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Interaction between fine-scale landforms and vegetation patterns in alkali landscapes – case study based on remotely sensed data

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Vertical position is an important driver of vegetation zonation at multiple scales, via determining abiotic environmental parameters like climate, soil properties and water balance. Despite small-scale elevation differences are proven to significantly influence soil salt content and water balance; relationships between elevation and vegetation types are rarely studied in inland alkali landscapes. Alkali landscapes of the Pannonian biogeographical region comprise the most connected salt-affected landscape in continental Europe which provides unique opportunities for studying elevation-vegetation relationships. For linking elevation data with vegetation patterns, remote sensing techniques offer a vital solution. Application of airborne laser scanning is a feasible tool for providing an elevation model of extent areas. Our goal was to test the correlation between fine-scale differences in vertical position and vegetation patterns in inland alkali landscapes by using field vegetation data and elevation data generated using airborne laser scanning. We studied whether the vertical position influences vegetation patterns at the level of main vegetation categories or even at the level of associations. Our study sites were situated in a lowland alkali landscape in Hortobágy National Park (East-Hungary). Associations of the study site can be grouped into four main vegetation categories: (i) loess grasslands, (ii) alkali steppes, (iii) open alkali swards and (iv) alkali meadows. Even though we detected a very limited range in the vertical position (121 cm) of the main vegetation categories; they were well separated along their vertical positions. The detected elevation gradient likely corresponds to environmental gradients (soil type, salt accumulation and water balance). At the level of association types, a more detailed elevation-based distinction was also possible in many cases. Based on the digital terrain model, we revealed a fine-scale vertical vegetation gradient. Our results show that high-resolution mapping based on remote sensing (RS) techniques is an ideal solution in alkali landscapes. It is especially useful as conventional habitat since mapping in such complex landscapes is often very difficult and time-consuming.