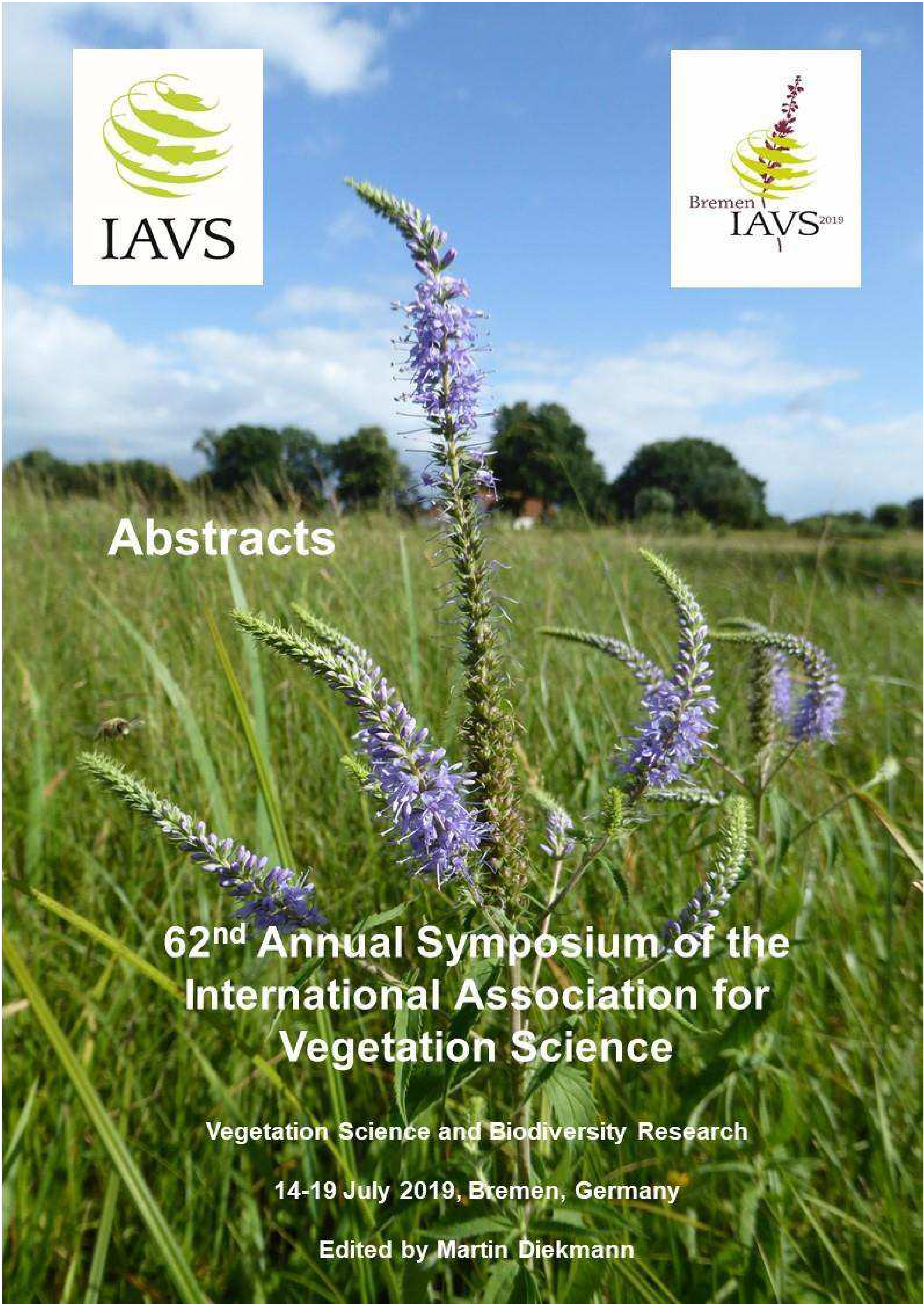

Abstracts

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The spectral species concept at wide geographical scales: estimating ecosystem alpha- and beta-diversity by remote sensing

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There is an increasing need to rapidly assess the biodiversity of ecosystems, due to the widely acknowledged trend towards biodiversity loss. Nevertheless, estimation of biodiversity using ecological field data can be difficult for several reasons. In particular, if an investigation area is large, it is challenging to collect data providing reliable information. Observer bias, restrictions in accessibility, funding and workload limitations, missing expert knowledge, dynamics in emergence and phenology are just some examples that limit the collection of representative in-situ information in Earth observation. Some of these restrictions in Earth observation can be avoided through using remote sensing approaches. Remote sensing is efficient and cost-effective.

Modern sensors allow the identification of biodiversity patterns in vegetation over large areas and provide sensitive information on the dynamics of their biodiversity. Obviously, shortcomings are also present such as sub-canopy diversity, limited representation of very steep slope surfaces, very different sizes (diameter) of plant species, similar spectral traits between species, or ecosystems that are constantly covered by clouds (e.g. laurel forest). Different works have estimated biodiversity on the basis of the Spectral Variation Hypothesis; according to this hypothesis, spectral heterogeneity over the different pixels reflects a higher niche heterogeneity, allowing more organisms to coexist. From this assumption, the concept of spectral species has been derived, following the consideration that the spectral heterogeneity at a landscape scale corresponds to a combination of subspaces sharing a similar spectral signature. At a local scale, with the use of high resolution remote sensing data, the different subspaces can be identified as different 'spectral species'. This has been done using an unsupervised method based on the clustering of the different subsets. From the distribution of these spectral species (and the derivation of alpha- and beta-diversity) is then possible to approximate the diversity of the species living in an area. Our approach derives from this concept and extends it at a wide spatial extent. We have been able to apply this method to MODIS imagery data, producing a map of the distribution of the spectral species over all Europe and an estimate of the European alpha- and beta-diversity. In this case, the diversity is not evaluated at species level, but at community level, introducing the concept of spectral community. We propose to apply the method on a stack of images of the months of the year, in order to cluster niches taking also into account their response to different seasons, and therefore to elaborate multi-temporal and multi-dimensional data.