Using UAV to monitoring selected populations of the European Hamster (*Cricetus cricetus* L.) in southern Poland

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ABSTRACT

The aim of the project was to asses practical usage and possibilities of geoinformation technologies - UAVs and GIS spatial analyzes in the process of inventory and monitoring of European hamsters on agricultural areas. The Yuneec Typhoon H520 drone with an E90 camera was used for the research, the air surveys was planned using to the Yuneec DataPilot software. The data were analyzed using DroneDeploy and Pix4D software. 10 surveys were carried out at different times and in different locations in Lesser Poland. The analyzed orthophotomaps were compared with the results received in traditional field inventory. The plant health index was also analyzed. It was observed that the burrows were visible in photos taken at a height of 50 m, preferably in areas where rapeseed was located, right after the harvest. There were also visible differences in the plant health index. UAV has been shown to be a good complement to the current inventory methods of European hamster (*Cricetus cricetus* L.). UAV would work in areas where little human resources make it impossible to check the whole area and on areas where the presence of the hamster is questionable.

INTRODUCTION

The European hamster (Cricetus cricetus) has been a protected species in Poland since 1995. In 1996 it was included in Annex II of the Bern Convention. Since 2002, it has been on the Polish Red List of Endangered and Endangered Animals in Poland with the status DD (data deficient - the status is poorly recognized, the threat is identified, but not specified). In 2004, according to the Nature Conservation Act, it was recognized as a protected species with the annotation of the need for active protection. The rodent is also called an umbrella species for areas of the agricultural environment with a diversified crop structure. This means that the preservation of its habitats will allow the protection of other rare species of agricultural areas, i.e. partridges or hares.

The range of the European hamster (Cricetus cricetus) in both Poland and Europe is rapidly shrinking and is becoming increasingly fragmented (Surov et al. 2016). In the 1970s, hamsters were common throughout central and southern Poland, excluding the northern part of the country (along the glaciation border) (Matysek et al. 2013). In the second half of the twentieth century, the rodent population collapsed rapidly, and its occurrence was essentially limited to two larger areas, i.e. the Lublin Upland with Roztocze and the Małopolska Upland with the Kraków-Częstochowa Upland (Satory-Wąsik et al. 2018). Significant reduction in coverage has been very rapid over the past 30 years and this process is still ongoing (Surov et al. 2016).

The monitoring of the European hamster's population consists in the annual inventorying of two types of its normal and temporary burrow. Permanent, normal burrows serve as an apartment, a place to hibernation or raise children. Temporary burrows allow immediate shelter or escape in case of danger. Permanent burrows are complicated and often used even for several years (Ziomek, Banaszek 2008). There are several entrances to the burrow, the main entrance is characterized by an inclined corridor and a large mound of soil built up at the inlet. There are no mounds at the temporary burrows and the tunnel leads vertically down. Monitoring is very time consuming, requiring the involvement of a large number of people due to the large area of search. The inventories depend on the progress of agricultural works, crops, phenology, atmospheric phenomena, current environmental situation (e.g. changes in

abandoned agricultural areas with encroaching secondary forest succession) and the deadline time. Monitoring must be carried out only after the harvest so as not to interfere in sown fields, but before soil preparation treatments for winter (period of about 2-3 weeks). In one season it is not possible to carry out thorough monitoring in the whole area of occurrence. It is possible to examine only a fragment of the range, usually at its borders. For this reason, the current situation of the European hamster in the center of the range is not fully known.

The aim of the project was to assess the practical possibilities of using geoinformation technologies, i.e. low-altitude unmanned aerial vehicles (BSP; UAV) and spatial GIS analyzes in the process of inventory and monitoring of European hamster in agricultural areas in terms of flight height, size of the monitored area and time needed to monitoring.

METHODS

During the days of measurements (22.06 - 02.08.2019) 9 flight were made in various locations: Igołomia two times, Pierzchów, Prawda, Myśliwska St. and Pod Kopcem St, Łuczyce, Tęczowa St. two times and Wspólna St. two times. We used a Yuneec Typhoon H520 UAV and RGB camera, with an E90 wide-angle of 20Mpix. Missions were planned using the dedicated drone software - Yuneec DataPilot. Each flight (except one) was performed on the settings: height 50 meters, front and side overlap 80%, images in turnarounds, resolution 1.5 cm / pix. In one case, images were made from a height of 50 and 70 meters to compare. Each flight carried out about 20 minutes. The images were processed into orthophotos in the DroneDeploy software. At 4 locations, the data was also collected using a traditional method - observed burrows were marked in the field using the GNSS GARMIN GPSMap 64 series receiver. Orthophotomaps were photointerpreted. Data was compared in The ArcMap software (ESRI).

RESULTS

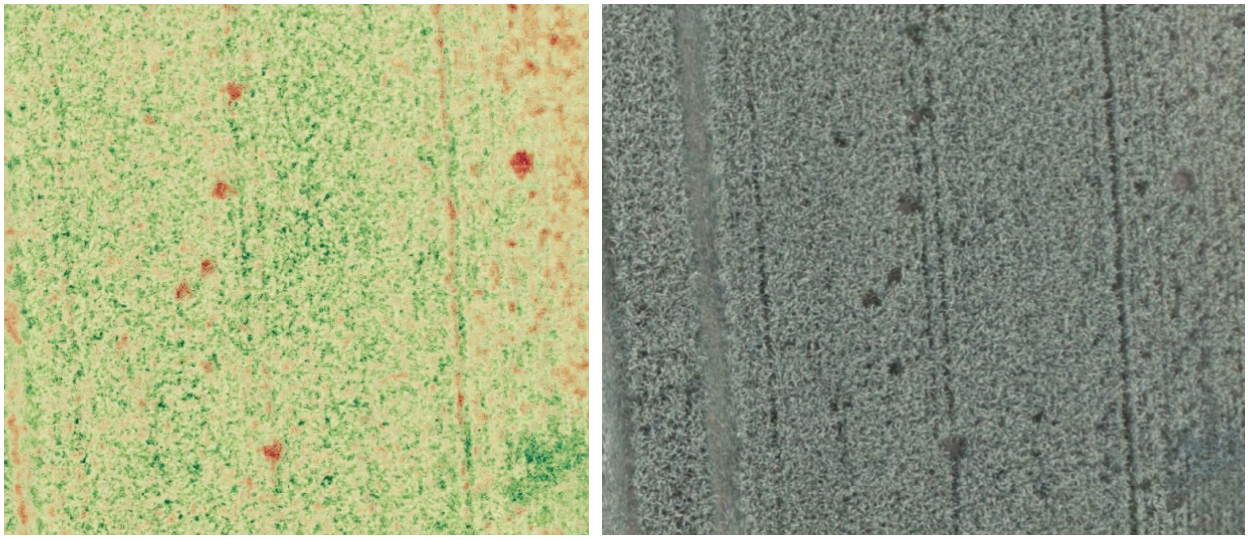
The monitoring covered 90 hectares of agricultural areas. The traditional method of monitoring in the studied areas showed 194 burrows, while the photointerpretation method with the naked eye showed 290 burrows. The main differences are indicated in Table 1

Table 1. Differences between traditional monitoring method of the European Hamster and photointerpretation of the ortophotomaps made from the UAV images.

	Traditional monitoring method	**Photointerpretation via UAV**
Burrows	192	290
Area (ha)	87	91
Time needed for monitoring (h)	18	3
Time needed after monitoring (h)	-	2
People involved in monitoring	4-5	2

The differences are mainly due to photointerpretation errors, i.e. shadows in the pictures imitating the appearance of the burrow, no visible burrow in the photo (e.g. a burrow among felled crops), burrows invisible in the photo because of the shadows of the trees, burrows in balk - very hardly noticeable on UAV photos. It was noticed that the best time to fly is right after the harvest. It was also noted that some crops are better to photointerpretation than another, e.g. rapeseed. Soil with weeds is the worst for photointerpretation. The optimal altitude for flights is 50 meters - the height of 50 and 70 meters was compared. From 70 meters the analyzed burrow was invisible. Burrows located directly in the field are clearly visible, while burrows in balk are very heavy in photo interpretation. Cloudless weather or sky tightly covered with clouds works best. Clouds generate shadows that prevent the burrows from being seen. The Green Health indicator was also analyzed. In crops in the development phase, without entering the field, it is possible to assume the presence of a hamster - regular, circular spaces are observed (Fig. 1)

Fig. 1 Green healf indicator in the monitoring images - Green health (left side) and reals photo (right side)



UAV has been shown to be a good complement to the current inventory methods of European hamster (*Cricetus cricetus* L.). UAV would work in areas where little human resources make it impossible to check the whole area and on areas where the presence of the hamster is questionable.

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