

Editorial: Perspectives of Urban Ecology – The Metropolis of Berlin as a Natural and Socioeconomic System

Introduction to the Special Issue of DIE ERDE

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In the 21st century, urbanisation is a very dynamic process worldwide which is forecasted by experts to increase even further in the future. In Germany, already about 80 % of the population live in cities. So far, the majority of research studies on urban environments has been conducted within the field of social sciences, investigating topics such as human population growth and migration (Bonnes et al. 1990). Recently, however, more and more city dwellers including natural scientists are also concerned about “the urban natural system” and its special driving forces and patchwork patterns. Meanwhile, research on urban forests, parks or gardens, urban climate or urban hydrology is supported by powerful programs of international organisations such as UNESCO. The overall aim of urban ecology is to investigate the complex system of the urban nature and its interaction with the urban socioeconomic system. Urban ecology in a broad sense is an interdisciplinary field in which natural and social scientists and planners collaborate in order to improve living conditions and promote a more sustainable development (Sukopp and Wittig 1998, Breuste et al. 2005).

Similar to the earth system on a macro-scale, on a local scale the city can be considered to be driven by two strongly interacting systems: the *socioeconomic* and the *natural system*; the latter itself is composed of different subsystems or *spheres*. The most important are (Fig. 1):

- urban *atmosphere*
- urban *pedosphere*
- urban *hydrosphere*
- urban *biosphere* including urban flora and fauna (Endlicher 2004).

In the German capital city of Berlin, the natural urban subsystems have been systematically investigated since the early 1970s. Whilst studies on urban ecology were in the beginning forced by the special political situation, in particular the Berlin Wall, spectacular research results soon led to the establishment of the “Berlin School of Urban Ecology” headed by Herbert Sukopp (Sukopp 1973, Sukopp 1990). This is why Berlin is perhaps not only the best-researched city of Germany in terms of its ecological situation, but has also served as the exemp-

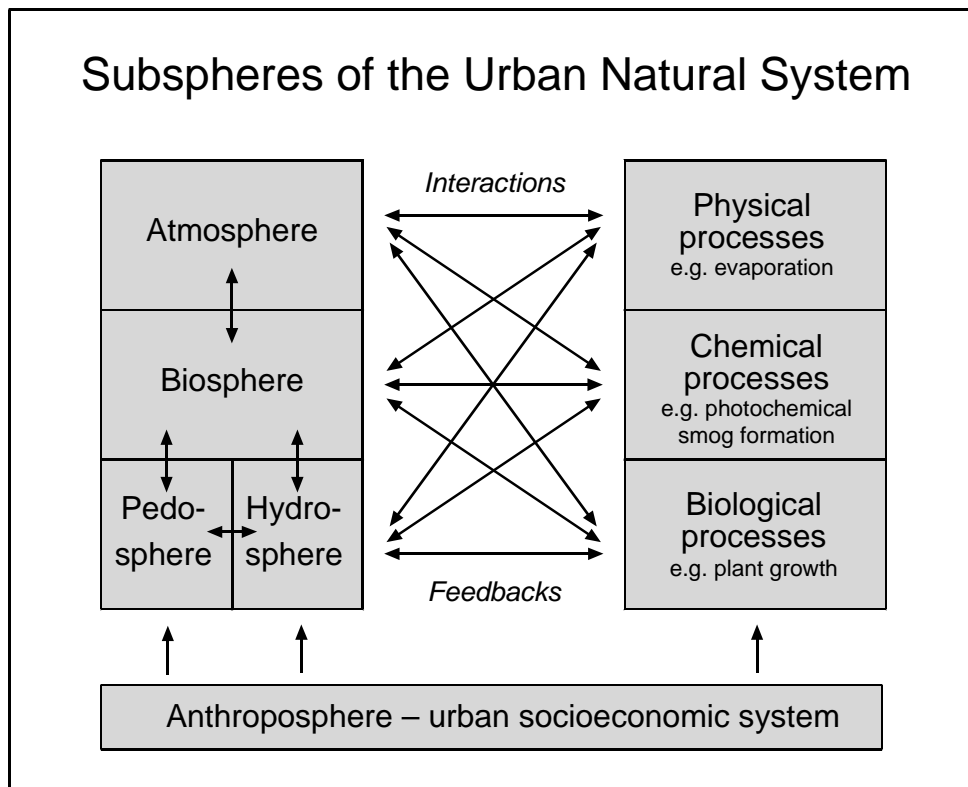


Fig. 1 The urban natural system and its subsystems / Das urbane natürliche System und seine Subsysteme

le for a growing number of studies on the subsystems mentioned above in many other cities. The Ruhr area, Germany's largest urban agglomeration, is another region where numerous problems of climate, soil and water have been the subject of intensive scientific research.

The field of the urban atmosphere, radiation and heat fluxes leading to the formation of the urban heat island as well as air pollution problems, have been widely investigated (Kuttler 1988, Endlicher and Lanfer 2003). In the *pedosphere* subsystem problems of soil sealing and soil pollution by hydrocarbons or heavy metals were addressed by specialised studies (Burghardt 1993, Arbeitskreis Stadtböden 1996, Blume and Schleuß 1997, Wes-

solek and Renger 1998, Kocher et al. 2002). In European metropolises the *hydrosphere* plays a very important role (Schuhmacher and Thiesmeier 1991). In Greater Berlin there are numerous more or less natural waterways, artificial channels, or transformed ponds. Availability and quality of surface and groundwater are of maximum importance as the Berlin water supply is exclusively realized within the administrative borders of the city. The three mainly abiotic subsystems are complemented by the two truly biotic subsystems, urban *flora* and *fauna*. In cities, the extinction of native species and the migration and sometimes establishment of neozoa and neophytes are some of the most important fields of research (Sukopp and Hejny 1990, Klausnitzer 1993, Sukopp 2003).

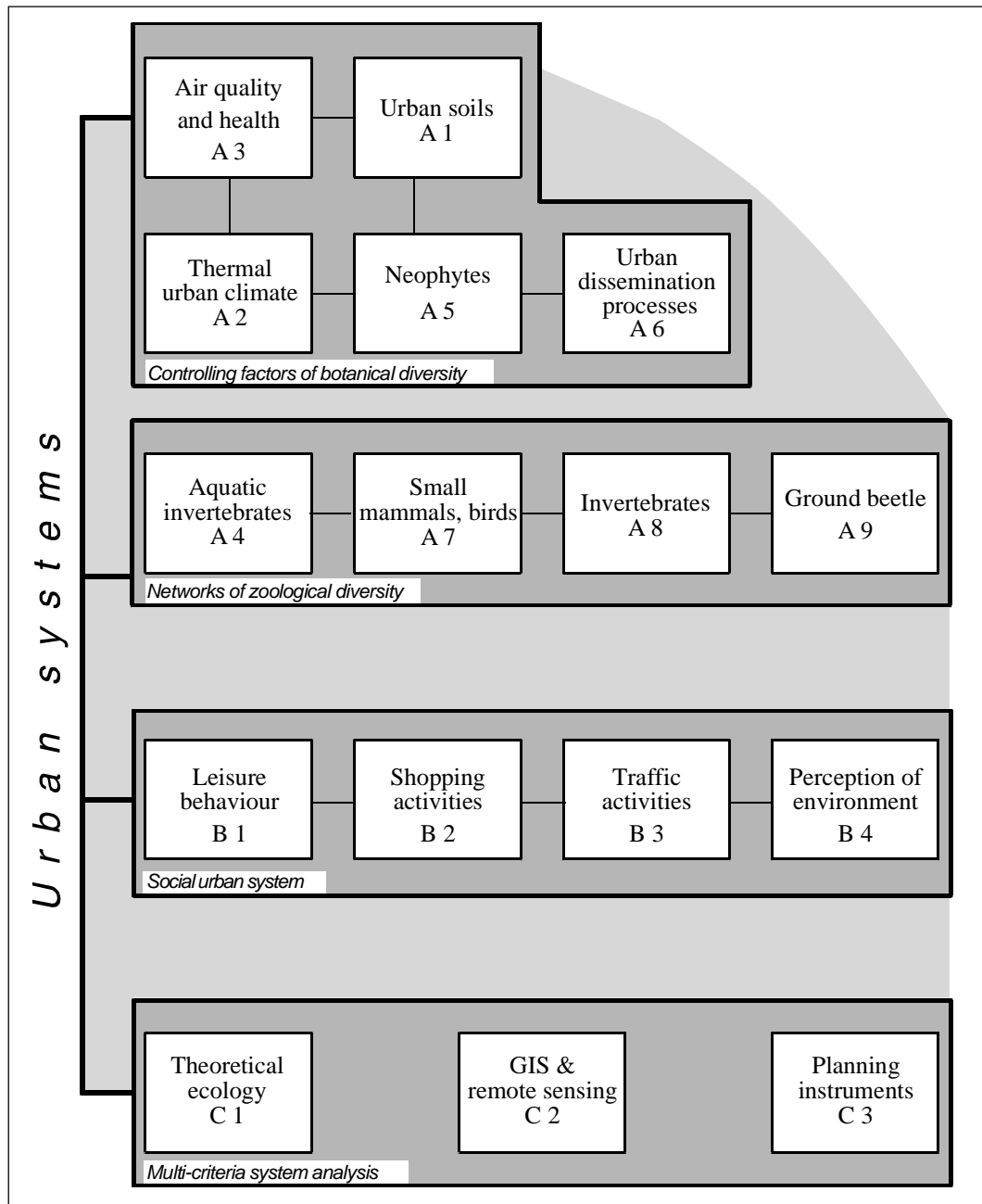


Fig. 2 Research themes and workpackages of the Graduate Research Training Program 780/1
 Forschungsthemen und Arbeitseinheiten des Graduiertenkollegs 780/1

The rediscovery of wild urban woodland, the wilderness just across the street coming up in urban brownfields, is another major research topic (Kowarik and Körner 2005).

The above-mentioned studies are examples for what Pickett et al. (2001) call "Ecology in the City": investigations focusing on the physical environment, soils, plants and vegetation, animals and wildlife. These studies opened the way for more detailed trans-disciplinary scientific investigation. It became evident that interrelated processes between the subsystems are most important for a better understanding of the city's nature as a whole: sensitive and latent heat fluxes inside the built-up structures depend on soil and water availability and the degree of sealed surfaces (Wessolek and Facklam 1997). The urban heat island is an important factor and driver for the invasion of alien species (Kowarik 2005). Worldwide urbanisation has massive effects on the populations of birds (Marzluff 2001), bats (Gehrt and Chelsvig 2003) or spiders (Shochat et al. 2004).

Today, however, the topical issue of urban ecological research is to understand the interactions between the natural and the socioeconomic system. This new research agenda is meant by the term "Ecology of the City" (Pickett et al. 2001). "Socioeconomics drive urban plant diversity" (Hope et al. 2003), "Integrating Humans into Ecology: Opportunities and Challenges for Studying Urban Ecosystems" (Alberti et al. 2003) or "Die Stadt als natürliches und gesellschaftliches System" (Endlicher and Kulke 2002) are examples of this new kind of scientific research. The aim of these studies is not only to supply suggestions for a more reasonable urban planning in order to bring nature closer to humans, but also to understand in more detail how human beings perceive urban nature and what the benefits are for both systems, the natural and the socioeconomic. Drivers (e.g. climate, population growth, infrastructure investments), patterns (e.g. heat islands, land use, transportation), processes (e.g. runoff, move-

ment of organisms, economic markets) and effects/changes (e.g. biodiversity, community dynamics, human behaviour) have to be investigated in an integrated way (Alberti et al. 2003).

This integrative approach was the basic idea of the Graduate Research Training Group "Perspectives of Urban Ecology (GRK 780)" of the Berlin Universities which started in 2002. Research Training Groups (*Graduiertenkollegs*) are university training programmes established for a specific time period to support young researchers in their pursuit of a doctorate. The Research Training Groups provide these doctoral students with the opportunity to work within a coordinated research programme run by a number of university teachers. Doctoral students are integrated into the research work being done at the participating institutions. The study programme aims to complement and extend the doctoral students' individual specialisations and aims to provide a structure for cooperation. An interdisciplinary focus of the research and study programme is desired (www.dfg.de).

The 16 subprojects of GRK 780 worked together in 4 workpackages (Fig. 2) addressing questions of both the natural and the socioeconomic system. The graduate students came from disciplines such as physical and human geography, biology, landscape ecology, planning sciences and urban studies. The five articles in this issue of DIE ERDE are written by members of GRK 780 and present first results of three years of integrated and interdisciplinary scientific investigations, reflections and research efforts. Wolf, Draheim and Endlicher, von der Lippe, Säumel and Kowarik, and finally Kübler and Zeller contribute to the knowledge of the natural system of the metropole of Berlin. These authors discuss aspects of the urban natural system: the distribution of particulate matter in the atmosphere, the anthropogenic dispersal of diaspores, the establishment and growth of neophytes and the feeding ecology of bird populations. The articles by Rosol and by

Lakes and *Pobloth* are related to the socioeconomic system and discuss problems of community gardens on the one hand and habitat networks and planning approaches on the other hand.

The outcomes of these studies are specific to Berlin, but contain many aspects of general importance in urban ecology.

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