2_2_1_Introduction_to_the_Nebelivka_micro-_and_macro-regions_(Marco_Nebbia)

The micro-hinterland (5km)

Since its inception, the research agenda of Trypillia studies has not included systematic field survey investigations. The Ukrainian literature yielded very few reports on unsystematic surveys, carried out mostly as “supplements” of major excavations on Trypillia sites and mega-sites. Archaeologists mostly relied on local farmers’ knowledge of Trypillia potsherd scatter locations in the fields, and most of the sites were found thanks to sporadic and unsystematic field surveys (Russian '*razvedki'*).

Data recording systems have been developing, and the introduction of GPS has considerably improved the site location process in the last few years. Nevertheless, data collection methods do not follow procedures that are now standard in Western European archaeology and they are still inadequate for the level required by the scientific community. Ukrainian methods of investigations in the field have always been quite traditional and not inclined towards technological and methodological innovations. Ukrainian archaeologists have been using remote sensing since the 1960s, without developing a tailored strategy for the specific case of Trypillia sites. The same conservative approach has been pursued with field survey, so that a new methodological agenda for field investigation was needed.

The first systematic field survey ever conducted in Ukraine has been carried out by the 'Early urbanism in prehistoric Europe?: the case of the Tripillia mega-sites' Project in the near hinterland of the site of Nebelivka (Trypillia Phase BII), covering around the 42% of available fields (ADS LINK TO 2_2_2_IMAGES/2_2_1_Small_finds_Neb_5km). During the 2009, 2012 and 2013 seasons, the project adopted a non-site sampling strategy (Thomas 1975) in order to assess the definition of ‘site’ derived from surface material. This involved picking up and positioning every single small find with an accuracy of 3 metres. No major surface scatters were found in 2009 or 2012. The 2013 results show four major surface scatters, which can be identified as archaeological sites (ADS LINK TO 2_2_2_IMAGES/2_2_1_Small_finds_Neb_5km) among a huge quantity of *off-site* material. Of approximately 1,000 potsherds collected in 30 sq. km., not a single sherd can be reported as dating to the Trypillia period (!).The results of the field survey show that there is very little, if any, archaeological material presence in the immediate surroundings of a 236-ha

settlement with almost 1,500 dwellings. Only four concentrated scatter of surface material have been attributed as sites of the Cherniahov archaeological cultural complex (2nd – 5th century AD). In the fields where these sites are located, no other period is represented among the collected surface material. In general, the surveyed areas rarely returned multi-period material scatters identifiable as sites.

The four small Cherniahov sites are located at the junction of two or more river valleys (some of which are currently dried out) and gulleys, but never occupying the first river terrace. These locational settings are shared across sites and settlements of all periods in the micro-region. Inter-fluvial areas and ridges, instead, returned a high concentration of burial mounds - the so-called *kurgans* – which can date from the Early Bronze to the Late Iron Age. Burial mounds have been subject to differential preservation, with examples located in currently cultivated fields often ploughed out. Their height varies from 0.30m to 4-5 m but even the subtler ones can be detected and mapped through the use of satellite imagery (ADS LINK TO 2_2_2_IMAGES/2_2_2_kurgans_sat_images_and_ground). The eroded mound tops reveal the sub-surface soil composition which has a spectral signature distinguishable from the background field. Kurgans are the major archaeological evidence found within the 5km Nebelivka micro-hinterland (ADS LINK TO 2_2_2_IMAGES/2_2_3_Neb_5km_hinterland) and represent a major post-Trypillia landscape transformation.

Looking at the immediate hinterlands of the other mega-sites in the SBD interfluve, it is noticeable how the absence of other coeval sites is a common characteristic for phases BI, BII and CI (ADS LINK TO 2_2_2_IMAGES/2_2_7_Nebelivka_mega_hinterland_BII_sites). This could suggest that those territories were devoted to farming, although the in-depth survey of the Nebelivka micro-region seems to contradict this hypothesis. More systematic field survey around megasites would help us to understand whether this is an isolated pattern or a common trait for these big settlements. As for Nebelivka, further evidence demonstrating a very small impact of the settlement on the local environment derives from the results of the pollen sequence obtained by a core located 250 m Northeast of the edge of the megasite at the bottom of the river valley (ADS LINK TO SECTION 3_4_THE_NEBELIVKA_1B_SEDIMENT_CORE). The results show how, during the occupation of the settlement, the quantities of cereals are even lower than during either the pre- or post-occupation period of Nebelivka.

Remote sensing in the micro-region

The investigation of the Nebelivka micro-hinterland has been supported by a systematic photo-interpretation of high-resolution satellite images. The intensive analysis of the multi-spectral WorldView-2 image produced over 300 features, mapped using a natural colour display (WorldView-2 multispectral acquired on 17 September 2011 – spatial resolution of 0.46m) (ADS LINK TO 2_2_2_IMAGES/2_2_4_Anomalies_Worldview2_Neb_5km).

The results showed that, overall, 51% of the features were manifested as cropmarks, where the presence of buried features restrained the crop growth, in comparison with 43% as soilmarks, where the presence of features affects soil moisture. Only 21% of the features have been attributed to an anthropogenic origin, whereas the majority of the rest show an intricate, and as yet undated, palaeo-hydrological network (ADS LINK TO 2_2_2_IMAGES/2_2_5_hydrological_anomalies_Neb_5km). Considering the sole features relating to potential anthropic origin (which include the Nebelivka mega-site, burial mounds and other potential smaller sites), 76% showed up as soilmarks (ADS LINK TO 2_2_2_IMAGES/2_2_6_Anthropic_anomalies_Neb_5km). The rotating agricultural regime allows us to appreciate the different visibility of the same feature under two different land use covers;[1] therefore, it was possible to show that, in cultivated fields, the archaeological anomalies were virtually invisible.

Overall, the majority of the features mapped from the satellite imagery can be interpreted as traces of an old hydrological system constituted by dry gullies and relict palaeo-channels connected with still active major rivers (ADS LINK TO 2_2_2_IMAGES/2_2_5_hydrological_anomalies_Neb_5km). The scenario represented by these natural features suggests a highly developed network of rivers and streams, which was active in the past. Although there is no chronological evidence to date the older features, we can argue that the layout of the outer and inner circuits with respect to one of the palaeo-channels suggests that the channel was active before and during the occupation of the Trypillia mega-site.

The macro-hinterland (25km)

[1] This is possible whenever we have two images, taken at different times and covering the same area.

The results of the first season of field survey in the micro-region suggested that the majority of archaeological sites sit on riverbanks at the junction of two or more river branches. The interfluvial areas are mostly free from settlements. The outcome of the first assessment suggested a planning strategy for further investigations of the Nebelivka hinterland - a targeted investigation of areas near watercourses. Therefore, further fieldwalking has been carried out along major and minor watercourses, some still active, some dried-up and currently used as pathways (ADS LINK TO 2_2_2_IMAGES/2_2_8_Surveyed_areas_Neb_25km). Table 1 summarizes the main periods and cultural attributions of the material collected during the field survey.

Table 1. Main periods and archaeological cultures found during the field survey.

Period or cultural label	**Dates**
Neolithic	4800 - 3000 /2900 BC
Bronze Age	3000/2900 – 1050/1000 BC
Iron Age	1050/1000 BC – 2nd century AD
Cherniahov	2nd – 5th century AD
Slavonic (e.g. Scythians)	5th – 10th century AD

A total of 143.5 km has been surveyed along river courses, covering an area of 574 ha during a short three-week season in 2014, finding 30 sites of all time periods, with two dated to the Trypillia period (ADS LINK TO 2_2_2_IMAGES/2_2_9_Neb_25km_hinterland). This result confirmed continuity in settlement locational strategies from the Copper Age to the Post-Medieval period. The investigated area included a transect leading from Nebelivka towards the partly coeval mega-site of Volodymyrivka (Trypillia BII) situated to the South-East along

the Synuha River (ADS LINK TO 2_2_2_IMAGES/2_2_10_Nebelivka_Volodymyrivka_transect). This choice was dictated by the question of looking for Trypillia settlements between these two contemporary megasites in an archaeologically understudied area. Furthermore, the territory covering a 25 km radius from Nebelivka has been chosen as the wider hinterland for investigation in order to understand the settlement patterns of the megasite macro-region. The macro-region comprises the counties (in Ukrainian, '*oblast*') of Cherkassy and Kirovograd, since the border between the two counties crosscuts the study area more or less diagonally from North-East to South-West. This left the South-East quadrant of the macro-region totally within the Kirovograd county, which has never been properly investigated archaeologically. Therefore, the field survey focussed on the right bank of the river Synuha and all the right tributaries, both active and dried out. In this way the South-East quadrant of the macro-region represents a sample for both completing our knowledge about Trypillia settlement and also gaining insightful data on long-term settlement patterns trajectories (ADS LINK TO 2_2_2_IMAGES/2_2_8_Surveyed_areas_Neb_25km & 2_2_2_IMAGES/2_2_9_Neb_25km_hinterland).

Another goal of the field survey conducted in the macro-region has been to establish a method of sampling the single site, in order to understand its extension and gain some insights on the internal structure. Given that site scatters are clearly discernible from the background and they are mostly single-phase (at least from the surface scatters), a sampling strategy was adopted to facilitate the shape, extent and internal organization of the site scatters. Very few off-site materials have been found. The survey technique was a mix between extensive and intensive; extensive coverage of long river branches and intensive sampling of each site scatter. A first assessment of the scatter extent defined sampling intervals ranging from 20 metres for small sites to 80 metres for larger sites, as in one case of a 1.8 km-long site located along the lower river terrace. In this way, it is still possible to compare sherd densities between sites, by simply reducing the 20 m sampling to 40 m or 60 m or 80 m. We walked multiple transects across each scatter and picked up surface material within 3 metres' radius samples until two consecutive samples were empty (e.g., ADS LINK TO 2_2_2_IMAGES/2_2_10_Nebelivka_Volodymyrivka_transect & 2_2_2_IMAGES/2_2_11_Kutsa_size_comparisons). Samples were located using a hand-handle GPS device. The finds database recorded information regarding sample number, quantity and chronological horizon, type of material, part of the vessel (for potsherds),

dimensions (for building material like daub) and comments for special finds. These data were merged with the points layer in GIS. The plotting of samples with material quantities and material types enabled the definition of the edges of the scatter and therefore its shape, as well as enabling the identification of the core areas with a higher density of material and other areas of open space with lower densities of daub and sherds. Despite the low percentage of multi-phase settlements, it was sometimes possible to detect expansions, contractions and shifts of settlements through time (as for the site of Krutenka (ADS LINK TO 2_2_2_IMAGES/2_2_12_Krutenka_site_sampling). This method has been fundamental for a better estimation of site sizes and therefore assisted the assessment of the reliability of information contained in the Encyclopaedia. Fig. 2_2_13 (ADS LINK TO 2_2_2_IMAGES/2_2_13_Volodymyrivka_site_transects) shows how sampling transects can help the estimation of the built-up area's edge in the Trypillia BII site of Volodymyrivka. The red line is the actual outer circuit of dwellings that define the limit of the main built-up area. It is clear from the picture how the surface scatter goes well beyond this limit, thus suggesting that most of the site sizes reported in the Encyclopaedia are an overestimation of the actual built settlement extent.

The settlement pattern in the Nebelivka macro-region shows how communities from all time periods selected similar topographical settings; moreover, the results of the field survey show the high intensity of occupation in the region across time, with a high potential for yielding much more archaeology in future surveys. From the portion of territory we investigated (ADS LINK TO 2_2_2_IMAGES/2_2_8_Surveyed_areas_Neb_25km), an intense occupation of the area during the Bronze Age is noted, with the presence of more ephemeral settlements alongside the development of burial mounds – whose mapping for the entire macro-region yields a total of 800 (ADS LINK TO 2_2_2_IMAGES/2_2_14_Kurgan_distribution_Neb_25km). Even though a fine-grained chronology is lacking for later prehistory, a clear transformation of settlement patterns and use of the landscape is recognizable after the Trypillia period. A drop in settlement intensity has been observed during the Iron Age, although chronological impediments hinders a more refined analysis. A remarkable increase in settlement intensity is instead recorded for the later Cherniahov period, when elongated settlements developed along major and minor watercourses, occupying the first river terraces, as exemplified at Lukyanivka I (ADS LINK TO 2_2_2_IMAGES/2_2_15_Lukyanivka_transects). These represent a new settlement form

for the period compared to the ones recorded in the micro-region, which were much smaller in size and situated further from watercourses.

Later occupation during the Post-Medieval period is very rare in the region, with only a few examples of the re-occupation of Cherniahov sites.

With regards to Trypillia settlement patterns in the Nebelivka macro-region, the closest evidence of coeval archaeological presence lies 7 km from the mega-site (ADS LINK TO 2_2_2_IMAGES/2_2_16_Nebelivka_Trypillia_hinterland_25km). However, the information is collected from the Encyclopaedia, as the field survey did not retrieve coeval surface material from the site of Ostrivets.

Not many coeval smaller sites that could potentially have supported a Trypillia mega-site like Nebelivka are located within 25km. Instead, other equally large, if not larger, settlements are situated within the macro-region, including some Phase CI sites like Majdanetske and Taljanki, whose occupations may well have overlapped with Nebelivka for some time [ADS LINK TO SECTION 4_9_THE_AMS_DATES]. Alongside the fact that most of the mega-sites are situated in the Southern Bug-Dniepr interfluve, this pattern of chronological overlap may suggest that the social and economic hinterland has to be examined on a wider scale. In general, Trypillia mega-sites rarely generate an immediate hinterland of satellite settlements that support and are supported by these large settlements; this is the case of Nebelivka and more fieldwork around other mega-sites could shed some light on whether this is a shared pattern or not.

Remote sensing in the macro-region

The field investigation of Nebelivka macro-region has been supported by the photo-interpretation of a set of WorldView-2 panchromatic images at 0.46m resolution (ADS LINK TO 2_2_2_IMAGES/2_2_17_Worldview2_coverage_25km). The analysis of the macro-region, through the satellite datasets, yielded a number of features that are similar in nature to the ones mapped in the micro-region (traces of a relict hydrological network, kurgans and, small archaeological sites). Furthermore, the region has also returned anomalies attributable to Trypillia settlements, even though the conditions under which these features are visible are quite restricted: this is due to several factors, but mainly to the limited availability of satellite datasets. In fact, a wider range of land uses, different times of data acquisition and different

sensors could help in overcoming some of these limitations. Only the availability of more data and a more accurate assessment of the best temporal window for data acquisition can improve the applicability of remote sensing analysis in this area. However, when Trypillia sites are detectable on the satellite images, individual structures are visible as *in situ* features, rather than homogeneous halos representing surface and sub-surface scatters of material. This allows the more accurate recording and estimation of site layouts, the number of dwellings and their orientation, and site limits.