Diversity changes of soil-growing lichens along the BIOTA Southern Africa transect – data gathering, maintenance and analysis

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Introduction
The BIOTA subproject S04 is focused on the gathering and processing of data on lichen diversity in Southern Africa. WP 01 is dedicated to the assessment of soil-growing lichen diversity and the exploration of diversity changes due to different abiotic and biotic factors. Furthermore, the indicative value of lichens and lichen communities is investigated, in order to develop a long-term monitoring strategy. WP 02 focuses on the development of a Java-based database client (“Diversity Navigator”) for maintenance and analysis of biodiversity data. The gathering, storage, management and analysis of data on lichen diversity is presented. Postgresql was selected as database system because it is open source and compilations exist for all major platforms. Some major specifications of the database client are: 1) Data entry and maintenance by table grid views and data forms; 2) Data validation, e.g. taxon names by parser functions; 3) Content data transfer between SGL databases of different types; 4) Queries on content data distributed in databases that are located on different servers under different domains; 5) Script generation for the statistical processing of data matrices (e.g., with the statistics package R) and data visualization with the Geographic Information System GRASS as web service.

Diversity of soil-growing lichens at transect level

General diversity of soil-growing lichens at the different observatories along the transect – Hotspots of diversity are found in the observatories of the winter rain area, especially Namues (20), Soebatsfontein (22), Goddelhoop (26), Ratelgat (27) and Moedverloren (28), and the observatory 16 placed in the Namib desert, with maximal values of 25 species/km². Much less taxa or no lichen taxa are found in observatories of the summer rain area and in the one characterized by a Fynbos vegetation.

Diversity of soil-growing lichens at observatory level (example 26, 27, 28)

Diversity and bioindicative value of soil-growing lichen communities – Digital sampling areas of 20 cm x 50 cm (1000 cm²) were analysed for at least 10 hectare plots of the 22 myco-ecologically investigated observatories. The open source programs MultiEps and ImageJ were used for elaborating the character profiles for semi-automated recognition. Soil-growing lichen taxa from observatories 26, 27, 28 were found being assignable to ten different “Photo-discriminable Morphological Units” (PdMU), i.e. morphologically distinguishable image elements based on colour and shape of the thallus or elements of the thallus. The character profiles for an automated recognition of such PdMUs could also be applied for analysing soil surfaces in plots of other observatories in the winter rain area.

Web clients for database query with information on specimen and observation data

Observation and collection data together with image files of lichen samples and of the monitored soil surfaces are stored in applications of the Diversity Workbench database suite, to be accessed by several web clients. For maintenance, such data may be queried and edited remotely by a Java database client (“Diversity Navigator”). Descriptive data on ecological, morpho-anatomical and chemical characters of soil lichen taxa can be maintained remotely and are used for dynamical visualization of character state distributions along the BIOTA Southern Africa transect as well as for the purpose of online identification of taxa.

Database client Diversity Navigator

Perspectives for the III BIOTA phase
Long-term monitoring of soil-growing lichen diversity changes along the BIOTA Southern Africa transect:
• routine digital photography of lichen communities (can partly be carried out by paraecologists)
• remote lichen vegetation resp. soil crust image processing (via server-based and local applications) and online data analysis (via rich client software and local applications)
Development of an online (and local) e-Learning system for biodiversity data, referring to organisms studied in the BIOTA observatories
Modulation of the Java-based rich client “Diversity Navigator” and implementation of the functional components in a Java/Eclipse-based framework. Implementation of further functionality for flexible adaptation to databases of different data structures of the various BIOTA Africa subprojects.

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