

LANDSAT TIME SERIES ANALYSIS IN FOREST BIODIVERSITY RESEARCH

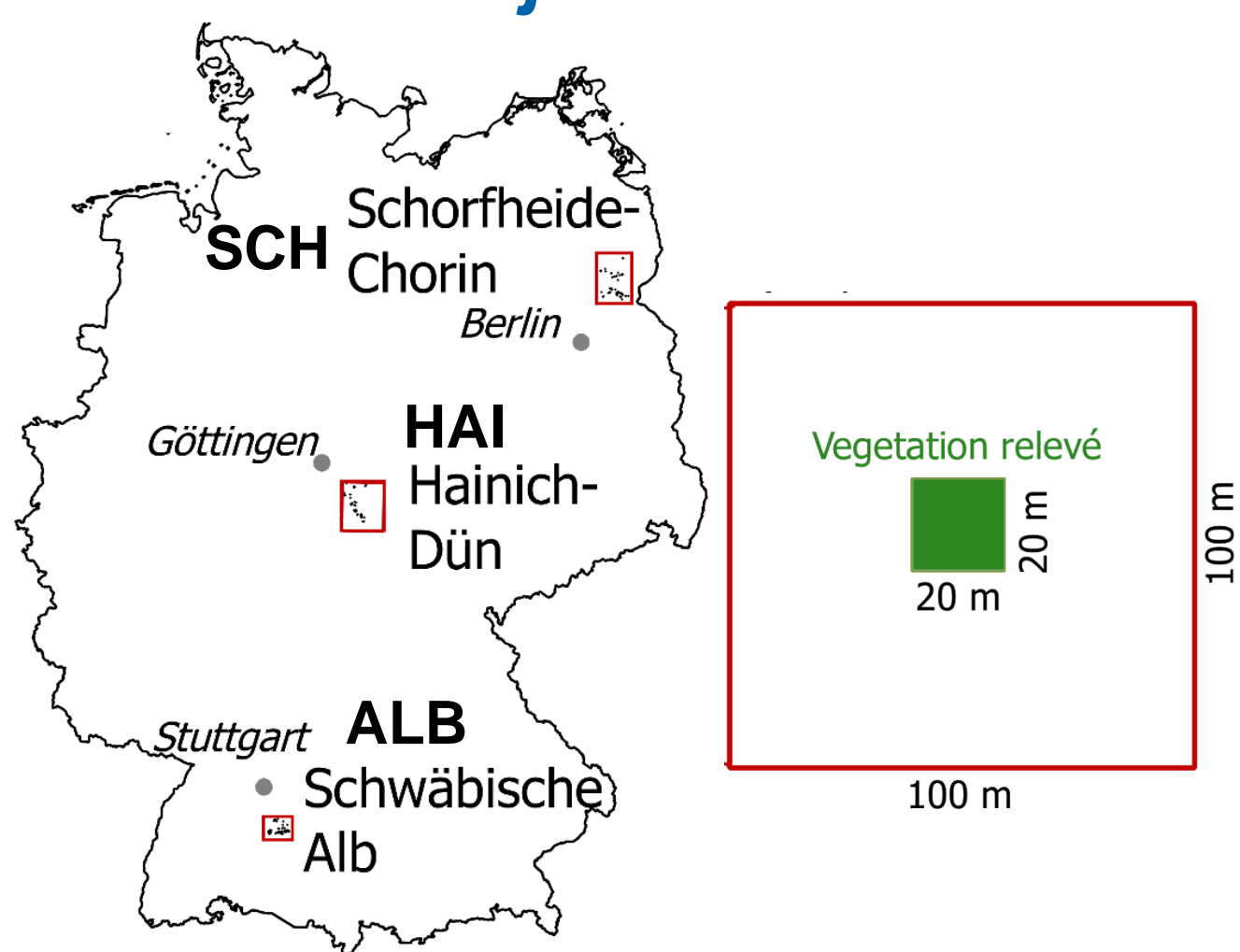
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Abstract

Herb layer plant diversity in forests is influenced by historic natural disturbances and management intensity. Medium-resolution Landsat time series allow analyzing differences in changes and variations in the forest canopy cover between different forest sites over long periods. However, these differences have not been related to differences in forest plant diversity yet. Landsat time series (1985 - 2015) of Collection 1 were used to investigate disturbances and stable forest systems, which were related to indicators of herb layer plant species diversity in temperate forests at three study sites (Schorfheide-Chorin: SCH, Hainich-Dün: HAI, and Schwäbi-sche Alb: ALB) in Germany. We compared the frequency of changes and stable values in NDVI time series between plots of the same forest type with a newly introduced time-independent SAX-dissimilarity measure (T-SAX). Based on T-SAX we clustered the plots and tested for significant differences in the Simpson's diversity index, Inverse Simpson's diversity index, Shannon index, and the silvicultural management intensity indicator (SMI) with its risk (SMIr) and density components (SMId). Cluster stability was assessed by mean Jaccard's similarity. The analyses showed significant differences in the diversity indices between clusters of pine, beech (SCH, HAI), and spruce forests, which could be explained by the development stage of the stands, the management intensity, or closed canopy cover. Our study suggests differences in natural disturbance, management intensity and developmental stages detected from Landsat time series, may improve understanding differences in herb layer diversity. T-SAX is a promising measure to investigate these differences.

Introduction & Objectives



Topic:
Relationship of natural disturbance and management intensity (from Landsat time series) and current herb layer plant diversity in temperate forests

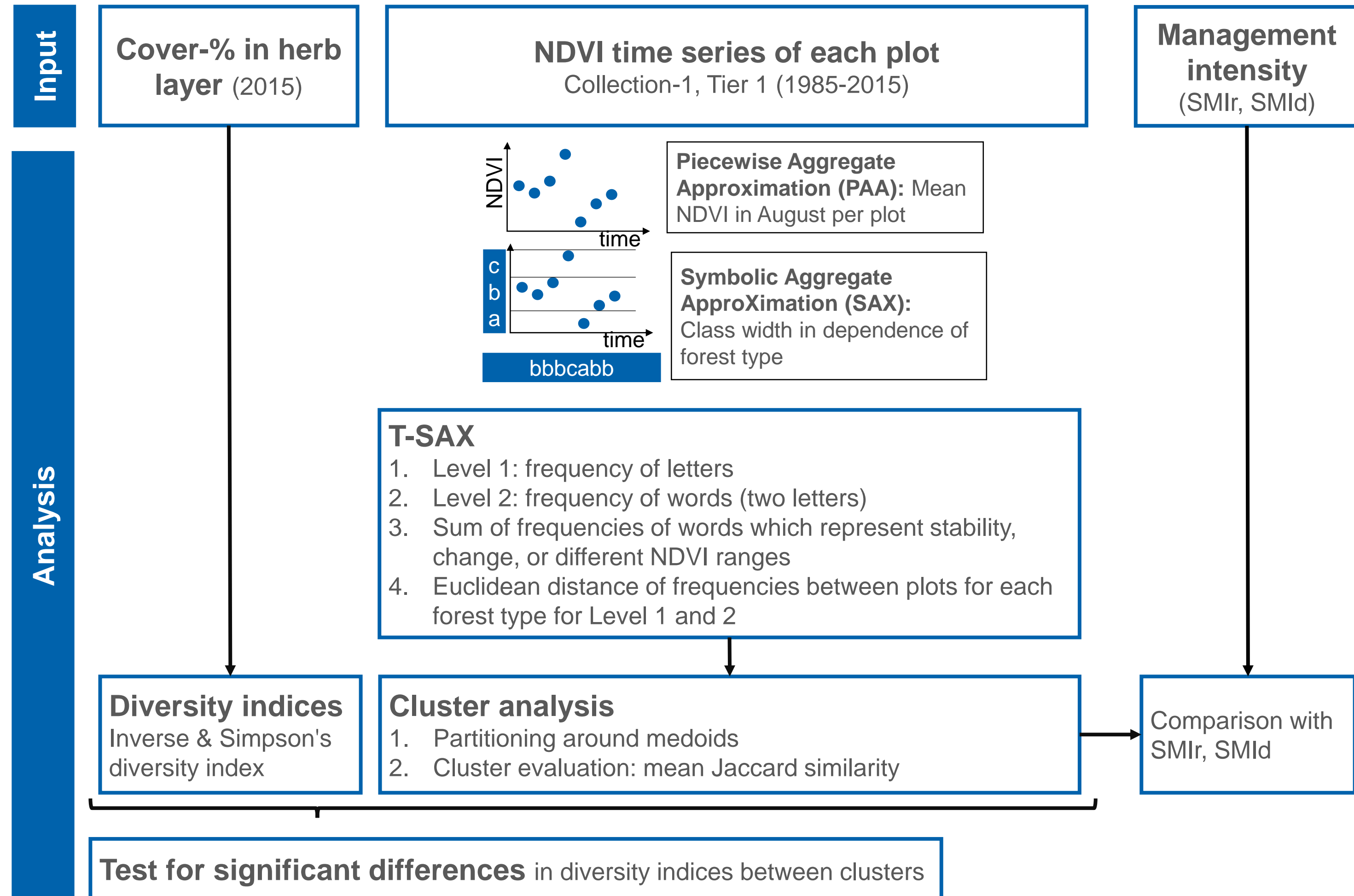
Questions:

- Can we identify differences in **forest disturbance, management intensity** and **stand developmental stage** from **Landsat time series**?
- Can we distinguish levels of diversity in the **herb plant layer**?

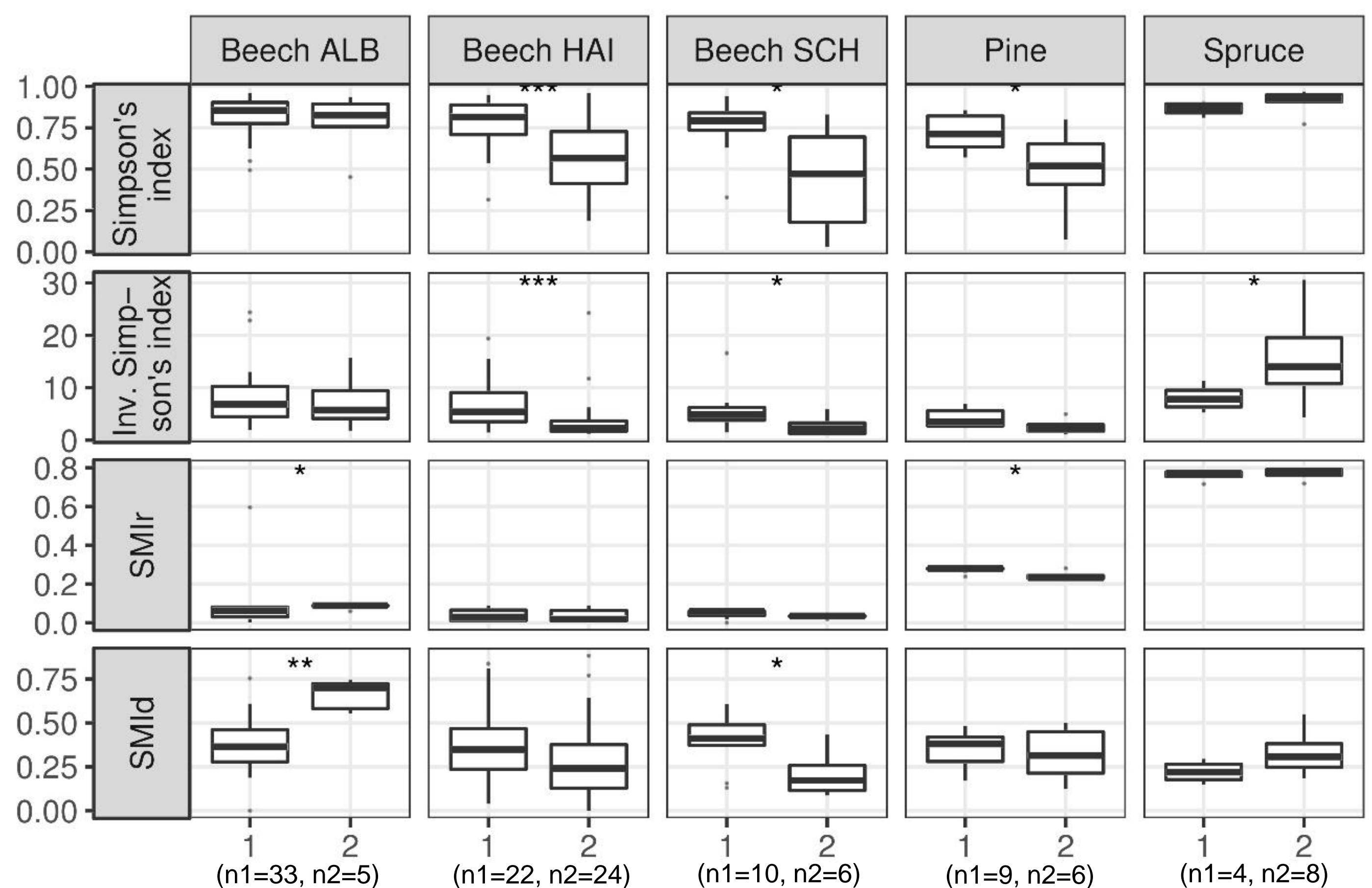
Discussion & Conclusion

- First study to relate Landsat time series and current diversity in herb layer in temperate forests
- Differentiation of levels of diversity, developmental stages, disturbance and management intensity
- T-SAX
 - requires to consider ecology and management practices of the different forest types
 - allows for time-independent comparison of time series, noise filtering, fast computation, easy interpretation

Methods



Results



Beech ALB Management intensity not related to diversity indices
Beech HAI High counts of high stable NDVI, indicating closed canopy cover, related to lower diversity
Beech SCH Higher management intensity related to higher diversity
Pine Younger stands related to higher diversity indices
Spruce Higher counts of lower NDVI related to higher diversity

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References:

Keogh, E., Kasetty, S., 2003. On the Need for Time Series Data Mining Benchmarks: A Survey and Empirical Demonstration. *Data Mining and Knowledge Discovery*, 7, 349-371.