Norbert Müller & Anita Kirmer (Eds.)

Excursion Guide

Third Conference of the COmpetence NeTwork URban ECology

Urban Biodiversity & Design

Implementing the Convention on Biological Diversity in towns and cities

Federal Agency for Nature Conservation

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Urban Biodiversity & Design

Implementing the Convention on Biological Diversity in towns and cities

Third Conference of the COmpetence NeTwork URban ECology

Erfurt, 21.-24. May 2008

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Preface excursion guide

NORBERT MÜLLER & ANITA KIRMER

As one of the oldest settlement areas in Central Europe, Erfurt and Thuringia are particularly suitable to visualise the aims of the conference ‘Urban Biodiversity & Design’ during field excursions. In the Neolithic Period, around 7000 years ago, hunters and gatherers settled down in the fertile Thuringian Basin and founded the first rural settlements.

The conference excursions have been selected to place emphasis on the relation between biodiversity and culture in Europe. For our guests, we want to convey the history and the culture of the Thuringian and German landscape. Thuringia is not only the green heart of Germany but also a centre of German culture. Many famous people lived and worked in Thuringia: Johann Sebastian Bach, Johann Wolfgang Goethe, and Martin Luther.

Each excursion has its own thematic focus:

The mid-conference excursion through the medieval city Erfurt and to the Petersberg citadel focussed on assessment and restoration of biological diversity as well as on sustainable planning of green spaces.

The thematic excursion to the UNESCO world heritage site Weimar and ‘Park an der Ilm’ demonstrates biodiversity and rich culture of old landscape gardens in Germany. Using the ‘Park an der Ilm’ as an example we want to show that the type of planning decisively influenced the future value of the park. Already 200 years ago in Europe’s Romantic Era, the inclusion of nature in design was the state of the art in ecological park design.

The thematic excursion to the UNESCO world heritage site Wartburg Castle presents isolated historic castles as model ecosystems for towns and cities. As isolated urban settlements, castles have a long lasting influence on the biodiversity of the surrounding natural or cultural landscapes.

In front of the conference ‘Urban Biodiversity & Design’ these three excursion destinations had been analysed by three diploma theses at the Department of Landscape Management and Restoration Ecology (University of Applied Sciences Erfurt).

Last but not least, Berlin, the capital of Germany is one destination of the thematic excursions. Berlin is the cradle of modern urban ecology and the work-place of Prof. Dr. Herbert Sukopp, one of the patrons of our conference. Caused by the Berlin Wall during the division of Germany, an inner city railyard has been run to seed for almost 60 years. The ‘Natur-Park Südgelände” developed to an experimental ground for urban ecology that is unique throughout the world.

The destination of the post-conference excursion is Hainich national park – one of the most important natural beech forests (*Fagus sylvatica*) in Central Europe for which Germany bear world-wide responsibility.

International congresses live from the dialog between participants and the resulting co-operation. We wish all participants stimulating discussions and unforgettable impressions.

And we like to thank all authors, excursion guides, and volunteers for their contribution to make our conference successful.

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General information about the conference venue state Thuringia (Germany)

ANITA KIRMER

1 Introduction

The third conference of the Competence Network Urban Ecology 'Urban Biodiversity & Design – Implementing the Convention on Biological Diversity in towns and cities' is being held in the federal state of Thuringia, Germany. Covering 357,000 km² and with 82.5 million inhabitants, Germany is one of the largest countries in Central Europe (Figure 1). Over 85 % of the total population lives in urban areas (STATISTISCHES BUNDESAMT DEUTSCHLAND 2005).

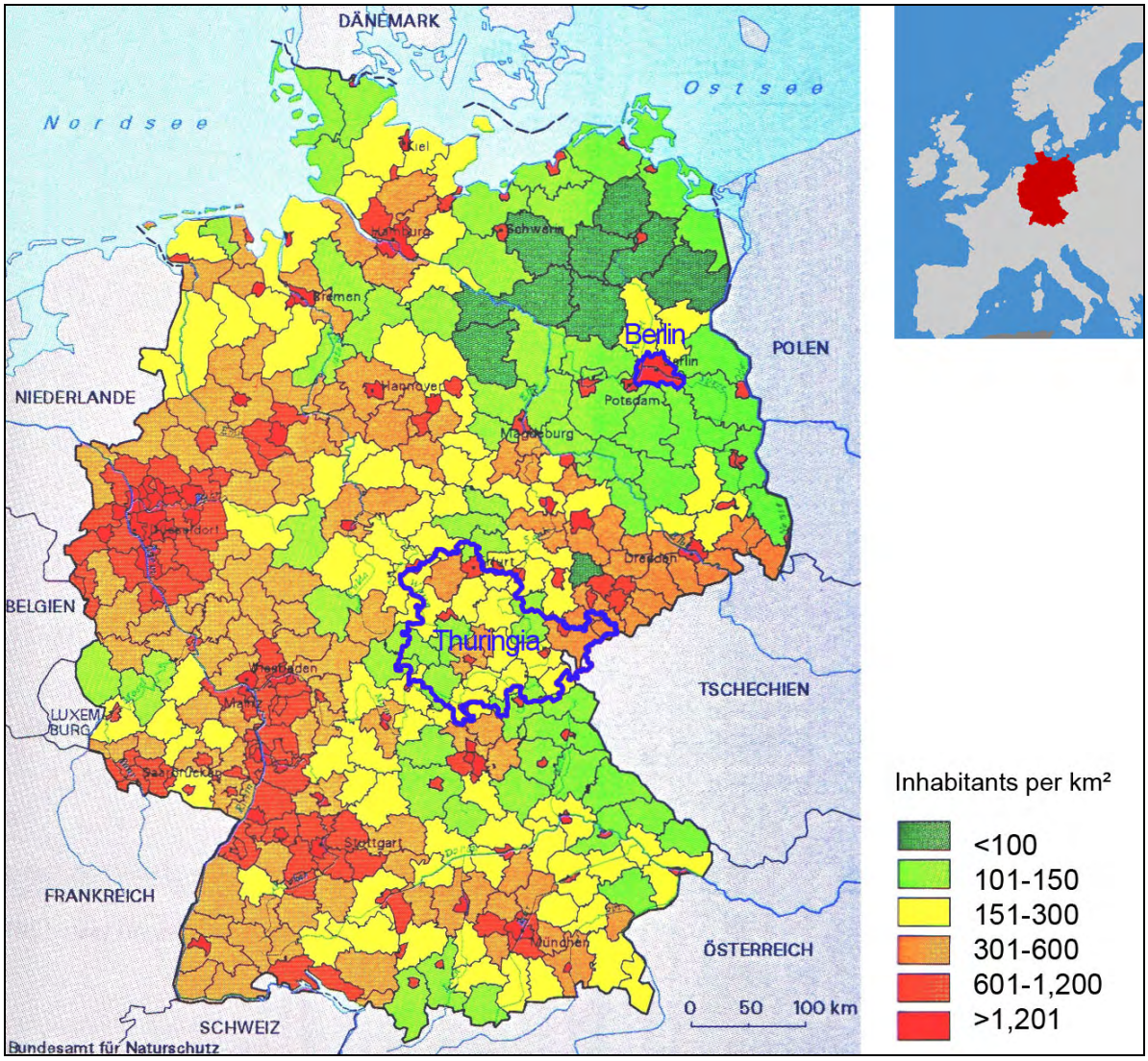

Figure 1: Population density in Germany. The federal states Thuringia and Berlin are marked with blue line (modified graph, from BFN 2004)

The landscape is very varied and ranges from the high mountains of the Alps (Zugspitze: 2,962 m) in the south to the North Sea and Baltic Sea in the north. There are five main biogeographical regions: the northern lowland, the Central European low mountain range, the southwestern German low mountain range, the alpine foothills and the Alps. 53.5 % of the total land area is used for agriculture, 29.5 % for forestry (BFN 2004). Some of Europe's longest and most important rivers, such as the Rhine, the Danube and the Elbe, flow through the country. The capital city of Germany is Berlin, a city state of only 891 km² (Figure 1). The Nature-Park Südgelände, an abandoned rail yard, destination of one of the thematic excursions, is located in Berlin.

The conference is held in the city of Erfurt, the capital of Thuringia. Originally marking the crossroads of key trading routes, Erfurt was founded in 742 AC and has one of the best preserved medieval city centres in Germany. Today, it has a population of around 200,000. The federal state Thuringia is located in the heart of Germany (Figure 1) covering c. 16.000 km² with a population of c. 2.5 million. Until 1919, Thuringia was composed of seven 'princedoms' and one Prussian administrative district, making it very culturally rich. Many famous people have lived and worked in Thuringia, including Johann Sebastian Bach, Franz Liszt, Johann Wolfgang Goethe, Friedrich Schiller, Martin Luther, Ernst Haeckel, Alfred Brehm, and Albert Einstein. The city of Weimar was the birthplace of Bauhaus Movement.

2 Biogeography, geology and climate of Thuringia

The biogeographical structure varies according to substrate and altitude. HIEKEL et al. (2004) described seven main types: low mountain range, red sandstone hill country, shell limestone highlands, basalt summit land, keuper and loess hill country, floodplains and lowlands, and Zechstein belts on the periphery to the mountain areas (Figure 2). The Thuringian Forest and the Slate Mountains reach heights of 800-900 m above sea level. The highest peak is the Beerberg at 982 m a.s.l. The Thuringian Basin, a large hilly area ranging between 130 m and 300 m a.s.l., is surrounded by mountainous areas (Harz, Kyffhäuser, Thuringian Mountains). It consists of multiple coloured marl layers mostly covered by thick layers of loess. The main soil type is a very fertile black earth.

The destinations of the conference excursions cover a wide range of biogeographical regions (Figure 2). Both Erfurt (195 m a.s.l.) and Weimar (220 m a.s.l.) are situated on the periphery of the Thuringian Basin on the border to the shell limestone highlands. Eisenach (220 m a.s.l.) with the Wartburg Castle (491 m a.s.l.) is located within the low mountain range of the Thuringian Forest. The geological bedrock consists of conglomerate with sandstone and shale layers (sediments of Early Permian). The post-conference excursion to the Hainich National Park (491 m a.s.l.) takes in the shell limestone mountain range.

The climate in Thuringia is characterised by extremes (HIEKEL et al. 2004). The low mountain ranges are chilly and humid (e.g. Thuringian Forest: 5-6°C average annual temperature, 900-1200 mm average annual precipitation) in contrast to the warm and dry hilly regions and the lowlands in the rain shadow of the mountains (e.g. Thuringian Basin: 8.5°C average annual temperature, <500 mm average annual precipitation).

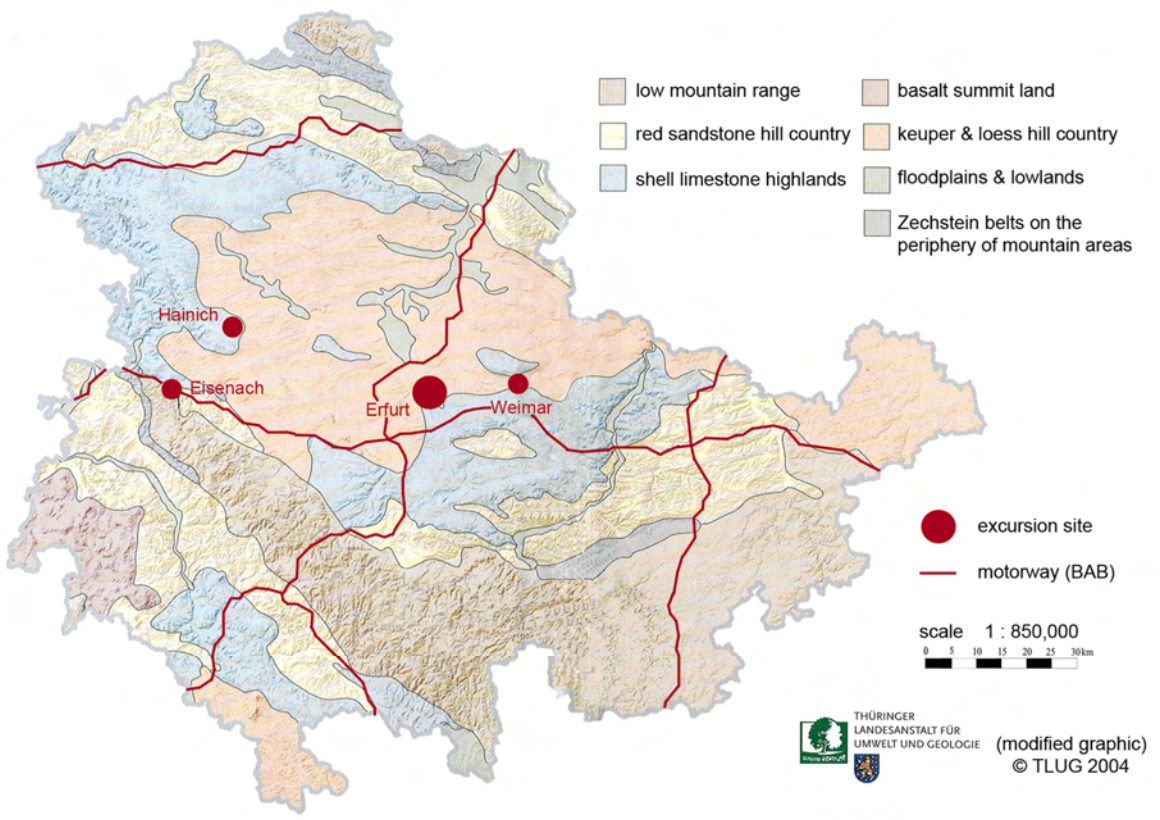

Figure 2: Main biogeographical regions in Thuringia with destination of excursions in Thuringia (modified after HIEKEL et al. 2004)

3 Post-glacial development and urbanisation in Thuringia

Without human influence, today Thuringia would be covered mostly by beech forests (*Fagus sylvatica*). In the dry and warm Thuringian Basin, *Quercus petraea* (sessile oak), *Carpinus betulus* (hornbeam) and *Tilia cordata* (small-leaved lime) would mingle with the beech forests. In the low mountain range, *Acer pseudoplatanus* (sycamore maple), *Picea abies* (Norway spruce) and *Abies alba* (white fir) would form mixed mountain forests. Fens and floodplains would be dominated by *Alnus glutinosa* (European alder) and *Fraxinus excelsior* (European ash). Fens and transition mires would be colonised by *Picea abies*. On south-facing, stony scarps *Quercus petraea*, *Quercus robur* (common oak), *Pinus sylvatica* (Scots pine), xerothermophilous scrub, and dry grassland would be found (HIEKEL et al. 2004).

Thuringia has a very long history of human settlement. Around 7000 years ago, the first Neolithic settlers began to clear the natural woodlands on the fertile soils of the Thuringian Basin. This region is one of the oldest human settlement areas within Central Europe (ELLENBERG 1996). The farming of livestock led to the creation of open pasture woodland, coppice, dwarf-shrub heaths, wet heaths and dry grassland. In medieval times, the cultivation of *Isatis tinctoria* (dyer's woad) and viniculture had a strong influence on landscape development (HIEKEL et al. 2004). Later, the industrial revolution in combination with drastic agricultural reform caused a steady decline in habitat cover and species. Today, near-natural deciduous forests are found on less then 10 % of the land area. Altogether, forests cover 32 % and more than 50 % of the land is agricultural (40 % arable land, 12 % pastures and meadows). Urban areas cover 9 % of the land.

4 Biodiversity and endangerment of flora and fauna

Today, more than 3300 higher plants have been recorded in Germany (BFN 2004), 60 % of them occurring in Thuringia. In Germany, Red Lists are available for the whole country (RIEKEN et al. 2006, RENNWALD 2000, BINOT et al. 1998, LUDWIG & SCHNITTLER 1996) as well as for each federal state. They are an instrument for assessing the endangerment of plant and animal species, plant communities and biotope types. Updates were made at 10-year intervals.

In Thuringia, a total of 17,003 plant and animal species have been recorded, 45 % of which are Red List species (FRITZLAR & WESTHUS 2001). Selected species groups are shown in Table.

Approximately 75 % of all higher plants in Thuringia are indigenous, around 8% being archaephytes, and 12 % neophytes (naturalised after 1500). All neophytic species have their main distribution range in rural and urban ruderal communities, road embankments and nitrophilous watersides.

Table 1: Total species number and percentage of Red list species of selected species groups in Thuringia (FRITZLAR & WESTHUS 2001)

Species groups	Species numbers	Red list species (%)
higher plants (Pteridophyta et Spermatophyta)	1988	34
mammals (Mammalia pt.) (without bats)	55	41.8
bats (Mammalia: Chiroptera)	20	90
birds (Aves)	164	50
reptiles (Reptilia)	6	50
amphibians (Amphibia)	18	66.6
dragonflies (Odonata)	52	61.6
grasshoppers (Ensifera et Caelifera)	54	46.3

The following species of the Annex II Flora-Fauna-Habitat Directive are present in Thuringia (FRITZLAR & WESTHUS 2001):

- Higher plants: *Trichomanes speciosum* (Killarney fern), *Angelica palustris* (marsh angelica), *Cypripedium calceolus* (yellow lady's slipper)
- Mosses: *Buxbaumia viridis* (green shield-moss), *Dicranum viride* (dicranum moss), *Drepanocladus vernicosus* (slender green feather moss)
- Mammals: *Lynx lynx* (lynx), *Castor fiber* (European beaver)
- Bats: *Myotis bechsteinii* (Bechstein's bat), *Myotis myotis* (mouse-eared bat), *Barbastella barbastellus* (barbastelle bat), *Myotis dasycneme* (pond bat, very rare). The bat *Rhinolophus hipposideros* (Lesser horseshoe bat) has in Thuringia its main distribution range.
- Amphibians: *Bombina variegata* (yellow-bellied toad), *Triturus cristatus* (great crested newt)

According to the Conservation of Wild Birds Directive the following birds are protected in Thuringia (FRITZLAR & WESTHUS 2001):

- Birds: *Tetrao tetrix* (black grouse), *Alcedo atthis* (kingfisher), *Anthus campestris* (tawny pipit), *Luscinia svecica* (bluethroat), *Lullula arborea* (wood lark), *Ciconia nigra* (black stork), *Coconia ciconia* (white stork) und *Bubo bubo* (eagle owl)

5 The study of biodiversity for nature conservation

Germany has a long tradition in botanical and faunal study with special emphasis on nature conservation (BFN 2004). Since the 1960s an investigation of all habitats important for anticipating losses of biodiversity has been started in the whole country. This so-called biotope mapping investigated in a first step natural and rural habitats (e.g. woodlands, grasslands) outside of urban

areas. Biotope mapping in urban areas began in the 1970s in Berlin and Bavaria (e.g. BRUNNER et al. 1979, MÜLLER & WALDERT 1981, SUKOPP et al. 1980). By 2002, biotope mapping of 224 cities in Germany (>10,000 inhabitants) had been completed (BFN 2004). In 1995, an area-wide survey of urban biodiversity in Thuringia was begun, covering 2339 villages (up to 2500 inhabitants), 13 small towns (2500-5000 inhabitants) and 5 towns (>5000 inhabitants) (SCHIKORA et al. 2003, SCHIKORA et al. 2005). Methods and first results are shown in SCHIKORA et al. (2003). In the city of Erfurt, the first area-wide biotope mapping was undertaken in 1991/92 (SPARMBERG et al. 1994). The biotope mapping was used to identify local areas of ecological value (e.g. STAIGER & MÜLLER 2004). For Erfurt, this has resulted in 31 protected landscape elements, 59 natural monuments, and 170 biotopes being given special protection under Thuringian law. Altogether in Erfurt, 12.6 % of the urban area has been awarded protection through a nature conservation designation (PONTIUS 1994). The results of biotope mapping are widely used in urban planning.

Germany ratified most international agreements concerning nature protection such as the Convention on Biological Diversity (since 1993), the Convention on International Trade in Endangered Species (since 1975), the Convention on the Conservation of Migratory Species of Wild Animals (since 1983), the Ramsar Convention on Wetlands (since 1975), the Kyoto Protocol (since 2002), and many others.

In 1836, the Prussian government bought the Drachenfels near Königswinter along the river Rhine with the objective to save it from being used as a quarry (EUROPARK DEUTSCHLAND E.V. 2006). This resulted in the first documented nature conservation area in Germany. In 1888, a first law passed concerning the protection of birds by the German Empire. The first Ministry for Environment in Europe was founded in the federal state of Bavaria in 1970. In the same year, the Bavarian Forest was dedicated as the first national park in Germany.

Worldwide, the Yellowstone region in the USA was declared in 1872 as the first national park (EUROPARK DEUTSCHLAND E.V. 2006). This idea spread all over the world and today there are more than 3,800 national parks in over 120 countries. In Europe, the first national park was established in 1909 in Sweden. Nowadays in Germany, 14 national parks had been established. Together with 14 biosphere reserves, over 90 national parks, and thousands of nature reserves and landscape conservation areas they cover a quarter of the German land area.

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Historic city of Erfurt and Petersberg Citadel – Evaluation, conservation and design of biodiversity in urban areas

REBECCA DENNHÖFER, NORBERT MÜLLER, ANITA KIRMER & RÜDIGER KIRSTEN

1 Introduction

In the middle of Thuringia at the edge of the Thuringian Basin lies the state capital Erfurt. The city has a long settlement history, already having been settled in the Neolithic Age. It was first documented as 'Erphesfurt' in 742 AD. The Petersberg Citadel is part of one of the oldest settlement points in the city. The excursion 'Historic City of Erfurt and Petersberg Citadel' as part of the conference 'Urban Biodiversity & Design' leads to interesting places in the history of Erfurt and provides an overview of projects about the recording, evaluation and planning of urban biodiversity.

2 Development of the landscape in and around Erfurt and its climate

Erfurt lies in the Thuringian Basin in the natural area 'Inner Thuringian arable hill landscape' (Figure 1). Geologically this belongs to the Triassic period (roughly 200 million years ago) in which covering layers of sedimentary rocks were laid down (coloured sandstone, shell limestone and Keuper). The 'Erfurt fault' (Erfurter Störung) is formative for the city area and crosses the city from the south-east to the north-west. This fault zone is visible through a repeated broken narrow chain of hills, which are made up of gently to steeply sloping protruding layers of shell limestone and Keuper. The Petersberg (231 m) belongs to these hills, as do the Cathedral Hill and the City Park Heights (HIEKEL et al. 2004).

Figure 1: Overview of the cultural landscape in the Thuringian Basin (from 'Wachsenburg' castle)

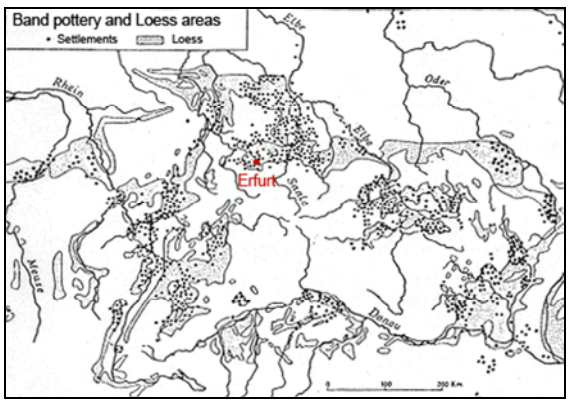

Figure 2: The Thuringian Basin and Erfurt are some of the oldest settlement areas in Central Europe due to there fertile loess soils. Settlements of the young stone-age (band pottery) and loess areas (from: ELLENBERG 1996)

A blanket of loess and loess-like sediments formed as a late ice-age deposit (11,000-8,000 BC) in the Thuringian Basin. The old city of Erfurt lies in the Gera lowland which was filled with gravel and sand in the last ice-age and was covered over with alluvial clay in the post glacial period. Already in the Neolithic Age (5500-1800 BC) the first farming settlements were concentrated in the low lying areas of loess or clay soils in Central Europe (see Figure 2) (ELLENBERG 1996). The high natural

fertility of the Thuringian Basin with the predominance of black soils is thus the reason why the Erfurt area counts as one of the oldest settlement areas in Central Europe where people settled and carried out arable and livestock farming.

The Inner Thuringian arable hill land forms part of the warm, continentally influenced dry areas of Central Europe. The average precipitation lies between 500 and 600 mm and the average annual temperature between 7.5°C and 8.5°C (HIEKEL et al. 2004). Erfurt itself counts as one of the areas with the lowest precipitation in Germany. The main wind direction is south-west. The Gera Valley plays an important role for the ventilation of the city as it functions as a passage for fresh or cold air. The Erfurt trough is susceptible to atmospheric inversion weather formations, particularly in winter, due to its location in a basin (increase in pollutants in the cold air near the ground). In the inner-city areas of Erfurt the temperature is on average 1.1°C higher and the relative humidity on average 8 % higher than in the surrounding countryside. Erfurt thus reveals a typical urban climate and forms a warm island in comparison with its surroundings with the warmest areas being the areas of high-rise buildings in the north and south-east of the city (TLUG 1995).

3 History of the city

Erfurt was first noted in written form in 742 AD in a letter from Bonifatius to the Pope Zacharias. The name Erfurt comes from the river next to which the settlement lay: the Gera of today was formerly named 'Erpha' or 'Erphes'. The name 'Erphesfurt' originates from this and later became Erfurt (GUTSCHE 1991). The landmark of the city and conference logo is the grouping of St. Mary's Cathedral and the Serveri church on the Cathedral Hill built in 1182 AD, a grouping unique in Europe. Erfurt had already become an educational centre of far-reaching importance in the 14th century. No other town or city in Germany had more students in the second half of the 14th century. In 1392 the University of Erfurt was founded as the fifth oldest university in Central Europe. One of the best-known graduates of the University of Erfurt was Martin Luther, who studied here at the Faculty of Philosophy from 1501 to 1505 (GUTSCHE 1991).

Figure 3: Extract from the field original of the Prussian original survey page from 1853, Page 2933 Erfurt, Scale 1: 25 000 (Source Reprint Thuringian Land Survey Administration, permit no. --101 548/ 2008--)

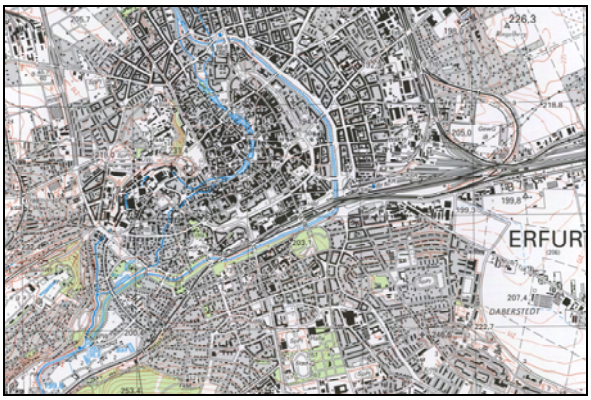

Figure 4: Extract from the current topographical map from 1998, Page 5032f Erfurt, Scale 1:25 000 (Source Reprint Thuringian Land Survey Administration, 1998, permit no. --101 548/ 2008--)

In the 15th and 16th centuries the town developed into a large town for the Middle Ages with c. 18,000 to 20,000 inhabitants. It thus reached the peak of its economic, political, intellectual and cultural development in the Middle Ages and became the central point of trade in Thuringia. In the Middle Ages, Erfurt formed the crossing point of two long-distance trading routes. The 'via regia' led

from France to Poland and Russia, whilst the 'Frankensteig' linked southern Germany with the North and Baltic Seas. The cultivation and trade of woad (*Isatis tinctoria*) influenced the economy of Erfurt from the 14th to 17th century (GUTSCHE 1991).

From the mid-19th century Erfurt developed into a centre for horticulture in Europe due to its extremely good soil and its favourable climate. Christian Reichart (1685-1775) is thought of as the initiator due to his use of new methods in agriculture and horticulture and he thus helped along the horticultural boom in Erfurt (GUTSCHE 1991). Some of the renowned horticultural enterprises came into being at this time, whose tradition continues up to the present day. For instance the company N.L. Chrestensen has been active in seed cultivation since 1867 and delivers flower, vegetable and herb seeds as well as flower bulbs around the world. At the turn of the 19th to 20th century there were about 100 horticultural companies in Erfurt.

The town grew enormously with the start of the industrial age; the first large industrial companies were built around and after 1850 in Erfurt. The population of Erfurt grew with the increasing industrialisation (see Figures 3 and 4). In 60 years the population increased from 40,000 (1871) to roughly 140,000 (beginning of the 1930s). This increase was accompanied by an expansion of the city area of Erfurt. Numerous industrial and trade areas were formed as well as semi-circular rings of Wilhelminian style houses for renting in space-saving perimeter block development. Apart from the working quarters there was also an increase in bourgeois living areas, for example to the south of the main station: the quarter near the city park (MEYER 2005).

Erfurt escaped wide-scale bombing during the Second World War. Afterwards the city developed further, mainly to the north and south-east. At the end of the 1960s large tower block residential areas were built in these districts. In the northern city areas 20,000 apartments were created in this way and in the south-east over 14,000. After the political changes in Germany (1989/90) a wave of building of private residential homes followed around Erfurt. Aside from this, the city development concentrated mostly on the redevelopment of run-down old-buildings in the inner-city areas in the 1990s. The continuing decreasing birth rate in the city and migration is causing the capital of Thuringia to shrink with the accompanying phenomena of empty flats as well as an increase in the number of wasteland areas (MEYER 2005).

4 Recording and protection of the biological diversity

There is a long tradition of the recording of biological diversity in Erfurt. The first "Flora" of Erfurt was produced already in 1914 (REINECKE 1914). After 1990 765 higher plants were recorded in the city area of Erfurt (see extract in Figure 3, KÜMMERLING 2007). This amazingly high number of species is due to the diversity of habitats - semi-natural woodlands, meadows, parks, railway areas, building sites – (see Figures 5 and 6). The first comprehensive representative habitat mapping of the entire city area took place in 1991/1992 by the Department of Environmental and Nature Protection Erfurt. In this 170 habitats of the natural and cultural landscape were recorded (according to §18 ThürNatG), for example semi-natural woodland and species-rich meadows (SPARMBERG et al. 1994). This survey was the vital basis for the current protected areas within the city boundaries (see Figure 7). From 1999 to 2001 this recording was extended to include specific urban habitats (such as parks, old wastelands) within the so-called selective urban habitat mapping (STAIGER & MÜLLER 2004, TLUG 2007). After the delineation of all land use (see Figure 5) all of the areas which are important for nature conservation were described in detail and handed over to form an important basis for the city planning (see Figure 6).

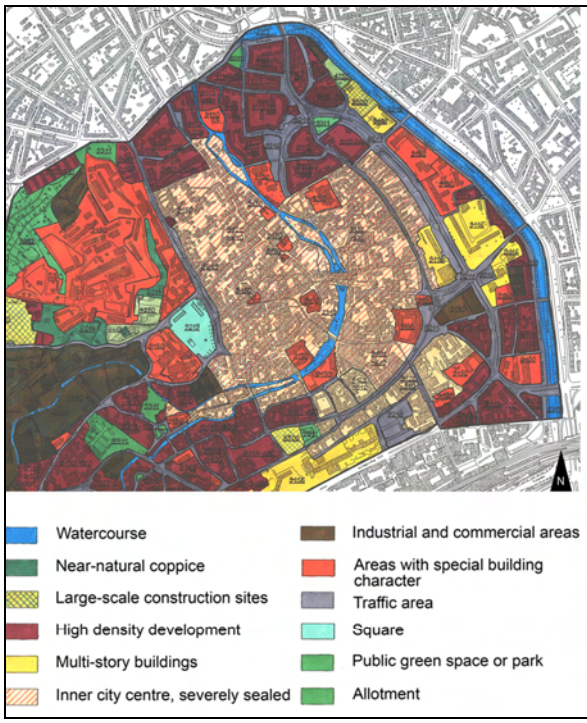

Figure 5: Types of habitat and land use in the city centre of Erfurt (from STAIGER 1999 slightly altered)

Figure 6: Habitats worthy of protection in the city of Erfurt – Results of the selective habitat mapping Erfurt, Thuringia (publication with permission of the Thuringian State Department for Environment and Geology, Jena 2007)

Further recording of individual urban land uses (so-called comprehensive habitat mapping) for the protection and development of biodiversity were carried out within various projects of the University of Applied Sciences Erfurt, for instance "Biodiversity and Evaluation of Wastelands in Erfurt" (MÜLLER & SCHUMACHER 2004) and "Biodiversity of Wilhelminian Style Front Gardens in Erfurt" (MÜLLER et al. 2007). There are also numerous area monographs for particularly valuable individual areas in the city area, e.g. for the Petersberg (SPARMBERG 2000, DENNHÖFER 2008).

In 1939, the first nature conservation area was established in the northwest of Erfurt (Kühnhausen). The 'Schwellenburg' (22ha) is a prominent gypsum hill in the middle of a rather flat, arable landscape. The continental steppic grassland of this hill is a relic from the post-glacial steppe period. It survived due to the particular climatic and geological conditions at this location (sun-exposed slopes, relatively low precipitation and gypsum of the middle Keupers as substrate) and is thus of particular value (LANDESHAUPTSTADT ERFURT 2008). Today 54 protected landscape areas, natural monument areas and natural monuments exist within the city of Erfurt with a total area of 26,000 ha (status 2004) (Figure 7).

A large woodland area lies to the south of the city centre - the Steiger - which is classified as a protected landscape area (LSG) and has been registered as an European Union Flora-Fauna-Habitat area of 2,300 ha (LANDESHAUPTSTADT ERFURT 2008). For a long time the economic development of the city of Erfurt was closely linked to this bordering deciduous woodland. In former times the Steiger delivered food, building material and firewood and was used as common grazing land for centuries ((MEYER 2005). Today the woodlands, which are mainly composed of oak, beech and hornbeam, are not only important for nature conservation but also play an important role as recreational areas for the city of Erfurt (LANDESHAUPTSTADT ERFURT 2008).

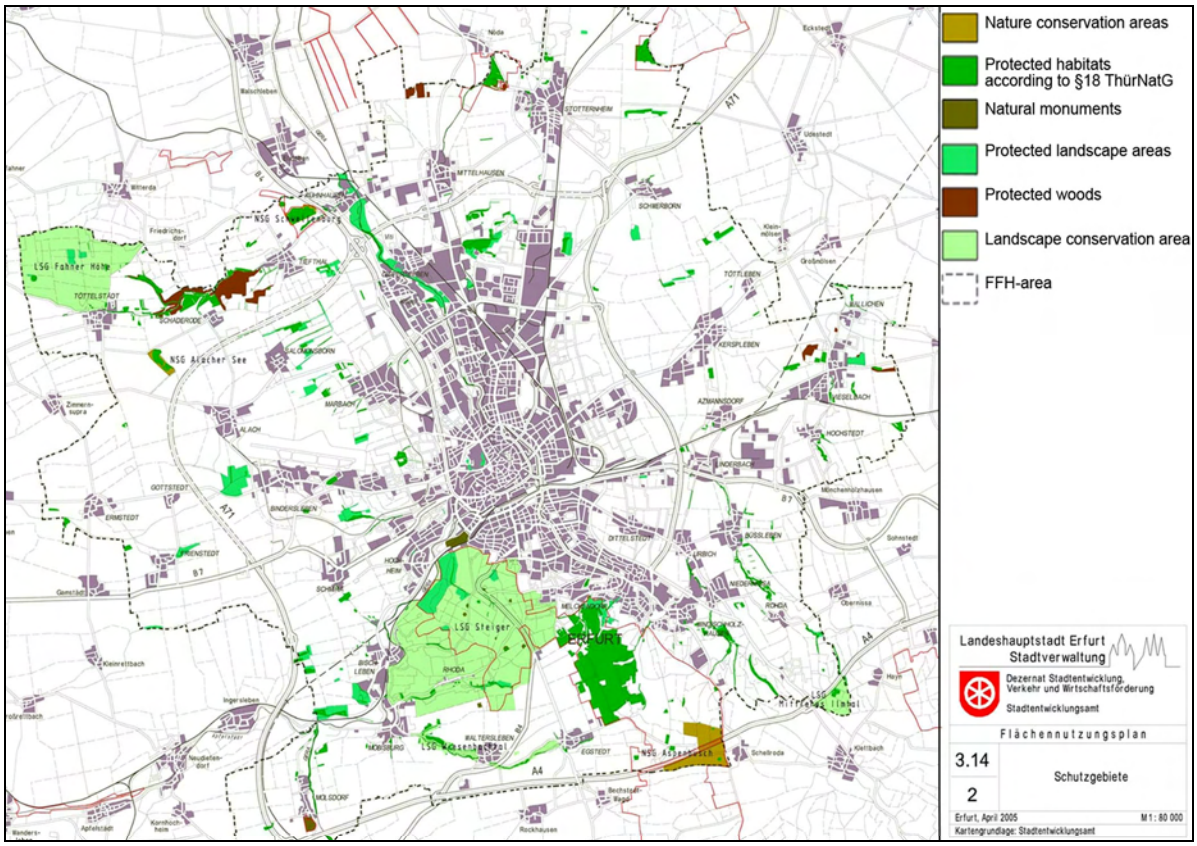

Fig. 7: Protected areas of the city of Erfurt (from LANDESHAUPTSTADT ERFURT 2005, modified)

5 Public Gardens and Parks

5.1 Overview

The inner- and outer green rings were created on the former area of the fortress, the current ramparts, after the de-consolidation of Erfurt (1870). The basic structures can be traced back to Erfurt´s first garden director Otto Linne (1869-1937). At the end of the 18th century the rapid development of the city was accompanied by the creation of numerous public parks, mainly along the rivers (North Park, South Park, City Park, Brühler Garden, Luisen Park). Figure 8 gives an overview of the various locations and sizes of the public green spaces. A comprehensive description of the history of the parks can be found in KIRSTEN (2003). The most important green spaces in the densely built old town are those that form a greenway and habitat corridor through the whole town along the Gera, as well as the Petersberg (see Figure 8 and Section 6.). At the south-western edge of the city there is a long greenway, the so-called 'EGA' (Erfurter Gartenbauausstellung - Erfurt Horticultural Show). This functions as a semi-public park and is thus not shown in Figure 8. In 1961 the first International Horticultural Show took place here. Up until today the park embodies the long horticultural tradition in Thuringia and provides a visible sign for the liveliness of the 'Flower City' of Erfurt. The protected park has a variety of special gardens and exhibition houses on offer (e.g. Japanese cliff and water garden, the largest ornamental summer flower bed in Germany, a butterfly house, and an orchid house). This park is connected to the Luisen Park by a dendrological corridor (see KIRSTEN 2006) which means that this corridor of linked green spaces forms the largest green area in Erfurt (LANDESHAUPTSTADT ERFURT 2008).

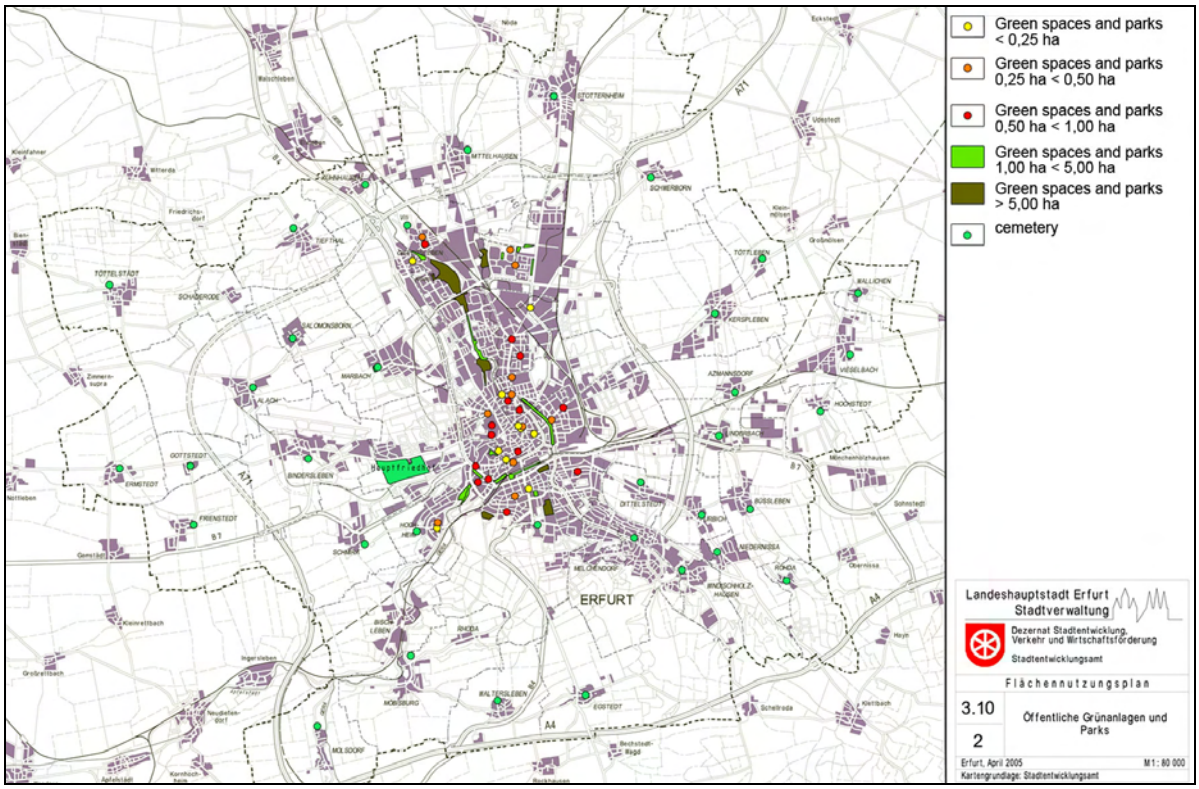

Figure 8: Public gardens and parks in Erfurt (from LANDESHAUPTSTADT ERFURT 2005, modified)

5. 2 The Petersberg Citadel

The citadel is one of the largest and best kept fortresses in Europe and shapes the cityscape of Erfurt. Today this imposing 16th century citadel is one of the largest attractions in the centre of Erfurt. The Petersberg Citadel offers a large number of linked green spaces in the otherwise densely built historical old town (Figure 9). It is a protected cultural monument and in 1997 part of the terrain was placed under protection as a protected landscape area 'Petersberg' (LANDESHAUPTSTADT ERFURT, STADTVERWALTUNG (ed.) 2001). The 2.2 ha protected landscape area includes urban woodland, geological exposure, areas of succession and parts of the old fortress walls in the south and eastern slopes of the Petersberg.

5.2.1 History and description of the location

The new development of the St. Peter and Paul Benedictine Monastery began in 1103 on the Petersberg and the Romanesque church nave still stands today (FREUNDE DER CITADELLE PETERSBERG ZU ERFURT e. V. 2006). The fortification of the Petersberg commenced in 1665 under the orders of the electoral Prince of Mainz (GUTSCHE 1991). Later (1813) the fortress was besieged, shot at and finally taken over by Austrian, Prussian and Russian troops. Further developments of the citadel took place under the Prussian rulers from 1815 to 1837 (FREUNDE DER CITADELLE PETERSBERG ZU ERFURT e. V. 2006). During the Nazi period the Petersberg was once again put to military use by the army. Now the citadel has developed into one of the loveliest and culturally important attractions of the inner city. The most recent building changes and restoration works on the citadel since 1990 have taken into account historical aspects, the use of the citadel, tourism as well as nature conservation aspects (KIRSTEN 2003). Currently the Petersberg Citadel incorporates a mixed use of administrative buildings, living quarters and gastronomic establishments.

Figure 9: Aerial photo inner city with the Petersberg Citadel, left in the picture (LANDESHAUPTSTADT ERFURT 2008: aerial photo 7/206 Reg.Nr. 021/62/110/07; aerial photo 8/236 Reg.Nr. 022/62/110/07)

5.2 .2 Fauna

Some remarkable faunal discoveries have been made on the Petersberg (SPARMBERG 2000) which support the importance of the Petersberg as an element in linking habitats and as a stepping stone in Erfurt:

- Evidence of five bat species, which have a regional to national importance as FFH species (species of common interest, Appendix II and IV of the FFH-Regulation) (see station 6).
- Evidence of four species threatened with extinction: two bat species (*Epitesicus serotinus*, *Plecotus austriacus*), a wild bee species (*Megachile rotundata*), and a wood beetle (*Exocentrus punctipennis*).
- Evidence of extremely rare wood beetles in Thuringia: *Clitostethus arcuatus* (ladybird), *Mesocoelopus niger*, *Nosodendron fasciculare* (tufted nosodendron).

Walls and ruderal pioneer woods provide important habitats for animals, particularly for the conservation of the protected bat and beetle species.

5.2.3 Flora and vegetation

Recently a total of 278 higher plants have been recorded on the Petersberg (DENNHÖFER 2008) of which 41 are archaeophytes and 54 neophytes. Of the neophytes on the Petersberg six species (19.4 %) are classified as invasive in Thuringia (MÜLLER et al. 2005). *Syringa vulgaris* (common lilac) and *Lycium barbarum* (matrimony vine) as typical species of walls and castles are building spatially confined scrub whereas *Robinia pseudoacacia* (false acacia) makes up a large proportion of the pioneer urban woodlands. The other invasive species are found only individually or in small groups on the Petersberg, e.g. *Bunias orientalis* (turkish rocket) and *Echinops sphaerocephalus* (globe thistle).

In relation to the proportion of archaeophytes and neophytes the flora on the Petersberg is more similar to urban flora than to typical castle flora (see Table 1). This is due to its position as an island in the city, its modern use and the restoration work carried out.

Table 1: The proportion of archaeophytes and neophytes in urban areas, in castle grounds and on the Petersberg (Erfurt) (from DENNHÖFER 2008)

	city (PYSEK 1998)	**castle** (DEHNEN-SCHMUTZ 2000)	**Petersberg** (DENNHÖFER 2008)
archaeophytes (in % of the total flora)	15,2	17,8	14,7
neophytes (in % of the total flora)	25,2	8,4	19,4

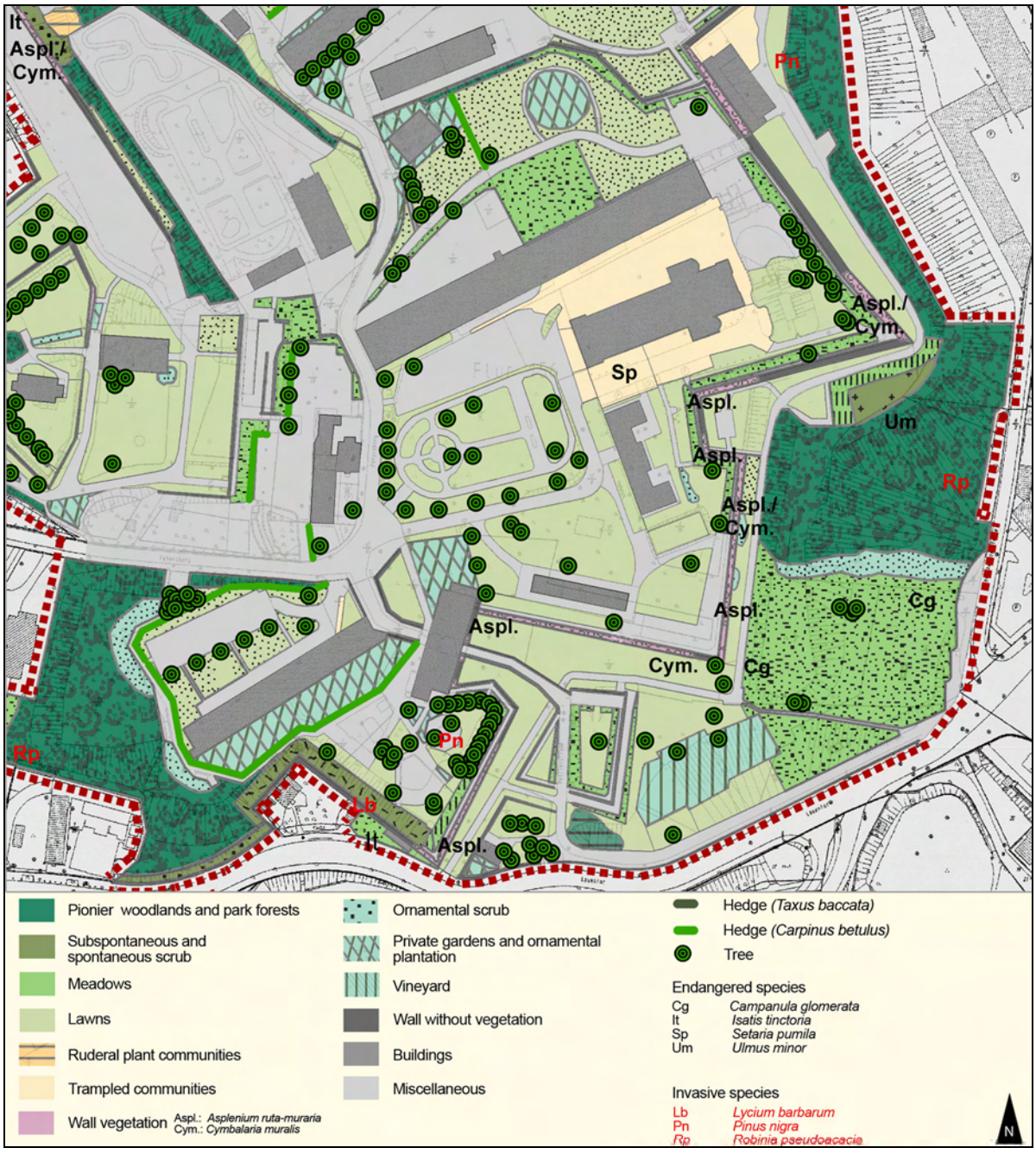

Figure 10: Vegetation on the Petersberg (extract from DENNHÖFER 2008)

Only a few plant associations are found on the Petersberg (see Table 2) which can be classed as typical for castle grounds or walls (BRANDES 1996). These are the *Asplenium-Cymbalaria* - association (*Asplenietea trichomanis*) and *Lycium barbarum* - stocks und *Syringa* -bushes in the walltop areas. The other plant associations are typical for urban areas.

Table 2: An overview of the vegetation of the Petersberg Citadel (from: DENNHÖFER 2008)

Pionier woodlands and park forests *Acer - Robinia pseudoacacia* community *Robinia pseudoacacia* - grove **Scrub** Ornamental scrub composed of *Prunus cerasifera* Ornamental scrub composed of *Rosa* and *Amelanchier* Subspontaneous *Corylus avellana* - scrub Spontaneous *Prunus domestica* - scrub Spontaneous *Syringa vulgaris* - scrub Spontaneous *Fallopia japonica* - scrub Spontaneous *Lycium barbarum* - scrub **Meadows** Subspontaneous semi-dry grasslands (*Brometalia)* Subspontaneous meadows (*Arrhenatheretalia*)	**Lawns** (*Cynosurion*) Young lawns Middle-aged lawns Old lawns Ruderal developed lawns **Ruderal plant communities** Perennial ruderal plant communities (*Artemisietea)* Annual ruderal plant communities (*Stellarietea mediae*) **Trampled communities** Annual trampled communities *(Polygono arenastri - Poetea annuae)* **Wall vegetation** *Asplenium-Cymbalaria* - communitiy (*Asplenietea trichomanis)*

5.2.4 The restoration of the citadel and its current importance as a green space

After 1990 the Petersberg was more strongly recognised as a special heritage object of European Castle Architecture. From 1990 the 'Bauhütte Petersberg' took over the safeguarding, restoration and reconstruction of the fortress area. As well as restoration of the buildings, the bastions and spying tunnels were laid open, lights mounted, ground levels adjusted, barracks demolished, slopes planted and large sections of a circular walk on the top of the walls and along the foot of the fortress developed (FREUNDE DER CITADELLE PETERSBERG ZU ERFURT E. V. 2004). The most recent restoration and building works in the citadel have to take into account not only historical aspects but also the use of the citadel, tourism as well as nature conservation aspects (KIRSTEN 2003). The vision of the Petersberg becoming a large public park in and above the city which serves tourists and local inhabitants as a place for recreation, for playing, action and culture is taking form (Figure 10) (ARBEITSGEMEINSCHAFT DANE & MANN 2002).

Figure 10: The Petersberg Citadel as an important public park in Erfurt with impressive buildings, walls and green areas

6 Historical Tour in Erfurt and the development of the green spaces

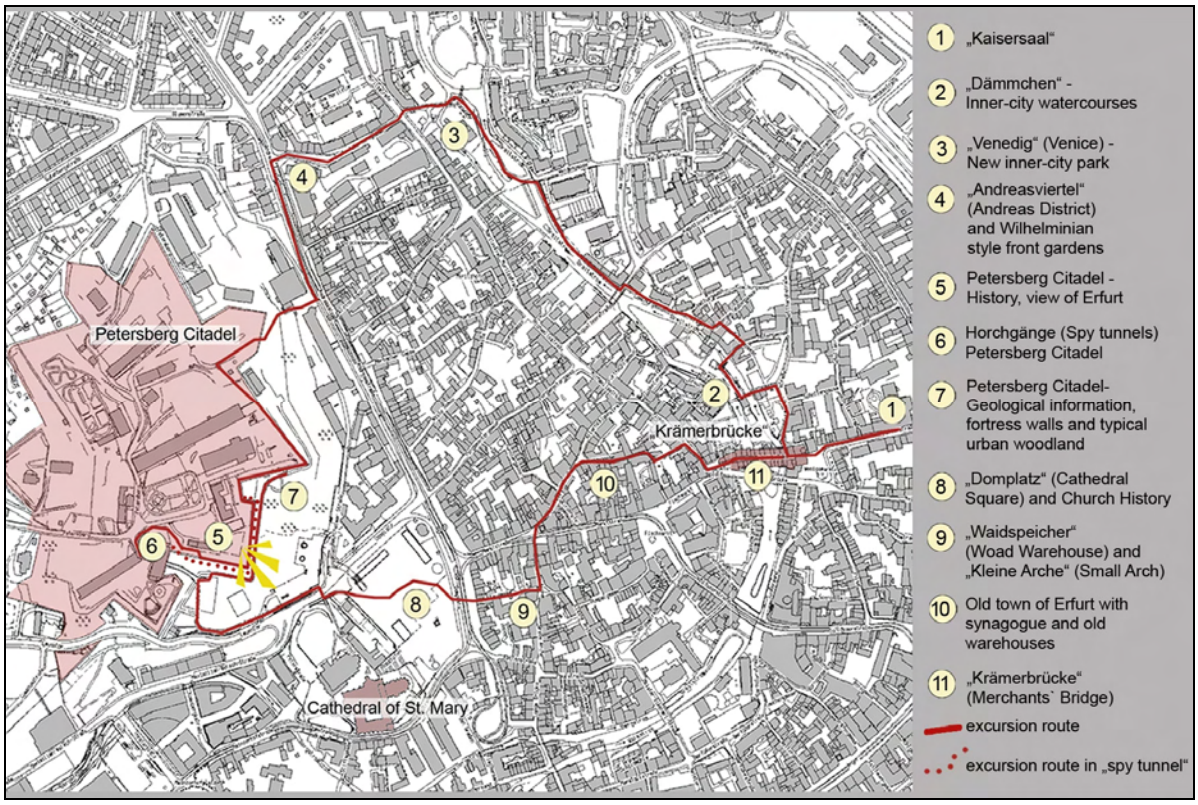

Figure 11: Excursion route

Station 1 – 'Kaisersaal'

The 'Kaisersaal' is a very important historical building in Erfurt. It was built in its current form at the beginning of the 19th century with the joining of three patrician's houses. In those days it was mainly used as a ballroom for the university and as a theatre. In 1808 the 'Kaisersaal' was the negotiating site of the Kings' Congress at which Napoleon I and the Tsar Alexander I took part. Comprehensive reconstruction and restoration work commenced in 1991 and the 'Kaisersaal' was re-opened for the public in May 1994. Today its historical atmosphere makes it a popular location for conferences, congresses and festive occasions (LANDESHAUPTSTADT ERFURT 2008).

Station 2 – 'Dämmchen' – Inner-city watercourses

In order to protect the town from flooding a flood channel was built around the old town at the end of the 19th century, which today carries a large proportion of the Gera's run-off water. The Gera itself flows in many branches through the historical old town and is an important part of the green space and biotope system of Erfurt. The river course was naturalised recently and made into an inner-city greenway. A bike- and footpath, which is bordered by green spaces and play areas, accompanies the waterway (see Station 3).

The good water quality of the river is indicated by species typical of semi-natural waterways - *Ranunculus fluitans* (water crowfoot) und *Cinclus cinclus* (white-throated dipper). These are indicator species of the FFH Habitat "Waterways with floating aquatic vegetation" (Natura-2000-

Code: 3260). There is a small remnant of alluvial forest on an island to the south of the Augustiner Street, which was recorded during the urban biotope mapping as a §18 protected area (see Section 4).

Station 3 – 'Venedig' (Venice) – New inner-city park

There is a path behind the 'Krämerbrücke' which leads to the north of Erfurt along the Wild Gera. Here one finds plants reminiscent of natural river bank vegetation in the middle of the city with *Petasites hybridus* (butterbur), *Phragmites communis* (common reed), *Phalaris arundinacea* (reed canary grass) and *Iris pseudacorus* (yellow iris), the latter planted as part of the new layout. Species such *Fraxinus excelsior* (common ash), *Sambucus racemosa* (red-berried elder) and *Salix* x *rubens (S. alba* x *fragilis*) dominate the woody species along the river bank. The willow is partly used as pollarded willow. In parts, the invasive species *Reynoutria japonica* build isolated scrub. On leaving the Augustiner Street one enters the island-like district, named 'Venice' (Figure 12). The Gera splits at this point where there were once seven working mills. In October 1994 the city of Erfurt offered a prize in a competition for the new design of the district. This resulted in the creation of the riverside park 'Venedig' in 1998 (KIRSTEN 2005). The park is limited by the river arms of the Small and the Wild Gera. In the north the grounds of a Kindergarten, which were to be re-developed, were included in the development of the central park area. In the centre of the newly created park there is a wider area which is emphasised in the design as a crossing point of the north-south greenway along the Gera with an east-west pathway from the flood channel to the Petersberg. The formation of the central park area is derived from the edges of the area. Relicts of the former horticultural use are included in the form of beds of gravel reflecting the linear structure of the former greenhouses. The rows of trees and the arrangement of decking also portray a historical relationship. Thus the park has obtained a new identity whilst also making a connection to the former use of the area (KIRSTEN 2005).

Figure 12: The Park 'Venedig' – a green oasis at the bend of the Gera in the middle of the historic old town (Extract from KIRSTEN 2005). The bridge made out of steel is a modern element of park design

Station 4 – 'Andreasviertel' (Andreas District) and Wilhelminian style front gardens

The Andreas District of the old town of Erfurt obtained its name from the church of Andreas. The settlement history of the 16.5 ha area goes back to the Neolithic Age. The stone and half-timbered houses were built in the 13th and 14th centuries. The street names used today stem from the trades which used to be situated here- dyers, tanners, paper makers and weavers. The belt of Wilhelminian style houses with its perimeter block style links to the old town in a semi-circular shape; this can

also be seen to the north connecting up to the Andreas District. Some of the Wilhelminian style houses still retain their typical front gardens. These private Wilhelminian style gardens provide a high biodiversity in addition to the public green spaces. In a recent investigation of 357 of these gardens, 367 wild plants and 528 ornamental plants were found in a total area of 3.64 ha. This corresponds to 93 % of the wild plant species recorded in the floral mapping in this particular survey section (30.25 km²) (MÜLLER et al. 2008).

Station 5 – Petersberg Citadel – History, view of Erfurt

From the plateau of the main fortress (historical background, see Section 5.1) one has a wonderful panorama over the city of Erfurt to far into the hinterland.

Station 6 – 'Horchgänge' (Spy Tunnels) Petersberg Citadel

On building the citadel the spy tunnels were built into the walls with a width of 1-1.2 m and a height of 2 m. In case of a siege the soldiers would patrol here in order to hear possible digging noises of the enemy. In the Second World War, these tunnels served as shelters for Erfurt's citizens during bombing raids. Today the most important bat colonies in Erfurt are found in the spy tunnels of the fortress (SPARMBERG 2000). Out of the 1600-1700 m of tunnels approx. 700-800 m can be accessed by tourists as part of guided tours.

Station 7 - Petersberg Citadel – Geological information, fortress walls and typical urban woodland

At 231 m the Petersberg is a monadnock of the lower Keupers, along with the Cathedral Hill and the City Park Heights in Erfurt. Typical are the alternating layers of clay and marl stone with their grey and red colours; these can be recognised at the geological exposure to the south of the Philipp Bastion. It shows that the upper covering layer is formed by an extra layer of anthropologically altered loess. In other areas of the Petersberg the soil is also strongly influenced by man (Figure 13).

Figure 13: Geological exposure on the Petersberg with an impressive view of alternating clay and marl stone layers as well as an indication of the long period of human influence

Figure 14: The ruderal pioneer woodlands are important experimental examples for urban ecology and – design, 60 years succession on urban soils (protected landscape area)

Faunal and floral specifics are found on the walls and in the woodlands of the Petersberg Citadel. Typical wall plants are found on the imposing citadel walls, for instance *Cymbalaria muralis* (kenilworth ivy) and *Asplenium ruta-muraria* (wallrue). The pioneer woodlands belong to the permanent inventory of almost every big town or city (WITTIG 2002). On the Petersberg these are particularly notable from a faunal point of view (birds and coleoptera characteristics) (SPARMBERG 2000).

Ruderal Pionier woodland

Semi-natural deciduous-mixed woodlands have formed on the strongly human-influenced soil of the Petersberg in the last 60 years. From 1900 to 1990 the areas was an off-limits military zone, so that a mainly undisturbed development could take place on the urban soil. The maple-acacia association is dominated by the species *Acer platanoides* (Norway maple) and *Acer pseudoplatanus* (sycamore). The spontaneous occurrence of these two species as a dominant association has often been noticed in other urban locations (WITTIG 2002) (Figure 14).

Species such as *Robinia pseudoacacia, Fraxinus excelsior, Aesculus hippocastanum* (horse-chestnut) and more rarely the species *Ulmus minor* (English elm), *Ulmus glabra* (wych elm), *Tilia cordata* (small-leaved lime) and *Acer campestre* (field maple) are found together on the Petersberg in the existing Maple-woodlands. The following species of the class *Galio-Urticetea* (Passarge ex Kopecky 1969) are found in the herb layer: e.g. *Alliaria petiolata* (garlic mustard), *Chaerophyllum temulum* (rough chervil), *Ballota nigra* (black horehound), *Chelidonium majus* (greater celandine), *Galium aparine* (cleavers), *Geranium robertianum* (Robert geranium) and *Viola odorata* (sweet violet).

Wall vegetation

Walls are a typical habitat for castles. There is relatively little wall vegetation to be found on the citadel walls of the Petersberg with their length of roughly 2 km and a height of up to 21 m. Almost all walls have been renovated in the last few years and are regularly looked after, which is why the wall communities have only developed in a fragmented fashion (fragment community of the class *Asplenietea trichomanes)* (Figure 15/16).

Figure 15: East-facing wall of the Leonhard Bastion with *Achillea millefolium, Campanula rapunculoides* and *Cymbalaria muralis*

Figure 16: *Cymbalaria muralis*

Station 8 – 'Domplatz' (Cathedral Square) and Church History

The cathedral of St. Mary, which was consecrated in 1182 and the neighbouring Severi church are enthroned on the Cathedral Hill over the city. The Serveri Church is one of the few five navel gothic hall churches in Germany and was built between 1278 and roughly 1400. Earlier church buildings also existed at this place. One of the attractions of the cathedral is the famous bell 'Gloriosa'. It is one of the biggest free swinging bells of the Middle Ages in the world. It was cast in 1497 and is 2.5 m high and weighs 11.5 tonnes. With its impressive size the Cathedral Square today offers space for markets and numerous events, but has only existed in this form since 1813. The district in front of the Severi Church was destroyed by shooting by French troops (LANDESHAUPTSTADT ERFURT 2008).

Station 9 – 'Waidspeicher' (Woad Warehouse) and 'Kleine Arche' (Small Arch)

Isatis tinctoria (woad) influenced the economic life of Thuringia from the 14th to 17th century and became an important factor of Erfurt`s economy (woad cultivation, woad trade) (GUTSCHE 1991). There were thus a large number of woad warehouses in the Middle Ages in Erfurt in which the woad was stored and processed. Blue dye was obtained in a difficult process from the woad and was used for blue print on textiles. In 1579 woad was grown in 49 villages around Erfurt. Today the old woad warehouse near the Cathedral Square serves as a stage for cabaret and puppet theatre (LANDESHAUPTSTADT ERFURT 2008).

Station 10 – Old town of Erfurt with synagogue and old warehouses

After passing by the 'Allerheiligenkirche' (All Saints Church), founded in the 13th century by the Augustiner Choir Men's Foundation, with its unusual ground-plan which follows the street plan, one comes into the 'Allerheiligenstrasse'. Five synagogues are found to have existed here in the Jewish residential area of the Middle Ages (in the area from the 'Ackerhof' to the 'Benediktsplatz'). The oldest building (which was a synagogue up to 1350) is situated in the 'Michaelisstrasse' behind the 'Feuerkugel' Restaurant (LANDESHAUPTSTADT ERFURT 2008). It is most probably the oldest synagogue in Germany.

Station 11 – 'Krämerbrücke'

The 'Krämerbrücke' (Merchants' Bridge) was first documented in 1117. With a length of 120 m it is the longest and only completely built up and inhabited bridge north of the Alps (with 32 houses). The famous 'via regia' crossed the river Gera here. Due to frequent fires the bridge was rebuilt from stone in 1325. The bridge used to be flanked by two churches, of which only the 'Ägidienkirche' remains. Today the 'Krämerbrücke' remains standing as a 'trading bridge' and a unique historic monument (LANDESHAUPTSTADT ERFURT 2008).

7 Summary

The territory of the capital Erfurt is one of the oldest settlement areas in Central Europe. The first people settled down during the Neolithic Period.

Erfurt is first mentioned in records in 742. Its landmarks, St. Mary's Cathedral and the Church of St. Severus, dated back to the 12th century. In medieval times the population increased up to c. 20,000 and the city reached its economical, politic and cultural climax. Since the mid-18th century Erfurt developed to a centre of horticulture due to high fertile soils and moderate climate conditions. In the Industrial Age of the 19th century a fast-growing population led to the building of a ring of Wilhelminian Style houses around the medieval city centre. Today, the city has a population of around 200,000 with regressive population growth.

Nowadays the system of green spaces within the city correlated significantly with the natural local features. For example, along the river Gera, an urban green corridor has been developed recently. Situated on Keuper hills are St. Mary's Cathedral and Petersberg Citadel. The latter has been restored recently as largest inner-city green space. During a selective biotope mapping in the late 90s of the last century, this area was identified as important sites for the preservation of typical urban biodiversity.

The mid-conference excursion during the international conference 'Urban Biodiversity & Design' will give an overview of the most important cultural and natural historic sites and green spaces within the medieval city. In this context, a highlight is the Petersberg citadel that towers over the city. Within the scope of the excursion, the biodiversity of typical urban habitats will be presented as well as methods of modern and sustainable design of urban green spaces.

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'Park an der Ilm' - Weimar (UNESCO World Heritage Site) – Historical landscape gardens in Central Europe as early heritages for the development of ecological designed parks

MARTIN KÜMMERLING & NORBERT MÜLLER

1 Introduction

Biological invasions threatening biological diversity are more problematic in the New World than in Europe. The reasons for this have been discussed widely among experts (e.g. DI CASTRI 1989, KOWARIK 2003). Because of its recent post-glacial development the European flora seems more resilient to competition from invading plant species compared to the flora of other continents. Conversely European plant species (and organisms in general) are exceptionally successful in many parts of the New World. CROSBY (1991) describes this phenomenon as "Ecological Imperialism – the biological expansion of Europe 900 – 1900". The success of 'Europeans' has also been documented with regard to their success as the most frequent spontaneous plants in mega cities of the northern hemisphere (MÜLLER 2005).

Horticulture, through respectively botanical gardens and (historical) parks, is the major source of invasive plant species throughout the New World (REICHARD & WHITE 2001). In Europe the situation is different. Studies show that under certain conditions parks are centres of biological diversity for species and habitats in urban areas. This applies to the biodiversity of wild plants and animals as well as to biological diversity of ornamental plants (e.g. KOWARIK 1998, KUNICK 1978, MÜLLER 1990a, NATH 1990).

The current paper considers a related question, namely how design, plant use and park management, i.e. the 'zeitgeist of horticulture', affects the biodiversity value of historical parks. This will be done through reference to the English landscape garden, a movement of European gardening art. In the creation of these landscape gardens over two hundred years ago many of today's ideas about 'sustainable design' were implemented.

The context of the article is a recent investigation into the floristic-phytosociology of the English landscape garden 'Park an der Ilm' in Weimar/Germany (KÜMMERLING 2007). The following matters are considered:

- The landscape gardens significance today for biodiversity and its protection
  - (a) at the habitat level
  - (b) at the species level
  - (c) at the genetic level
- The correlation between historical design, park management and the parks current value for biological diversity

The landscape garden 'Park an der Ilm' is the destination of an excursion of the international conference 'Urban Biodiversity and Design' (Erfurt 2008). Consequently this article will also look at historical and cultural highlights which are part of the excursion.

2 Formal principles of the English landscape garden

The English landscape garden is a design movement which was developed in eighteenth century England. It was a reaction against the French baroque garden and its mathematically designed beds and hedges based on the ideas of King Louis XIV, the Sun King of France. In contrast to the French baroque gardens, the English landscape garden designers tried to mirror nature by using its concepts. A basic principle of inspiration was the 'genius loci' (lat. spirit of place, a location's distinctive atmosphere). The challenge was to form an idealistic landscape from the existing natural landscape. Among the natural and cultural elements of the landscape which were often used were woods, wood pasture, hay meadows and pasture, streams, ponds and fishing lakes. Also used were cliffs, grottos etc – but the main component of design was vegetation. All these elements could be artificially created though the goal was to make them look like their natural ideals. Some parts of the garden were enriched with ornamental plants fashionable at the time. How strong the idea of an idealistic landscape was, can be seen by considering the periphery of the garden: Neighbouring habitats were used to create the garden so that a nearly seamless transition to the surrounding landscape was achieved (SCHNEIDER in lit. 2008).

Through the eighteenth and nineteenth century the small Duchy of Saxonia-Weimar-Eisenach evolved to become a prominent intellectual and cultural centre. During this period the first small landscape gardens were created in Weimar and environs – especially Ettersburg and Tiefurt. These gardens, among them the 'Park an der Ilm', belong to these period.

The Ducal landscape gardens in Tiefurt, Belvedere and Ettersburg and the 'Park an der Ilm' in Weimar have been part of the UNESCO-World heritage site 'Classic Weimar' since 1998. The 'Park an der Ilm' is situated among the Ilm river between the Ducal city palace of Weimar in the north and the now suburbanised village of Oberweimar in the south. Nearly one and a half kilometres long and covering about forty-eight hectares the 'Park an der Ilm' is a visitor attraction attracting 200,000 to 250,000 visitors per annum (SCHNEIDER 2008, oral notification).

Figure 1: The base principle of inspiration for English landscape gardens was an idealistic landscape

Figure 2: To form this idealistic landscape, parts of the historical cultural landscape – e.g. meadows like pictured 'snake meadow' – were used

3 Basic facts about the natural environment

Weimar and the 'Park an der Ilm' are situated on the south-eastern edge of the Thuringian basin, on the boundary with the shell limestone highlands. The park itself lies mostly within the floodplain of the river Ilm, its soil consisting of alluvial clay. The slopes of the Ilm valley are both keuper and shell limestone, in the southern parts of the park the famous 'Ehringsdorf travertine' breaks through

the surface of the steep slopes (HIEKEL et al. 2004).

Climatically Weimar belongs to the arid environment of the Thuringian basin alee of the mountains of the Thuringian forest; its annual precipitation is about 557 mm. Prevailing wind directions are southwest, west and northwest. Average annual temperature is 8.3°C, with an average of -0.7°C in January and 17.2°C in July (SALZMANN 1999).

4 A short history of Weimar and the landscape garden 'Park an der Ilm'

The oldest record of a region named 'Wimares' dates back to the year 899. In the following centuries Weimar existed as the politically autonomous shire of Weimar, later Weimar-Orlamünde. A settlement named Weimar is first mentioned in 1250, and in 1410 received its town charter.

At the turn of the eighteenth and nineteenth centuries the liberal and enlightened leadership of Duchess Anna Amalia and her son Duke Carl August attracted many artists to Weimar. Many of them, including Goethe, Herder, Schiller and Wieland, benefited from their patronage and took up permanent residence. Through the following decades Weimar remained a cultural and intellectual centre in Germany, with more artists – like Böcklin, Liszt and Wagner – choosing to live and work here. Like other German cities Weimar was grew in the nineteenth century, due to the industrial revolution and the railway. But Weimar did not grow to the same extent as other Thuringian cities and has kept its character as a residential town (q.v. Figure 3 and 4).

In 1919 the Bauhaus was created under Henry van de Velde. In the same year the national assembly passed the constitution here, giving the emerging democracy of the German Reich its honorary nickname 'Weimar Republic'. During the years of the republic Weimar became a centre of nationalistic and conservative attitudes, forcing the Bauhaus to move to Dessau in 1925. In 1937 the national socialists under Hitler set up the 'Buchenwald' concentration camp on the Ettersberg, north of Weimar. After the end of World War II Thuringia, and with it Weimar, became part of the Soviet zone of occupation, from which the German Democratic Republic developed.

In 1998, eight years after German reunification, the legacy of classic Weimar as well as those of the Bauhaus became protected by UNESCO as World Heritage Sites and in 1999 Weimar was the European Capital of Culture. Today Weimar is an urban district and with 65,000 inhabitants the fourth largest city of the state Thuringia (STADT WEIMAR 2006).

The origin of the 'Park an der Ilm' English landscape garden dates back to 1778. It was based on formal gardens, near the ducal city palace, dating back 100 years, situated on what at the time was the outskirt of Weimar. Some artistic improvisations were made in the Ilm valley, some distance from the palace, for a festival in honour of the name day of Duchess Luise. From those improvisations the park developed in three stages.

The first stage from 1778 to 1786 was heavily influenced by the Age of Sensibility. With the involvement of J. W. Goethe some small memorial sites were placed in the historic cultural landscape of the Ilm valley, e.g. the 'Schlangenstein' and the 'Dessaustein'.

The second stage from 1786 to 1798 during the period of Weimar Classicism saw larger park spaces emerge from the small memorial sites, using the existing relief and parts of the former cultural landscape like meadows and small groves. The 'Roman House' and the vistas that were created with its construction are typical of this period

During the third stage after 1798, the post-classic period, the landscape garden reached its present extent (q.v. Figure 3 and 4). This period was influenced by Duke Carl August's growing interest in botany and horticulture, resulting in the increased introduction of non-native plant species. These species were often planted near the 'Roman House', the summer residence of Carl August. From then there were no great changes to the base structure of the park until the middle of the twentieth century. In 1860 the city of Weimar began to enclose the park, starting with the construction of mansions on the 'Belvedere Avenue' west of the park and the so called 'Horn' in the east. During this time the river Ilm flooded the floodplains periodically, but with increasing river training in the twentieth century flooding has nearly disappeared.

During the last months of World War II the 'Park an der Ilm' was damaged by air raids. After the end of the war a small part of the park was used as a Soviet memorial cemetery as remains so today.

A partly marginal management, increased recreational use and insensitive development further damaged the park during the second half of the twentieth century. For example hay meadows on the floodplain cut twice-yearly have become short-mown, cut twenty times a year. Nevertheless the 'Park an der Ilm' was included as part of the 'Classic Weimar' UNESCO-World Heritage Site in 1998 (BEYER & SEIFERT 1995; AHRENDT / KNORR / SCHNEIDER 2006/2007, oral notification).

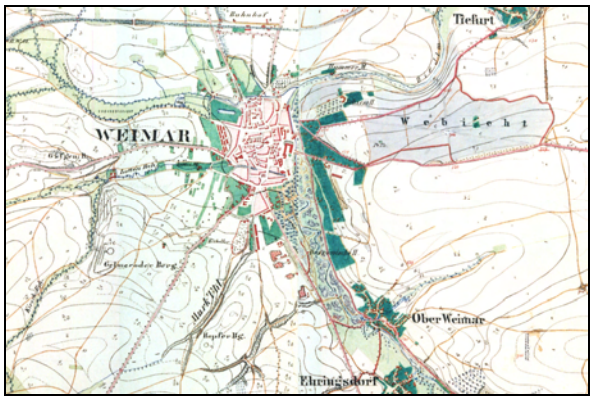

Figure 3: Merged details from the field original of the Prussian ordinance survey map from 1855, sheet 2934 'Weimar' and sheet 2935 'Magdala', original scale 1:25,000 (source: reprint by Thuringian land survey administration; permit number: --101 548 / 2008--)

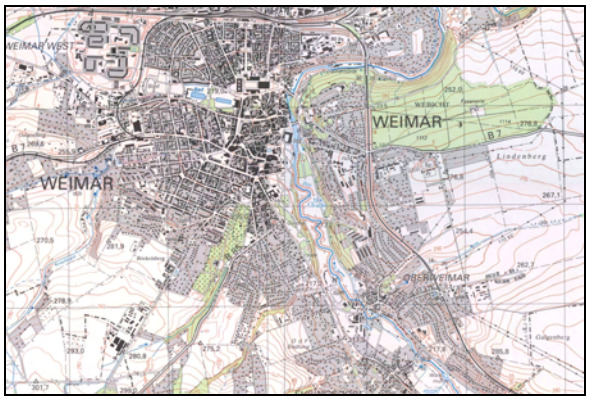

Figure 4: Merged details from the topographic map from 1994, sheet 5033 'Weimar' and sheet 5034 'Weimar O', original scale 1:25,000 (source: Thuringian land survey administration; permit number: --101 548 / 2008--)

5 Flora

In the summer of 2006, 381 taxa of vascular plants (spontaneous and sub spontaneous) were recorded in the ‘Park an der Ilm' (KÜMMERLING 2007). In comparison with other parks of the same size the 'Park an der Ilm is species-rich (cp. researches about other German English landscape gardens e.g. KUNICK 1978, MÜLLER & WALDERT 1998). The nomenclature of the flora follows JÄGER et al. (2005).

5.1 Urbanophobic, urbanoneutral and urbanophilic species

Almost two third of the recorded vascular plants of the 'Park an der Ilm' are urbanophobic plants as defined by WITTIG et al. (1985), which means, their centre of dispersion lies in non-urban areas. For example *Lathraea squamaria* which is found in the 'Park an der Ilm' is a characteristic species of alluvial and ravine forests (q.v. Figure 5); *Milium effusum*, *Rumex sanguineus* and *Ranunculus*

auricomus agg. are typical for deciduous forests; while *Ranunculus sceleratus* can be found normally on shores of lakes, ditches and rivers. A third of the recorded vascular plants are urbanoneutral, meaning these species are neither benefited nor disadvantaged by urban ecological conditions. Examples of urbanoneutral plant species in the 'Park an der Ilm' are *Capsella bursa-pastoris*, *Humulus lupulus* and *Plantago major*. Only 42 of the recorded species are urbanophilic, with their centre of dispersion in urban areas, having special adaptations or requirements relating to these habitats. Urbanophilic species in the Weimar landscape garden include *Eragrostis minor*, *Hordeum murinum* und *Parthenocissus inserta*. This shows that the park provides a refuge for urbanophobic species in an urban region.

Figure 5: *Lathraea squamaria*, a characteristic species of alluvial and ravine forests

Figure 6: *Reynoutria japonica* is rated invasive neophyte in Thuringia

5.2 Origin of plants, park specific flora and invasive neophytes

About 79% of the recorded species are natives, consisting of 72 % (272) indigenophytes and 7 % (28) archaeophytes. About 21 % (81) of the species are non-natives or neophytes. The latter include most of the plants considered as indicators of old gardening art.

The term 'indicators of old gardening art' or 'Stinzenplanten' is used for plant species, which are at least in a specified region nearly restricted to historic parks, castles and other historic components of settlements with horticultural areas. These species have been imported from other biogeographical regions and then cultivated in Central Europe as ornamental, medicinal or otherwise useful plants. Today they are naturalised and characteristic elements of historic horticultural complexes like parks. Depending on the age and history of such a complex different indicators of old gardening art can occur. Those indicators may be even specific for particular fashions of historic horticulture (NATH 1990). Indicators of old gardening art which can be found in the 'Park an der Ilm' include *Asarina procumbens*, *Geranium phaeum*, *Ornithogalum umbellatum* agg., *Telekia speciosa* and *Tulipa sylvestris*.

A second group of park-specific plant species are the 'grass seed invaders'. The term is used for plant species carried by chance among grass seeds. Like the indicators of old gardening art they are only valid as grass seed invaders in a specified region (MÜLLER 1988). In the 'Park an der Ilm' *Veronica filiformis* may be considered a grass seed invader. This species originates from the Caucasus where it is endemic (MÜLLER & SUKOPP 1993).

Neophytes showing invasive behaviour in Thuringia (MÜLLER et al. 2005) can be found in the 'Park an der Ilm', for example *Solidago canadensis* and *Reynoutria japonica* (q.v. Figure 6). These invasive neophytic species are not characteristic species of English landscape gardens.

5.3 Endangered species and species protected by law

The following plant species recorded in the 'Park an der Ilm' are endangered in Thuringia: *Rosa jundzillii*, *Geranium phaeum* and *Populus nigra*.

In Thuringia autochthonous (native on genetic level) populations of *Populus nigra* are threatened with extinction through hybridisation with *Populus* x *canadensis*. So the 'Park an der Ilm' is an important refuge site for this species. The autochthony is based upon the historical practice of using native trees from woodlands surrounding the park instead of importing them from supra-regional tree nurseries. The *Populus nigra* of the 'Park an der Ilm' have been used as source for autochthonic planting material in the recent past (ARENHÖVEL 2007, oral notification). Other tree species with individuals of adequate age may be used in the same way. Typical of the 'Park an der Ilm' is *Fagus sylvatica* f. *purpurea* – a natural mutant of ordinary *Fagus sylvatica* which occurred in the mountains 'Hageleite' near Greußen in northern Thuringia which was brought as a speciality to the park during Duke Carl August's rule (SCHNEIDER 2007, oral notification).

Of the plants protected by Thuringian law on nature conservation (THÜRNATG 2006) the 'Park an der Ilm' has three orchid species: *Listera ovata*, *Neottia nidus-avis* and *Cephalanthera damasonium*.

5.4 Ornamental plants

Around 130 species and cultivars of ornamental shrubs and non-native tree species can be found in the 'Park an der Ilm', some examples are: *Quercus petraea* 'Muscaviense', *Gymnocladius dioicus* und *Fagus sylvatica* 'Pendula' (BAUMKATASTER PARK AN DER ILM 1996-2006). The majority of them are showing no sign of spreading.

6 Fauna

Nomenclature of the fauna follows SCHAEFER et al. (2002).

Amphibians verified in the park are: *Rana temporaria*, *Rana* kl. *esculenta*, *Triturus vulgaris*, *Triturus alpestris* und *Bufo bufo* (ROTH et al. 2002; ARENHÖVEL 2007, oral notification).

The river Ilm is populated with many fish, most of the species introduced by anglers. Most frequent are: *Oncorhynchus mykiss*, *Salmo trutta* and *Thymallus thymallus* (ARENHÖVEL 2007, oral notification).

There is only one reptile to be found: *Natrix natrix*, an endangered species for Thuringia (ROTH et al. 2002).

The best investigated group of mammals in the 'Park an der Ilm' are bats. These use the park's old trees and an artificial cave called 'Parkhöhle'. The following bat species are to be found roosting in the park: *Nyctalus noctula*, *Pipistrellus nathusii*, *Plecotus auritus* and *Myotis daubentonii*. Other bat species, for example *Pipistrellus pipistrellus*, only frequent the park to hunt. It is not known whether any species breed in the park (FRANZ 2007). Other mammals found in the park are various mouse species, *Sciurus vulgaris*, *Erinaceus europaeus*, *Talpa europaea*, *Mustela erminea*, *Vulpes vulpes* and *Capreolus capreolus*. The park's importance for mammals is due to it acting as a wildlife corridor (ARENHÖVEL 2007, oral notification).

The Park is particularly important for birds, because of its many old trees and rich stock of shrubs providing opportunities for nesting. Further important features are sources of food and the river Ilm,

providing habitat for water-loving bird species as well as good network and corridor functions connecting urban and non-urban areas. At least 59 breeding bird species use the 'Park an der Ilm', like for example *Alcedo atthis* and *Dendrocopos medius* which are endangered in Thuringia (HEYER 1991; ARENHÖVEL 2007, oral notification).

Invertebrates of the park have been little studied although based on richness of structure a high species diversity would be expected. Only *Orthoptera* have been surveyed marginal (SOCHA 1998).

7 Vegetation and excursion route

The following chapter describes the several stations visited (q.v. Figure 9). The excursion is split into two parts. Part one is about the history and sights of Weimar generally – part two concentrates on the 'Park an der Ilm'. Part two includes details about history of the park and an overview of the parks vegetation units (q.v. Figure 10) as well as special characteristics and the effects of management on biological diversity. Nomenclature of Vegetation is after SCHUBERT et al. (2001).

7.1 First part of excursion – City of Weimar

Station 1 – August-Baudert-Platz (August-Baudert-Square) – Starting point

The starting point of the excursion is situated in front of the railway station of Weimar.

Station 2 – Theaterplatz (Theatre square) – Bauhaus museum

The Bauhaus is a product of the fusion of the college of arts Weimar and the Ducal Saxon School of applied arts Weimar in 1919. It is a famous school for architecture, crafts and art, with the goal of combining fine arts, applied arts and visual arts. The liberal minded Bauhaus resided at Weimar until 1925, when it was forced to move to Dessau by political groupings close to the national socialists. Famous artists of the Bauhaus are amongst many others Walter Gropius, Henry van de Velde and Wassily Kandinsky.

Station 3 – Café Residenz – Lunch break

Part 1 of the excursion ends at the 'Café Residenz' next to the ducal city palace and the 'Park an der Ilm'.

Figure 7: Bauhaus museum in the centre of Weimar

Figure 8: Historical town hall in the centre of Weimar

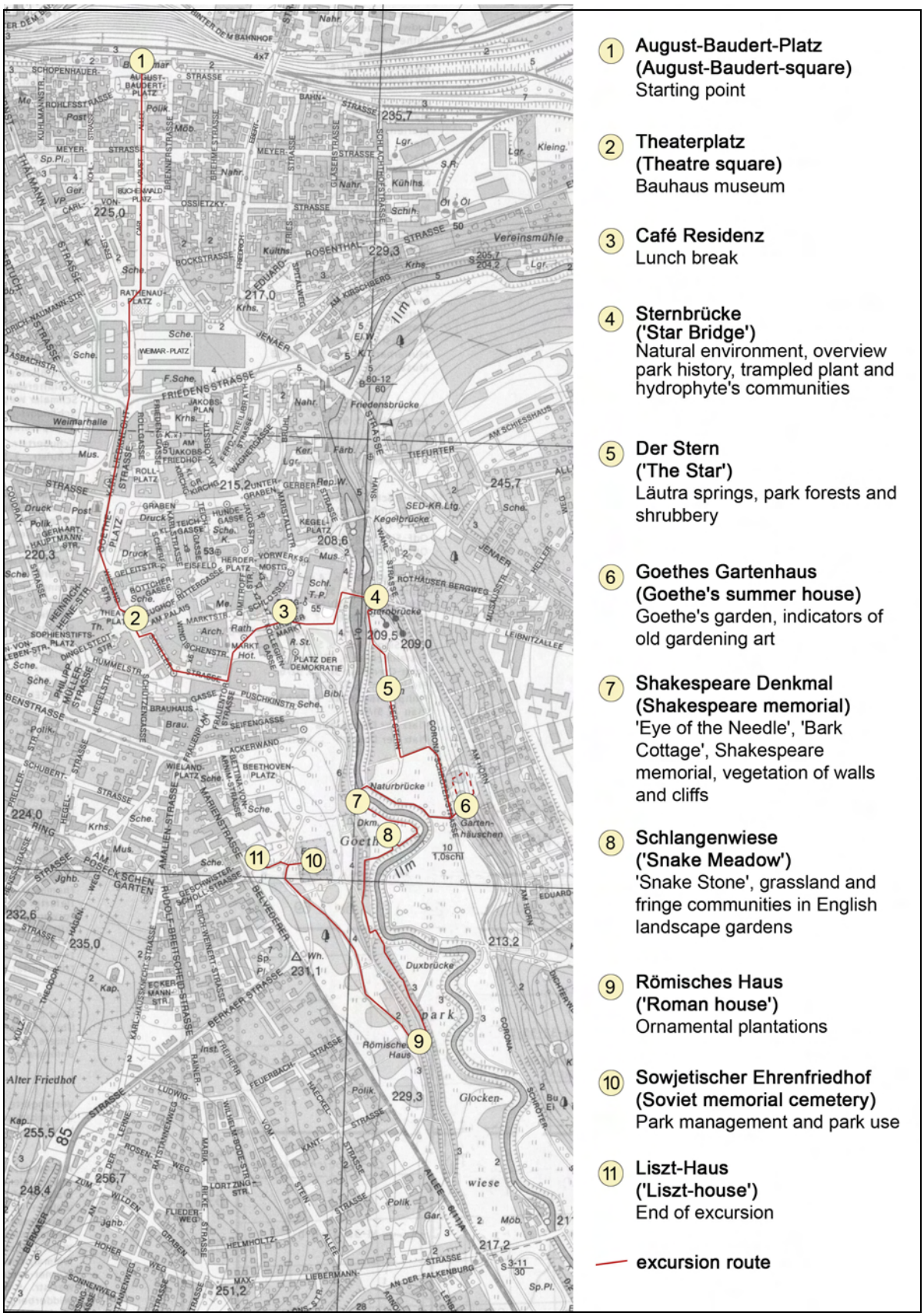

Figure 9: Excursion route. Map based on altered detail from the topographic map, sheet 32-47-B-a-2 'Weimar', original scale 1:10,000 (source: Thuringian land survey administration; permit number: --101 548 / 2008--)

Figure 10: Vegetation types of the 'Park an der Ilm' (source: KÜMMERLING 2007, altered - based upon Baumkataster 'Park an der Ilm' 1996-2006)

7.2 Second part of excursion – Park an der Ilm

Station 4 – Sternbrücke ('Star Bridge') – Natural environment, overview park history, trampled plant and hydrophyte's communities

The natural environment and park history have been summed up in chapter 3 and 4.

The trampled plant community *Sagino procumbentis-Bryetum argentei* Diem. et al. 1940 is one of the typically urban vegetation units found in the 'Park an der Ilm'. It is a community found in paving cracks, thus avoiding being trampled. In the 'Park an der Ilm' it is nearly exclusive to the 'Sternbrücke' ('star bridge') because most other park lanes are not paved. Most park lanes are free from vegetation due to use of herbicide, only waysides are sometimes covered by *Matricario matricarioidis-Polygonetum arenastri* Th. Müller in Oberd. 1971.

North of the 'Sternbrücke' one of the reeds of the 'Park an der Ilm' can be seen, which is made up from *Phalaris arundinacea*. Other plant species on surface of and within the water bodies of the rivers Ilm and Läutra which can be found in the park are: *Lemna minor, Callitriche palustris* agg., *Agrostis stolonifera* and *Berula erecta*. All of the park's hydrophyte's communities are single species stands and very rare.

Station 5 – Der Stern ('The Star') – Läutra springs, park forests and shrubbery

On the hillside near one of the Läutra springs an artificial grotto was created in 1784 and endowed with a 'sphinx' two years later. The statue was created by the Weimarian court sculptor Martin Gottlieb Klauer from Seebergian sandstone. Initially a tiny veil of water and conifers planted around gave the scene a mysterious and eerie appearance. But after some structural changes in the aquifer system of the park, the veil of water ran dry.

Alongside the side walls of the river Läutra grows the *Cymbalarietum muralis* Görs 1966, characterised by the violet flowering *Cymbalaria muralis* which is an indicator of old gardening art naturalised in Germany during the sixteenth century.

The name 'Star' ('Stern') is derived from the system of park lanes radiating from a central round square. Between the lanes tree filled bosquetts have been set up. The 'Star' is part of the planning of a very ambitious Ducal pleasure garden with canals dating back to the seventeenth century, which was only partly realised. Part of the canal system was a rafting trench surrounding the 'Star', it was filled in 1798/99. After that, heavy structural alterations took place in this part of the park. Among an avenue of *Populus* x *canadensis* and very wet, seasonally inundated, the 'Star' is characterised by some of the park’s oldest groves. These trees were planted in the seventeenth century and due to the long period of growth without major interference, they have developed to near-natural alluvial forests of *Alno-Ulmion*.

Next to grasslands, the Park forests cover the largest part of the area of the 'Park an der Ilm'. They are not real forest communities, since they are planted for their aesthetic effect but then naturally seeded due to minimal management. The tree layer of park forests is orientated on natural archetypes, but often interspersed with conifers or non-native ornamental trees. Therefore as a general rule the park forests are classified first by their most frequent tree species. The shrub layer is mostly a mixture of native and non-native species also, often with a somewhat higher degree of

competition between the species. In the herbaceous layer sylvan index species are missing more often than not. Figure 10 follows the classification by most frequent tree species. The park forests in the 'Park an der Ilm' can also be classified by their herbaceous layer into three groups:

1. Park forests with herb-rich herbaceous layer. Here nitrophilous plant species like *Aegopodium podagraria* and *Stachys sylvatica* dominate. This group can be seen at the 'Star'.
2. Park forests with grass-rich herbaceous layer. Here diverse woodland grass species like *Dactylis polygama* and *Brachypodium sylvaticum* dominate.
3. Park forests with poor herbaceous layer. This group is characterised by a thick shrub layer, mostly *Symphoricarpos albus* and *Ribes alpinum* or a thick carpet of *Hedera helix*, which prevents nearly all growth of herbs.

Like park forests the shrubbery of the park is planted. Two groups can be distinguished:

1. Shrubbery of mostly native species. These can be portrayed as communities from the *Carpino betuli-Prunion spinosae* (R. Tx. 1925) H. E. Weber 1974. Often these make up forest outskirts.
2. Shrubbery dominated by non-native species which have run to seed. In the 'Park an der Ilm' the most frequent species of this group are *Philadelphus coronarius*, *Symphoricarpos albus* and *Syringa vulgaris*. Often the spontaneous native *Sambucus nigra* joins the non-native species.

Station 6 – Goethes Gartenhaus (Goethe's summer house) – Goethe's garden, indicators of old gardening art

Following the poplar avenue the groves open to the meadow 'Sternwiese'. Situated on the eastern slopes of the Ilm valley, some of the park's oldest undisturbed meadows can be seen as well as the 'Euphrosyne' memorial. This memorial site was set up in honour of actress Christiane Neumann-Becker (1778-1797). The park now holds just a copy; the original is now in Jakob's cemetery in Weimar.

In 1776, just a few months after his arrival in Weimar, the German poet, philosopher and natural scientist Johann Wolfgang Goethe was given a small summer house surrounded by a garden down in the Ilm valley by Duke Carl August. The garden inspired Goethe with his first natural scientific experiences. Shortly after he moved in, Goethe started to alter the garden to his liking.

Figure 11: Goethe's summer house at the 'Park an der Ilm'

Figure 12: *Geranium phaeum*, an indicator of old gardening art, can be found in Goethe's garden

The basic structure of the garden made by Goethe is still visible today: Next to the house rose shrubs and flowerbeds; today's lawns were vegetable patches at Goethe's time. Also the orchard and the small landscape garden part with its sidled paths and perches remain. The summer house was Goethe's home until 1782.

During the circuit through Goethe's garden following indicators of old gardening art (cp. chapter 5.2) may be looked at: *Geranium phaeum, Tulipa sylvestris* and *Hieracium aurantiacum.*

Station 7 – Shakespeare Denkmal (Shakespeare memorial) – 'Eye of the Needle', 'Bark Cottage', Shakespeare memorial, vegetation of walls and cliffs

In January 1778 a young court damsel, Christel von Laßberg, committed suicide by drowning in the river Ilm. Goethe was deeply shocked and created a so called 'rock and grotto piece' within the western slopes of the Ilm valley in her memory. A key feature of this artwork is a stair winding down the rocky slope and through a rock portal, commonly known as 'The Eye of the Needle'.

In July 1778 the name day of Duchess Luise offered another welcome opportunity to create a small piece of garden art: A cottage made of bark, which became the first step towards the creation of the English landscape garden in the Ilm valley.

To the newer park memorials belongs the Shakespeare memorial. It was created by sculptor Otto Lessing in 1904.

Walls (ruins, springs , supporting walls, sculptures) and cliffs (natural and artificial outcrop, rocks, sculptures) in the 'Park an der Ilm' are largely covered in woodland species like *Geum urbanum*, fringe species like *Chelidonium majus*, grass species and advance of trees or shrubs. *Hedera helix* clothes some walls. *Cymbalaria muralis* and the native fern *Asplenium ruta-muraria* are among the few species or communites that are truly indicative of walls, the fern *Cystopteris fragilis* sometimes accompanying the latter.

Station 8 – Schlangenwiese ('Snake Meadow') – 'Snake Stone', grassland and fringe communities in English landscape gardens

The name 'Snake Meadow' comes from the memorial 'Snake Stone', which was erected on the western slopes of the Ilm valley in 1787. It is the most well known memorial in the 'Park an der Ilm' and was created by court sculptor Martin Gottlieb Klauer. Its inscription 'GENIO HUIUS LOCI.' can be translated as 'in honour of the spirit of this place'. Relating to the park it means to pay deference to this place as a masterpiece of art and nature.

Meadows and pastures as well as transitions to dry or wet unmanaged grasslands are typical of English landscape gardens. Often they are relics of the former cultural landscape, merged with the park during the planning process. Lawns, a common type of urban vegetation are relatively recent plant communities, and were much more limited in extent until the arrival of the powered mower during the second half of the last century (MÜLLER 1990b).

The 'Snake Meadow' is one of the oldest and least disturbed areas of the 'Park an der Ilm', and was probably a hay meadow before the founding of the park. Its vegetation belongs to the *Arrhenatheretum elatoris*, but also shows some characteristics of *Bromion erecti*. The 'snake meadow' is one of the meadows with the highest biodiversity in the whole park. This demonstrates

that parks can be important refuges for habitats of the historical-cultural landscape today. Meadows play an important part in defining the visual character of the 'Park an der Ilm' and are concentrated in the Ilm valley on nutrient rich soils (alluvial clay) and on the eastern slopes of the Ilm valley. The dominant plant species of the hay meadows most are *Arrhenatherum elatius* and *Dactylis glomerata*.

Pastures (*Cynosuro cristati-Lolietum perennis* Br.-Bl. et de Leeuw 1936) are regularly fertilised and grazed. In the 'Park an der Ilm' they are mown twice a year and grazed three times a year by sheep and goats. Pastures are found on nutrient rich, moist soils. They are characterised by dominance of *Lolium perenne*, *Trifolium repens* and *Ranunculus repens*. *Arrhenatherum elatius* and other index species of meadows seem to show that the pastures at the 'Park an der Ilm' were probably once meadows.

Lawns, mown twenty or so times a year, are the most frequent type of grassland after meadows. In comparison they are not as species-rich as meadows or pasture. According to MÜLLER (1990b) they are phytosociologically associated with *Festuco commutatae-Crepidetum capillaris* Hülb. et Kienast ex Kienast 1978 (lawns of continental climate) and *Trifolio repentis-Veronicetum filiformis* N. Müller 1988 (lawns of Atlantic climate). As Thuringia is situated on the transition between continental and Atlantic climates, both types of lawns occur in the 'Park an der Ilm'. Indicative species, and also the most frequent, are *Lolium perenne*, *Poa pratensis*, *Festuca rubra* and *Agrostis capillaris*. Nearly all lawns are dominated by *Taraxacum officinale* agg., *Plantago major* subsp. *major* and *Bellis perennis*. The eponymous indicative species for the lawns of Atlantic climate, *Veronica filiformis*, is to be found in the 'Park an der Ilm', too. The immigration of this neophyte is to be considered as positive, because it helps enrich these otherwise species-poor lawns (MÜLLER & SUKOPP 1993). On moist sites lawns are dominated by *Agrostis stolonifera* and *Ranunculus repens*. Extensively trampled lawns along lanes and paths lead over to the trampled plant communities (cp. station 4).

There are different groups of fringes in the 'Park an der Ilm'. Most frequent are moist nitrophilous fringes like *Urtico dioicae-Aegopodietum podagrariae* R. Tx. 1963 ex Görs 1968 and near the river Ilm *Aegopodio podagrariae-Menthetum longifoliae* Hilb. 1972. Not as frequent are nitrophilous riverside fringes like *Impatienti glanduliferae-Convolvuletum sepium* Hilb. 1972 and *Cuscuto europaeae-Convolvuletum sepium* R. Tx. 1947. Even less frequent are nitrophilous forest saums like *Alliario petiolatae-Chaerophylletum temuli* (Kreh 1935) Lohm. 1949. On one site can be found a neophytic fringe dominated by *Reynoutria japonica*.

Passed by on the way from station 8 to station 9 is the so called 'Dessaustein' ('Dessau Stone'). Growing over this memorial rock is an indicator of old gardening art, *Asarina procumbens*, a plant of the Atlantic climate region of Western Europe. The 'Park an der Ilm' holds one of the very few populations of this species in Germany.

Station 9 – Römisches Haus ('Roman house') – Ornamental plantations

The 'Roman house' was intended as an architectonical focus of the upper park between Ilm valley and 'Belvedere Avenue' and was built between 1792 and 1797. Reflecting the topography the building was placed on the side of the Ilm valley and surrounded by a system of pathways. It connects between the Ilm valley and the upper part of the park. By integrating the 'Roman house' into the 'Park an der Ilm' an 'ideal' landscape was created, referring to historic Mediterranean landscapes.

Figure 13: View over the Ilm valley from the lower floor of the 'Roman house'

Figure 14: Memorial sites like the 'Dessaustein' work like artificial cliffs, hosting communities of wall- and rock species like *Asarina procumbens*

Near buildings like the 'Roman house' ornamental plantations commonly occured as parts of English landscape gardens, too. Today they are very intensively cared for and formal in their layout. Spontaneous plant species occur very seldom, usually species like *Stellaria media* agg., *Euphorbia peplus* and *Euphorbia helioscopia*.

Station 10 – Sowjetischer Ehrenfriedhof (Soviet memorial cemetery) – Park management and park use

The Soviet memorial cemetery was constructed on a former tree nursery belonging to the park, which was damaged during World War II. The air raid also damaged the 'Templar house' which now can be viewed as a ruin – a symbol for the transience of mankind and his works.

In historic times the management of the ornamental plantings was carried out by gardeners. The numerous meadows have been managed for hay by farmers. In addition the larger meadow areas in the Ilm valley have been used for sheep grazing. Cattle have also been used for grazing as part of 'ornamental farming'. Grazing with sheep and goats is still a strong component of park management in the 'Park an der Ilm' today. In the last 1970s all the meadows in the western parts out of the Ilm valley were converted to lawns, reflecting greater demand for recreational use (BEYER & SEIFERT 1995, AHRENDT / KNORR / SCHNEIDER 2006/2007, oral notification). This intensification in management continues today and has resulted in a significant loss of biodiversity in the affected areas.

Figure 15: Flock of sheep used for grazing in the 'Park an der Ilm'

Figure 16: Greater demand for recreational use caused a change from meadows to lawns

Today the vegetation of park lanes is controlled with pesticides. Wall vegetation is cleared periodically Tree maintenance and rejuvenation of groves are only done as necessary for the security of visitors and the preservation of certain important artistic vistas. Areas not used by and where there are no important views of vistas are left unmanaged. Consequently these groves provide habitat for birds, bats and other (dead) wood dwellers (KNORR 2006, oral notification).

Station 11 – Liszt-Haus ('Liszt-house') – End of excursion

The park exit at the 'Liszt-house' is situated not far from the Soviet memorial cemetery. Here the excursion officially ends.

The 'Liszt-house' originally belonged to the ducal plant nursery. In the years between 1869 and 1886 the composer and piano virtuoso Franz Liszt used it as a summer residence and school for his students. Subsequently Duke Carl Alexander turned it into a museum dealing with the life and work of Franz Liszt, as it remains today.

8 Conclusion

This paper has been shown that the 'Park an der Ilm', after two hundred years of development, is important for biodiversity at the three levels of

(a) Habitats:

- Refuge for species-rich meadows, fringes and near-natural forests
- Functioning as a corridor in an urban region for those habitats and their inhabitants

(b) Species:

- Centre of urbanophobic species within an urban region
- Regional naturalised ornamental plants as indicators of old gardening art

(c) Genetics:

- Space of retreat for autochthonous (native on genetic level) plant species

There are three aspects to the park worth considering in relation to its value today for nature conservation:

- Inclusion of the surrounding landscape and its biological diversity as an important component of design
- Continuity of management over two centuries in maintaining the design of the park
- The extent of the park allowing a different development of the vegetation in the face of the urban development of the surrounding area

The 'Park an der Ilm' therefore is an outstanding example of the potential for parks, with the appropriate initial sustainable design, to provide important areas of natural habitat within cities.

Important functions parks can provide in accordance with the CONVENTION ON BIOLOGICAL DIVERSITY and especially with reference to the 'sustainable use of diversity' are:

- Social value from contact and visual appreciation of nature
- Natural space for recreation and social interaction
- Climatic amelioration
- Economical benefits from tourism

Last but not least the 'Park an der Ilm' is an outstanding cultural monument, which has been recognised by UNESCO by being awarded the status of a World Heritage Site in 1998.

9 Acknowledgements

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Wartburg Castle by Eisenach (UNESCO World Heritage Site) – Old isolated castles as models for the influence of settlements on biodiversity

ANDRÉ HÖLZER, ANITA KIRMER & NORBERT MÜLLER

1 Introduction

From an ecological point of view old castles can be regarded as prototypes for the influence of settlements on biodiversity (SUKOPP 2005). Firstly, due to the climatic conditions native and exotic plants from warmer areas are concentrated here and form a specific urban flora. Secondly, as isolated urban settlements, castles have a long influence on the biodiversity of the surrounding natural or cultural landscapes because of clear-cutting and logging, eutrophication by waste deposition, introduction of ornamental plants, forestry and agriculture, recreational activities and tourism. Under these assumptions Wartburg Castle that is situated on a 410 m precipitous hill to the southwest of Eisenach (Germany) was subject of a study in the year 2007. The 900 year old castle is in the midst of a nature reserve comprising natural deciduous forest. Our research focused on the characteristics of the urban habitats of the castle as well as the influence of the castle on the biodiversity of the surrounding vegetation. In a botanical-historical tour round Wartburg Castle during the conference 'Urban Biodiversity and Design' we will show you how human influence has affected the typical plant communities of the region. The castle affords spectacular views of the area. In addition the Wartburg Society will provide a guided tour of the cultural highlights of Wartburg Castle. We shall also visit Eisenach's famous Bachhaus (dedicated to Johann Sebastian Bach).

2 Biogeography, geology and climate

The Wartburg area is situated south of Eisenach within the low mountain range on the northern border of the Thuringian Forest. The area is dominated by deciduous woodland and covers 68km² and reaching an altitude of 560 m above sea level on its south-eastern border (HIEKEL et al. 2004). Erected on a belay and visible over a long distance, Wartburg towers above the surrounding woodland (Figure 1 and 2).

The geological bedrock is characterised by conglomerate with sandstone and shale layers (sediments of the Early Permian Age). The origin of these layers dates back to 220-250 million years ago. The uplift and following erosion of the material resulted in the present-day formation of cuestas with steep slopes and deep gorges. The unique formation of puce-coloured conglomerate alternating with loamy layers of sandstone is called the 'Eisenach-formation' or the 'Wartburg-conglomerate' (HAUPT et al. 1990).

Due to the pronounced relief of the landscape, the soil types are very heterogeneous (HIEKEL et al. 2004). Cambisols dominate. On dry sites such as sunny belays, the soil types give way to ranker (shallow soil which has developed from siliceous rock, lacking a B horizon) or skeletal soil. On shallow slopes and in the bottom of valleys waterlogged Gleysols and Fluvisols occur. All soil types in this region are prone to acidification.

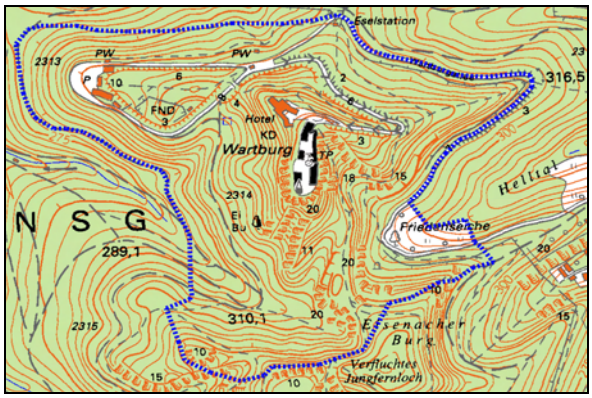

Figure 1: Wartburg area. The border of the study area is drawn in blue (based on TK10 5027 NO Eisenach, permit number: --151 548 / 2008--)

Figure 2: UNESCO World Heritage Site Wartburg Castle amidst deciduous woodland (view from the south-west)

The Wartburg area belongs to the central German montane and upland climate region (HIEKEL et al. 2004). Long-term average annual precipitation is around 700 mm. The average annual temperature reaches 6-7.5°C. In January the average temperature is around –1°C to –2°C; in July c. 16°C. In summer on south-facing belays a warm and dry climate prevails whereas valleys and gorges are characterised by a humid and cool climate.

3 Cultural and natural history of the area

Wartburg Castle was first documented in 1080 (WARTBURGSTIFTUNG EISENACH 2007, SCHUCHARDT 2007). Bruno, the Bishop of Merseburg, described in his book of the Saxon War "De Bello Saxonico" the temporary military camp of King Heinrich IV next to a castle called Wartberg. It was the seat of the Thuringian landgraves until 1440, and as a place of courtly culture it became in around 1207 the venue of the Sängerkrieg, the Minstrels' Contest, with contestants such as Walther von der Vogelweide, Wolfram von Eschenbach, and many others, taking part. Wartburg Castle was temporarily home to many celebrities. Elizabeth, the daughter of the King of Hungary, grew up as the fiancée and later consort of Ludwig IV (1211-28). She was to be one of the best-loved saints of the Medieval Age. It was at Wartburg Castle where Martin Luther translated the New Testament, creating the foundations of the Protestant faith and at the same time standardising the German language (1521-22). In 1777, Johann Wolfgang von Goethe paid his first visit to Wartburg Castle. He subsequently visited the castle and the town Eisenach on numerous occasions. At the German student fraternities' Wartburg Festival in October 1817, around 500 students and professors came together for the first democratic public meeting in Germany. In 1999, the Wartburg Castle was added to the UNESCO World Heritage List as an "Outstanding Monument of the Feudal Period in Central Europe" and is linked to "Cultural Values of Universal Significance". The Wartburg Castle is an ensemble of Romanesque, Gothic, Renaissance and Historicism architecture (Figure 3 and 4). The oldest building, the Pallas, dates back to the 12th century.

In 1180, the first documentary evidence of Eisenach can be found following the conflation of three trading settlements in the mid-12th century (STADT EISENACH 2007). In the 14th century, Eisenach's prosperity was weakened by its geographical isolation on the western edge of the landgrave's territory and by devastating town fires. Between 1498 and 1501, Martin Luther was a pupil at the Latin School in Eisenach. In 1685, Johann Sebastian Bach was born in Eisenach. The Bachhaus in Eisenach which is now more than 600 years old was once presumed to be his birthplace. Since 1907, it has been a museum.

Figure 3: Inner yard - Pallas with knights' bath and cistern (March 2007)

Figure 4: Inner yard – castle garden (‘Senkgarten’) (June 2007)

Different woodland types have long been the dominant vegetation in the area surrounding Wartburg Castle. Before the construction of the castle, the area had been densely wooded. With the start of construction, a large amount of timber was needed. In the following years, the forests were used as 'Niederwald' (simple coppice forest) and 'Mittelwald' (coppice-with-standards forest). Near the castle, the forests had been cleared for strategic reasons (HOFF & JACOBS 1807, HAUPT et al. 1990). In the 16th century, mining and smelting of ore led to a high demand for timber. With the decline of the mining activities in the following century, the forests were able to recover. In large areas of the Thuringian Forest, the plantation of coniferous species led to forests with *Picea abies* (Norway spruce) as the dominant species. In the Wartburg area, the amount of planted coniferous forest was much smaller (20 % in 1822, BÖF 1995). Today woodlands in the Wartburg are the densest they have been in a hundred years. Forestry operations are non-intensive because the Wartburg area is part of the ‘Wartburg-Hohe-Sonne’ nature conservation area. In addition, the forests are protected within the European Flora-Fauna-Habitat Directive. Management in the woodlands is restricted to the preservation of the walking trails. Every now and then, maple pioneer forests adjacent to the castle were cleared to maintain open views (WARTBURGSTIFTUNG EISENACH 2007).

4 Potential and actual natural vegetation

The potential natural vegetation in the area is deciduous forests dominated by *Fagus sylvatica*. On sunny and dry belays the forests would reach their limit. In transition zones to sunny and dry belays and ridges of conglomerate rocks, the beech forests would change to oak forests (*Quercus petraea*). On sites with extremely shallow soil such as belays, siliceous dry grassland develops (WESTHUS et al. 1995, HIEKEL et al. 2004). The actual vegetation types are developing toward to the potential natural vegetation (e.g. beech forests, siliceous dry grassland).

Around Wartburg Castle, eutrophication as well as dispersal of ornamental and medicine plants from the castle gardens, influences the adjacent vegetation. Typical urban vegetation has been able to develop (urban forests, shrub formations, ruderal communities, nitrophilous ecotonal communities).

5 Flora

In 2007, 332 higher plants were recorded in the Wartburg area (HÖLZER 2007) comprising 255 indigenous species, 39 neophytes, 33 archaeophytes, and five ornamental plants. Of all species, 25 % belong to the woodland species group and 25 % to the species group of frequently-disturbed places.

The latter are evidence of prolonged human influence on the vegetation. In the transition zone between castle and natural woodland, persistent ruderal plant communities have developed as well as scrub with ecotonal communities which show a high proportion of hemerochoric as well as neophytic species. Only 13 % of the neophytic species are invasive (*Fallopia japonica, Impatiens parviflora, Robinia pseudoacacia, Symphoricarpos albus, Solidago canadensis*). Examples of medical plants from the castle gardens which immigrated into the natural surroundings are *Doronicum pardalianches, Leonurus cardiaca* and *Tanacetum parthenium*. Altogether, 31 species that are listed for plantations in the castle gardens have been recorded in the surrounding vegetation. Some of these species can be found even on adjacent belays as well as in gorges and valleys leading away from the castle. Examples for agriophytes are *Anthemis tinctoria, Cymbalaria muralis, Pseudofumaria lutea, Sedum spurium,* and *Syringa vulgaris.* Altogether, six species are listed in the Red List for Thuringia (*Doronicum pardalianches, Geranium lucidum, Leonurus cardiaca, Nepeta cataria, Scleranthus perennis, Taxus baccata*). Only four indigenous typical species of rock crevices and walls have been found: *Asplenium ruta-muraria, A. trichomanes, A. septentrionale, and Cystopteris fragilis.* The occurrence of the calciphilous *Asplenium septentrionale* is caused by calcareous emissions (dust and plaster residue) originating from Wartburg Castle.

6 Fauna

The high heterogeneity in the Wartburg area results in high species richness of animals. Examinations were made by HAUPT et al (1990) and BÖF (1995). In the deciduous woodlands, the most common large mammals are *Cervus elaphus* (red deer), *Capreolus capreolus* (roe deer), *Sus scrofa* (wild boar), and *Meles meles* (badger). The following Red List species (RL) can be observed very frequently in the area: *Neomys fodiens* (Eurasian water shrew), *Talpa europaea* (mole), *Muscardinus avellanarius* (hazel dormouse), *Mustela nivalis* (weasel), *Martes martes* (European pine martens). The Wartburg area is home to the annex II species of the FFH Directive *Myotis myotis* (greater mouse-eared bat, RL TH) and *Myotis bechsteinii* (Bechstein's bat, RL TH).

With regard to the avifauna, woodland species dominate the area, such as *Buteo buteo* (common buzzard), *Accipter gentiles* (northern goshawk), *Falco tinnunculus* (common kestrel), *Bubo bubo* (Eurasian eagle owl), *Strix aluco* (tawny owl), *Dryocopus martius* (black woodpecker), *Dendrocopos major* (great spotted woodpecker), *Sitta europaea* (Eurasian nuthatch), *Turdus philomelos* (song thrush), *Pyrrhula pyrrhula* (bullfinch).

Amphibians can be found near waterbodies, e.g. *Bufo bufo* (European toad), *Rana temporaria* (grass frog), *Salamandra salamandra* (fire salamander, RL TH), and *Triturus cristatus* (great crested newt, annex II species and RL TH). The reptiles *Anguis fragilis* (blind worm) and *Lacerta vivipara* (common lizard) are very common in the area.

7 Excursion route

Station 1 – Southern castle wall with wall vegetation and ruderal ecotonal communities

The walls around Wartburg castle are only sparsely vegetated. The highest abundance is located on conglomerate walls dating back to the 14th century. Parts of the castle walls are habitats for the neophytic species *Cymbalaria muralis* and *Pseudofumaria lutea* (Figure 7). The plant communities of the *Cymbalarietum muralis* Görs 1966 and *Corydalietum luteae* Kaiser 1926 are developed only fragmentary. Dominant species are *Asplenium ruta-muraria, Cymbalaria muralis* and

Pseudofumaria lutea. *Fallopia japonica* is the only invasive plant species that has been able to colonise the walls. Other species such as *Artemisia absinthium, Mycelis muralis, Nepeta cataria, Poa compressa, Sedum acre, Taraxacum officinale,* and *Valerianella locusta* are only present in small populations or as single plants.

Ruderal plant communties are typical elements in urban areas. At Wartburg Castle the main types are annual trampled communities (see station 12) and ruderal wormwood and thistle communities (*Artemisia* spp., *Cirsium* spp., *Carduus* spp.). On the wayside, nitrophilous ruderal communities can be found (class *Artemisietea vulgaris* Lohm. et al. ex V. Rochow 1951 em. Dengler 1997). They are typical of castles (LOHMEYER 1976, BRANDES 1996). Here, these communities have been invaded by *Fallopia japonica* and *Symphoricarpos albus*.

On the western part of the castle walls near the stairway to the southern tower, *Nepeta cataria* and *Melissa officinalis,* two old medical plants, have been found. On the southern wayside two other medical plants *Tanacetum parthenium* and *Leonurus cardiaca* grow. Another garden escape is *Doronicum pardalianches* (Figure 5 and 6). In Thuringia, only agriophytic occurrences of *Doronicum* are known.

Figure 5: *Doronicum pardalianches* in natural woodlands (June 2007)

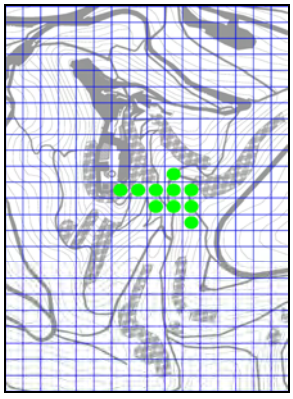

Figure 6: Distribution of *Doronicum pardalianches* (from HÖLZER 2008)

Figure 7: *Pseudofumaria lutea* on conglomerate wall (May 2007)

Station 2 – Natural rock site south of the Wartburg Castle

On exposed, open rocks and belays of conglomerate substrate small-scale mosaics of siliceous dry grassland have developed (order *Sedo-Scleranthetalia* Br.-Bl. 1955, Figure 8). Remnants of the association *Diantho gratianopolitani-Festucetum pallentis* Gauckl. 1938 are found in patches on this site with a fairly large population of *Dianthus gratianopolitans* (Figure 9 and 10). The herb layer is very species-rich: *Allium lusitanicum, Avenula pubescens, Campanula rotundifolia, Euphorbia cyparissias, Festuca ovina, Festuca pallens, Koeleria pyramidata, Lychnis viscaria, Potentilla argentea, Rumex acetosella, Scleranthus perennis, Sedum album, Sedum reflexum, Sedum rupestre, Trifolium alpestre,* and *Thymus pulegioides*. In some places, the influence of the castle led to transitions to nitrophilous ecotonal communities. Parts of the site are threatened by shrub encroachment.

Figure 8: Siliceous dry grassland on conglomerate rock (April 2007)

Figure 9: *Dianthus gratianopolitanus* (May 2007)

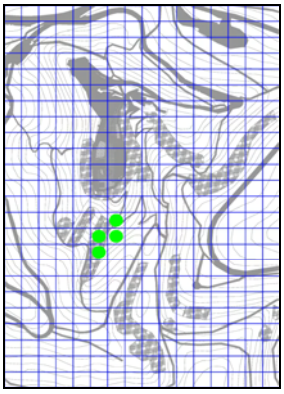

Figure10: Distribution of *Dianthus gratianopolitanus* (from HÖLZER 2008)

Station 3 – Natural rock site and shrub formations north of the Wartburg Castle

Due to the northern exposition of the rocks, mosaic stands of chasmophytic vegetation of siliceous rocks, mesic ecotonal communities and shrub formations have developed. The chasmophytic vegetation can be described by the alliance *Cystoperidion fragilis* J.L. Richard 1972. Typical for these northern exposed rocks is the shade-tolerant fern *Polypodium vulgare*. It is common on shaded rocky sites below oak and maple forests. It is absent on dry and sunny sites.

The ecotonal communities belong to the class *Trifolio-Geranietea sanguinei* Th. Müller 1962 with *Origanum vulgare, Solidago virgaurea and Hypericum perforatum* as characteristic species. They show a tendency to the alliance *Trifolion medii* Th. Müller 1962. The vegetation is very heterogeneous. Dry grassland species (e.g. *Sedum album, Festuca pallens, Saxifraga granulata, Scleranthus perennis*), neophytic species (e.g. *Cymbalaria muralis, Helianthus annuus, Sedum spurium*) as well as species from azidophileous ecotonal communties (e.g. *Hieracium maculatum, H. lachenalii, H. laevigatum*) established dependent on the local site conditions.

The rock sites north of Wartburg castle are prone to shrub encroachment. Most shrub formations are composed of neophytic species (e.g *Syringa vulgaris, Symphoricarpos albus*). In parts blackthorn (*Prunus spinosa*) shrub stands are established. On small rocks below the entrance of the castle, we can find shrub formations with *Prunus spinosa, Evonymus europaeus, Rosa canina* and *Acer campestre* in combination with stump sprouts of *Acer pseudoplatanus, A. platanoides, Ulmus glabra* and *Fraxinus excelsior*. The herb layer is composed of species from ecotonal and ruderal communities (e.g. *Chaerophyllum temulum, Geranium robertianum, Geum urbanum, Poa nemoralis* and *Sedum maximum*.

Station 4 – Thermophilic ecotonal communities

In the transition zone between rocky heaths and woodland thermophilic ecotonal communities have developed (alliance *Geranion sanguinei* R. Tx. in Th. Müller 1961). The shrub layer is dominated by *Rosa canina* whereas the open tree layer consists of *Quercus petraea* and *Acer campestre*. *Sedum maximum, Tanacetum corymbosum, Hypericum perforatum and Trifolium alpestre* (Figure 11) are typical species of the herb layer. On the way to station 5 on shaded rock sites and along the wayside we will find large populations of the otherwise rare species *Geranium lucidum* (Red List Thuringia, Figure 12 and 13). Its centre of distribution is in the Wartburg area.

Figure 11: *Trifolium alpestre* on conglomerate rock (June 2007)

Figure 12: *Geranium lucidum* (May 2007)

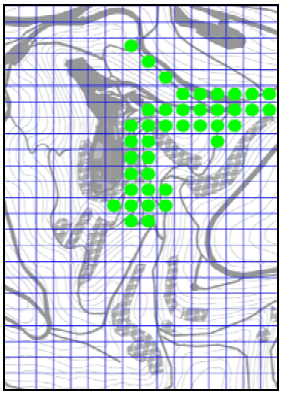

Figure13: Distribution of *Geranium lucidum* (from HÖLZER 2008)

Station 5 – Dry oak forests and heaths on conglomerate banks

The area is characterised by in-situ conglomerate ridges and banks. This resulted in very heterogeneous forest types. On belays and ridges with predominantly dry site conditions dry oak forests dominated by *Quercus petraea* is the main vegetation type (alliance *Quercion robori-petraeae* Br.-Bl. 1932, Figure 14). In the shrub layer *Sorbus aucuparia* can be found. The herb layer is dominated by *Deschampsia flexuosa, Agrostis capillaris* and *Melampyrum pratense*. Additional species are *Anthericum liliago* (see Figure 15 and 16), *Convallaria majalis, Lychnis viscaria* and *Campanula persicifolia*.

Figure 14: Dry oak forest south of the Wartburg Castle (April 2007)

Figure 15: *Anthericum liliago* (May 2007)

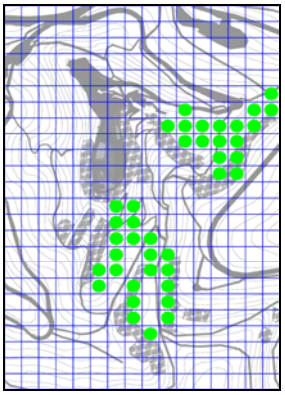

Figure 16: Distribution of *Anthericum liliago* (from HÖLZER 2008)

Station 6 – Tilio-Acerion forests of ravines east of the Wartburg Castle

Tilio-Acerion forests (Annex I FFH) have developed near the castle in a shaded ravine (alliance *Tilio platyphylli-Acerion pseudoplatani* Klika 1955). Adjacent to the castle, they merge into ruderal, maple-rich forests that are defined as typical ‘castle forests’ (‘Burgwälder’ BRANDES 1996, SIEGL 1998). BRANDES (1996) described these forests close to the association *Fraxino-Aceretum pseudoplatani* (W. Koch 1926) R. Tx. em. Th. Müller 1966 with an increased share of maple species (*Acer* spp.). The site conditions nearby castles are characterised by eutrophication and deposition of debris. This results in higher species numbers. The tree layer of natural and urban forests is dominated by *Acer platanoides, Acer pseudoplatanus, Tilia platyphyllos, Fraxinus excelsior* and

Ulmus glabra. The shrub layer consists mostly of *Sambucus nigra*. Close to the castle also *Evonymus europaeus, Ribes uva-crispa* and *Ribes alpinum* can be found. Species of the herb layer such as *Alliaria petiolata, Arum maculatum, Geranium robertianum, Stachys sylvatica* and *Urtica dioica* provide an indication of the nutrient-rich site conditions. A special feature of the ravine is the large population of *Doronicum pardalianches* that has been able to spread out into the forests.

Station 7 – Heaths, and oak-hornbeam forests of the *Carpinion betuli*

In the Wartburg area, the dwarf-shrub heaths are restricted to open, rocky sites with shallow soil. They mostly occur within the dry oak forests. If a tree layer is existent, the species are *Quercus petraea* and *Sorbus aucuparia* in very open stands. The herb layer is dominated by *Calluna vulgaris, Vaccinium myrtillus, Deschampsia flexuosa, Agrostis capillaris* and *Rumex acetosella*.

East of the path, oak-hornbeam forests of the *Carpinion betuli* (Annex I FFH) are developed. They belonged to the association *Stellario holosteae-Carpinetum betuli* Oberd. 1957. The tree layer consists of *Quercus robur, Carpinus betulus* and *Fagus sylvatica*. In the shrub layer *Crataegus monogyna* und *Corylus avellana* can be found sporadically. The herb layer is characterised by *Stellaria holostea, Anemone nemorosa,* and *Corydalis cava*.

Station 8 – *Luzulo-Fagetum* beech forests

Acidophilous *Luzulo-Fagetum* beech forests (Annex I FFH) are typical for the area and they are surrounding the Wartburg Castle. They originated from plantations of *Fagus sylvatica*. These beech forests are generally very species-poor with mono-dominance of beech in the tree, shrub and sometimes also herb layer. In addition to the beech plantations, the alliance *Luzulu-Fagion* Lohm. et R. Tx. in R. Tx. 1954 is well developed. Typical species in the herb layer are *Luzula luzuloides, Epilobium angustifolium, Oxalis acetosella* and *Dryopteris filix-mas*. The neophytic species *Impatiens parviflora* is widely distributed across the whole area. It can be found in ecotonal communities as well as in the herb layer in the forests. It can be considered as an invasive species.

Station 9 – Different forest types and heaths

Overview of *Luzulo-Fagetum* beech forests, oak-hornbeam forests of the *Carpinion betuli* and heaths on rock. On rocky sites with shallow soil *Pinus sylvestris* has been able to establish.

Station 10 – Maple-beech forests

West of the car-park, the deposition of rubble led to the development of the alliance *Aceri-Fagion* Ellenb. 1963 em Schub. 1995. The tree layer is characterised by *Fagus sylvatica, Acer pseudoplatanus, Acer platanoides* and *Fraxinus excelsior*. In the shrub layer sometimes *Sambucus nigra* can be found. *Mercurialis perennis* is a typical species in the herb layer.

Station 11 – Different woodland types

View of typical ‘castle forests’ (maple pioneer woodland) above an underground wastewater disposal line (Figure 18). Other woodland types are *Tilio-Acerion* forests (Annex I FFH), oak-hornbeam forests, and *Luzulo-Fagetum* beech forests. Within the woodland moss-covered rocks can be found.

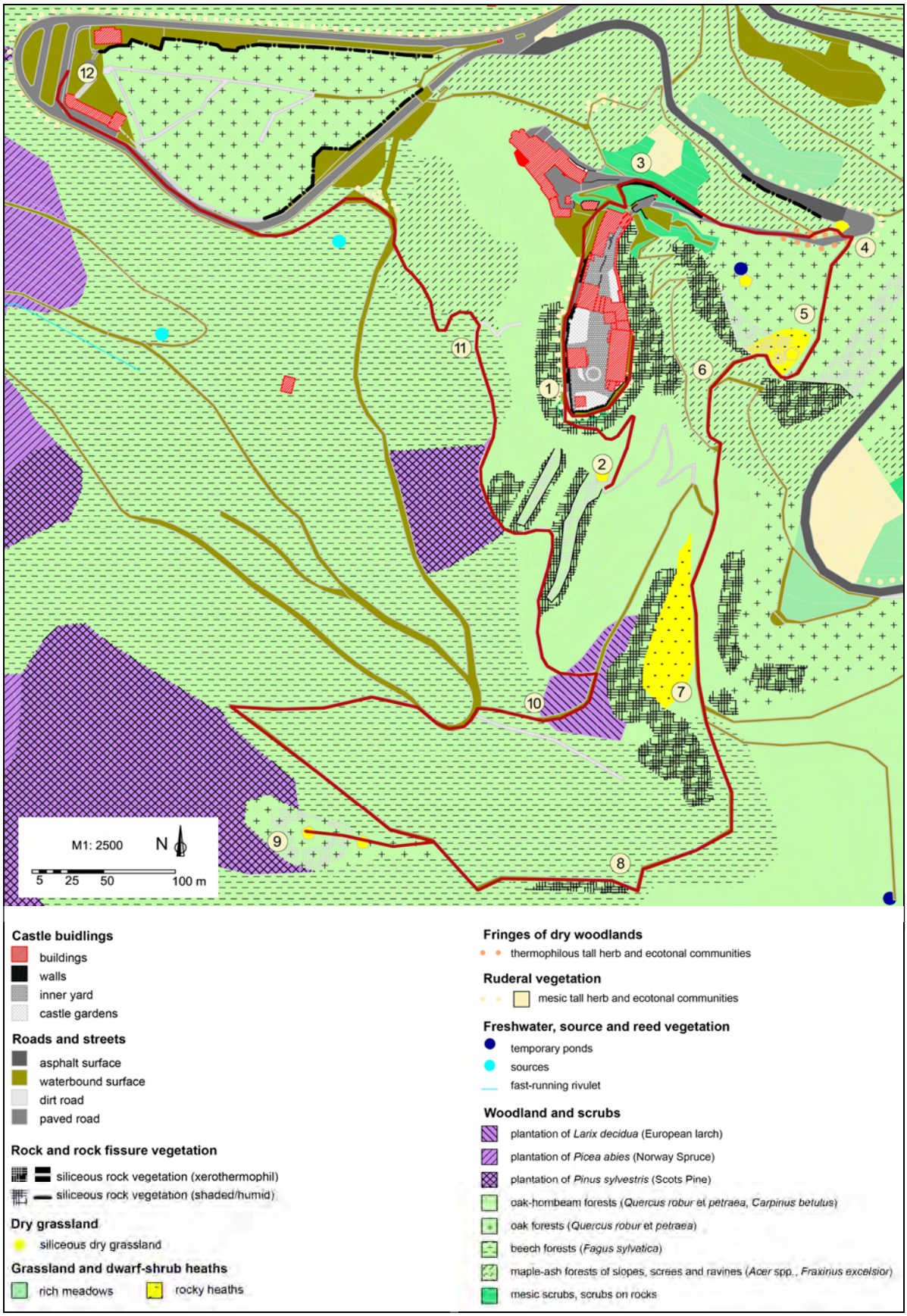

Figure17: Map of biotope types in the Wartburg area (from HÖLZER 2008) and – in red line - excursion route with stations 1-12 (based on TK10 5027 NO Eisenach, permit number: --151 548 / 2008--)

Station 12 – Geological natural monument and annual trampled communities

Annual trampled communities occur in linking elements of paving, on waysides, and on frequently trodden surfaces (e.g. rocks). In the car-park, we will find the alliance *Matricario matricarioidis-Polygonion arenastri* Riv.- Mart. 1975 corr. Riv.-Mart. et al. 1991 with the very common association *Poetum annuae* Felf. 1942. Typical species are *Poa annua, Plantago major* and *Taraxacum officinale*.

The geological monument 'Wartburg-conglomerate' is located in the car-park (Figure 19). This monument gives an impressive example of the typical bedrock of the area with its sequence of puce-coloured conglomerate alternating with loamy layers of sandstone.

Figure 18: Typical 'castle forests' (maple pioneer woodland on rubble) above an underground wastewater disposal line (June 2007)

Figure 19: Geological natural monument Wartburg-conglomerate (March 2007)

8 Influence of the Wartburg Castle on the surrounding vegetation – conclusions

More than 1000 years of human interference has left its mark on the Wartburg area. The specific utilisation of the woodland area as well as the impact from the castle itself (e.g. eutrophication by waste deposition, introduction of foreign species for gardening) influenced the development of the surrounding plant communities. This influence lessened with increasing distance to the castle.

- The Wartburg area is characterised by natural woodlands composed of acidophilous beech forests, oak-hornbeam forests, dry oak forests, and lime-maple forests.
- Adjacent to the castle, typical plant communities for castles have developed including wall vegetation, vegetation of rocky habitats, nitrophilous scrub with predominantly non-native species (e.g. *Syringa vulgaris, Symphoricarpos albus*), eutrophic maple pioneer woodland, and nitrophilous ecotonal communities.
- 23 % of the plant species in the Wartburg area are non-native but only five species are invasive (*Fallopia japonica, Impatiens parviflora, Robinia pseudoacacia, Symphoricarpos albus, Solidago canadensis*) according to MÜLLER et al (2005). Nearby the castle some non-native species have been able to invade the natural communities (e.g. *Cymbalaria muralis, Doronicum pardalianches, Sedum spurium, Tanacetum parthenium*) but they are restricted to the close vicinity of the castle or to gorges and valleys leading away from the castle. Only *Impatiens parviflora* is widely distributed within the area.
- Typical vegetation types for castles such as wall vegetation and ruderal communities are only

fragmentarily developed. Wall vegetation can be found almost exclusively on the southern castle walls with *Cymbalaria muralis* and *Asplenium ruta-muraria* as typical species.

- Ecotonal communities are widely spread over the area. Dependent on the specific site conditions, they can be characterised as thermophilic, mesic or eutrophic. Of note are the thermophilic ecotonal communities within the dry oak woodlands. They contain rare species such as *Trifolium alpestre* and *Anthericum liliago*.
- Only ten species typical for castles (DEHNEN-SCHMUTZ 2000) have been recorded, e.g. *Hedera helix, Laburnum anagyroides, Sedum spurium, Syringia vulgaris, Vinca minor*.

The future development of the area is difficult to predict in the long run. The propagation of agrophytic species surely will continue but to what extent depends on many variables. Disturbance caused by human interference as well as climate change will influence the typical castle flora as well as the natural plant communities. Global warming may facilitate the distribution of thermophilic, non-native plant species into the natural vegetation.

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Natur-Park Südgelände: Linking conservation and recreation in an abandoned railyard in Berlin

INGO KOWARIK & ANDREAS LANGER

1 Introduction

The particular political situation in Berlin between 1945 and 1989 had significant effects on the development of nature in the inner city. In the western part of Berlin, urban development ran in slow motion for four decades. In contrast to other parts of war-torn Europe, here large, formerly built-up areas that had been destroyed in the war remained free of renewed development; these areas were set aside as reserves to allow for future planning with Berlin as the capital city. In four decades, natural colonization processes on numerous, often heavily fragmented areas led from herbaceous and shrub stages to wild urban woodlands. The same occurred on many railyards in West Berlin because the rights for all Berlin railyards had been given by the Allies to the Reichsbahn, whose seat was in East Berlin. This organisation controlled by East Germany, reduced train service to a minimum in West Berlin, allowing natural succession to begin on many old railyards.

The special political situation of West Berlin also made possible here, earlier than in other places, the development of specific urban-industrial ecosystems which we identify today as a particular type of nature, as 'nature of the fourth kind' (see KOWARIK 2005); these ecosystems have long been studied systematically by Berlin's urban ecologists (see overview in SUKOPP 1990). The plans of the Berlin administration provided for the integration of many of these areas into the urban open-space system because, in the walled-in western part of the city, the availability of green spaces and opportunities for experiencing nature were seen as particularly important. After reunification in 1989, construction began on many new wilderness areas. This reversal was a symptom of a joyful change, but meant a risk that the social and ecological functions of inner city abandoned areas would be lost. In addition to recreation functions and ecosystem services (e.g. climate regulation, hydrologic cycling), cultural-historical functions would be affected as well. The abandoned areas, with their characteristic mosaic of the remnants of former uses and natural recolonization stages, call to mind the history of the sites, especially of the historical events that first made such new natural development possible. The Schöneberger Südgelände, which we present in this chapter, is an exception, as its condition has been secured. Originally a desolate freight railyard, then for over four decades an almost untouched new wilderness, today it is one of the first official conservation areas in Germany in which urban-industrial nature is protected and made accessible to the public. We wish to show, with the example of the 'Natur-Park Südgelände', how different goals have been united and how the conceptual and design principles have opened up access to the new wilderness.

2 From freight railyard to 'new wilderness'

The Wartburg area is situated south of Eisenach within the low mountain range on the The Südgelände, approximately 18 ha, lies on the southern border of the inner city of Berlin in the district of Schöneberg-Tempelhof. It is a component of a much larger freight railyard ('Rangierbahnhof bei Tempelhof') that was built between 1880 and 1890. Old photographs show a desolate railyard on

which trains have been shunted on a multitude of parallel tracks. Tracks for the long-distance trains as well as for the inner-city express train define the area to the east and west. From the north and the south, heavily trafficked streets adjoin the site, with the result that the Südgelände has an island-like character despite its urban location.

After train service was discontinued in 1952, the Südgelände was mostly, but not entirely, abandoned. A large hall was still used for repairing the train cars, so access had to remain open. Trains were still shunted on a few tracks for a few years. On the majority of the site, however, natural development began to take place, which, by 1981, had led to a richly structured mosaic of dry grasslands, tall herbs, shrub vegetation and individual woodlands. Table 1 illustrates that between 1981 and 1991, the proportions of herbaceous vegetation and vegetation dominated by woody species had reversed. In only 10 years, the area of woodlands had doubled from 37 to 70 %. Pioneer species predominate, especially the native *Betula pendula* and the North American *Robinia pseudoacacia.*

Table 1: Decline in herbaceous vegetation and increase in woody vegetation over a ten-year period on Berlin's Südgelände (after KOWARIK & LANGER 1994, data from ASMUS 1981 and KOWARIK et al. 1992)

	1981	1991
Area of research (ha)	22.4	20.0
Investigated vegetation cover (ha) (= 100%)	21.6	19.1
Herbaceous vegetation (%)	63.5	30.9
Woody vegetation (%)	36.5	69.1
Dominated by:		
Robinia pseudoacacia (%)	11.2	21.3
Betula pendula (%)	13.7	23.8
Betula pendula & *Populus tremula* (%)	?	5.3
Populus tremula (%)	1.3	2.3
Acer platanoides, A. pseudoplatanus (%)	0.2	1.4
Others (%)	10.1	15.0

A study of the vegetation types showed that both the herbaceous and the woody vegetation are richly structured (ASMUS 1981; KOWARIK & LANGER 1994) and provide habitats for a multitude of plant and animal species (Table 2). Rare and threatened species are found primarily in the dry grasslands and only rarely in the woody vegetation. A large proportion of the vegetation is typical of cities and differs greatly from the species composition in the rural surroundings. Among the woodlands, there are substantial differences between stands of native and non-native species. In the birch and poplar stands, a convergent development to forest communities that approach the original, widely distributed oak–pine forests is becoming apparent. In the black locust stands, on the contrary, a divergent development can be noted that can be traced back to a combination of properties of black locust that the native trees don't have at their disposal. Nitrogen fixation promotes the establishment of more demanding species (*Acer platanoides, A. pseudoplatanus*), and clonal growth allows black locust to regenerate within its own stands, so that it is unlikely to be entirely driven out by other trees (KOWARIK 1992, 1996a, b). At least in these stands it is foreseeable that the new wilderness will be very clearly differentiated over the long term from the original communities that occurred in the Berlin area.

3 From new wilderness to nature park

The development of new wilderness took place at the Südgelände nearly unnoticed for a long time due to the inaccessibility of the site. Plans to completely clear the vegetation in order to erect a new freight train station led, at the beginning of the 1980s, to strong protests and to the founding of a NGO which has worked since then to preserve the Südgelände as a nature area. As a result of these efforts, a number of studies were undertaken that demonstrated the high species richness and the presence of rare species at the Südgelände (Table 2). At the end of a very changeful planning process (details in MOHRMANN 2002), it was determined that the Südgelände would be set aside and developed as a nature park as a compensatory measure for new railyards in the inner city area. After a preliminary study (KOWARIK et al. 1992), the Grün Berlin Park und Garten GmbH, a semipublic corporation for the development of prominent green-space projects in Berlin, commissioned the planning group ÖkoCon & Planland with the design of the nature park. After an implementation period, which was financed with funds from the government of Berlin as well as the Allianz Umweltstiftung (Allianz Foundation for Sustainability), the nature park was opened to the public in May 2000. The area has been legally set aside as the Schöneberger Südgelände landscape and nature conservation area.

Table 2: Species richness of the Schöneberger Südgelände (sources: KOWARIK et al. 1992, PRASSE & RISTOW 1995, SAURE 2001, DAHLMANN pers. comm.)

	n
Vascular plants	366
Breeding birds	28
Macrofungi	49
Grasshoppers and crickets	14
Spiders	57
Wild bees and wasps	208

4 Challenges and approaches of the master plan

The master plan for the Natur Park Südgelände had to find planning solutions for two classic conflicts that likely arise frequently in the development of urban woodlands.

4.1 The 'conservation versus recreation' conflict

The species diversity of the Südgelände (Table 2) has, in principle, developed without human intervention. The dry grasslands in which most of the rare species are found, have emerged on nutrient-poor anthropogenic soils and are not suited to being trampled. If the small clearings of the grasslands are made accessible to visitors, eutrophication and trampling will foreseeably lead to a decline of most of the rare species. Excluding visitors, however, contradicts the goal of urban nature conservation, which is, above all, to promote natural experiences for urban residents (AUHAGEN & SUKOPP 1983). Keeping in mind the general lack of public acceptance for nature conservation in Germany (KÖRNER 2005), there is all the more need in urban nature conservation to combine social functions with species conservation functions.

4.2 The 'wilderness versus biodiversity' conflict

In general, species diversity is greater in the earlier and middle stages of succession than in later woodland stages. This is true for the Südgelände as well with one small exception. The 40- to 50-year-old black locust stands have shown themselves to be astoundingly rich in plants, ground beetles, and spiders (KOWARIK 1992; PLATEN & KOWARIK 1995). Rare and threatened species of plants as well as hymenoptera, however, are predominantly found in the dry grasslands (PRASSE & RISTOW 1995; SAURE 2001). A substantial increase in woodlands would emphasize the wilderness character of the Südgelände, but would also lead to a decline in the characteristic species and communities of the open landscapes. Thus, the master plan for the Natur-Park Südgelände had to address two challenges: first, how to open the site to the public without endangering the rich local flora and fauna, and second, how to respond to the natural vegetation dynamics that would, in a short time, lead to a complete dominance of woodlands.

4.3 The model of culture and wilderness

The approach of the master plan was based on the model of simultaneity of culture and wilderness, of distance and nearness of the visitor. To implement this, a concept of zoned spaces was created in which natural and social processes were partially controlled and partially left to their own dynamics. With this approach, different goals could be combined with one another.

- In some areas, uncontrolled development of the new wilderness is allowed, without influence on the species composition. In this way, the important role of non-native species in the vegetation of the Südgelände and as a characteristic of urban vegetation was expressly accepted.
- In other areas, the open landscapes are maintained, within which succession is to be controlled through maintenance. The goal is to maintain habitats for the characteristic and often rare species of the grasslands and other non-woody vegetation communities. In these areas, remnants of the earlier railway uses should remain at least partly recognizable. The open areas allow the underlying cultural layer of the old railyard to be easily perceived, which contrasts distinctly with the naturally derived wilderness character of the woodlands.
- In a large part of the park, the visitor may move about completely freely. A newly created path system should open the site to visitors who otherwise would have no access to the urban wilderness of an abandoned railyard.

5 Implementation of the model

Figure 1 shows the Natur-Park Südgelände today, after significant implementation of the master plan. A few new elements were added to our planning during the implementation phase, including additional paths and the integration of works of art in the nature park.

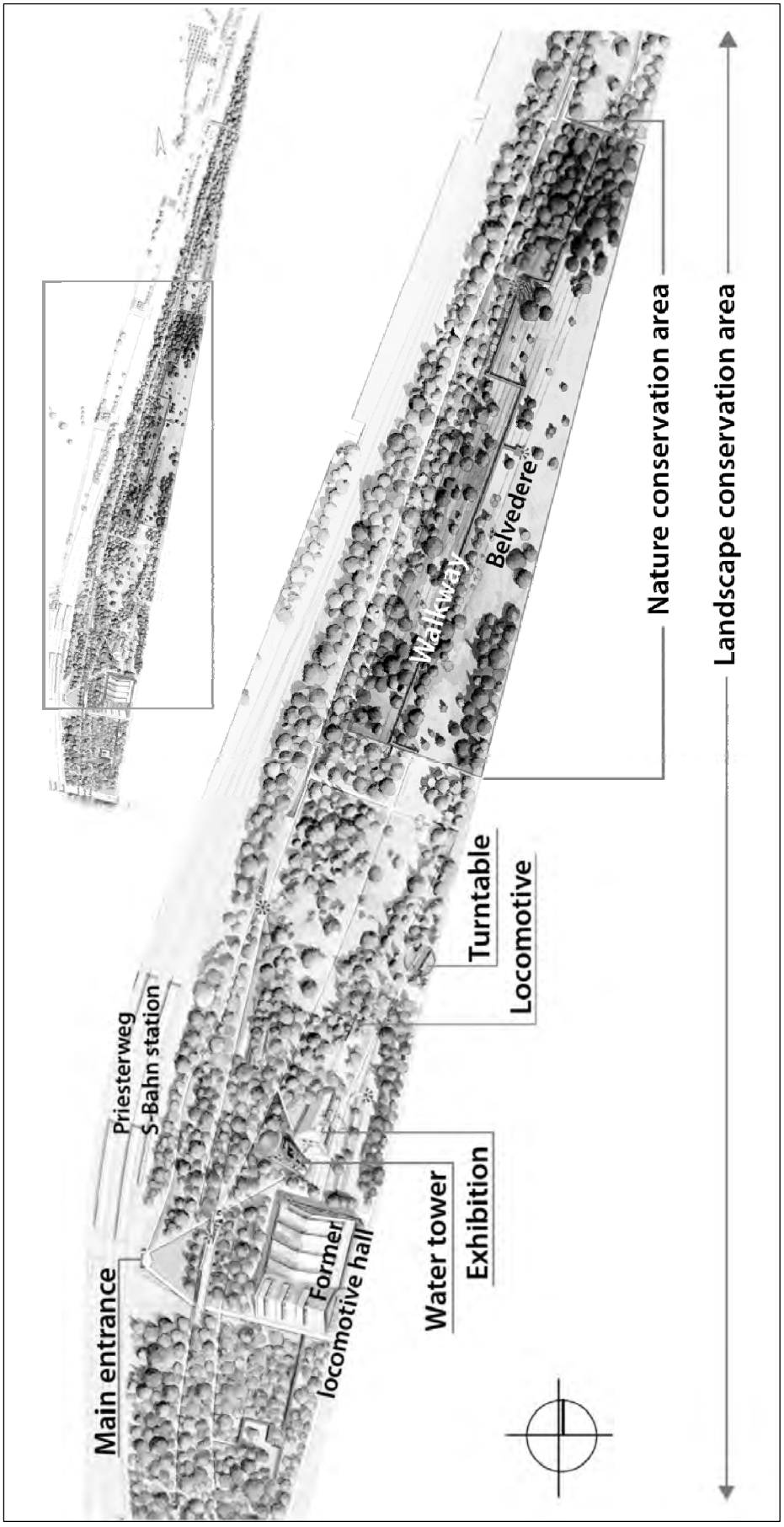

Figure 1: Plan of the Natur-Park Südgelände with enlarged central section. During the implementation of ÖkoCon & Planland's master plan further elements were added, mainly works of art of the Odious group (Illustration: M. Ley and K. Zwingmann, Berlin, on behalf of the Senate Department of Urban Development Berlin)

5.1 Access concept

Starting from the park's main entrance at the S-Bahn station Priesterweg, a path system was developed that is based, fundamentally, on the linear structure of the earlier railyard. Here train tracks were made into paths (Figure 2). Existing ramps and underpasses that once served for crossing the tracks were used to establish the path system on three different levels. Through this inclusion of the third dimension, quite different views of the area result. Because the vegetation was maintained between paths that are very near to each other, the area is perceived as larger than it actually is. A few new connections make circular routes possible. The nature conservation area in the middle of the Südgelände is accessed by a path as well, this one, however, runs as a raised walkway 50 cm above the vegetation while following the old tracks for the most part (Figure 3). Its design was the result of the work of the artists' group Odious. Through this new path typology it is clear to the visitor that the nature conservation area, in contrast to the rest of the Südgelände, should not be accessed off of the paths.

Figure 2: Existing train tracks are used for the path system in the Natur-Park Südgelände (above, left). The nature conservation area in the center of the Südgelände is accessed by a raised walkway (below, left) from which the dry grasslands and the uncontrolled wilderness of the urban woodlands (above, right) can be perceived without leaving the path. The above, right picture shows a stand of the non-native *Robinia pseudoacacia*, which has been entirely left to the natural processes of the forest dynamics.

5.2 Definition of a room typology

In order to make clear, in accordance with the general model, the transformation from railyard to urban wilderness over time, the natural dynamics of some areas are arrested. In this way, three types of spaces or 'rooms' were defined: 'clearings' are to be kept free of shrubs over the long term. Stands that are light and open are to be maintained as 'groves', while in the 'wild woods' the natural dynamics can proceed fully unfettered. The spatial determination of the three types was carried out according to nature conservation and landscape aesthetic criteria. In addition to the presence of rare species and communities, lines of sight within and outside of the site were considered as well as relics of the old rail industry and particularly attractive vegetation and individual trees. Before the opening of the nature park, plants were removed from overgrown areas that were once clearings or

groves in order to create the predefined room structure. The open character of these rooms is ensured through long-term maintenance (mowing, removal of trees) by the Berlin nature conservation authority. The spread of the 'wild woods' into the other spaces is prevented through maintenance measures. In the interior of the woodlands, natural processes proceed undisturbed (Figure 2).

Figure 3: Creative tension between the natural dynamics of the Südgelände and the relics of the railway industry as well as the new artistic elements. The reforestation of the clearings (middle right) and the groves (below left) is prevented with maintenance measures. The picture below right, shows an art installation of the Odious group.

6 Nature conservation and recreation

Most of the Natur-Park Südgelände is protected; the core area has been designated as a nature reserve (3.2 ha) and the rest as a landscape conservation area (12.9 ha). In the nature reserve, species conservation takes priority. The targeted species are, above all, insects of open habitats and plants of the dry grasslands, such as several rare hawkweed (*Hieracium*) species. The clearings, which may not be entered by the public, are cared for in such a way as to give the characteristic species of the open landscape a chance to survive. The landscape conservation area is to be fully accessible.

Dangerous areas that aren't visible (e.g. shafts) were secured before the park was opened. The defined rooms are stabilized through maintenance measures. In the landscape conservation area, an attractive landscape image is more the goal than species conservation. Since its opening in May 2000, the Natur-Park Südgelände has proved to be very attractive to visitors. Estimates start at 50,000 visitors per year. A long-term exhibition on the history and nature of the Südgelände in one of the old train buildings had approximately 6,000 visitors in 2003.

To maintain the visibility of the remnants of the railway history in the face of the powerful natural dynamics, selected railway relics such as the signals and the old turntable were restored. The many paths set in the old tracks are a permanent reminder of the cultural foundation of the nature development of the Südgelände. A new cultural layer has been established through the art works of the Odious group, which present a creative tension with the developing wilderness as well as with the relics of the railway (Figure 3). The water tower was secured as a landmark of the Südgelände, old buildings were surrendered to a controlled decay or are used for the exhibition or as studios for the artists.

7 Conclusion

Is the Natur-Park Südgelände a good example of a successful integration of urban wilderness into the open-space system of a metropolis?

What speaks in its favour is the simple fact that this kind of nature development has indeed been successfully safeguarded despite substantial competition for use in the reunited German capital. The contrast between dynamic nature and the remnants of the railway industry heritage is fascinating to all visitors. Unfettered wilderness development is always taking place in parts of the Südgelände. Through the spatially differentiated maintenance plan, the earlier and middle stages of nature development are maintained and thereby the diversified vegetation complexes are maintained in the long term. The species targeted for nature conservation profit as well from the maintenance measures. The public acceptance of the nature park is extremely high. The original railway wilderness has, however, clearly been affected by design interventions in the form of the new path system, the maintenance and the art objects.

Has this destroyed the original uniqueness, the 'wilderness' of the Südgelände?

Certainly the character of the site has changed. The few who earlier had discovered the Südgelände on their own recognize the contrast very clearly. To wake Sleeping Beauty, however, also means to open the urban wilderness to a multitude of visitors who did not have an inherent sympathy for the nature of urban abandoned areas. That such access, even designed access, satisfies a need for wilderness has been shown in studies such as the one by BAUER (2005). The wild urban woodlands of the Industriewald Ruhrgebiet (the Industrial Forest of the Ruhr) have been made accessible very successfully through landscape architectural means and through works of art (DETTMAR 2005). The Südgelände, however, is much smaller than most of the abandoned areas of the Ruhr, so the proportion of designed elements is greater here and perhaps sometimes compete with the natural processes that are characteristic of the area. Arrangements should therefore continue to be fine-tuned (KOWARIK et al. 2004).

Taken together, however, there is a great deal of evidence that the Natur-Park Südgelände has been successful in bringing humans living in urban neighbourhoods a step closer to biodiversity in its characteristic urban expression.

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Hainich National Park, Western-Thuringia – Biodiversity of a representative European beech forest (*Fagus sylvatica*)

MANFRED GROßMANN

1 Introduction

Hainich is a large deciduous wooded area in Thuringia, Germany, not far from the town of Eisenach with the famous Wartburg Castle. With a total area of ca. 16,000 hectares (13,000 hectares of which is forest), Hainich is the largest continuous area of deciduous woodland in Germany. On the 31.12.1997 the southern part of Hainich, with an area of 7,500 hectares, was declared Germany's 13th National Park. Since then it has been seen as a place of relaxation close to nature that is open to sustainable tourism. The area has gone through an amazing development which is quite unique.

For many years the military determined the history of the area. It was used from the thirties as a tank training ground for the 'Wehrmacht'. After 1945 the area was taken over by the Red Army. From 1965 onwards the National People's Army of the GDR also used the area for training. The civil population was excluded and as a result of the division of Germany the whole area was out of the way and isolated as it was only a few kilometres from the former inner German border, the so-called 'Iron Curtain'.

It was only after the political change in Eastern Europe and the reunification of Germany in 1990 that Hainich became of interest for the population again. After the first excursions to Hainich it quickly became clear to nature protection specialists that an extremely valuable nature paradise had developed in the shadow of the Iron Curtain. There was, however, damage to certain small areas due to the tanks and shelling. However, it was more important that hardly any forestry had taken place in the large wooded parts of the military training area. This meant that nature had been able to develop over the past fifty years creating what is very close to natural forests – something that disappeared a long time ago in Central Europe. Due to forest clearing for military use there were large open spaces which show now an impressive re-foresting process. Similar processes can also be seen on the shooting ranges which were kept short by sheep grazing. Due to these disturbances the former military site presents itself to the observer as a colourful habitat mosaic consisting of barren grassy areas on the edges which are interspersed with numerous pools as well as smaller and larger bushes and undergrowth, these areas are adjacent to areas of larger bushes which merge into a large variety of deciduous trees of different types and structures which house a large proportion of dead wood.

With the withdrawal of the military there was a unique chance to preserve the natural heritage of Hainich but also a chance to foster a development perspective for people in the region. In response to these opportunities the concept of a 'National Park' emerged. A deciduous National Park with beech had long been discussed in Germany. Beech forests are restricted by their nature to Europe, therefore, Germany has a special responsibility for their preservation. The beech forest of Hainich represents a typical European landscape. There are woodland areas which, without the influence of people, would naturally grow in large areas of Central Europe. Hainich presents a wide spectrum of beech wood types growing on limestone, where, in addition to beech, numerous other types of deciduous trees can be found such as ash, maple, oak and lime.

One of the main tasks of the National Park administration, founded in 1998, was to make the National Park known to the public and enjoyable for the visitor. It was necessary to create a minimum of tourist infrastructure in and around the National Park. However, for all the measures carried out in the National Park, the protection goal of "securing and creating an undisturbed process in which nature can continue" had to be taken into account. At the edge of the National Park, at the starting points for signposted circular walks, several car parks were installed with information facilities. In the first year of the park's existence, four information centres were installed around Hainich in order to provide the visitor with information on the National Park.

As a further attraction, but also designed for environmental education and research, the first canopy walk way in an European National Park was initiated in the year 2005.

As well as information on current events, brochures and publications about the National Park, the centres also allow visitors to see films, slide-shows and exhibitions. As early as the autumn of 1998 the National Park administration offered visitors a comprehensive programme with excursions, lectures and guided tours.

2 Land use history of Hainich

For many centuries the forest experienced an unregulated use: the wood was felled, where and how it was required at that time. In the late Middle Ages the look of the forest was shaped by 'Niederwald' (simple coppice forest) and 'Mittelwald' (coppice-with-standards forest) use as well as by forest grazing. Due to the increasing need for wood of the growing population the pressure on the wood increased and the first signs of overuse appeared.

From the mid 1900s a far reaching change occurred: the 'Mittelwald' forestry lost importance due to the beginning of the industrial era. In time the forest owners altered their forest management. Part of these changes included the creation of a selection forest ('Plenterwald') an uneven-aged stand with selective logging dominated by *Fagus sylvatica* (European Beech), a form of forestry which especially marked Hainich and made it quite well known in forestry circles.

The area of the National Park is almost identical with two previous military training areas. When the military took over the forest area in the 20th century the forestry use changed in the area of the current National Park. The intensity of use during the military period varied greatly throughout the area. Large areas were only lightly forested. Parts of the forest were able to become structure- and species-rich with large amounts of dead wood.

Apart from the forestry use the grazing of open areas also played a large role in Hainich. The forest edges were characterised by sheep tracks with extended juniper heath, of which fragments still exist today. During the military training period the shooting ranges were intensively grazed in order to keep the vegetation growth in check. This grazing is still taking place, even after the creation of the National Park, but in a much reduced area. In most of the formerly open land reforestation is taking place through succession.

3 Basic facts about the natural area

Hainich forms the western part of the shell limestone ring around the Thuringia Basin and belongs to the natural area ‘Hainich-Dün-Hainleite’. The mainly forested shell limestone plateau with altitudes from 300-500 m above sea level is characteristic of this natural area (Figure 1).

Figure 1: Hainich National Park - unique Central European beech forest on calcareous substrate

Hainich has an average annual precipitation of c. 600-800 mm and an average annual temperature of 7-8°C and thus lies in the transition area between the west European climate, influenced by the Atlantic, and the continentally influenced east European climate. The clear zonation in the west-east direction is reflected in the vegetation. There are, on average, 30-40 foggy days a year. The prevailing wind direction is south-west with a mean annual wind speed of 3.4 m/s.

The shell limestone takes up by far the largest land area in the territory with the dominating layer being the upper shell limestone. During the Pleistocene the upper areas of the Hainich were strongly influenced by landslides and the accumulation of loess. Steep escarpments were formed through the weathering of the lower shell limestone towards the valley of the Werra ('Werratal'). Anhydrite was washed out of the middle shell limestone which led to a flattening of the slopes on the eastern side towards the Thuringian Basin. These slopes are partly covered with loess deposits. The numerous stream valleys are typical of the eastern part; these usually only contain running water after heavy rainfall or snow melt. There are also many small sink holes, some containing running water, in the eastern part (the extended areas of the upper shell limestone) as a result of washing out processes in the middle shell limestone. The highest point in Hainich is the 'Alte Berg' at 494 m above sea level. The lowest point in the National Park lies at 225 m above sea level.

Weathering products of the upper and lower shell limestone dominate the National Park. Clay – alternating from loamy to stony – in 0.6 to 1 m thickness dominates above the upper shell limestone, which is followed underneath by platy clay rich limestone, chalk marl and clay marl. The Kalton-Rendzina formed here is the most common soil type in the National Park. Stony loam and Loam-Rendzina loamy skeleton soil are common in the lower shell limestone. The high areas, flat upper slopes and the slope hollows often contain Terra fusca. These are covered by loess in accumulation areas (lower slopes, dips, dry valleys) and in the eastern side of the territory. The flood plain areas of the extended stream valleys are covered by Holocene alluvial loam (Loam-Vega, Silt-Vega).

4 Species and habitat composition

4.1 Animals, plants and fungi

Plant, animal and fungal species typical of the Central European chalk beech forests are represented in Hainich. These are mostly common species, which are also found in other deciduous woodlands in Central Europe. However, due to the large forest area, the temporal stability, the high structural richness and the high proportion of dead wood, the National Park provides habitats for a wide range of common as well as specialised species. Prominent examples are *Felis silvestris* (wild cat, Figure 2), *Myotis bechsteini* (Bechstein's bat), *Dendrocopos medius* (middle-spotted woodpecker) and highly endangered dead wood beetle species. The faunal investigations so far support the high importance of the National Park for the conservation of old-wood and dead-wood inhabitants. This is also true for fungi, since numerous endangered wood-living species of fungi have been identified in the Park.

Figure 2: *Felis sylvestris* (wild cat), foto: Thomas Stephan

Species of nutrient-poor meadows, hedges and bush habitats as well as of small open water features are found in the large scrub and meadow areas outside the forest. Bird species such as *Saxicola rubetra* (whinchat), *Emberiza citrinella* (yellowhammer), *Sylvia nisoria* (barred warbler), *Lanius collurio* (red-backed shrike) and *Jynx torquilla* (wryneck) are found here as well as amphibians such as *Hyla arborea* (European tree frog), and numerous insect species. The following species of the Annex II Flora-Fauna-Habitate Directive are living within the Hainich area: *Myotis bechsteini* (Bechstein's bat), *Myotis myotis* (mouse-eared bat), *Barbastella barbastellus* (barbastelle bat), *Bombina variegata* (yellow-bellied toad), *Triturus cristatus* (great crested new), *Leucorrhinia pectoralis* (large white-faced darter), *Eurodryas aurinia* (marsh fritillary) and *Vertigo angustior* (narrow-mouthed whorl snail).

The compiling of species data was a focal point in the research work of the National Park in its first years. An annually updated species report of the National Park can be found under www.nationalpark-hainich.de (see Table 1).

Table 1: Species numbers of selected species groups in Hainich National Park (status 12/2006)

	n		n
mammals	46	spiders	224
birds	185	molluscs	97
reptilians	5	higher plants	806
amphibians	12	mosses	221
beetles	2002	lichens	134
butterflies	764	fungi	1580

4.2 Habitats and woodland types

Woodlands currently take up about 70 % of the area of the National Park with deciduous woodland having by far the largest proportion (see Figure 3).

The total area registered by Thuringia to the EU for the protected area network 'Natura 2000' as part of the FFH Regulation includes 244 areas covering 161,460 ha - equivalent to 10 % of the land area of Thuringia. The largest of these areas is Hainich with an area of 15,000 ha. Hainich National Park is incorporated completely in this area. The beech forests in Hainich are of European importance due to their species and habitat composition.

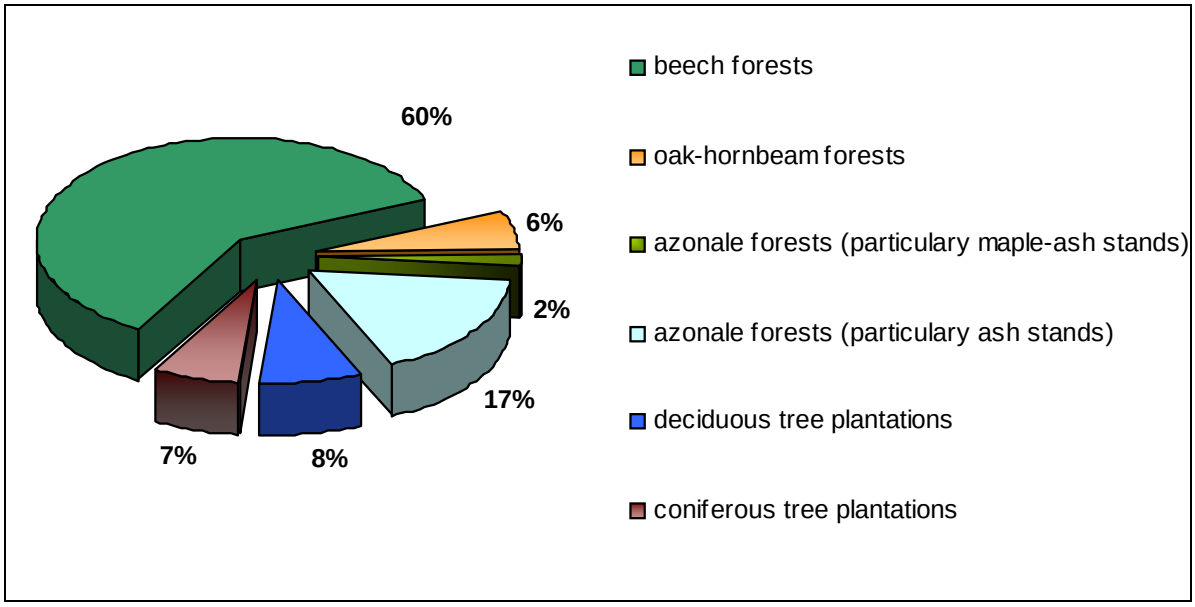

Figure 3: Woodland types within Hainich National Park based on the woodland biotope mapping in 1998/2003

3,391 ha of forest (=68 % of the mapped forest area) are allocated to one of seven forest habitat types according to the FFH Regulation. The habitat type *Asperulo-Fagetum* beech forests covers the largest area of the FFH habitat types in the National Park with more than 70%. Table 2, Figure 3 and Figure 6 show proportion and distribution of the different woodland habitat types.

Table 2: Annex I woodland habitat types of the Flora-Fauna-Habitat Directive in Hainich National Park

	area (ha)	proportion (%)
Asperulo-Fagetum beech forests	2.462	72,6
Medio-European limestone beech forests of the *Cephalanthero-Fagion*	521	15,4
Sub-Atlantic and medio-European oak-hornbeam forests of the *Carpinion betuli*	40	1,2
Galio-Carpinetum oak-hornbeam forests	277	8,2
Tilio-Acerion forests of slopes, screes and ravines	41	1,2
Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior*	50	1,4
Bog woodland	< 1	< 0,1
total	3.391	100

In Figure 6, the large areas of beech forest in the central and north-western part can be seen clearly. The pioneer forests are found at the edges of the former shooting ranges between the high forest and the open land as well as on the large clear-felled areas (from 1980/81) in the south. The drought resistant oak forests- almost all oak-hornbeam forests- are found mainly in the east of the National Park in the transition area to the continentally influenced Thuringia Basin with an annual precipitation of 500 mm. Azonal forests are found in the stream valleys. Culturally influenced deciduous and coniferous woodland only occur in small areas, mostly in the eastern part of the forest (see Figure 4 and Figure 6).

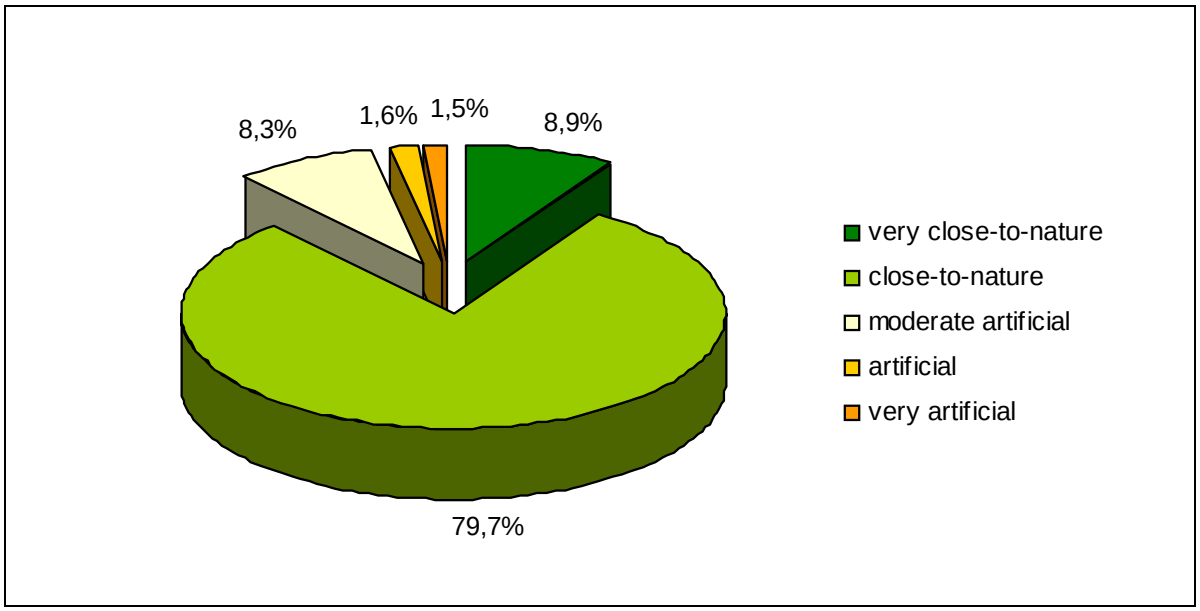

Figure 4: Naturalness (%) of the total woodland area in Hainich National Park

5 Outlook - What could be achieved with the creation of Hainich National Park?

(a) An area of primeval forest can develop again in the centre of Germany.

At the start of the foundation of the National Park there was already a large part of natural stock and only a few areas of unnatural, coniferous woodland. This meant that there were good pre-conditions for natural development. Due to the fact that deciduous trees were not cut down 90 % of the National Park can be considered unused. This means that with about 5,000 hectares, Hainich National Park has the largest area of non-managed broadleaved woodland in Germany.

Figure 5: Old beech forest stands with deadwood in Hainich National Park

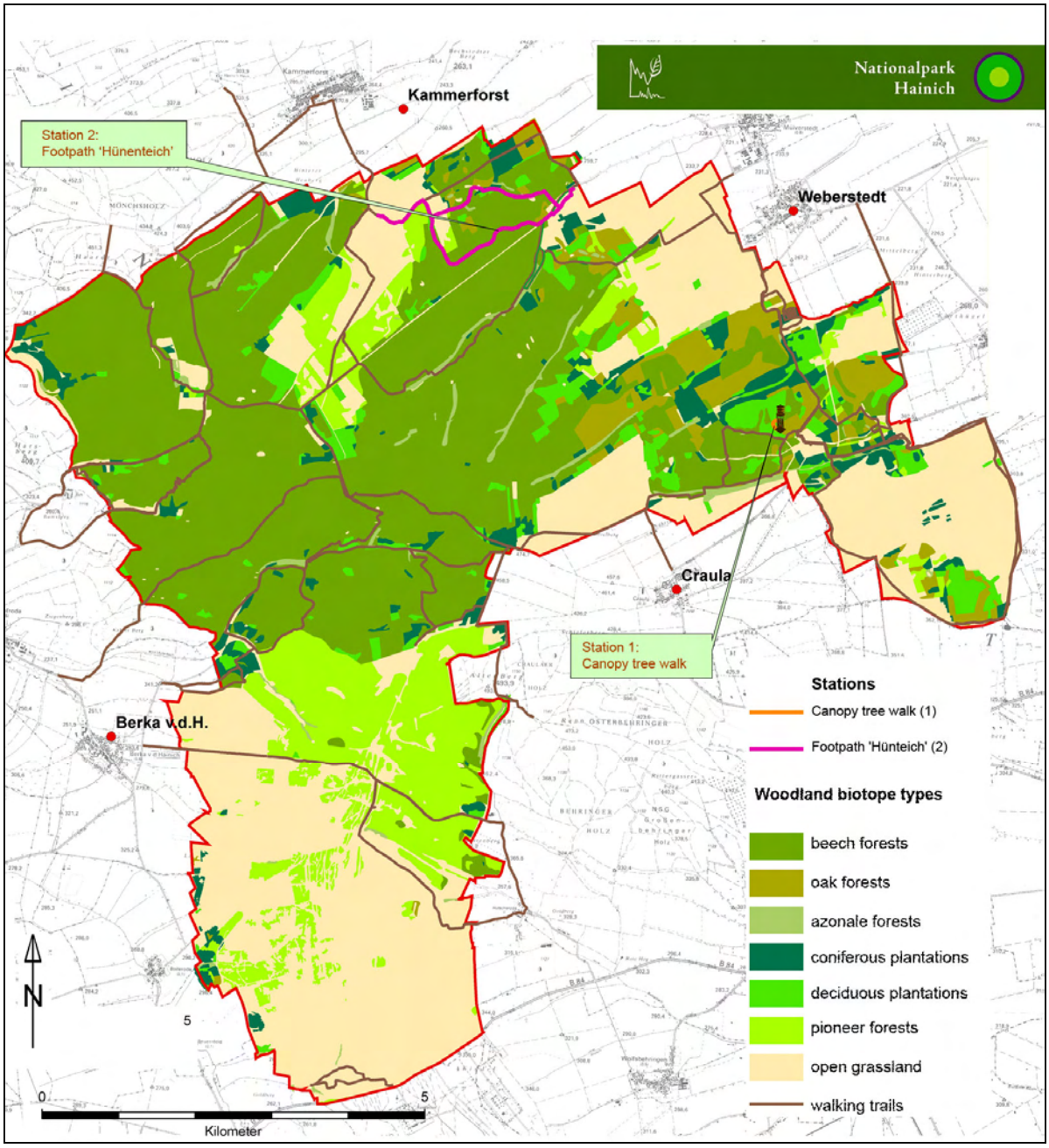

Figure 6: Map of Hainich National Park with excursion route and stations

(b) Hainich provides a valuable contribution to the preservation of European natural heritage.

Germany has a particular responsibility for the beech forest, which can only be found in Europe. Thuringia has lived up to its responsibility for the preservation of the beech forests and has registered the large areas of the deciduous mixed forest of the Hainich (total area c. 13.000 hectares) within the framework of the European protection network Natura 2000 according to the FFH directives. This is one of the largest beech forests in Europe and is an important building block for the Natura 2000 network. The following statistics clearly demonstrate the importance of Hainich for the preservation of biological diversity. Hainich National Park is home to: 46 species of mammals, 14 species of bats, 185 bird species, c. 2,000 varieties of beetles including endangered inhabitants of deadwood and c. 1,600 species of mushrooms (estimated more than 2,000 species)

(c) Hainich is an important reference area for conservationists and forestry personnel.

Hainich National Park is relatively small at 7,500 hectares but offers very good conditions for research into the dynamic processes in Central European deciduous forests due to its closeness to nature and the high percentage of unmanaged area. During the next few years and decades valuable knowledge for nature protection and forestry can be expected. For experts from Germany and abroad, with its natural vegetation of typical Central European trees Hainich is very important as a place for excursions and for study purposes.

(d) For the visitor there are excellent opportunities for nature leisure recreation and environmental education.

In Hainich the visitor can experience the motto for the German National Parks “Let nature be nature”. At Hainich National Park the visitor can find large areas of woodland which have been excluded from use by humans; feel the enormous power of nature; observe the competition for light, water, and nourishment; and explore the variety of habitats created by the undisturbed, ongoing processes of nature. Especially by enjoying the canopy tree walk, those natural processes and powers can be experienced and observed, in a so far unknown way.

(e) Future perspectives have been created for the National Park region

In 1999 the National Park administration, together with the adjacent municipal authorities, produced a brochure entitled “National Park Region Hainich – Nature and Culture in the Centre of Germany”. Due to its central position in Germany and its location in a rich cultural landscape (the famous Wartburg Castle is only 8 km ‘as the crow flies’ from the National Park) the future of the National Park region can be seen as extremely promising. The park has become well known. Also the advertising carried out over the past years is a cause for expectation that clear growth will take place over the next years. In the year 2004 the number of visitors was approximately 140,000 while the number of visitors rose in the year 2005 and 2006 considerably. The increase in visitors is in great parts due to the first European canopy tree walk in a National Park.

To summarise, Hainich National Park is an impressive example of how, through sensible use of former military sites and common efforts of those involved, excellent opportunities for both nature and people can be created in a region at the heart of Europe. The tanks have disappeared and now people can enjoy the play of nature and feel the power of nature which shapes this forest. Trees of all sizes, colourfully mixed, strange forms, mighty tree veterans, lying and standing deadwood, covered in mosses, lichen and mushrooms – a piece of prospective “primeval forest in the centre of Germany”.

6 Excursion

Station 1 – Canopy tree walk

The first canopy tree walk in a European National Park was initiated 2005 in Hainich.

The canopy tree walk is placed in the south-eastern parts of Hainich in a close-to-nature forest with 11 tree species and many different structures in the closer surrounding. The building contains a tower with a tree house and a view point that reaches above the trees, so one can enjoy the uncommon view over the tree tops and the pleasant setting of the park.

Figure 7: Canopy tree walk in Hainich National Park in April 2007

The path has a length of 310 meters, begins at the tower and guides the visitor in a wide arch downwards through the trees back to the tower. It affords unknown and impressive insights into the world of trees and the biology of European forests. In cases of good luck one can see the rare and protected Middle Spotted Woodpecker or other animals that occur in the park.

Another path, 21 meters over the ground, comes close to a group of old beeches. The building has a size of 44 meters and was mainly designed for environmental education, but there are also many possibilities to use it for research. The view point on the top of the tower offers a rare view over the mosaic of the tree tops and the pleasant setting of the park.

The canopy walk way can be considered as a particular successful device, as 30,000 visitors were counted in the first month and about 260,000 visitors in the first year.

Station 2 – Footpath ‘Hünenteich’

Stop over at:

- Spontaneous afforestation of former arable land and meadows
- Barrier-free adventure trail Brunstal
- Flora of a *Hordelymo-Fagetum* (Tx. 1937) Kuhn 1937 em. Jahn 1972
- Woodland en route to primeval forest
- Environmental education and wildcat forest for children
- Woodland in strange places (swamp forests of European alder in sinkholes)
- Spontaneous afforestation in former coniferous plantations

The footpath ‘Hünenteich’ is 6 km long with little variation in altitude. It starts at the car park ‘Fuchsfarm’ at the eastern border of the National Park. The path runs firstly through the former open areas (arable fields, orchards, meadows). At the entrance to the ‘Brunstal’ the path crosses the barrier free adventure trail ‘Brunstal’. The path continues through old beech forests which have not been used for the past 10 years, with some areas lying unused for longer. Half-way along the trail the path crosses over a former shooting range, which is now being re-forested. An environmental learning centre and a wild cat forest for children are situated at the edge of the shooting range. On the way back the path passes close by several sink holes to include these special features.

Habitat descriptions

Fagus sylvatica (European beech) is the dominant tree species. It is found in all forest associations as well as in small areas of extreme locations. The *Hordelymo-Fagetum* beech forest is found on the fresh, nutrient-rich and alkaline soil of the Hainich. This herb-rich beech forest is particularly impressive in spring with its plentiful stand of spring flowers. *Leucojum vernum* (spring snowflake) *Corydalis cava* (bird-in-the-bush), *Hepatica nobilis* (hepatica), *Viola reichenbachiana* (early dog-violet), *Anenome nemorosa* (wood anemone) und *Anenome raunculoides* (yellow anemone), *Allium ursinum* (wild garlic) and *Lilium martagon* (martagon lily) are particularly noticeable. The *Hordelymo-Fagetum* beech forest has certain characteristics, depending on the location. For instance there are large areas with wild garlic, a montane variation with the *Cardamine bulbifera* (bittercress) and stands with *Mercurialis perennis* (dog´s mercury). On the hill slopes and on loess deposits *Melica uniflora* dominates the under-storey whilst fern rich woodlands are found on the shady and cool northern and eastern slopes. In areas where the loess-clay layer is thicker and there is acidification of the upper layers the chalk-loving species are missing and the *Asperula-Fagetum* beech forest is found instead.

Apart from beech other tree species are also found in the *Hordelymo-Fagetum* beech forest, e.g. *Acer pseudoplantanus*, *Fraxinus excelsior* and *Carpinus betulus*. Less commonly are *Ulmus glabra* and *Sorbus torminalis*. With the exception of *Lonicera xylosteum* (fly honeysuckle) and *Daphne mezereum* (spurge laurel) there are no shrubs found under the closed tree canopy.

On some steep, south-exposed slopes, which are found only as small areas, the *Hordelymo-Fagetum* beech forest changes to a Medio-European limestone beech forest of the *Cephalanthero-Fagion*. Apart from *Convallaria majalis* (lily-of-the-valley), *Carex montana* (mountain sedge) and *Carex digitata* (fingered sedge), warm- and light-loving orchids are also found in these dry forests e.g. *Cephalanthera rubra, C.damasonium* (white and red helleborines), *Neottia nidus-avis* (bird's-nest orchid) and various *Epipactis* species.

As well as the beech forest the oak-hornbeam forest is found at the transition to the continental Thuringian Basin. These are relatively open forests, which offer a wonderful floral richness in spring. Species such as *Stellaria holostea, Galium sylvaticum, Milium effusum and Lamium galeobdolon* are characteristic of the herb layer. The tree layer consists mainly of *Tilia cordata* (small leaved lime), *Prunus avium* (wild cherry) and *Sorbus torminalis* (wild service tree) and *Acer campestre* (common maple).

Ash-maple stands are found in the moist valleys of Hainich. In wetter locations there are small stands of swamp forests with *Alnus glutinosa* (common alder) and *Carex elongata* (wetland sedge).

Apart from these forest associations, which occur naturally in Hainich, there are also substitute associations such as poplar and conifer stocks. These form only a small percent of the forest area.

The plant associations on the former shooting ranges are very diverse. They range from nutrient poor chalk meadows (partly ruderal) and fresh meadows and pioneer vegetation through to bush associations and pre-wood stages to the wood stage. Numerous small water features with their specific vegetation are mainly found in the south of the National Park due to the use of tracked vehicles in these areas.

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