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Conference Abstract

Can commercially available UAVs aid practitioners in long-term monitoring of European grasslands? Case study of a sandy steppe eLTER site

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Abstract

Large-scale habitat degradation and destruction have been marked as the most important causes of biodiversity loss in the last 100 years. To combat this problem, proper monitoring and, if deemed necessary, restoration measures, must be taken. The economic value of restoration actions in Europe alone has exceeded one billion euros but despite this fact, many projects have failed to restore ecosystem functions of targeted areas. The lack of proper monitoring and steering of restoration actions, i.e. translating scientific findings into practical, easy-to-do actions for practitioners is probably one of the causes for this failure.

„Sunčani salaš“ eLTER site (https://deims.org/5f5c850d-0036-49ac-97be-f9b314898607) was established in 2021 to monitor the progress of the revitalization of this former arable land parcel into the original sandy grassland habitat. The site is located within the Subotica sands protected landscape in northern Serbia, along the Hungarian border. Prior to the field campaign, we divided the study area into zones based on visual differences inferred from drone imagery. We performed a classical plot-based botanical survey and used hand-held GPS to determine the spatial distribution of finely

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differentiated vegetation types. Based on fieldwork data, we classified Sunčani salaš vegetation into appropriate EUNIS (European nature information system) classes and assessed its conservation status. These classes were then translated into site-specific key habitat types for site management purposes. In parallel, we used a commercially available and easy to operate DJI Inspire UAV (unmanned aerial vehicle), equipped with a Zenmuse X3 RGB camera to assess whether the commercially available RGB sensor and a relatively high flight altitude (100m) of the UAV have discriminative capacity to aid site managers by mapping identified steppe development stages. Both campaigns were performed monthly throughout the vegetative season (April-September).

Based on the presence of characteristic species, we identified four main habitat types according to the EUNIS classification: Pannonic loess steppe grassland (E1.2C1 and E1.2C2), Pannonic sandy steppes (E1.2F4), Broadleaved deciduous woodland (G1.4) and Bare tilled land (I1.51). These were then translated into site-specific categories, termed: Young steppe I, Young steppe II, Forest steppe and Fallow land, respectively, which were all quantified across the habitat-specific zones. For image classification purposes, these categories were translated into categories: Class C0 or “Steppe”, encompassing Young steppe I and II, Class C1 or “Shrubs”, Class C2 or “Forest–Steppe”, Class C3 or “Bare/fallow land”.

Of all detected habitat types, Pannonic loess steppe grassland (E1.2C1 and E1.2C2) and Pannonic sandy steppes (E1.2F4) are of conservation importance and are listed in the Annex I of the Habitat Directive. UAV vegetation maps show that the estimated extent of steppe habitat, class C0, dominates in most of the identified observation zones. In centrally positioned zones, steppe cover varies between 58% and 68% between the zones. Shrub cover across these zones is low (<5%), while the cover of bare soil is even lower, and stays under 2%. The extent of the western-marginal zone characterizes the presence of steppe cover C0 with high percentages of shrubs C1 (47% and 18%, respectively). The extent of southern-marginal zone characterizes the presence of forest C2 area range of approximately 60%. Both these zones are characterized by a significant percentage of pixels with a low confidence score. We consider 60% of the open habitat to be characterized by young steppe vegetation. According to the results of the UAV mapping, the extent of the young steppe is the largest in centrally positioned zones, where it reaches almost 70%.

Results of the UAV campaign show that the proposed flight characteristics allow for more generalized classification of habitat types, but fine scale classification was not possible (e.g., it was not possible to distinguish Pannonic loess steppe from Pannonic sandy steppe). For this, higher spectral resolutions instead of RGB images would ease the classification problem and probably enable solitary UAV acquisitions, instead of repeated ones. Nevertheless, protected area managers can benefit from the results of the study, offering cost-effective and efficient tool for assessing habitat diversity and detecting broader ecological trends within protected areas.

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Ethics and security

This research posed no ethical or security issues. Permits were aquired for all UAV flights.

Author contributions

MA, MV and TNL performed the in-situ botanical survey and subsequent analyses. BI performed the drone flights. BB, PL and BI performed all image classification analyses. MA wrote the abstract, all other authors have read and approved the text.

Conflicts of interest

The authors have declared that no competing interests exist.