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Joanna Pilszyk*, Piotr Szmyd**

Use of LIDAR ISOK data Available With the Use of Geoportal 2 Website for Discovering Archaeological Sites

ABSTRACT

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The aim of the following study is to present archaeological sites, the discovery of which was possible due to the use of spatial data obtained within the framework of the ISOK project and shared in the service of viewing shaded relief terrain for NMT with a resolution of 1m using Geoportal 2.

Key words: ALS, LIDAR, ISOK, Geoportal 2, non-invasive archaeological research

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LiDAR (laser scanning), an acronym from the words Light Detection and Ranging, also known as ALS (Air Laser Scanning), is a topographic research technique that uses an optical laser to scan the earth's surface in 3D (Davis 2012, 4). The pulse is emitted from a scanning device placed under the plane. The result of ALS scanning is a cloud consisting of several thousand to millions of points, which are then processed in the Geographic Information System (GIS) software to generate digital terrain (DEM – acronym Digital Elevation Model). LIDAR is now becoming the primary source of geographic data. This technology collects very accurate geographic data. They are used by scientists representing various fields of science. Data of this type perfectly reflect the shape of the land surface, revealing sites with their own landscape form. Thanks to LIDAR data created within the framework of the ISOK project, we are able to receive accurate imaging of the earth with outlined structures such as earth ramparts, moats, remains of trenches or burial mounds. The obtained imaging has an accuracy of 15 to 30 cm.

ALS has become a very popular method in searching for relics of the past. While analyzing images, it is possible to notice the earth structures

* Ujejskiego 10 Street, 38-200 Jasło; joannapilszyk@wp.pl

** The Carpathian Troy Open-Air Museum at Trzcينica, Trzcينica 646, 38-207 Przysieki, Poland; pszmyd@poczta.fm

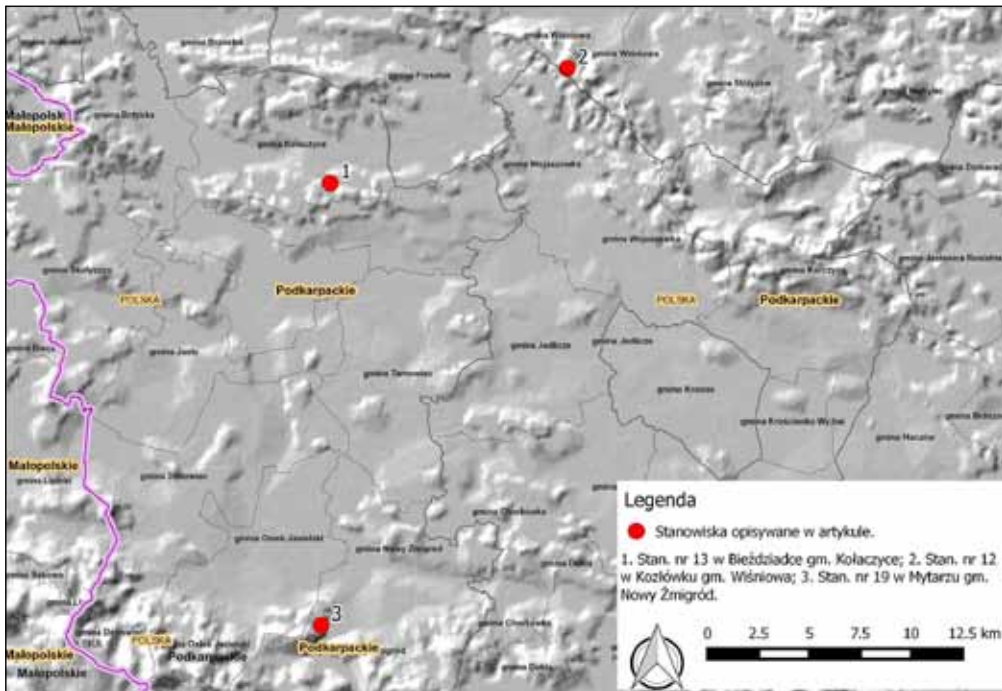


Fig. 1. Location of defensive objects described in the article

hidden under vegetation and inaccessible to the observer in the field. It is a method that allows for non-invasive discoveries and research of historical remains with their own landscape form. In addition, it allows us to generate 3D models of the object as well as its surroundings together with the cross-section of the area. What is more, it makes it possible to study and control destruction processes of given objects.

Based on DEM, DSM (Digital Surface Model) or DTM (Digital Terrain Model) are created. The aforementioned models can be used for various purposes, from area development plans to defining the flood risks. Archaeologists use them to search for relics of the past. DTM is the most useful for archaeological purposes, which reflects the land surface without vegetation and buildings.

Tomasz Brzeziński from Esri Polska defined LIDAR as an „optical method of receiving data. Its operating principle is similar to radar, but instead of a radio beam waves it sends a beam of light. Then we can determine the distance between a sensor and a point that is an obstacle

on the basis of measuring the time between emission and reception of the reflected laser pulse” (Brzeziński 2012, 12).

ISOK is a Polish acronym derived from the words „IT system of the Country’s Protection Against Extreme Hazards”. ISOK data cover 90% of the country, i.e. 289,000 km² (Bakuła *et al.* 2014, 309). The project aims to protect the country against threats, mainly against floods. The areas covered by the scan were selected by the National Water Management Authority – KZGW. The data in the ISOK project were prepared in two standards. In the first one, the average density was 4 or 6 points / m². In the second standard, the average density was 12 points / m² (Kiarszys, Szalast 2014, 271–272).

Polish archaeology used the LIDAR technology for the first time near Piła in Wielkopolska Voivodeship. At the request of the Voivodeship Office for Preservation of Objects of Cultural Heritage, the German company TopScan researched an area of 20 km². The research cost 20 thousand euro. Apart from archaeologists the obtained information was used also by geographers and naturalists. Due to these studies, previously unknown burial mounds, fortified settlements and even the system of ancient arable fields were discovered (<http://www.rp.pl/artykul/1030693-Archeologia-bez-lopaty.html#ap-2>).

Since then, several research programs have been implemented. The flint mines in the Świętokrzyskie Mountains and the Neolithic cemetery in the Muszkowickie Forest in Przedgorze Sudeckie were examined due to financial support by the Ministry of Culture and National Heritage. (<http://archeowiesci.pl/2011/10/31/lidar-odkrywa-pozostalosci-pragornictwa-w-polsce/>; <http://naukawpolsce.pap.pl/aktualnosci/news,393586,pradziejowe-cmentarzyskaodkryto-na-przedgorzu-sudeckim.html>). Another milestone in Polish archaeology was to give the access (free of charge) to a website with the LIDAR spatial data viewing service collected as a part of the ISOK project. The data were made available thanks to the website – Geoportal 2. They allowed the archaeological researchers to discover unknown, anthropogenic sites of their own landscape form and great historical significance as well as they allowed scientists to verify already known objects.

Press reports inform us about a series of discoveries from all over Poland. In Stumiany (east of Szczecin) 100 burial mounds were discovered, (<http://naukawpolsce.pap.pl/aktualnosci/news%2C401434%2Cponad-100-kurhanowodkryli-archeolodzy-w-woj-zachodniopomorskim>).

html) in Masuria barrows and fortified settlements were discovered, as well as the outlines of arable fields, a fortified settlement and burial mounds were identified in the Białowieża Forest (<http://archeologia.com.pl/2017/01/01/odkrycia-w-puszczy-bialowieskiej/>). In addition, in Gieczno (Zgierz district) a knight's castle, coming from the late Middle Ages was found (<http://archeowiesci.pl/2016/02/13/gieczno-grod-odkryty-dzieki-laserowi/>), whereas in the intersection of the Biebrza and Supraśl rivers in Podlasie voivodeship, a team of archaeologists from the State Archaeological Museum in Warsaw traced a cluster of fortified settlements (<http://geoforum.pl/?page=news&id=23742&link=imponujace-laserowe-odkryciena-podlasia&menu=46816,46853&category=40>).

Below we present a description of three sites discovered in the basin of the Wisłoka and Wisłok rivers. They were all discovered owing to the possibility of viewing the shaded relief terrain representation for NMT with a resolution of 1m (data from the ISOK project) which are available through Geoportal 2. They have their own landscape form. They are characterized by features that allow them to be included in objects with defensive qualities. These objects are located in wooded areas, on headlands falling into valleys of streams or rivers (site No. 13 in Bieździadka, site No. 19 in Mytarz) or on a hill (site No. 12 in Kozłówek), (Fig. 1).

1. Bieździadka, Kołaczyce commune, Jasło district, site No. 13 – „Koci Zamek” (Fig. 2)

The site is located in the north – central part of the Warzyce Ridge which is part of the Strzyżów Foothills. The object is located on the narrow branch of the headland falling down to the Bieździadka stream.

Three sides of it were defended by a natural steepness of the slopes, whereas from the upland, in the place where access was the easiest, the entry was protected by means of two lines of ramparts and the preceding moats. The height of the ramparts reached over 2m and it can be assumed that they were finished with a fence or a palisade. The dimensions of the construction are 42×25 m.

The size of this object is intriguing. It covers an area of about 9 ares. The internal square covers an area of about 3 ares. Such a small space could accommodate only one small dwelling. Furthermore, it is

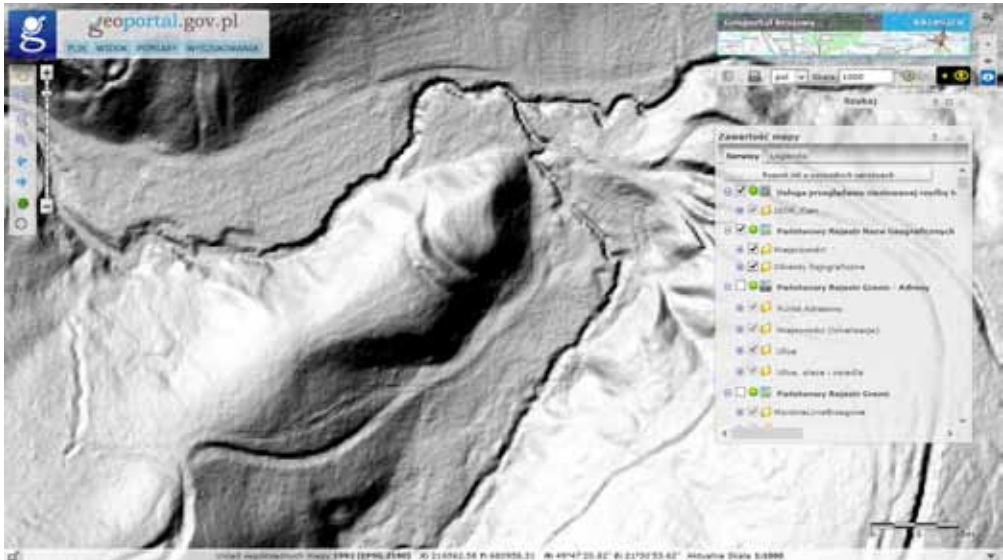


Fig. 2. Screenshot of the website www.geoportal.pl showing site No. 13 in Bieździadka, Kołaczyce commune, Jasło district

worth adding that as for this place there is no extensive view of the area. Therefore, it excludes the possibility of a position of a watchtower or an observation point. The location of the object gives the impression of „covered” or „hidden” one between the hills, located far from the main rivers, which may indicate the desire to hide in the valley, away from the transport routes.

What is more, dating of the object remains the puzzle. During the field research, no artefacts were found, which has made the dating of the object difficult. Some assumptions about the chronology can be drawn from the local name – „Koci Zamek”.

„Koci Zamek”, „Kocie Miasto”, „Kocia Góra” are terms specifying places related to the stay of Hussite groups seeking shelter in Poland in the 15th century. Refugees were looking for peaks with gentle hills with a vast panorama or abandoned defensive places.

2. Kozłówek, Wiśniowa commune, Strzyżów district, site No. 12 (Fig. 3)

This stronghold is located in a place with very good defensive qualities, at the top of a dome-shaped, forested hill (410 m above sea

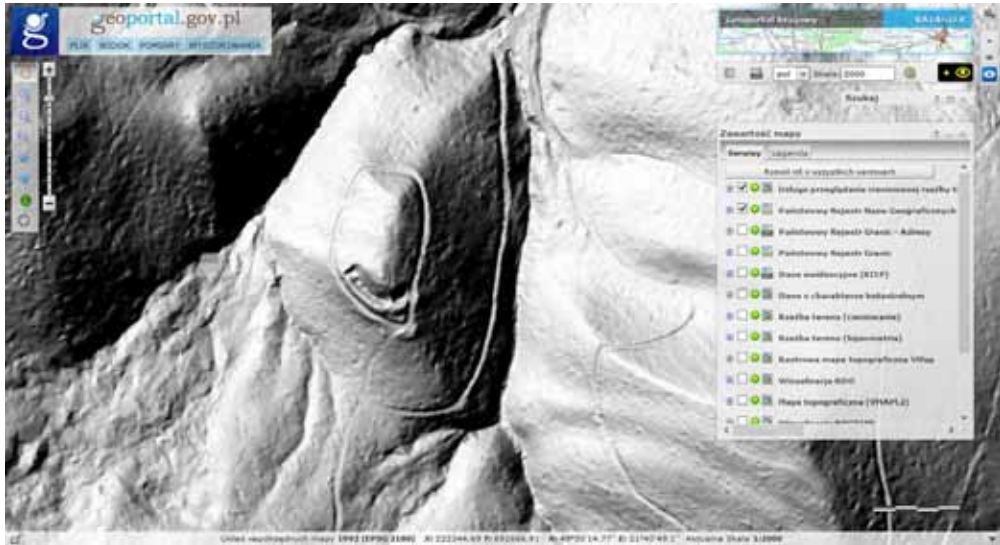


Fig. 3. Screenshot of the website www.geoportal.pl showing site No. 12 in Kozłówek, Wiśniowa commune, Strzyżów district

level). On three sides it is surrounded by a steep slope, descending towards a nameless stream and the „Kamienny Potok” watercourse. From the S side, access is protected by a massive barrier rampart. The stronghold is surrounded by a kind of terrace – a road that was created as a result of the slope buttressing and levelling the surface creating a „road” surrounding the stronghold.

The site covers an area of approximately 60 ares and its dimensions are: 115×65 m. During field research carried out by Joanna Pilszyk and Piotr Szmyd, no historical artefacts were found that could date the object. Initially, the construction can be described as a cone-shaped stronghold based on the form of terrain and analogy.

3. Mytarz, Nowy Żmigród commune, Jasło district, site No. 19 (Fig. 4)

The site is located in the village Mytarz on a nearby headland descending into the Wisłoka river and covered by the forest. This headland is part of a larger hill called Gamracz (436 m.n.n.).

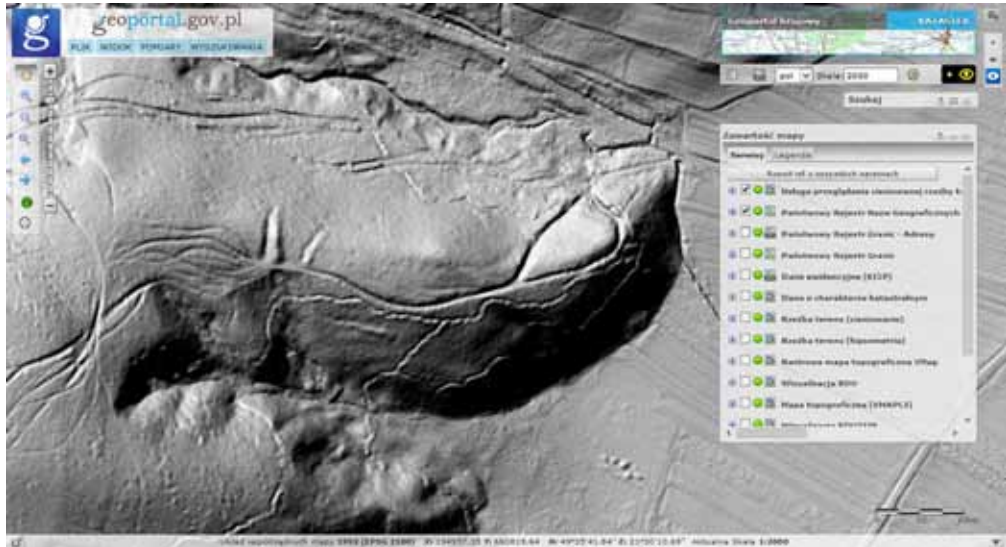


Fig. 4. Screenshot of the website www.geoportal.pl showing site No. 19 in Mytarz, Nowy Zmigród commune, Jasto didtrict

During the field research, two well-preserved earth ramparts were registered, preceded by a moat. The fortifications block the road from the plateau (W) i.e. they are in the place where access was the most convenient.

In other parts, access to the interior was protected by natural slopes or structures that did not leave any records in the area. During the site inspection, no artefacts were found that might date the object. In this place there are also visible trenches from the Second World War.

LIDAR has repeatedly proved its usefulness and archaeologists have received a tool with a powerful cognitive power to discover relics of the past or to verify archaeological sites already known. All you need is the internet access and a review of free of charge data provided by the Geoportal2 platform. The LIDAR ISOK data made it possible to discover sites by means of the proverbial „finger-wandering on the map” without leaving the house. The examples above illustrate how useful they are. And their free of charge access has triggered a flood of discoveries of sites with their own landscape form. That is unique and thus extremely valuable sites. They have enriched historical landscape and broadened our knowledge about the past.

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