

The effects of growth, shrinkage, population aging and preference shifts on urban development—A spatial scenario analysis of Berlin, Germany



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ARTICLE INFO

Article history:

Received 23 April 2015

Received in revised form

19 November 2015

Accepted 15 December 2015

Keywords:

Urban growth and shrinkage

Scenario simulation

Urban form

Demographic change

Reurbanization

Residential preference

Population aging

Berlin

ABSTRACT

We observe diverse urban development trends in European cities, with processes such as population aging, growth, shrinkage, and reurbanization having unclear consequences on land use and the urban form. The effects of these processes are especially difficult to determine when they occur quickly and simultaneously. We use varying scenarios of contrasting and exceeding variants of these urban development trends to uncover possible interactions by focusing on demographic and residential preference shifts that were simulated in a previously presented land use model (Lauf et al., 2012). Using urban form indicators and landscape metrics, we determine urban to peri-urban effects. Among other interesting results, we discovered that population aging expedited by population shrinkage greatly affects land consumption. This effect is especially pronounced in the outer city due to the residential preferences of elderly people and thereby reduces urban shrinkage. In contrast, a shift in preferences toward reurbanization reduces land consumption significantly. Population aging produces synergies in terms of urban growth and landscape fragmentation and trade-offs in terms of urban shrinkage and compactness, and the opposite holds for increasing reurbanization.

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1. Introduction

European cities are currently undergoing diverging urban development trends (Brade et al., 2009; Kasanko et al., 2006; Turok and Mykhnenko, 2007). These trends challenge urban planners and policy makers due to limited housing space in inner cities, land degradation due to urban sprawl and increasing environmental burdens (Alberti, 2008).

Urban development is the result of several processes, such as population dynamics and preference shifts, that can interact (Batty, 2007; Forman, 2008). These processes affect land use and the urban form and have crucial implications for cities in terms of infrastructure and green space provision, emissions and heat load, and possibly social cohesion (Bramley et al., 2009; Dugord et al., 2013;

Schwarz, 2010). Based on the major trends in European cities, the following processes can be distinguished and analyzed:

1. Growth and shrinkage (Haase et al., 2013).
2. Household and preference shifts (e.g., suburbanization versus reurbanization), (Buzar et al., 2007).
3. Population aging (Rechel et al., 2013).

Growth, shrinkage and preference shifts are predominantly socio-spatial urban processes (Brade et al., 2009). Urban shrinkage in cities that were among the first to industrialize often emerges when traditional industries begin to decline, which induces general economic crises, unemployment, low fertility, and outmigration to other prosperous regions (Couch et al., 2005; Haase et al., 2013). Urban growth is the result of the opposite trends. Suburbanization, or the growth of detached houses at the city edge, is considered to be the most prominent post-industrial urban development process and is widely attributed to the residential preferences of family households (Champion, 2001). In contrast, reurbanization describes a process of absolute or relative population gains in the

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inner city in comparison with its surroundings. Due to changing patterns of living arrangements and residential preferences, reurbanization captures both the populating and diversifying of the inner city by a variety of residential groups of different ages and socioeconomic backgrounds (Buzar et al., 2007). The Urban Audit data collected by the European Commission reveals that the above-listed urban development processes are occurring next to each other in different European cities (Eurostat, 2014). Moreover, current research by urban scholars suggests that these varying processes might occur in the same urban region simultaneously, e.g., in different residential segments or locations (Brade et al., 2009; Couch et al., 2005; Lauf et al., 2012). It is difficult, however, to predict which of these processes will dominate in the short term and how they interact.

In European cities, population aging can be observed per se as an aspatial process, but with characteristic implications for the urban space (Eurostat, 2014; Nefs et al., 2014), e.g., due to the specific preferences of the elderly (e.g., regarding housing), (Rosenberg and Everitt, 2001; Temelová and Dvořáková, 2012). Assuming that the urban demographic trends of the last 20 years hold, most European cities are aging and will continue to do so over the coming decades, especially under conditions of population decline (EU, 2011; Eurostat, 2014; FOBRP, 2008). Therefore, it is necessary to re-think the planning approaches toward transport, shopping and green infrastructure (Rosenberg and Everitt, 2001; Ugolini et al.,

2015). In addition, demographic research suggests that the trend toward small single- and two-person households will continue, not least because of increasing proportions of elderly people who generally live in smaller households (Eurostat, 2014; van de Kaa, 2001). As a consequence, more living space and more housing units might be needed despite an aging and declining population (Haase et al., 2013). Thus, these urban processes are accompanied by demographic changes that have unknown interactive effects, and their influence on urban and peri-urban land use patterns remains unanswered.

In this paper, we model the simultaneous effects of different assumptions on population aging, growth and shrinkage and reurbanization using the metropolitan region of Berlin. Berlin represents a suitable case study because all of the above-mentioned processes can be detected there. We link our assumptions to a previously implemented and well-validated land use change (LUC) model that covers the above processes (Lauf et al., 2012). We expect to detect the effects of each process and combinations thereof on urban development and the urban form in the Berlin metropolitan region by running the calibrated model for the time horizon of 2030. The study will allow a better understanding of the consequences of the simultaneously occurring processes of urban concentration and aging in a spatial sense.

Accordingly, the objectives of this paper are, firstly, to input recent and future urban development trends of (a) growth and

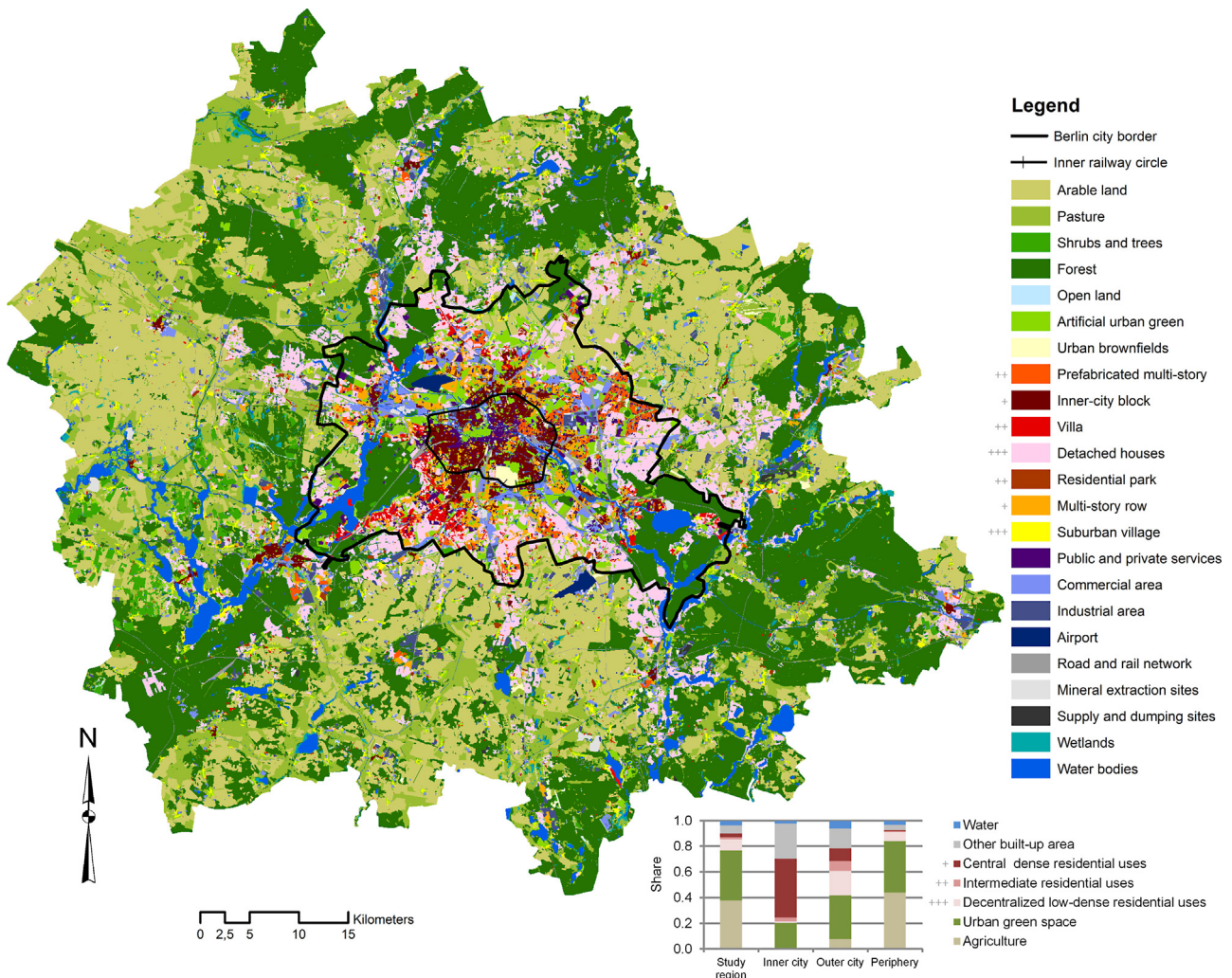


Fig. 1. The metropolitan region of Berlin; the listed land uses provide the basis for the applied LUC model; spatial units: the inner city (inside the inner railway circle), the outer city (between the inner city and the periphery), the periphery (outside the city border); plus signs indicate more general categories (cf. diagram below right).

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