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Vegetation Survey of Thayatal National Park – status and first results

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Abstract

Austria´s smallest nationalpark is known for its high diversity in flora and vegetation. This is due to specific ecological conditions in the narrow inserted valley of the Thaya-river. With the forests, meadows and meadow-fallows as well as the forest-free dry grasslands the most important terrestrial habitats of the Thayatal National Park could be documented with respect to their plant communities in the period from 2000 to 2006.In doing so, a knowledge gap existing for the Austrian section of this important nature area was closed, after the Czech Podyjí National Park had already been thoroughly investigated starting from 1989. The complete field survey of all meadows and meadow-fallows as well as all forest-free dry grasslands was accomplished after previous aerial photo interpretation. In a second phase, the investigation of the expanded forests was based on a stratified random sample. After classifying the whole nationalpark by means on geodata, representing its high lithological and geomorphologic variety, 200 points were selected. For all habitats, altogether 534 vegetation relevees were taken and classified with the help of multivariate procedures. As a result 54 vegetation types could be differentiated and 37plant communities on the level of association and/or subassociation could be identified. For 17 types no suitable literature references were found and in these cases a provisional description was given and a syntaxonomic allocation was suggested. Based on the regional distribution of species and plant comminities, the spatial patterns of vegetation diversity was analysed aiming at the identification of "hot" and "cold spots". Furthermore, a monitoring system was established to allow for the controlling of management interventions in grassland and forest habitats. The latteris pointing at further research need, particularly within habitats which are currently submitted to successional changes in species composition.

Keywords

Thayatal National Park, vegetation ecology, plant communities, meadows, fallow meadows, dry grasslands, deciduous forests, syntaxonomy, monitoring

Introduction

The smallest among Austria´s nationalparks is situated in the "Thayatal "at the northeastern stateborder and forms an important international transboundary protected site together with the nationalpark Podyje in the Czech Republic. Botanical research in this region has a long tradition since a number of rare plants can be observed due to the occurrence of specific geological, geomorphological and microclimatological conditions and the resulting diversity of habitats (OBORNY 1879, HIMMELBAUER & STUMME 1923). After the Second World War, the area became part of the socalled iron curtain and was largely unaccessible from Moravia, whereas the Austrian side showed only marginal economic activities. After the "velvet revolution" the river gorge and its adjacent forests became freely accessible and received growing attention from naturalists, leading to the establishment of the nationpark Podyje by Czech authorithies and yielding a series of scientific publications regarding flora and vegetation (CHYTRY 1991, CHYTRY & VICHEREK 1995, CHYTRY et al 1997). In Austria, the nationalpark was founded ten years later, after a period of intensive discussion and planning. Driven by the need for scientific foundation for management measures and zonation, surveys of main vegetation types were commissioned by the Nationalpark management and were then conducted by the lead author and his colleagues.

Thus, research on habitats and plant communities in the nationalpark Thayatal is aiming at

- Contributing to biodiversity research in Austria
- Stocktaking of "nature values" by a systematic inventory in the protected area and its environs
- Detection of spatio-temporal patterns of (phyto)biodiversity in the unique Thayatal landscape
- Deriving a reference for the evaluation of conservation efforts and respective management interventions in forests and grassland habitats
- Establish a baseline for ongoing and planned monitoring activities, including an early warning system for priority setting

Material and methods

During the years 1999–2012, different studies were conducted on behalf of the Thayatal National Park by the lead author (WRBKA et al. 2001a, 2001b, 2010, WRBKA & ZMELIK 2006). They were all aimed at filling gaps in

knowledge of ecology, species composition and spatial distribution of different ecosystem types and natural habitats in this region. Given the extent of the investigation area (approxm. 13km²) and the intended completeness of the survey, two different sampling methods were applied: for the open habitats (meadows, dry grassland, rock outcrops) an interpretation of CIR-orthofotos was applied, followed by a field visit of all patches that were idintified as being forest-free. This procedure was feasable, as only 10% of the nationalpark is covered by dry grassland, meadows and abandoned grassland. On the other hand, forest is the dominant habitat type covering more than 10 km² and could therefore not been surveyed with the same rigour. In this case a statistical sampling design was applied based on a stratification of the whole investigation area, derived from a classification of available gedodata. Similar to the approach decribed by REITER & GRABHERR (1997), a digital terrain model and digital thematic maps (geological map: ROETZEL et al. 2004; potential natural vegetation: CHYTRY & VICHEREK 1995) was used to group grid cells of 25x25m into "ecotopes" according to their similarity in site variables. As a cluster-algorithm, the K-means method as implemented in the S-Plus 2000 software proved as the most appropriate procedure, followed by a random selection of an equal number of sample sites from the 20 ecotope-classes (Fig.1).

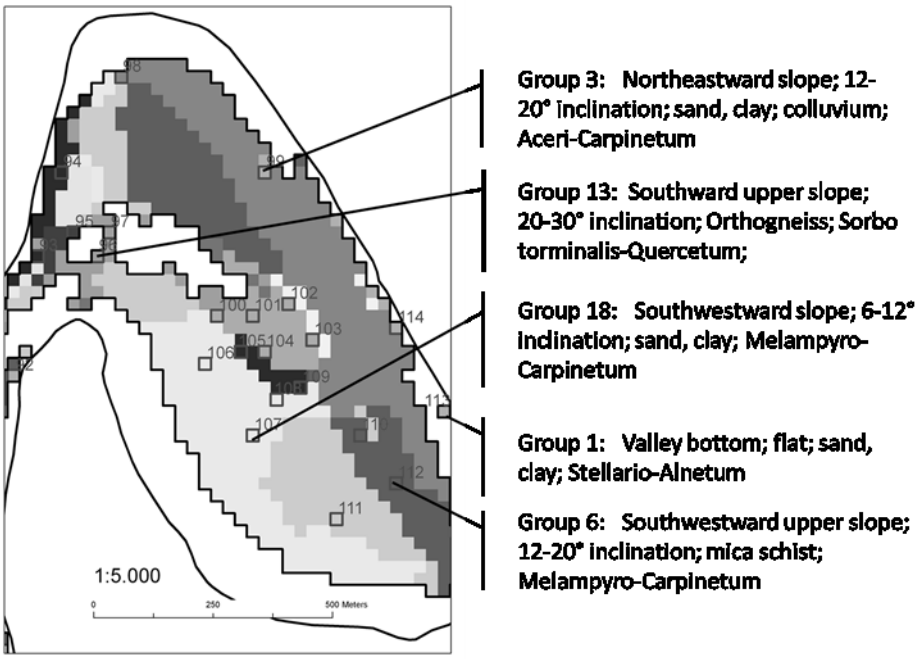

Fig.1: Nationalpark Thayatal, Region „Umlaufberg"; classification of ecotopes and forest types

Detailed investigation of vegetation types (forests, meadows, fallow and xeric grasslands) was performed by combining the traditional phytosociological Braun-Blanquet approach with modern numerical methods like divisive cluster analysis (TWINSPAN; HILL 1979) to classify and identify plant communities and setting up a database with syntaxonomical classification, GIS coordinates and photographic documentation. Identification of plant communities was done by consulting the relevant sections of the standard text book on Austrian plant communities regarding natural vegetation of non-wooded habitats (BALATOVA-TULACKOVA et al. 1993, GRABHERR & MUCINA 1993, MUCINA & KOLBEK 1993a, b, c), anthropogenic vegetation of non-wooded habitats (MUCINA et al. 1993, ELLMAUER & MUCINA 1993, ELLMAUER 1993) and forest vegetation (WILLNER & GRABHERR 2007). To better depict the regional context, published literature and unpublished theses and reports with high regional relevance was used additonally (CHYTRY 1991, CHYTRY et al. 1997, CHYTRY & VICHEREK 1995, LICHTENECKER et al. 2003, BASSLER 1997, TICHY et al. 1997, THURNER 2000). Plant identification and taxonomy was based on FISCHER et al. (2005).

Results

With respect to non-wooded open habitats, 26 communities of xeric grassland and 21 communities of managed mesic meadows and pastures could be identified and scientifically described. In detail, the regarding vegetation types could be assigned to the following phytosociological classes: Phragmito-Magnocaricetea (4 communities), Molinio-Arrhenatheretea (8 communities), Galio-Urticetea (5 communities), Trifolio-Geranietea (5 communities), Calluno-Ulicetea (3 communities), Festuco-Brometea (9 communities), Koelerio-Corynephoretea (3 communities), and Rhamno-Prunetea (5 communities).

As a detailed list and description of all vegetation types is given in WRBKA et al. 2010, here only few examples are briefly mentioned: two outstanding plant communities of the class Festuco-Brometea are domintated by feathergrass (*Stipa*) species and appear to be confined partly to natural forest gaps on the south-facing upper portions of cliffs, but also partly to secondary habitats. The lnulo oculi-christi Stipetum pulcherrimae *Vicherek et Chytr*y 1996 (Festucion valesiacae) is a dry grassland on basic soils, particularly on marble and carboniferous shists in warmer parts of the study area. The Genisto tinctoriae-Stipetum joannis ass.nova (Festucion valesiacae)

is a dry grassland vicariating with the lnulo oculi-christi-Stipetum pulcherrimae in cooler and wetter areas. Its localities are concentrated on amphibolite, marble and limestone, harbouring the rare species Stipa dasyphylla. Forest fringes with thermophilous tall herb-communities are among the most spectactular vegetation types in the nationalpark Thayatal, represented by the newly described Iris variegata-Elymus hispidus (Geranion)-association. This plant community is frequently occuring in the famous "Umlaufberg" region and harbours rare species like Melica altissima and Hesperis sylvestris.

In addition to the survey, a monitoring programme of non-wooded habitats in the open landscapes was initiated. 40 monitoring sites in representative habitats have been established with permanent plots and have been revisitated in 2012. As expected, this control procedure revealed ongoing secondary succession in abandoned meadows, but yielded quite satisfying results in the managed grasslands pointing at good management practise. Few exceptions to this observation are notable, especially regarding increased disturbance caused by wild boar and red deer in some specific localities.

The second part of the vegetation survey was dealing with woodland ecosystem types. As a result, 19 forest plant communities have been described in the context of a complete revision of the syntaxonomical system of forest vegetation in Austria and a map of the potential natural vegetation has been actualized accordingly. Taking advantage of the statistical sampling procedure, the spatial pattern of forest types was modelled for 25x25m gridcells. Thus not only the expected eological gradients in altitude and bedrock were revealed, but also the ecological niche of main forest types could be described in great detail. Beech forests are represented by the association Galio odorati-Fagetum typicum and are mainly occuring in the western part of the national park with an altitude greater than 340 m above sea level. Dominant forest types are oak-hornbeam communities, belonging to the Galio sylvatici-Carpinetum with three different subassociations, one on mesic sites (subass.typicum), a second one on warmer and Ca-rich sites (subass.primuletosum veris), and a third one on sites with low ph-value (subass.luzuletosum). Oak forests are represented by two acidophilic associations, Luzulo-Quercetum petraeae and Genisto pilosae-Quercetum. Steep slopes in the rivergorge are inhabitated by communities formed by Tilia and Acer species, identified as Aceri-Tilietum platyphylli and harbouring a surprisingly rich flora of oreophytes. Finally forests on sites with prononunced environmental resources should be mentioned. The Lithospermo-Quercetum pubescentis is occuring on dry rocky slopes and extraordinarily rich in species due to its open character and forest-steppe like transitions to thermophilous fringes and dry grassland patches. The Stellario nemorum-Alnetum glutinosae is forming small woodland stripes along the Thaya river, thus representing the group of alluvial forests.

As 20% of the forest area consists of spruce and larch plantations and are gradually transformed to decidous forest types, this ecological restoration measure was also documented by a subset of vegetation releves. In some parts of the forest the influence of historic forestry measures like intensive coppicing is still visible, resulting in dense, species poor Hornbeam stands. Based on these scientific findings, a short interpretation guide for identifying forest plant communities was produced to serve educational purposes as well.

In addition, "hot" and "cold" spots of vascular plant biodiversity could be identified and visualized by combining the data of all vegetation studies for the whole national park. The spatial pattern of alpha- and gamma- diversity could be interpreted in line with modern ecological theories. In essence, the distribution and richness pattern of vegetation types appeared to be congruent with the occurance of calcium rich rock types (eg. marble, carboniferous shists) and a pronounced microtopography (eg. Steep south-facing slopes). Cold spots of phytodiversity could mainly be found on plateaus with low topographical variance and underlying acidic bedrock (eg. Thaya-granite).

Conclusion and outlook

An overview of the plant communities for all major habitat types in the nationalpark Thayatal could be given based on a systematic survey. Nevertheless, some knowledge gaps are remaining regarding plant communities found on screes and rocks dominated by mosses and lichens. Furthermore the few examples for habitats with strong and regular anthropogenic should be studied to complete the list of syntaxa, but also to account for a potential source of ruderals and invasive species in the area. Monitoring activities will be continued for all habitats including forest, and will focus on the influence of disturbances caused by red deer and wild boar, aiming at setting tresholds for wildlife management.

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