

## MAPPING ECOSYSTEM SERVICES BASED ON GEOINFORMATION DATA BY HIGH-RESOLUTION REMOTE-SENSING METHODS

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In May 2019, under the Interreg project Danube Transnational Programme (DTP2-018-2.2) tests have been conducted for the methodology „*Ultra-high spatial resolution aerial survey for the monitoring of ecosystem services*”, developed by Interspect Ltd. in the time period of 2008-2018.

The method is based on orthophotos from the specific area with a spatial resolution of 0,5 cm – 5 cm and at least 20 cm spatial resolution 3D model (DSM dense point cloud and DTM mesh and DTM contour isolines) that results from areal photogrammetry survey taken from an airplane. The spatial data thus obtained will be subjected to laboratory analysis supplemented with detailed field survey that can provide more accurate and objective result compared to the former habitat-, vegetation-, land cover mapping, land-use and ecosystem service- and degradation mapping practice.



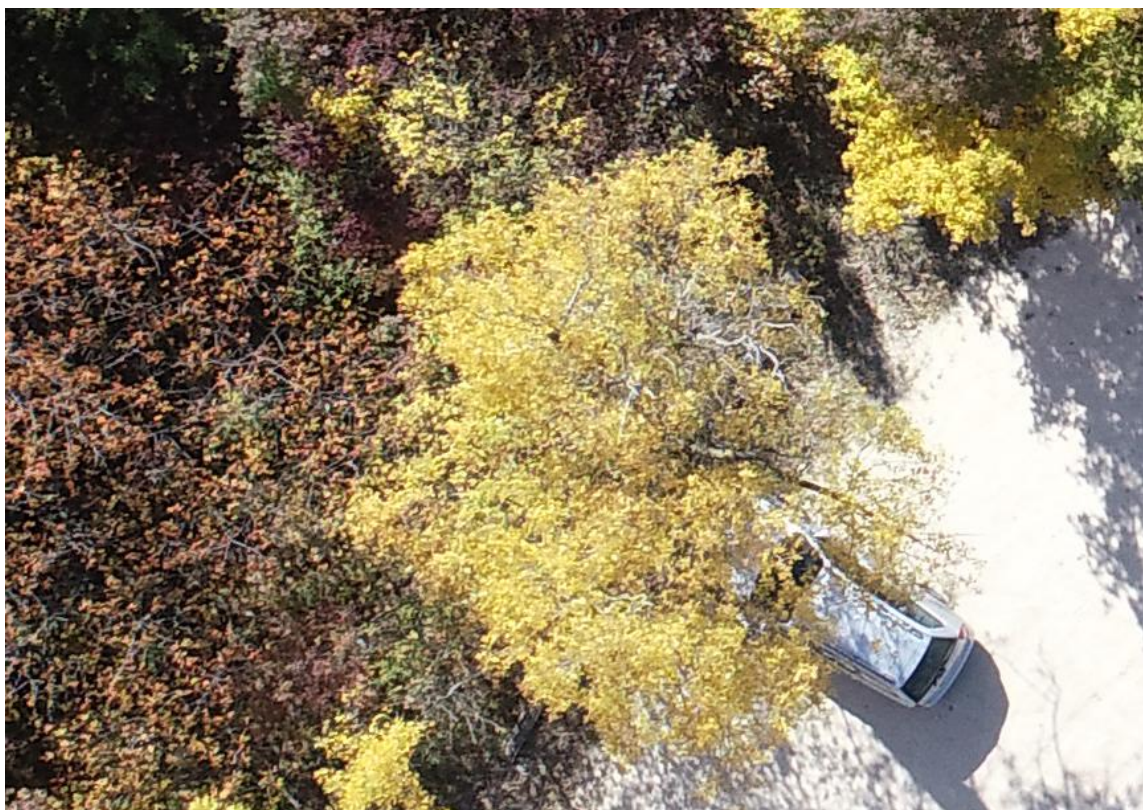
The observation area - the whole area of Hármashatár mountain – is framed by the densely inhabited areas of the capital. It is rich in natural values, popular among tourists and therefore strongly exposed to anthropogenic effects and covered by extensive forests. It is stressed by invasive plant species, trampling damage, littering and further anomalies.

The main principle of the methodology was developed by the staff of Interspect Ltd. before 2018. It means essentially that the work area is segmented into a fully covered polygon map without overlaps or gaps along orthogonal canopy contours in the upper canopy and boundaries of patch dynamics in case of the lawn. All freestanding wooded plants and all homogenous tree groups will be displayed as a separate polygon. The properties - recorded according to different criteria (species, services, damage, soil conditions, habitat types, land use, etc.) – will be recorded into the appropriate attribute columns of these polygons. Therefore the map will be consistent and statistically valuable in all aspects. It is more detailed than the conventional forestry and ecological habitat maps and enables precise surface measurement. Another benefit is that this data structure is easily readable by algorithms based on artificial intelligence, therefore, it can be also well used for big data analyse.





The method was not available earlier, because the design and the signs used for mapping base, were not possible to release by remote-sensing materials with smaller than 5 cm detail in spatial resolution. Furthermore, it was not possible to carry out such exact cover estimates on the terrain.



Whole resolution detail orthophoto (INTERSPECT Ltd. – Gábor Bakó)

In case of maps for scientific-and regulatory purposes the reduction of subjective effects crucial and it can be achieved with the following:

- Increasing the spatial resolution of basic data
- Increasing the geometrical accuracy of the basic data
- Standardisation of the evaluation methods
- Developing an appropriate validating system

### **Some important features of the methodology**

One of the characteristics of our method is that the canopy contours derived from orthogonal projection of canopies and other discrete natural boundaries (eg. streams, rocks, the species composition of grass areas) create the physical area boundaries. The maps of all other features will be derived from the classification of these spots. The habitat area is a result of the crowns of the different species of the given habitat and the holes of the forest in case of matching polygons with appropriate attribute columns. For example the soil type, age distribution can differ according to the spots, these features will collect other groups of the polygons, so the colouring of the map depends on the attributes.

However, it is a more important advantage that despite the patch-morphology allowing irregular shapes, all interpretation criteria units are perfectly covered with each other. It is also a very important aspect that the drawing of the spot boundaries instead of occurring on small-scale recordings, considering more elements, and freehand drawing allowing freedom, it occurs on detailed (level of species) contours of the vegetation maps. The freestanding solitary trees and the crowns surrounded by other tree species are shown as single elements on the maps, while the treegroups with homogeneous composition appear as polygons. In case of upper canopy species that are inseparable mixed tree group can be presented. In case of the invasive plants or the protected, rare species identifying and localizing them individually would be appropriate.

The photogrammetrical laboratory work a whole area covering is followed by the seamless delineation of vector graphical polygon boundaries (visual interpretation) with no overlapping. The resulting polygon map's polygons will be filled with data through the fieldwork.

It is also necessary to go into the delimited spots on the field. It is not enough to only identify its vegetation from the edge of the association. On the mobile device the movements of the field surveyors need to be logged, because looking through it we can sense when a polygon isn't measured sufficiently detailed.





## Dr. Gábor Bakó

Co. ceo of Interspect Ltd. forensics and remote sensing expert

### PROFILE

Detail-oriented leader with ten years of management experience  
4 scientific research, 107 aerial surveys, 40+ UAV aerial surveys  
and 3 engineering projects



## Fruzsina Stefán

Project manager at Interspect Ltd. planning engineer

### PROFILE

Landscape engineering, project management and control of projects,  
Landscape- and urban design, documentation, communication with  
partners

## Main activity of Interspect Group

Our Company primarily collects information of scientific value for environmental protection, urban planning and landscape ecological projects. We also deal with camera system construction for high spatial resolution aerial mapping. In our laboratories we synchronize and calibrate photogrammetric equipments. The cost-effective aerial mapping with more and more surface details is become possible with the using of these innovative equipments, in the sopatial resolution from 0.5 cm to 5 cm. We are pleased that the sub-centimeter spatial resolution – which is a breakthrough in aerial mapping and interpretation – had been reached by fast speed aircraft firstly by our Hungarian research group (2012), and so we can provide to our customers. The increasingly obtainable information-content can be used in many sectors. Beside the change monitoring, finding the illegal constructions and landfills and surveying the vegetation, these multispectral ortho image maps are effective to detect the invasive plant species, in inland water mapping, to make precision agriculture maps and, in addition, to a number of scientific research. Now our high spatial resolution multispectral process can be used simultaneously with the hyperspectral imagers of more than 400 bands and we offer accurate 3D point clouds from our photogrammetric method and the same flight.

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