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Short communication

A murmur in the trees to note: Urban legacy effects on fruit trees in Berlin, Germany

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ABSTRACT

This study aims to unveil historic legacy effects in the urban forest of the formerly divided city of Berlin, Germany. A tree survey based on a stratified random sampling approach across five land-use classes was analyzed in respect of fruit tree density in the former East and West. In order to consolidate the findings, data from a foraging website (*mundraub.org*) were analyzed in the same regard. Results show that more fruit trees can be found in East Berlin than in West Berlin. We attribute these findings to legacy effects of the separation of the city in the Cold War, when two different political, social and cultural systems of the 20th century led to different demands concerning fruit trees. Even though the city was reunited 25 years ago, today's ability to forage for fruit in Berlin is still influenced by legacy effects going back to the former division of the city.

1. Introduction

Urban trees are essential for delivering ecosystem services in cities. The benefits provided by trees include improving air quality (Nowak et al., 2013a; Taylor et al., 2011) and local climate (Hamada et al., 2013) as well as carbon storage (Nowak et al., 2013b). Trees also improve the psycho-physical well-being of urban dwellers (Koo et al., 2013) and the aesthetic quality of the urban environment. In addition, trees provide habitat for wildlife in cities (Shanahan et al., 2014). It is for these reasons that many cities have started ambitious tree planting programs in the past decade (see for example Lu et al., 2014 but also Pincetl et al., 2012).

Other benefits provided by urban trees are less well studied, not commonly utilized or not much is known about their utilization. This is true for timber and biofuel production (Tyrväinen et al., 2005; Zhao et al., 2014), but especially for food production (McLain et al., 2012; McLain et al., 2014; Poe et al., 2013). This does not mean that food production is not important in cities. In fact, it has been for most of history (Barthel and Isendahl, 2013) and is still essential for the livelihoods of many urban residents in the developing world (Hamilton et al., 2013). The lack of research on food provisioning by trees probably reflects the general bias of urban ecosystem service studies towards Western Europe and North America (Haase et al., 2014), where cities today depend mostly on outside sources of food (Folke et al., 1997; Morgan, 2009, 2014). But even there and in recent history, local food production played an important role during times of crisis, when every available spot was used for growing food during the Great Depression and after the World Wars (Barthel and Isendahl, 2013; Gröning, 1996; Lieske, 2010). This was also the case in Berlin, Germany (Lachmund, 2013; Maurer, 1998; Zerbe et al., 2003).

After World War II, Berlin was divided and like the two German states, the two parts of the city followed very different political and economic trajectories with far-reaching consequences for green development (Lachmund, 2013) but also food provisioning (Weinreb, 2010). While the quick economic recovery of West Germany allowed people to buy domestic and exotic fruit throughout the year and at low cost, this was not the case in the East (Lieske, 2010; Weinreb, 2010). Reflecting this, Maurer (1998) still found fruit trees planted during and after World War II in the 1990s in a housing estate located in former East Berlin. In a comparable housing estate in West Berlin, fruit trees planted after the war had been replaced by ornamentals.

Designing and conducting a tree survey in Berlin in 2013, we did not have such legacy effects of the city's Cold War past in

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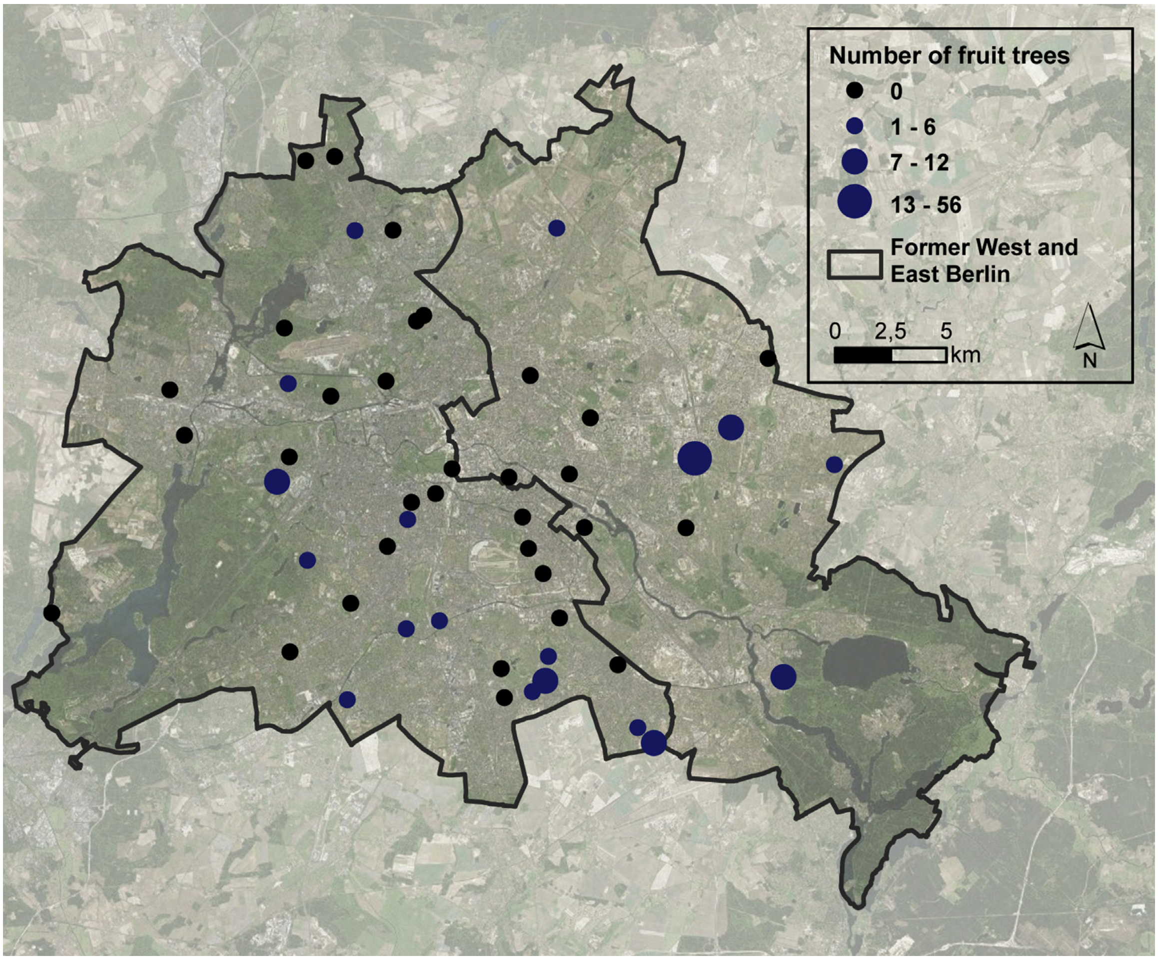

Fig. 1. Distribution of fruit trees on the 50 mapped plots; the size of the blue points indicate the number of fruit trees per plot, black points indicate plots without fruit trees. Basemap © ESRI, HERE, DeLorme, MapmyIndia, OpenStreetMap contributor and the GIS user community.

mind. Therefore, we were somewhat surprised when we found evidence of a higher number of fruit trees in East Berlin a quarter of a century after the city was re-united. We probably should not have been surprised, because legacy effects of former land use and socio-economic drivers on urban vegetation have been reported before (Clarke et al., 2013; Troy et al., 2007). In this short communication we will explore legacy effects on fruit trees within the urban forest of Berlin. We build on a tree survey conducted on sample plots across Berlin and on data from the web map portal *mundraub.org*, which allows users to located fruit trees in public spaces. The *mundraub.org* data represents a second, independent dataset on fruit trees in Berlin and it also allows us to discuss our findings in the light of contemporary foraging movements.

1.1. Study site

Berlin is the capital of Germany and its largest city with a population of about 3.5 million (Senatsverwaltung für Stadtentwicklung und Umwelt, 2012). After World War II, Berlin was divided into a British, French and American sector, which later formed West Berlin (486 km^2) and a Soviet sector which became East Berlin (405 km^2), the capital of the German Democratic Republic (GDR). West Berlin became an enclave of the Federal Republic of Germany (FRG) within the socialist GDR. After the collapse of the GDR in 1989 and the German reunification in 1990, Berlin became one city again.

1.2. Tree survey and analysis

A field study was conducted during the summers of 2013 and 2014 in Berlin on 50 plots each 1 ha in size. For stratification, five land-use classes from the Urban Atlas (European Commission, 2011)were used. They include four urban fabric classes (classification based on sealing rates ≤30%, 30–50%, 50–80% and ≥80%) and the green urban areas class. An area-weighted number of random points were placed within each of the five land-use classes. The final sample included eight plots in the ≥80% soil sealing class, 13 plots in the 50–80% soil sealing class, 11 in the 30–50% soil sealing class, six in the ≤30% soil sealing class and 12 plots in green urban areas. Five densely vegetated plots in green urban areas were mapped using a 15 m radius around the center, interpolating the results for the whole hectare. Plots were located using high resolution orthophotos. On each plot we determined the species and recorded the diameter at breast height (DBH) for all trees with a DBH above 5 cm. Of the 50 sampling plots, 12 were located in the East and 38 in the West (Fig. 1). The original goal of the study was to gather data on tree density and diversity across the Urban Atlas land-use classes for the use in ecosystem service assessments.

For statistical analysis, we first extracted data for the main fruit trees, namely apple (*Malus domestica*), cherry (*Prunus avium*), plum (*Prunus domestica*) and pear (*Pyrus communis*). The number of trees within the genera *Prunus* (plum, cherry), *Malus* (apple) and *Pyrus* (pear) is shown in Table 1. We then conducted Chi-square tests, as recommended for count data (Crawley, 2007). We explicitly looked