Understanding London using Open Data

Introduction

Worldwide, over half the population currently live in urban areas. Therefore, creating a healthy city environment has become a priority. Cities, however, are known to have a negative influence upon mental health, with mood and anxiety disorders being more prevalent in city dwellers (Peen et al., 2010) and schizophrenia incidence correlating with those raised in cities (Pedersen & Mortensen, 2001; Krabbendam & van Os, 2005). Although the general consensus attributes these findings to an urban city's environment, the specific characteristics are difficult to pin down and range from case to case. For example, overcrowding, increased noise pollution, or as discussed in this report, lack of access to green space.

It has been argued that natural environments support restoration, relaxation and well-being better than other environments (Kaplan & Kaplan, 1989; Laumann et al., 2001; Hansmann et al., 2007). Specifically, in a study by Bratman et al (2015), after a 90-minute walk through a green park participants reported decreased anxiety, rumination, and negative affect, compared to those walking in an urban environment. Furthermore, analysis by White et al (2013) suggests individuals are happier, showing significantly lower mental distress and significantly higher well-being, living in urban areas with greater amounts of green space.

Consequently, the aim of this report is to provide an initial exploration into whether anxiety levels throughout the boroughs of London vary depending upon the amount of green space and access to it. To carry out this analysis data from the London data store was downloaded for each borough's anxiety score, percentage of green space, and household access to different types of green space. The aim translates to the following objectives:

- To analyse the spatial distribution of levels of anxiety, area of the borough that is green space, and good access to nature.
- To determine if there is a correlation between anxiety levels and access to nature and green spaces of varying sizes.

Results

Firstly, four maps were created to show the spatial distribution and variation of levels of anxiety, area of the borough that is green space, and good access to nature (Figure 1).

For each map, there appears to be a general pattern moving from the centre of London outwards. The boroughs with the highest anxiety scores, City of London, Hackney and Islington, are clustered within the centre of London. Whilst the boroughs with the lowest score – Enfield, Harrow, Barnet – are in the far north-west. Similarly, the boroughs with the lowest percentage of green space are centrally located – City of London, Islington and Kensington and Chelsea – and the highest percentage are on the outskirts – Havering, Bromley, Richmond upon Thames.

The percentage of households with good access to nature follow a more convoluted, though still similar, pattern. Percentage of households with access to a local park, however, follows the opposite pattern, with the highest boroughs having a central location – City of London, Kensington and Chelsea and Tower Hamlets.

The observations from the maps suggest there may be a relationship between anxiety score and percentage of green space or access to nature. The Pearson correlation was therefore worked out for each variable (Table 1).

Table 1: *The Pearson correlation between anxiety score and the other variables.*

	Anxiety.Score
% of Green Space	–0.433
Access To Nature	–0.568
Local Park Access	0.48
District Park Access	–0.364
Metropolitan Park Access	–0.101

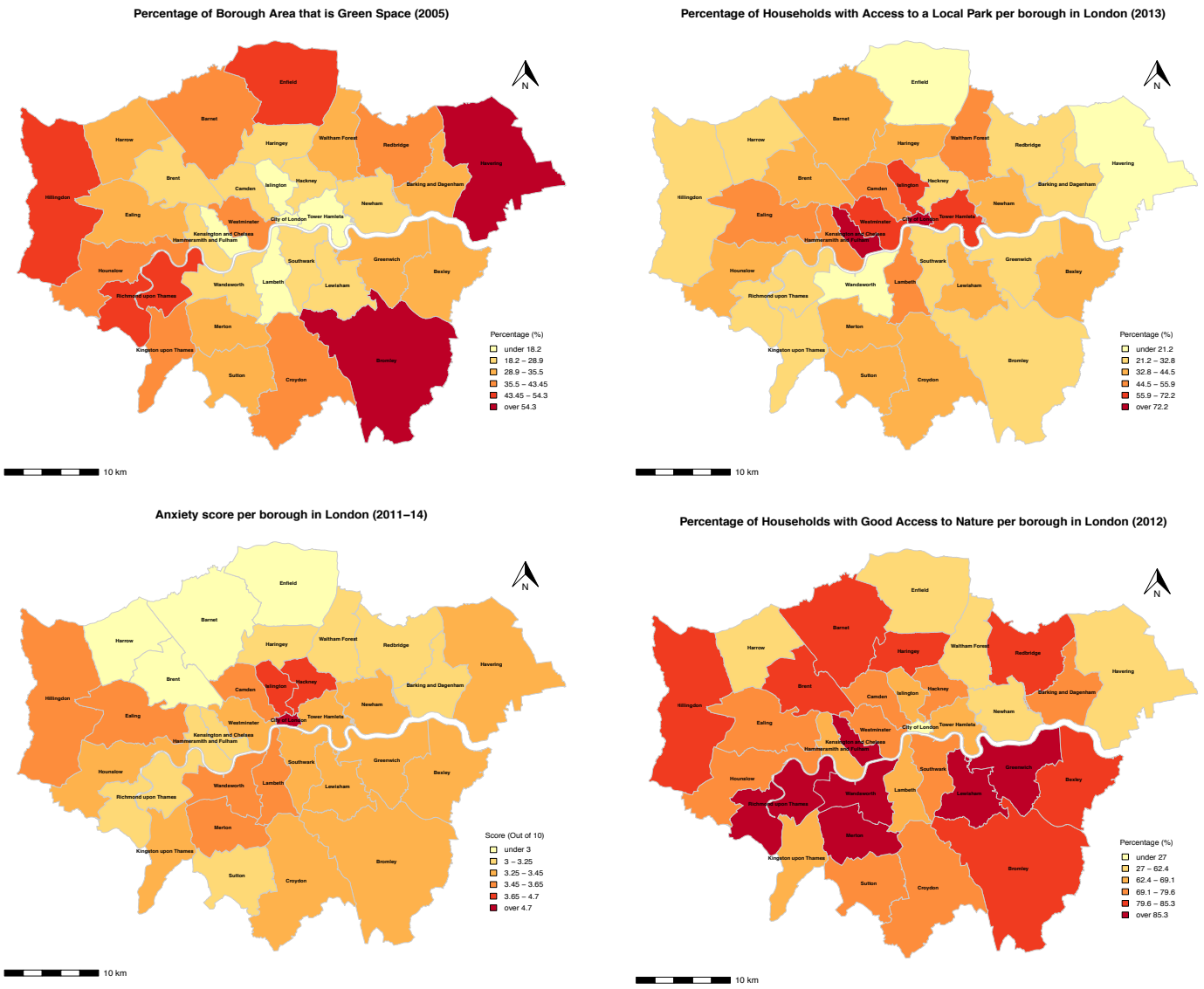

Figure 1: *Four maps showing the spatial distribution of the variables.*

The table shows a moderate negative correlation between anxiety score and household access to nature, along with negative, albeit weaker, correlations between anxiety score and both percentage of green space and district park access. It is important to note, however, that the anxiety score for City of London presents as an outlier and may have therefore influenced these correlations. After creating scatter plots for the variables with the negative correlations of highest significance – access to nature and percentage of green space – it can be seen that for access to nature especially, the City of London result may have had an influence (Figure 3).

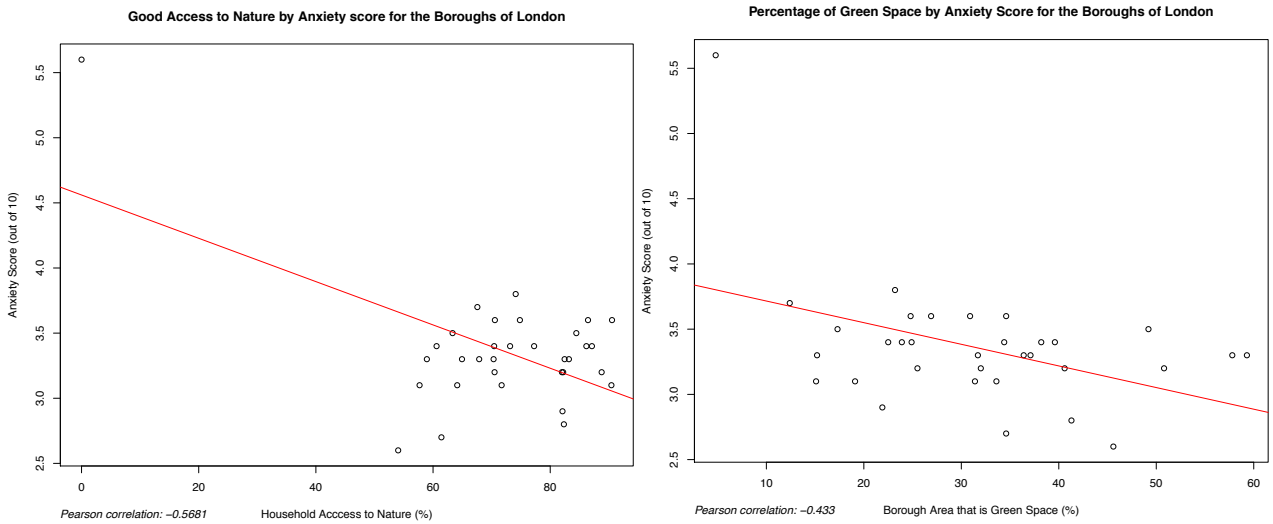

Figure 3: *Two scatterplots showing anxiety score by households with good nature access (left) and percentage of green space (right).*

Due to unexpected values, such as the City of London's anxiety value, residual values were calculated in order to show the difference between the predicted and observed values (Figure 4). The map shows the City of London, followed by Wandsworth, displayed actual anxiety score values larger than estimated. On the other hand, Enfield, followed by Harrow and Waltham Forest, displayed anxiety scores value lower than expected.

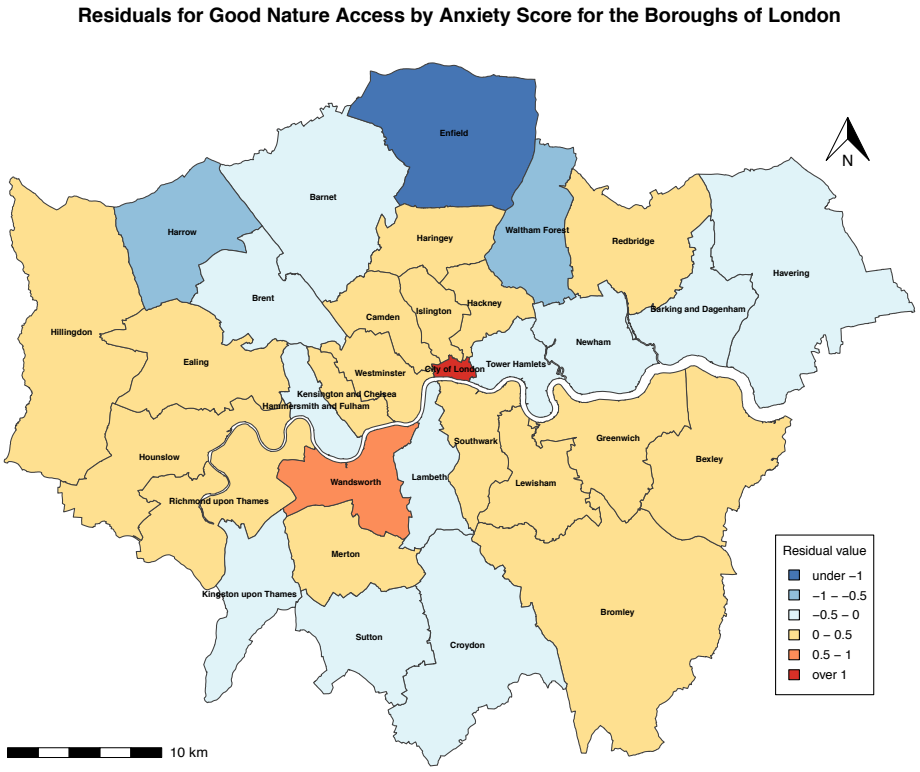

Figure 4: *A map showing the residual values for Good Nature Access by Anxiety Score. The red indicates boroughs where the actual values are larger than the model estimated. The blue indicates boroughs where the actual values are smaller than the model estimated.*

Discussion

Firstly, the results from the previous section show that anxiety levels throughout London do vary from borough to borough. A spatial pattern was also identified, suggesting higher anxiety levels can be found towards the centre of the city. This pattern is a somewhat expected considering Peen et al (2010) found anxiety levels to be more prevalent in city dwellers, however, it could be of relevance to further investigate the variation in anxiety levels within London specifically.

Similar spatial patterns were observed for percentage of borough area that is green space, and household access to nature. Senanayake et al (2013) also found scarcity of green space near the centre of the city Colombo City, Sri Lanka. Although, this was likely

linked to the prevalence of unplanned settlements. In Gulbarga City, India, Anguluri and Narayanan (2017) found varying levels of proportional green space on a ward level. However, they observed no uniformity in the distribution.

Secondly, the correlation figures provide evidence towards there being relationship between anxiety score and green space, as a negative correlation is observed between anxiety score and access to nature, percentage of green space, and district park access. This would support past research suggesting individuals show lower mental distress and significantly higher well-being when living in urban areas with greater amounts of green space (White et al, 2013).

A positive relationship, however, between anxiety score and local park access, acts against this. Furthermore, research by Nordh et al (2009) exhibits the importance of small urban parks for restoration. Consequently, it would be necessary to carry out further research in order to make assumptions about household access to green space and its affect upon anxiety levels.

After discussing the results, it is apparent that they do hold value in suggesting a relationship between anxiety levels and access to nature and green space. However, it is imperative to consider that there is a myriad of factors that would influence anxiety levels in reality, so a causation should not be assumed. Additionally, the unexpected anxiety level results calculated for certain boroughs shown by the residual values, may be influenced by other factors. Furthermore, the correlation values discovered in the results only show a moderate or weak relationship between the variables. Future research, therefore, should consider a variety of factors in order to understand the variation in anxiety levels throughout the boroughs of London to a fuller extent.

References

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Appendix 1

Table containing data used ordered by anxiety score. The highest and lowest three boroughs for each variable are marked in green and red, respectively.

Borough	% of Area is Green Space	% of Households with Good Access to Nature	% of Households with Access to a Metropolitan Park	Anxiety Score
Enfield	45.6	54.0	25.7	2.6
Harrow	34.6	61.4	7.7	2.7
Barnet	41.3	82.3	23.4	2.8
Brent	21.9	82.1	46.7	2.9
Waltham Forest	31.4	57.7	26.5	3.1
Hammersmith and Fulham	19.1	64.1	51.1	3.1
Kensington and Chelsea	15.1	90.4	99.8	3.1
Barking and Dagenham	33.6	71.7	62.6	3.1
Redbridge	40.6	82.0	63.1	3.2
Sutton	32	70.5	65.1	3.2
Richmond upon Thames	50.8	88.8	64.0	3.2
Haringey	25.5	82.2	72.1	3.2
Kingston upon Thames	36.4	67.9	37.5	3.3
Croydon	37.1	70.3	44.6	3.3
Bromley	57.8	82.5	68.9	3.3
Havering	59.3	58.9	44.6	3.3
Bexley	31.7	83.2	81.7	3.3
Tower Hamlets	15.2	64.9	41.8	3.3
Hounslow	39.6	77.2	86.3	3.4
Southwark	24.9	70.4	2.6	3.4
Lewisham	22.5	86.2	54.9	3.4
Greenwich	34.4	87.1	60.5	3.4
Westminster	38.2	73.2	94.0	3.4
Newham	23.9	60.6	38.9	3.4
Hillingdon	49.2	84.5	43.0	3.5
Lambeth	17.3	63.3	66.8	3.5
Ealing	30.9	74.8	72.1	3.6
Merton	34.6	86.5	37.5	3.6
Wandsworth	26.9	90.5	90.2	3.6
Camden	24.8	70.6	88.4	3.6
Islington	12.4	67.6	52.0	3.7
Hackney	23.2	74.1	63.9	3.8
City of London	4.8	0.0	0.0	5.6