Vegetation databases & spatial analysis

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Book of Abstracts

WINALP

Europäische Territoriale Zusammenarbeit | Grenzübergreifendes Förderprogramm

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Wildfire in Bohemian Switzerland NP (Czech Republic): long-term dynamics and the impact on forest vegetation

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The importance of wildfire for existence of certain northern hemisphere forest ecosystems is well known from the Mediterranean, North America, Scandinavia or Siberia. The general perception of Central Europe region is that this phenomenon does not occur naturally there and its ecological impact on forest vegetation dynamics has been neglected. But closer observations from areas where wildfires occur and current paleoecological knowledge show that the ecological role of wildfires on temperate forest dynamics deserves consideration.
Bohemian Switzerland National Park is situated in the northern border region of Czech Republic next to Saxon Switzerland NP in Germany. Its landscape is composed mainly of sandstone rocks and covered by forest. Prevailing forest types are coniferous relic pinewoods (Pinus sylvestris) and man-made spruce stands (Picea abies), and, less frequently, acidophytic beech forests (Fagus sylvatica). Compared to the rest of the Czech Republic forest fires occur markedly more frequently in this area.
The aim of our study is to reveal the occurrence and dynamics of forest fires during the Holocene to the present in this particular region and to identify wildfire impacts on local forest vegetation.
The occurrence of prehistoric wildfires was detected based on paleoecological records of charcoals in peat sediments, and recent wildfires were tracked in the archival records of forest administrations. Wildfires and particular landscape structures were linked by spatial analysis using GIS software. The wildfire impact on the vegetation was demonstrated by phytosociological sampling of various post-fire succession phases.

A finite mixture model for mapping the potential forest types of Italy

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Forests cover about 29% of the Italian peninsula and provide important goods and services including CO2 sequestration, protection of watersheds from erosion, biodiversity conservation and provision of recreational areas. Current European Union agrarian policy boosts the abandonment of the least productive agricultural lands in favor of productive or protective reforestations. In order to plan this task and in addition to other aspects, forest managers need to know which species or combination of species is suitable in each site.
The present paper explores the relevance of modelling tree species groups with respect to environmental variables potentially influencing their distributions. To this aim a finite mixture model (FMM) was used to identify the main forest types of Italy and produce a map of their current potential distribution. FMM provides a convenient yet formal setting for model-based clustering. Within this framework, forest data are assumed to come from an underlying finite mixture model, where each mixture component corresponds to a cluster. The goal of model-based clustering is to provide a partition of the data into clusters of homogeneous observations; to achieve this, after model fitting an additional step is required to assign each observation to a different cluster according to some pre-specified rule. Finite mixtures of Gaussian densities are by far the most commonly used representation in model-based clustering which are characterized by clusters centered at the means, with increased density for points nearer to the mean. Geometric features (shape, volume, orientation) of the clusters are determined by the corresponding covariance matrices. As the number of mixture component increases, the number of parameters to be estimated may become quite large, especially the number of free parameters in the covariance matrices. To obtain more parsimony and stability, it is not surprising that restrictions are typically imposed on the component specific covariance matrices. An important extension of this model which is outlined is the inclusion of covariates to predict class membership and/ or the inclusion of covariates to have direct effects on the dependent variables, allowing to the conditional means to be directly related to the covariates. These can be both external covariates such as, for example, climatic and topographical parameters, as well as geographically covariates, as for example class membership of site neighbors. The spatial structure is captured by the use of a Gibbs representation for the prior probabilities of component membership through a Strauss-like model. FMM was applied to a national forest inventory consisting of 6714 plots where a measure of abundance of 27 tree species was recorded. In this way a potential forest cover map of Italy was produced with 15 forest types and their ecological and biogeographical features were analyzed and discussed.

Vegetation Changes of Dry Grasslands in the Southeast Romania

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There is a vegetation database of dry grasslands in Southeast Romania with more than 2500 relevés from a surface of 120,000 km². It includes relevés belonging to Koelerio-Corynephoretea (incl. Sedo- Scleranthetea, Festucetea vaginatae), Festuco-Brometea, Trifolio-Geranietea sanguinei, Elyno-Seslerietea (Seslerietea albicantis, Kobresio myosuroidis-Seslerietea caerulea classes from more than 350 references since 1931 to the present. We compared relevés from different sampling periods performed in the same areas to detect vegetation changes that have occurred in the last decades.

Relative importance of propagule pressure and land use to the level of invasion in different non-forest habitats

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Plant invasion is one of the most serious threats to biodiversity and ecosystem functions worldwide. It is well-known from the scientific literature that both propagule pressure and disturbances influence the level of invasion. Landscape Ecological Vegetation Database & Map of Hungary (MÉTA database, http://www.novenyzetiterkep.hu) contains data on the level of invasion (binary data: the habitat is invaded or not), cover of invasive species in the surrounding landscape (a measure of propagule pressure) and land use (the main source of disturbance). Generalized additive models were fitted to data from the database, and explained variances were calculated separately for the following habitats: Non-peaty reed and Typha beds (B1a), Non-tussock beds of large sedges (B5), Molinia meadows (D2), Salt meadows (F2), Arrhenatherum hay meadows (E1), Open sand steppes (G1), Slope steppes (H3a), Forest steppe meadows (H4), Closed steppes on loess, clay and tufas (H5a).

Propagule pressure explained more variation than land use in each habitat except salt meadows. The explained variation was highest in slope steppes and forest steppe meadows. These habitats are only extensively used; therefore the relative role of land use is low here. Another distinctive feature of these two habitats is that their abiotic conditions do not differ from the surrounding areas, thus invasive species occurring in the surroundings can invade them.

In the marshes and wet meadows, the relative importance of land use increases with decreasing water level. In the dry- and semi-dry grasslands land use explains more variation in habitats occurring in lowlands (G1, H5a) than in habitats occurring in hilly and mountain areas (E1, H3a, H4).

Application of the forest vascular plant list in nature conservation in the state of Lower Saxony, Germany

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Forests play a key role in the conservation of Central Europe’s natural heritage. The conservation of forest plants is one of the most important goals of forest conservation and forest resources management. The new edition of the forest vascular plant species list (Schmidt et al. 2011) may serve as an important scientific database for the development of sustainable forest management and forest conservation practices. By the example of Lower Saxony, Germany, we present applications of the forest vascular plant species list in combination with spatial distribution data available for the complete area of the state through the Lower Saxony vascular plant species monitoring program (1982-2004), focusing on three subjects: (1) Identification of hotspots of endangered forest plants; (2) the effectiveness of protected area systems for the conservation of forest vascular plant species in the lowlands; (3) The prediction of forest communities by forest plant distribution models.

The Global Index of Vegetation-Plot Databases (GIVD): update on status and perspectives

Jürgen Dengler[1] & GIVD Steering Committee

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Vegetation-plot records or relevés, broadly defined as records of plant taxon co-occurrence at particular sites, constitute the primary descriptive data on which much of vegetation science is based and serve as the single most important data resource available to vegetation scientists. During the last two decades, various regional or national databases for such vegetation-plot data have emerged. The amount of data that became available through vegetation-plot databases facilitated, inter alia, consistent large-scale vegetation classifications, macroecological pattern analyses, and the assessment of global change effects on vegetation. However, it was not an easy task to retrieve the appropriate databases for such analyses, in particular at a supra-national level. Therefore, we compiled the Global Index of Vegetation-Plot Databases (GIVD; www.givd.info), supported by the EVS and Ecoinformatics Working Groups of the IAVS and co-ordinated by an international Steering Committee.
GIVD is a metadatabase that contains descriptive data of vegetation-plot databases worldwide, such as scope of the database, owner and contact data, number, geographical and temporal distribution of the relevés, and environmental data available for these. Since its launch in autumn 2010, approx. 150 databases comprising approx. 3 million independent vegetation plots have been registered in GIVD. In this presentation, we will (i) give an updated overview of the available data, (ii) highlight the perspectives that GIVD provides for vegetation science, and (iii) discuss options for further development of GIVD.

pnv 2.0 - from typology to ecological model

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Thanks to its wide use, the concept of potential natural vegetation (pnv) is a phytosociological success story. Managers and planners often require maps of biotic potentials. Criticism of pnv points out fundamental problems in the derivation of units and failure to account for dynamics in environment and vegetation. More fundamentally, traditional pnv mapping must be criticised for being based on correspondences rather than on understanding cause and effect, resulting in narrative rather than scientific models.

Pnv is closely related to the display of ecological conditions acting on population and communities of crop plants in site mapping. Thus, forest site types have often been delimited and named as types of natural communities.

We propose to update pnv mapping by founding it on explicit models of ecological gradients, which are calibrated by regressing species composition (response) against site variables (dose). There are three new dimensions to this: (1) GIS and spatial modelling provide a tremendous amount of area-wide, high resolution data on climate, soil and relief, (2) new regression techniques allow to model complex dose-response relationships and (3) anticipated changes in ecological factors can be incorporated in scenarios.

Ellenberg indicator values summarise the compositional response with respect to defined ecological factors. The response of key species such as trees can be modelled individualistically and overlaid with pnv units. Pnv units are obtained as hypervolumes with known site properties and probabilities of tree species occurrence, which takes them out of the realm of expert opinion and disguised value judgement.

It remains crucial to quantify anthropogenic biases in calibration data to avoid and remove distortions by hidden confounders.

The procedure is exemplified by the GIS-based mapping of forest types for the Northern Alps in the project WINALP.

Species distribution models of Fraxinus excelsior and Abies alba in Bavaria – Different modelling strategies and spatial scales in dependence on data availability and species traits

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Species distribution models (SDMs) are useful tools to adopt land use to climate change and are now used more frequently in forest management planning. In order to model future species distribution based on climate scenarios, calibration data should cover the whole niche space of a species in order to allow extrapolation into a warmer and drier future climate. Therefore, we used European species distribution data derived from international forest inventories (Level I) and natural vegetation maps for Europe (Bohn & Neuhäusl 2003). Since environmental data at the European scale lack sufficient information on soils, and yield only coarse relief data like SRTM, many SDMs published in recent years explain species distributions based solely on coarse scale data (e.g. WorldClim). On the other hand, national forest inventory (NFI) data cover only a small area of the species distribution but are coupled with high resolution soil and terrain data. High resolution data are relevant for the distribution of a species like Fraxinus excelsior, which strongly depends on high base saturation in the soil and local climate, whereas a European model seems to be appropriate for a more euryoecious species like Abies alba. We present discrepancies in modelling strategies and discuss them against the background of data and species traits.

Soils, climate, tree cover and space as joint drivers of species composition in mountain forests

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1505 plots were sampled during the WINALP-project (www.winalp.info) along the northern Alps in Bavaria following a design combining systematic, stratified and preferential sampling. At each plot a vegetation relevé was accompanied by standardised soil descriptions. As all inventory points were exactly georeferenced by GPS, climate data for each plot could be added from climate models.
Our contribution addresses some problems associated with such a remarkably large data set, such as the bias introduced by a variety of surveyors and sampling seasons, as well as the sheer size of the data set itself.
Floristic gradients and underlying ecological factors were identified and quantified by canonical ordination techniques. Floristic variance was partitioned between unique and overlapping contributions of soil, climate, tree layer composition and space.
In our data set climate had a stronger influence on understory species composition than soil conditions. Tree layer composition appeared to be an independent environmental factor acting on the ground layer, that represents land use legacies as well as natural site factors not adequately measured by the environmental variables at hand.

Integrating herbarium data and geodatabase to explore the spatial pattern of fern biodiversity

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The study explores the spatial pattern of fern distribution and diversity in Tuscany (central Italy). The data used are stored in a geodatabase based on PostgreSQL/PostGIS open-source database system containing geographic information concerning the Pteridophyta of Tuscany, obtained from the main regional herbaria. The herbarium data are sources of historical and ecological data to survey floristic and vegetation diversity but often these data are scattered in different places and are quite difficult to access. The chance to digitalize the herbarium data in a single database provides a resource for taxonomic, distribution and ecological studies, and is an important support for planning and management of natural resources. The direct link between the geodatabase and GIS application with the support of the output webgis system permits to explore the relationship between species distribution and environmental variables.
In particular, the spatial pattern of the sampling effort and the species richness based on Pteridophyta herbarium data have been analyzed. The results showed a non-homogeneous floristic exploration at regional scale, with highly explored areas and areas with a very low number of surveys, pointing out the spatial correlation of herbarium data.
Some relationships between species richness, intensity of sampling and topographic and climatic variables as distance from water bodies and roads, average temperature, rainfall have been analyzed and discussed.

Assessing climate change effects on tree-growth based on forest inventory data from Bavaria

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Providing a quantitative assessment of likely climate change impacts on tree growth is a key challenge for both ecology and forestry. Here we aim to estimate changes in tree growth for selected species and to identify regions most strongly affected by projected climate change, using forest inventories from the "Bayerische Staatsforsten" (Waldinventuren BSF) and climate models from "Worldclim" (Hijmans, R.J. 2005). Additionally we take soil depth into account, based on information from the "European Soil Database v 2.0" (Van Liedekerke, M. 2006). Following Kunstler et al. (2011), we aim to predict annual tree growth as a function of diameter at breast height (DBH), water availability over the growing season (WB), degree-day sum over the growing season (DD), and an index of competition (CI). As statistical method we use linear regression.
We find statistically significant effects of the four explanatory variables on tree growth for the species Picea abies, Fagus sylvatica, Pinus sylvestris, and Quercus spec. (Q. robur and Q. petraea) and identify areas where future growth is projected to be below current levels.
We intend to further develop this approach using additional forestry inventory data from the Bavarian Forest National Park, continuous meteorological measurements, and Bayesian statistics. In addition, we aim to contrast the results from the statistical models with those from the process-based forest landscape model LandClim (Schumacher et al. 2004).

Literature

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EvaplantE - data base on endemic vascular plants in Europe

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At the moment, EvaplantE comprises information about approx. 6,200 vascular plant taxa - species groups, species, subspecies - which are restricted to Europe.
The organisation of the data base is a long-time project which is permanent in progress.
Until now information and numbers of more than hundred floras were collected and involved in the data base.
EvaplantE is a source for scientific analyses and publications about distribution patterns, altitudes, ecological data, and related habitat groups. On the other hand, it can be a basis for nature conservation activities.
The data itself (indices, numbers), different methods of analyzing the data and first results are discussed. Difficulties are related to the term "endemism", to differences in taxonomy and to different species concepts.

AuVeg: a database for vegetation of German floodplains

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The Federal Institute of Hydrology (BfG) is responsible for the management of German navigable rivers. This includes the ecologically sound and sustainable treatment of floodplain vegetation. Furthermore, the BfG is involved in the German Adaptation Strategy (DAS) to climate change dealing also with the effects of changing hydrology on vegetation.
One important task of the BfG is to evaluate impacts on vegetation caused by construction, restoration or maintenance works. Therefore, we develop models to assess and evaluate such impacts. Another aim is the projection of climate-induced changes of floodplain vegetation.
All these studies are based on vegetation relevés and measures of site conditions. To provide an accessible pool of these data for scientists dealing with floodplain ecology, we started to collect and store vegetation relevés in the TURBOVEG database AuVeg.
So far, the database contains about 2400 relevés from the river Rhine, 1000 from the Elbe and 2200 from the Danube. The basic requirement to be included in the database is an exact geo-reference. This is necessary to correlate spatially explicit hydrologic information with the vegetation data.
Examples of some preliminary analyses and models from the rivers Elbe and Rhine are shown and discussed.

Randomization tests are indispensable - scientific pitfalls due to the non-randomness of vegetation-plots

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Vegetation plots provide countless avenues of research possibilities. Many of them are using averages of species traits per plot. I will show examples why results based on those averages are not trustworthy without randomisation tests like permutation of the species traits. This is due to the non-randomness of species occurrences within vegetation plots.
The examples include the correlation between average Ellenberg indicator values and site measurements, the preference of alien species along ecological gradients and the identification of High Nature Value farmland with indicator species lists.

News in VegetWeb, the German online vegetation plot database

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The introduction page lists all projects with counts of plot and links to exports.
Beside the limited export of vegetation plots as denormalized HTML Table via the windows scratchboard now there exist various unlimited export possibilities:

1. VegX, the new published worldwide standard from IAVS.
2. Simple comma separated value (CSV) format for quick mass exports divided in header and species data.
3. VegetWeb's internal XML format ESVeg, which preserves full information and can also be imported.

As a further, important milestone the ESVeg export from the wide spreaded vegetation data tool TurboVeg now supports species observation parameters like original author taxon names.
All non standard TurboVeg fields are preserved either automatically as user defined VegetWeb fields or mapped by a comfortable user mapping dialogue.

Evaluation of a site-classification model for the Northern Alps with forest inventory data

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The Alps is one of Europe's great mountain range systems, stretching from Austria in the east through Italy, Switzerland and Germany to France in the west. In this study we concentrate on the German and the North Austrian part of this region, called further on Northern Alps. This region is of big importance in Germany and here especially in Bavaria because it is covered mainly by forests. In the past, one knowledge gap hindered practical forestry work: there was no site-classification system available for this region. Within the project WinALP a site-classification model based on high-resolution physiographical data was developed. Within this study we evaluated this site-classification with available forest inventory data from state forest enterprise in Bavaria.
In detail, we tested with non-parametric statistics, if the dominant heights of the most important tree species in the Northern Alps (Norway spruce) differ for the classified sites.
The results show that especially in the submontane and montane altitudinal belt the dominant heights differ significantly.
Further on we can show that in the lower regions of the Northern Alps the height growth of Norway spruce trees is depressed on calcareous sites in comparison to siliceous sites.

Life history traits and habitat preferences of species during spontaneous succession in a sand-pit

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The purpose of the work was to analyze which species life history traits and habitat preferences are important during the succession after abandonment of mining activity in a sand pit (southern Poland). During a 15-year period (1996-2010) 176 phytosociological relevés were made within vegetation patches of different age. They were divided according to soil moisture and formed two series of chronosequences ranged from 0 to approx. 50 years. The dataset were analyzed both by DCA/CCA ordinations and regression trees methods. The successional gradient apart from theoretically predicted replacement of R by C strategists, revealed the occurrence in the early successional stages of stress-tolerant ruderals and competitive ruderals. However, the differences between the wet and dry series have been observed. On dry soils the ruderals, anemochorous, wind pollinated species dominated in early phases. On the other hand on wet sites in the early successional phases, species with vegetative growth, hydrophytes, chamaephytes and stress-competitors prevailed. Later in succession they were replaced with insect-pollinated, typical for species-rich and stress-tolerant ruderals and finally by species with strong competitive ability.

Spatial modelling of forest soil pH with vegetation databases: a case study from the Czech Republic

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Vegetation databases all around the world store huge amount of valuable data about species distribution and co-occurrence and therefore about underlying environmental factors. Moreover, these data are often accurately georeferenced and can be therefore used for production of environmental data with high spatial resolution. However, this potential of vegetation databases is largely unexplored.
Here, I aim to create the map of forest soil pH in the whole Czech Republic from the vegetation data stored in the Czech national phytosociological database. First, I collected vegetation data for almost 3 000 forest plots accompanied with laboratory measured reaction (pH-H2O) of the upper soil horizon. From this dataset, I calculated species optima along the soil pH gradient as a mean pH value of the plots in which the species occur. Then, I extracted about 10 000 forest vegetation plots from Czech national phytosociological database and calculated their soil pH as average optimum value of species present within the plot. Finally, I used spatial interpolation of these values in order to produce the map of forest soil pH in the whole Czech Republic.

The VegItaly project for a national vegetation database: first applications, criticality and perspectives.

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Relevé databanks play a special role in monitoring and analyzing vegetation and to objectivize phytosociologiacal investigation. With the purpose to create an Italian database for archiving and sharing data, the project AnArchive for botanical data was developed in the last decade (http://www.anarchive.it).
AnArchive is a collaborative project that involves several Italian universities coordinated by the University of Perugia. Among the subprojects carried out VegItaly (http://vegitaly.anarchive.it), represents a new web database designed to store, retrieve and analyze vegetation data (phytosociological and field plot) according to the definition of "vegetation database" suggested by the Global Index of Vegetation-Plot Databases (GIVD) and the IAVS Eco-informatics working group.
Comparing to similar projects particular attention has been taken to handle classification information assigned to each relevés taken from original papers or reassigned after further revision (e.g. type relevé, phytosociological rank etc.), in order to make available all metadata.
Currently about 7000 relevés of different vegetation types are stored in the system just enough to implement specific output format for statistical analysis packages or perform classification methods such as the Cocktail method on a large data set extracted from the system. To perform the Cocktail method, the database system was interfaced with the program Juice 7.0 creating a compatible exporting data system.
The use of different classification methods allowed obtaining important results, not only about classification models, but also providing ideas for improving the functionality of the archive system. Formal definitions will be integrated in the project VegItaly in order to create a simple classification method available to users. Moreover several tools and functions will be created to facilitate the statistical and spatial analysis.
During the work some criticalities have emerged such as superficial collecting and archiving data methods, weakness in taxonomical and syntaxonomical interpretation of the data published by different authors, the requirement of standardized floristic data in accordance with the taxonomic system continuously in developing, lack of funding and still a scarce interest of researchers to acquire a rigorous archiving system.
VegItaly is supported by Italian Society of Vegetation Science (former Società Italiana di Fitosociologia-http://www.scienzadellavegetazione.it/).

Regionalisation of predicted Ellenberg moisture value in alluvial forests

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Understanding vegetation-environment relationships is important for monitoring and prediction of changes induced by restoration of riparian forests. We performed a baseline survey of 117 permanent plots in an alluvial forest along the river Danube, where flooding will be re-established. Besides vegetation sampling data on environmental conditions (soil, nutrients, groundwater) were collected on these plots. To model Ellenberg moisture value spatially, the first step is the selection of the best fitting environmental predictors. Two criteria must be fulfilled: (i) the data has to be available for every plot and (ii) information about environmental conditions must exist for every grid cell in a GIS of the target region. We chose height (DEM), soil type, site moisture, soil thickness and groundwater level as predictors.
Moisture values measured in plots will be modelled against environmental predictors using General Additive Models (GAM). The GAM will then be applied to the grid of environmental predictors, resulting in area wide map of moisture values. By replacing pre-restoration levels by the new groundwater regime a scenario map of post-restoration moisture values will be created, thus visualizing the expected effects. These predictions will be validated against trends observed in the post-restoration sampling campaign.

Accurate type I error estimation for the interpretation of compositional patterns by species characteristics

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Classification and ordination methods are commonly used for revealing patterns in species composition of the vegetation. When reliable environmental measurements lack, these patterns are interpreted by the aid of species characteristics, e.g. indicator values, life forms or chorological types etc. Obviously, if two plots share many species, they will likely to be classified into the same cluster or they will be placed close to each other in an ordination. But, as they have many common species, the frequency distribution of species characteristics will also be similar. In such cases, one aspect of species composition is explained by another, thus violating the assumption of independency. Therefore, if the test statistic, expressing a between-cluster difference or correlation with an ordination axis, is compared to its standard distribution, the probability of type I error would be underestimated.
In this study we demonstrate a new randomisation procedure that produces unbiased estimations of the type I error rates.
The new method generates the reference distribution of the test statistic from many randomised trials. Each trial starts with the randomisation of the compositional matrix. Then the randomised matrix is analyzed on the same way as the original matrix (i.e. it is classified or ordinated), as well as the test statistic is calculated for each trial. With this procedure, the reference distribution contains values that are calculated between non-independent aspects of species composition, similarly to the actual value of the test statistic.
We examined the performance of the standard estimation method, the simple permutation test and the new method on classifications of artificial data sets with random structure. The rejection rates of a null hypothesis stating no difference between two groups of the classification were compared. The standard method and the permutation test always gave higher rejection rates then the expectation based on the predefined significance levels. The rejection rates of the new procedure never differed significantly from the expectation. The bias of the traditional methods was stronger when the simulated species pool was low or the number of plots was high.
We recommend using this new method for testing between-cluster differences or interpreting ordination axes based on variables derived from species characteristics.

Community context of selected native and invasive plant species in Central Europe

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The success of biological invasions is determined by the interplay of the invasiveness of the species and the invasibility of the new range. While abiotic conditions, e.g. climate, often remain similar in the new range, the biotic circumstances can be different. However, there are few studies on such differences in the community context of invasive alien species so far. This study focuses on the relevance of changes in the community context and vegetation structure for the invasion success of plants. Native species that have been in their range for a long period of time have a higher probability of filling their potential range (Pearson & Dawson 2003) and of occupying their potential habitats and should exhibit lower fluctuations in abundance and fitness compared to recently introduced species. Especially, recently invading alien species might have not reached all vegetation types they possibly could colonize (e.g. Thiele et al. 2008). The process of invasion will most likely allow them to get to additional regions and habitats after some time ('secondary invasion'; Dietz & Edwards 2006). Therefore, in invasive alien plants the realized niche should be narrower than their potential ecological niche. It follows that the number of occupied vegetation types should be larger for native than for invasive species. Additionally, they are facing the challenge of regional and local adaptation (Leger et al. 2009) and are exposed to the dynamics of biotic interactions in the invaded range (Park & Blossey 2008). With respect to invasion history and assumed lacking local adaption it is hypothesized that invasive alien species
i) occupy fewer vegetation types than congeneric native species,
ii) show more regional variation in their community context (in terms of occupied vegetation types), and
iii) occur in more vegetation types the longer they have been present in the new area.
To test these hypotheses the community context of invasive alien plant species and congeneric native species is investigated along a north-south gradient in Central Europe. Several pairs of species are included, among others Impatiens parviflora and I. noli-tangere, Solidago canadensis and S. virgaurea as well as Prunus serotina and P. padus. Data from published phytosociological relevés is collected from meta-databases (e.g. Global Index of Vegetation-Plot Databases (GIVD); Dengler et al. 2011). Relevés containing the selected species are compiled to a uniform database including presence-absence data, sample year and geographic reference. Species names follow the reference list GermanSL (Jansen & Dengler 2008). Additional variables are obtained from species traits databases (e.g. Klotz et al. 2002). Vegetation types are distinguished by several community traits, e.g. number of species, fraction of different life forms and Ellenberg indicator values. The poster shows the aims and methods of the project, it will give information on the compiled data set as well as some preliminary results.

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Changing of beech forest vegetation along a phytogeographical gradient in SE Europe

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Our study comprises mesophilous beech (Fagus sylvatica) forests in the Southeastern part of Europe. Generally accepted macroecological and phytogeographical gradient of that area goes along Dinaric Alps in the North-West to South-East direction; in our case it is about 1000 kilometres long.
The aim of our study was to detect how biogeographical and ecological factors (ecological indicator values of plant species) influence the beech forest floristic composition and structure and how they change along the observed gradient. We were also interested to estimate how life forms and chorotypes change along this gradient. Therefore we assembled a vegetation database, which includes georeferenced phytosociological relevés of the researched area. After the projection of relevés to the chosen gradient axis we correlate them with different factors.
Along the gradient, there is a significant increase of proportion of chamaephytes, hemicryptophytes and therophytes towards South-East. At the same time the proportion of geophytes and phanerophytes significantly decreases in the same direction. Also there is a significant increase of proportion of Stenomediterranean, Eurimediterranean, Mediterranean-Montane, and Eurasian species while Boreal species decrease toward South-East. The results also show that beech forests on the Northwestern part of the investigated area have wider altitudinal range, while beech forests of the Southeastern part are restricted mainly to higher altitudes. But there is not only an altitudinal limitation of beech forests in the Southeastern part of the research area, but also structural and functional changes of forest structure as a result of changed macroclimatic factors.

Information on species distribution from vegetation plot data: relevant for INSPIRE?

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The INSPIRE directive (2007/2/EC) came into force on 15-May-2007 and aims to create a European Union (EU) spatial data infrastructure, enabling the sharing of environmental spatial information. Spatial information addresses any data with a direct or indirect reference to a specific location or geographical area. In Annex III data specifications are currently worked out for 21 spatial themes, number 19 being "species distribution". By 15-June-2011 the version 2.0 of the specification has been published. This specification will be presented and its relevance for vegetation plot data will be discussed. Since NetPhyD is registered as a "Spatial Data Interest Community (SDIC)", it has the opportunity to comment on the specification during a testing period until 21-October-2011.

Spatial modelling of forest site quality in the Bavarian Alps based on indicator values and environmental predictors

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Besides temperature (T), moisture (M) and reaction (R), macronutrient (NPK) supply is a component of site quality that is crucial for assessing impacts of increasing biomass harvesting in mountain forests. The aim of our study is to establish a map for forest site trophy for the Bavarian Alps at the scale 1:25,000. The WINALPecobase provides data about vegetation and soil derived from a stratified inventory with ca. 1,500 points covering all important forest types of the region. We used mean Ellenberg indicator values for nutrients (mN) derived from vegetation plots as a proxy for community response to macronutrients, and regionalised it based on soil and climate predictors. Model predictions were tested against height of Norway spruce at reference age (site index) of an independent forest inventory data set. Among indicator values, mN contributed considerably to the prediction of site index over a wide range of soil properties, but the growth potentials on acidic soils could not adequately be explained by that covariate. A proper model requires a combination of mN with mR or parent rock types as predictors for nutrient supply. In summary, inclusion of nutrient values improved spatial information about the vulnerability against biomass harvesting and growth potentials in the Bavarian Alps considerably.

TURBOVEG CHECK-UP: Access application for checking relevés

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TURBOVEG CHECK-UP is a Microsoft Office Access database application designed for quality control and quality assurance of phytosociological relevés stored in the TURBOVEG database program. Its main target is searching for errors in species data and header data. In the species data there are, e.g., keying errors in species names or species assignment to wrong layers. In header data there can be, e.g., missing values or values outside the given range (e.g. altitude). This application can be accessed using a simple user friendly interface and therefore it is possible to use it without deeper knowledge of Microsoft Office Access. Errors or summaries of data are displayed in well-arranged sheets, which can be printed. It represents a useful tool especially for database managers who can check relevés before downloading them to national or regional databases. Although recently TURBOVEG CHECK-UP is customized to search for errors in the Czech National Phytosociological database, it can be easily modified for other databases which use different species lists.

Inventory, ecological range and distribution of medicinal plants in Bavarian forests

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Besides the primary function of forests as timber supply they play a major role in many advanced functions, summarized as "ecosystem services". One of these services is to provide raw materials for herbal medicines, cosmetics, and food , here called "Medicinal and Aromatic Plants (MAPs)".. The aim of this study is to capture the potential for MAPs of the Bavarian forests to ensure the use of these plants for future generations. Five key questions are examined: Which MAPs occur in Bavarian forests? Do hot spots of MAPs in Bavarian forests exist? In which forest communities do MAPs mainly occur? Which MAPs can be used to date? Which MAPs are threatened?
To answer these questions several databases were combined. First of all a medicinal data base of native species was created. MAPs, which are used in herbal medicine or homeopathy application or MAPs, which are used in folk medicine, are included. In addition, MAPs used by food and cosmetic processing companies were added. Moreover information which parts of plants (roots, flowers etc.) are used, was collected. MAPs that are listed in the German standard list of native vascular plants are considered as native. The medicinal plant database was combined with the forest vascular plant list and distribution maps of FLORKART to identify MAPs occurring in Bavarian forests and to determine distribution hot spots. The analyses in which forest communities MAPs occur was based on the data from the Bavarian forest reserves. The product portfolio of two companies which trade in MAPs was included to find out which MAPs are currently in trade. The threat of MAPs in forest communities was determined with the help of the "Red Data book of endangered species". Ellenberg's indicator values may provide clues to MAPs which are threatened by climate change.
Combining these data bases it was possible to show that 561 MAPs are present in Bavaria. 301 MAPs appear in the forest vascular plant species list. 159 MAPs thereof are traded on the market. The spatial distribution of MAPs in forests shows "hot spots" in the northwest, southwest and southeast of Bavaria, mainly on calcareous soils. The forests of the bavarian forest reserves can be classified into 41 different forest types with 221 MAPs occurring there. The various forest types differ a lot in the number of MAPs which they include. Looking at the distribution of MAPs differentiated by layer, the absolute number of MAPs in the herb layer is the highest. 22 species with low indicator value for temperature and 29 species with a low indicator value for continentality are threatened by climate change. The Red Data Book threat categories show that out of 221 MAPs occurring in the bavarian forest reserves, 29 MAPs are classified as endangered, 36 MAPs are on the early warning list. 155 MAPs remain that can be used without concerns.

Species richness patterns along the altitudinal gradient in Hyrcanian area, N Iran

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Hyrcanian vegetation zone is a green belt stretching from Talish in Republic of Azerbaijan and over the northern slopes of Alborz mountain in north of Iran ranges in Golestan, Mazandaran and Gilan provinces. This area in Iran is approximately 800 km long and 110 km wide and has a total area of 1.85 million. This forest is consisted of a unique closed canopy of mesic deciduous trees in northern Iran contrasted to the arid and semi-arid steppe landscapes throughout most of the country. The forest part is distributed from near to the Caspian sea up to 1900-2500 m which there is a timberline and forest/steppe ecotone. This rather distinct altitudinal variation of timberline (1900-2500) can be considered as human impacts on the upper altitudes. There is an ecotone part above the timberline which mostly covered by shrubby species. Other prominent vegetation in the upper altitudes is an Irano-Turanian type of steppes and grasslands which is relatively more similar to steppes and dry grasslands of other parts of Iran but still possess some specific endemics which are not found in the southern slopes. In this study, the pattern of variation of species richness was evaluated along the altitudinal gradient ranging from -25 m a.s.l. up to 5000 m a.s.l. Floristic data related to the species distribution for each 100m altitudinal band were extracted from the reviews, monographs and floras (such as Flora Iranica, Flora of Iran), GBIF data as well as our field experiments across different parts of the area. Total collected data were evaluated in four separate datasets, including total species (approx. 3580 vascular plant taxa) as well as the species that only found in each of three mentioned provinces. Pattern of species richness for the total dataset represents a hump-back shape with the richest area around 1200-1300 m a.s.l. Different provinces represent relatively different patterns of species richness along the altitudinal gradients and could be interpreted due to different management regimes and more or less different climates. Additional to the literature data on the altitudinal bands, three 400 m^2 plots were made along five transects to show the relationships between literature data and plot data. The pattern of species richness along the altitude were evaluated with climatic data such as precipitation and annual temperatures. It indicates that the climatic factors are the most prominent factors affect the species richness in the Hyrcanian area.

The RMT-model of potential natural vegetation in mountain forests

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In the course of advances in spatial modelling and improved availability of digital geodata, the traditional mapping of potential natural vegetation (pnv) can be replaced by ecological modelling approaches. We developed the simple RMT-model to map the spatial distribution of forest types representing the potential natural forest vegetation in the Bavarian Alps. The RMT-model is founded on a three-dimensional system of the ecological gradients reaction (R), moisture (M) and temperature (T). Within such a "site cube" forest types can be defined as homogenous site units that give rise to forest communities with comparable species composition, structure, production and protective functions. The three gradients were modelled by regression techniques that use area-wide, high resolution geodata on climate, relief and soil as predictors and average Ellenberg indicator values for acidity, moisture and temperature of vegetation plots as summary parameters of plant responses to the ecological gradients. The resulting predictor-response relationships allowed predicting gradient positions of each raster cell in the region from geodata layers. The three-dimensional system of gradients was partitioned into forest types, which can be mapped for the whole region. RMT-based units are supplemented by forest types of special sites (46% of the forest types) defined by other ecological factors such as geomorphology, for which individual GIS-rules were developed. Our model delivers an intermediate-scale map of potential natural forest vegetation that will be integrated in a forest information system and used to effectively manage and protect forest stands. We see four advantages of our model to traditional pnv-mapping: 1. It is based on environmental predictors. 2. Its rules are explicit and repeatable. 3. It can be updated and modified according to scenarios of environmental change. 4. It conveys consistent information on principal growth factors to the practitioner.

Vegetation change and homogenization of species composition in nutrient-deficient Scots pine forests

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Studies on the effect of eutrophication on forest understory vegetation and a subsequent homogenization of species composition have not been conclusive until now. Nutrient deficient sites have been neglected in this regard until now, so we carried out a resurvey of 77 semi-permanent plots from the year 1965 in Scots pine forests on poor acidic sands in the Lower Spreewald, Brandenburg, Germany in 2010. Vegetation change was analyzed using multidimensional ordination, dissimilarity indices, mean Ellenberg indicator values, and winner/ loser species and by correlating between-year changes of these variables with initial forest type reflecting N conditions. Species composition changed strongly and overall shifted towards higher N and slightly lower light availability. Strongest compositional changes occurred in the oligotrophic forest type (lichen-pine forests: Cladonio-Pinetum), while strongest increase of nitrophilous species was in the more mesotrophic forest type (Leucobryo-Pinetum). The response to N enrichment is confounded by canopy closure on N-richest sites and probably by water limitation on N-poorest sites. Despite an overall increase in species numbers, species composition was homogenized between study years due to the loss of species adapted to low N availability (mainly lichens and bryophytes) on the most oligotrophic sites. The relative importance of atmospheric N deposition in the eutrophication effect is difficult to detangle from natural humus accumulation after historical litter raking. However, the profound differences in species composition between study years across all forest types suggest that biotic homogenization in pine forests on nutrient-deficient sites is not simply explained by natural succession.

The (mis)match between individual species and community distribution models

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The question if the phytosociological concept of plant communities can be transferred to produce meaningful predictions of species range shifts strongly needs closer investigation. Plant communities are commonly used to describe vegetation patterns over large areas; however, they are less often used than individual species in predictive vegetation modelling. In our study we compared the results of species distribution models for multiple species with subsequent classification and the modelling of plant communities classified prior to modelling for two arid ecosystems: the southern Atlas Region of Morocco and the Namib Desert of Namibia. For both regions we used information on plant species from vegetation data bases covering a large extent of the ecosystem. Environmental predictor variables were derived from Worldclim, geological surveys and high resolution DEMs. All models were calculated using the package BIOMOD in R allowing for ensemble forecasting of potential distribution. To project potential range shifts of communities and plant species we implemented IPCC scenarios for the year 2050. This study provides answers to the questions a) if plant communities resemble the extent of the plant species they represent, b) whether plant communities show similar responses to a changing climate, and c) if the composition of plant communities will change due to a changing climate.

Indicators of plant biodiversity for grasslands in Saxony

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The maintenance of species-rich grassland is an important nature conservation goal. This goal can usually only be achieved by payments enhancing a proper management. Nature conservation schemes need to retain a maximum of flexibility for farmers to ensure their acceptance. Therefore, result-oriented conservation schemes are increasingly under discussion. For such schemes good indicators for species-rich grasslands are needed.
We combined vegetation relevés of several datasets (Natura 2000 survey, grassland monitoring, efficiency control of agri-environmental schemes) in Saxony. The aim of the study was to determine good indicator species for species-rich grasslands and to look for the plant biodiversity pattern in the grasslands in Saxony.
We identified 30 species that are good indicators for species-rich grasslands. Good indicator species of species-rich grasslands prefer nutrient-poor and sparse grasslands. The majority of grasslands in our dataset contain less than 30 species. The diversity of grassland species does not correspond with the diversity of red-list species.

Spatial modelling in vegetation science – recent challenges

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The analysis of interactions between spatial patterns and ecological processes in landscapes is an essential part of landscape ecological research. Understanding the complex interactions between abiotic and biotic landscape elements and identifying the driving forces is pivotal to derive reliable predictions for scenarios of environmental change and its consequences for the conservation of species, biodiversity, and ecosystem functioning. Therefore, spatial models for quantitative predictions of species distribution patterns are central instruments.
This talk gives an overview referring to recent advances in statistical and process-based spatial modelling approaches. It shows several examples of applications. The examples include new approaches in i) disentangling environmental, spatial and spatiotemporal effects on species distributions as well as in ii) coupling pattern-based statistical and process-based mechanistic model approaches. Finally, I will also discuss recent challenges, limitations, and research needs of spatial modelling in vegetation sciences.

Expert identification of geographical coordinates of historical phytosociological relevés using GIS

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Precise localization of phytosociological relevés by geographic coordinates (latitude, longitude) is vital in the context of national vegetation overviews and statistical evaluations of large datasets (cf. Jarolímek & Šibík 2008). In the same way they represent spatial background in transnational syntheses at continental level by various interdisciplinary studies with interconnection of vegetation (floristic) data and abiotic part of the landscape (pedological, geological, climatic, etc.). Visualization of these relevés (samples, species, etc.) in the form of a map output, or their analysis, together with other data representing various environmental variables (e.g. solar radiation, air temperature, etc.), lead to a better understanding of the distribution of plant communities and their mutual relationships. The precise localization of individual samples in space is therefore a crucial prerequisite for the exact analysis and forecasting of potential local and/or global changes. Historical phytosociological relevésrecorded in the period before the expansion of portable GPS devices lack precise geographical coordinates. Therefore, we have decided to determine the missing data ex post by exact methods using the GRASS GIS v6.4, GNU/GPL platform. To automate this process and to achieve the highest possible accuracy, we have established an on-line application for expert identification of geographic coordinates of phytosociological relevés running on Debian GNU/Linux. This can help experts to identify the geographic coordinates of the historical relevés, stored in databases, using GIS based on knowledge of certain known parameters (geomorphological unit, elevation, slope, slope aspect and type of biotope). Traditional botanical approaches need to adapt to the challenge for a greater precision and spatial objectivity within a GIS environment. Modern geotechnologies bring a huge methodological impetus.

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Forest classification and mapping using field and LandsatTM/ETM+ data

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Modern research on forest biodiversity deals with processing of large amounts of heterogeneous data at different spatial levels. To meet the purposes of systematization and analysis of data an information system on the basis of GIS technologies and remote sensing has been developed. The 600,000 ha test area is located in the south-western part of the Moscow region within the mixed coniferous-broad-leaved forest subzone that is dominated by spruce (Picea abies), birch (Betula sp.), poplar (Populus tremula), lime (Tilia cordata) and oak (Quercus robur). Field data was collected in the period 1997-2010, more than 900 relevés were done. The satellite data consisted of four near cloud-free Landsat 5 TM/7 ETM+ images from 30 August 1992, 20 May 2007, 30 May 2002 and 14 March 2003. The images were radiometrically corrected using a standard methodology. The process of forest mapping included two steps: 1) forest vegetation class definition was made using cluster analysis, and 2) supervised classification of Landsat images with the use of traditional per-pixel processing techniques was carried out. Multivariate data processing was made using Statistica 8 and SPSS 14. For visualizing and geographic analysis of classification results MapInfo 9.0, Erdas Imagine 8.5 and SAGA were used. Two variants of classifications were performed: 1) by floristic composition of all vascular species and 2) by only tree species composition. For the second variant an overall accuracy for the 7 classes was 56%, the highest accuracy of 90% had alder forests (9 relevés). A reasonable accuracy had the biggest group of spruce forests (65%, 233 relevés) A low accuracy had the mixed spruce-birch (45%, 73 relevés) and spruce-oak forests (13%, 13 relevés).

Ontology-based data-integration on ecosystem functions in a changing climate

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Ecological consequences of climate change in all their dimensions are still not yet fully understood. In this context, data integration by means of ontology is a novel tool to deal with data heterogeneity and complexity. The application of ontology offers the possibility to interlink ecological data beyond data treatments within single disciplines. The Bavarian research cooperation FORKAST ("Climatic Impacts on Ecosystems and Climatic Adaptation Strategies") integrates 17 different sub-projects across various ecological disciplines. Here we integrate data from three sub-projects working on the impact of climate change on the biodiversity of mountain grasslands in the National Park Berchtesgaden, Germany. Specifically, we use our own data and available databases across different trophic levels to design a semantic web which was derived by the Extensible Observation Ontology (OBOE, Madin 2007). By that new ecological hypotheses and research gaps may also be identified, e.g. within the field of biotic interactions and their outcome for ecosystem functions such as phenology and pollination. Besides extant application, the ontology based data organization allows for further specific evaluations independent from the data collector and without loss of data and metadata information. Our paper aims to push the frontier of ecologically focused climate change research toward a more intense interdisciplinarity.

Madin J, Bowers S, Schildhauer M, Krivov S, Pennington D, Villa F (2007): An ontology for describing and ynthesizing ecological observation data. Ecological Informatics 2: 279-296.

The invisible impact of space on ecological processes

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Although we live in time and space, in ecological research there is no obligation to take space-time process into consideration. Much of vegetation data published half a century ago appeared without spatial coordinates and date of recording included. But as the discipline progressed it became clear that spatial and temporal effect might explain what competition and facilitation or site conditions sometimes fail to do. In classical vegetation analysis we usually operate on the level of a sample composed of randomly chosen sampling units, our observations. But as soon as we do this in spatial context, the sampling units become interconnected and that is the outset of our spatial analysis. In my presentation I demonstrate how temporal analysis leads into a dead end when space is lacking. I do this using our succession project in the Swiss National Park starting in 1917, a long story on how finally an ecosystem view resulted out of efforts and ideas contributed by many actors. From this it is easy to show that the reverse is also true: Spatial analysis without temporal consideration limits recognition of processes, because spatial interaction takes time. But this implies another challenge for vegetation ecology: Recording a high-resolution space-time process in the field is extremely resource consuming and despite satellite born devices as yet difficult to achieve. I demonstrate a time-space simulation suggesting that the observation of such a process is still possible only on the level of computer models.

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