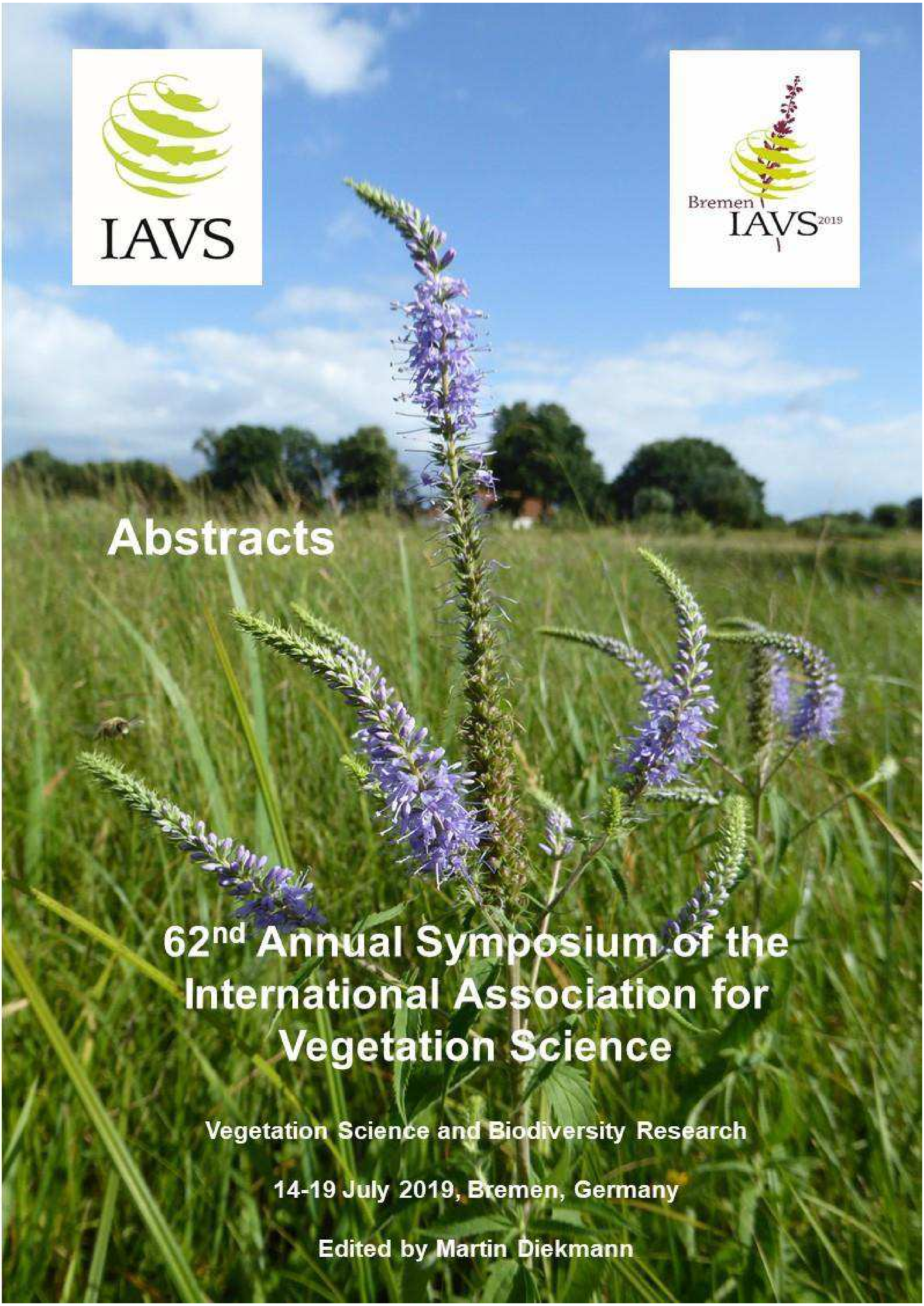

Abstracts

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Linking spectral and functional diversity to predict ecosystem functions at community scale

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Given the present rate in global change, biodiversity assessments at different scales and on a real-time basis are of prime importance. Similarly, it is crucial to unravel biodiversity's relationship with ecosystem functions and related ecosystem services. Recent years have seen rapid advances in two fields that have great potential for these purposes: remote sensing and functional trait-based approaches. New remote-sensing platforms have increased the availability of spectral data with high spatio-temporal resolution at both local and global scales, while functional trait ecology has come of age, providing a solid framework for understanding how species contribute to ecosystem functioning. When surveying vegetation, spectral data represents an aggregated signal of how light interacts with the chemical and structural composition of the canopy, which in turn is underpinned by a plant's biochemical and morphological traits. This means that the spectral diversity (SDiv) of a certain plant community, defined as the variation of the spectral signal over space, should reflect its plant functional diversity (FDiv) and therefore its ecosystem functions. To test this, we used 80 different 1.5 m x 1.5 m experimental mesic grassland communities expressing different levels of functional diversity but having the same species richness. We gathered the spectral information of the field site using an UAV (multicopter Kingfisher, Robodrone industries) mounted with a Tetracam Mini-MCA6, which provides canopy-level spectral data across six bands across the visible and NIR wavelengths (490nm, 550nm, 680nm, 720nm, 800nm, 900nm) with 10 nm of bandwidth at 3 cm spatial resolution. We summarized the spectral information by selecting the first axis deriving from a PCA on all the bands. For each community, we measured SDiv using the mean Euclidean distance of the values of the first PCA axis of all the pixels in each plot; FDiv was calculated as weighted mean species pairwise distance, which was calculated through Gower distance considering plant height, specific leaf area, leaf dry matter content, seed mass, life form, growth form, life span, flowering period and nitrogen fixation ability; and total standing biomass was measured to quantify primary production ecosystem function. Using linear mixed effect models, we found that SDiv was significantly negatively correlated to the FDiv of the communities, although the model explained a low variance (R2m=0.052). Surprisingly, total biomass production was significantly positively correlated to SDiv (R2m=0.369) but was not significantly correlated to FDiv. Our results suggest that SDiv at community level might be a better predictor of primary production compared to FDiv. This might depend on the fact that SDiv, in contrast with our measure of FDiv, better represents both the intra-specific variability and the canopy trait diversity crucial for primary production.