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Can you catch a shepherd from an airplane?
Interpreting aerial photographs of Bukovica

Filomena Sirovica¹, Mario Bodružić, Ivan Huljev, Iva Perinić and Ante Purušić

In the period from 16th to 26th October 2013, the city of Zadar was host to the Aerial Archaeology in the Karst Region (AAKR) workshop. The first part of the workshop introduced aerial reconnaissance and air photo interpretation as tools for archaeological studies of Karst landscape through time. After this, for the second part, participants were divided into two groups with a task to formulate different research questions which can be studied with tools presented during course introduction (Figure 1).

![Fig. 1: Our group during question formulation.](image)

Our research focused on a central part of Bukovica, an area situated in deep Zadar hinterland, between Southern Velebit and area of Ravni Kotari (Figure 2). Bukovica is a region with an almost continental climate, scarce water sources and rare karst fields (Batović 2004: 7). These conditions led to the emergence of a special kind of animal husbandry characterized by seasonal migration of herders between Bukovica and Velebit, the longest mountain ridge in Croatia. Research conducted during AAKR course focused on the natural pathways located between higher hills in Bukovica that were until recently used for this kind of seasonal migrations (Marković 1980; 2003; Miletić 1993; Čače 2007). In the background of our research was a presumption that in Bukovica, economics based on pastoralism can be traced during not only historic but also prehistoric times and that evidence for this special way of life, usually hardly traceable in the archaeological record (Miracle, Forenbaher 2005), can be implicated by the analysis of the location pattern of archaeological sites. For this type of landscape research, aerial reconnaissance represents a significant type of approach which allows detailed documentation and study of site’s structure and location.

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Fig. 2: Study area with locations of contemporary settlements and roads that mainly follow natural pathways through Bukovica.

Fig. 3: Potential archaeological sites mapped during desk based assessment.
In our research area, which covers almost 600 km$^2$, we expected to conduct several flights with the main goal to identify and then photographically document locations with larger drywall structures which could represent archaeological features, presumably prehistoric enclosures. In order to successfully complete this procedure, the first part of the research was focused on conducting a desk-based assessment which included mapping larger structures visible on aerial photographs that can be found on different Internet portals, such as GeoPortal, Arkod, and Google Earth. Each observed structure was marked by a point in QuantumGIS program and included in our database where they were classified in two main categories: enclosures and barrows. During this procedure we mapped 72 locations with archaeological potential, 58 of which were categorized as enclosures and 14 as barrows (Figure 3).

Next day we had four flights over the research area during which we took 1675 photographs that documented many of the locations mapped during our desk-based assessment (Figure 4).
Photographs were transferred to previously prepared archives and included in the list of photographs with the help of CataThumb program. From the basic set of photos we selected those of the highest quality and then the ones which were most suitable for rectification and georeferencing. Oblique photographs of six locations were selected for mapping and were rectified and georeferenced in AirPhotoSE before being imported into QGIS. Photo interpretation was done on screen, making reference to the original oblique pictures, and features were mapped and results imported into our database (Figure 5).

![Image of photographs and maps](image1.png)

Fig 5: Some of the stuff from our archive.

This new information was then analyzed and interpreted in relation to the known data about archaeology in Bukovica and assumptions about possible way of life in this area in prehistory. Analyzing positions of sites documented in the research area we identified several concentrations of different enclosures on the higher plateaux situated near the natural pathways between higher hills in Bukovica. One of these pathways crossed the center of our research area and linked the small villages of Bruška and Medviđa. It is a natural path that, in the broader area of central Bukovica, represents the only possible way towards Velebit (Miletić 2004: 17). Its route is marked by the previously known large enclosures: Brgud, Jerebinjak, Otavac, and Samograd (Figure 6) overlooking its southern entrance, and big Medviđa hillfort (see below) on its northern side. All of these locations were photographed from the airplane, and all four enclosures on the southern side of pathway were rectified, georeferenced and mapped (Figure 7). As prehistoric material has been found on all of them (Sirovica, Burmaz 2011; Sirovica 2013) we can assume that they represent prehistoric enclosures, some of which can easily be considered hillforts.
Fig. 6: Brgud, Jerebinjak, Otavac and Samograd – enclosures located on southern side of pathway that connects Bruška and Mevida.

Fig. 7: Mapped enclosures.
Medvida (Figure 8), on the other hand, is widely known prehistoric hillfort that probably had its peak during the Roman period. It is situated on the crossroad of two main paths towards Velebit. One of these leads to the North and crosses Velebit through its lowest part and the other goes West towards the biggest pastures on Velebit (Čače 2007). Analyzing the pattern of site location in the northern part of research area (Figure 3) we can see two concentrations of enclosures which are likely to relate to known pathways that were until recently used for seasonal pastoralism.

Analysis and interpretation of gathered data clearly suggests that the location of documented sites is directly connected with the natural pathways through this area (Figure 9). The possibility that documented sites represent prehistoric structures could be important evidence showing that a special kind of economics highly connected with seasonal pastoralism has its roots in prehistory. Although the study of this problem needs more long-term and intensive
research, we hope that our project shows that aerial reconnaissance and air photo interpretation represents a necessary part because it enables detailed documentation and study of site structure and location pattern in wider landscape framework and provides an irreplaceable tool for broader studies of relationship between people and landscape in the past.

**References**


