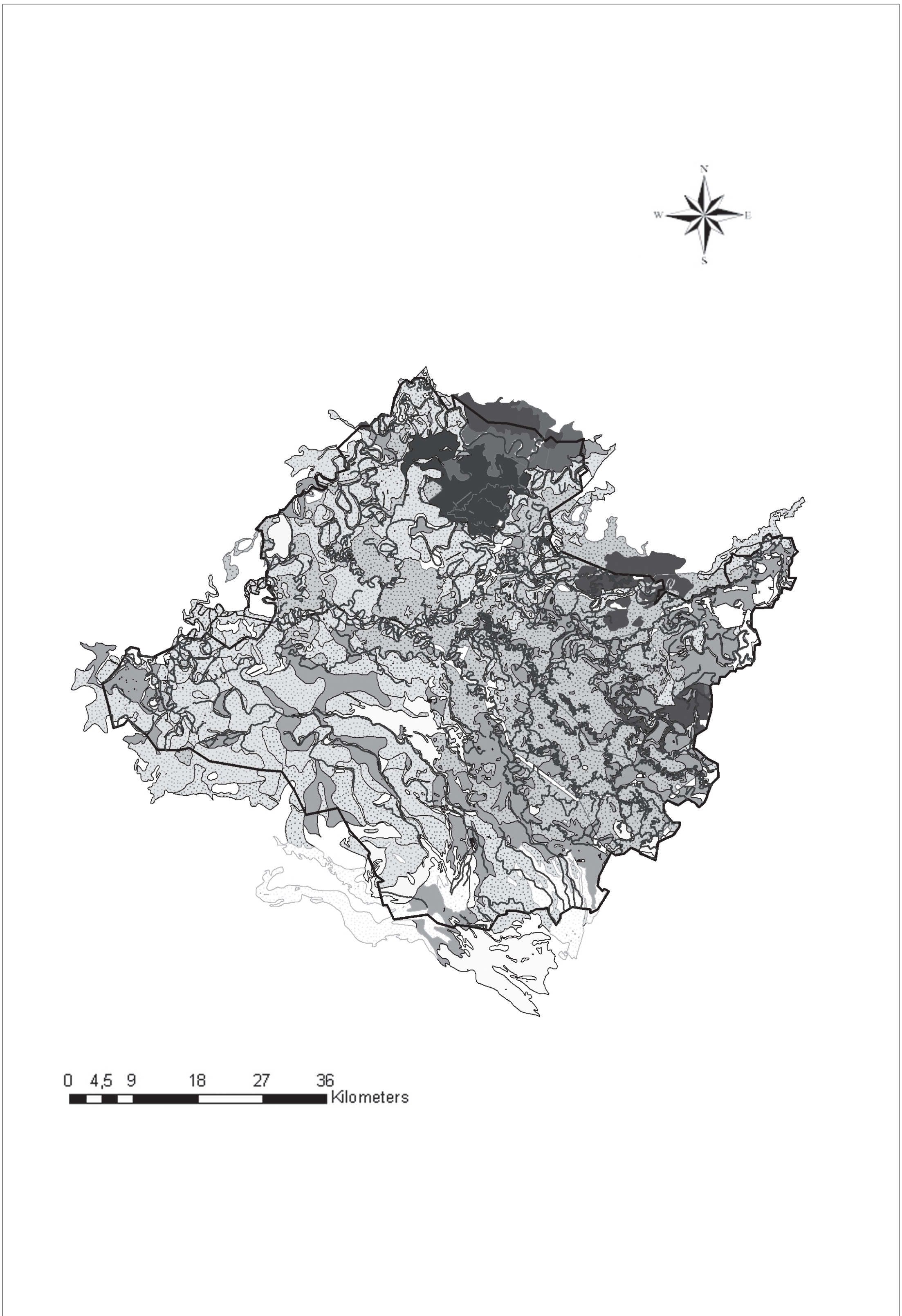

Fig. 6: Reliefs and hydrology in the Holocene.