Application of unmanned aerial vehicles for ungulate surveys and assessing crop damage

Reliable assessment of population size is a necessary requirement for effective wildlife management. None of currently used survey methods is satisfying in terms of cost-effectiveness and accuracy. Modern technologies such as unmanned aerial vehicles and thermal infrared cameras may have great potential as tools for more effective wildlife monitoring method.

The aim of the first part of the project was to test the performance of the innovative wildlife survey method with use of a drone and thermal infrared camera. The research was conducted in 2017-2021 in Bierzwnik, Drawno, Głusko forest districts (RDLP Szczecin), Tuczno forest district (RDPL Piła) and Drawieński National Park. Total area studied was 86,682 ha. Data were collected with the use of unmanned airplane flying along parallel transects at an altitude of 150 and 120 m above ground level. Flights were conducted at times of animals' peak activity (from dusk to dawn). For animal detection on thermal images we used a dedicated program based on artificial intelligence, and for abundance estimation distance sampling method. Some of the studied sites were additionally monitored with camera traps. For density estimation based on camera traps collected data, we used the random encounter model. Population densities estimates derived from both of the used methods – drones and camera traps – were relatively similar. Thermal drone detectability tests carried out with humans show that even in dense pine forest stands the probability of detection in winter is equal to or above 70%. The quality of thermal images acquired in the summer months was similar to those acquired in winter – thermal contrast between animal signatures and the background was sufficient for their detection. Our results indicate that drones with thermal cameras are useful tools for ungulate surveys. Moreover, wildlife monitoring with camera traps allows for obtaining reliable data on population density and distribution. Thus, both modern research methods applied in the project can be used in wildlife management practice.

Second part of the project was carried out in agricultural areas where damage crops was located. The total area investigated was ~ 1000 ha. Two types of unmanned platforms were used: multi-rotor and fixed-wing.

During the implementation of the project tasks, a photogrammetric flights were carried out over different agricultural areas. The main factors that determine the choice of type of UAV platform are:

a) flight time,
b) possible distance to be covered in one flight,
c) max. wind strength - resistance,
d) telemetry range.

The project implementers decided to choose the sensors: Parrot Sequoia (multispektralna, RGB, NIR, RedEdge (RE)), SIGMA DP2 (RGB, NIR), Canon (RGB). Photogrammetric and observation flights was performed at a height of 30 - 100 m AGL. After the test flights, the obtained image data was analyzed (single images and orthophotos) and based on the available methods, remote sensing indicators and basic statistics was calculate.

Remote sensing analysis has been divided into two main parts: analysis of the quality of spectral imaging and analysis of spectral reflectance. The best information is obtained by using indicators based on the NIR and RE bands. Both of these bands allow you to capture even minimal changes in the state of vegetation. The additional combination of these bands with R or G allows for an accurate estimate of the depressed vegetation condition. For RGB bands, the damage to the vegetation cover is best shown by the CIVE and VARI indicators. These indicators are based on all three RGB bands.