Analysing spatial and temporal population trends within Liverpool City Region including Day-Time, Night-Time and Population change

Lecturer

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By

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Introduction

Liverpool City Region consists of six districts Liverpool, Sefton, St. Helens, Wirral, Halton and Knowsley. Liverpool City Region (LCR) is located to North-West of the United Kingdom. By Combining all six districts, Liverpool City Region has a population of 1.5 million and over 37,000 active businesses (Christie, 2013). The Latitude and Longitude of LCR are 53.402°N, 2.977°W with an Areal Extent (Land) of 726 km2 ('Liverpool City Region', 2023). I have done analysis of Day-Time and Night-Time Population trends and their comparison, identifying Industry type clusters and potential commute patterns, Major Employers, Population change between 2011 and 1991, Social Grade Type in Workplace zones of Liverpool City Region. Geography tries to represent real world which is infinitely complex in spatial or non-spatial format for better understanding inherent phenomena. Advancements in Geographic Information (GI) systems which handles geographic information and analyses can be considered as Geographic Information (GI) Science.

Methods

For Day-Time and Night-Time Population analysis, I collected data from CRDC Geodata Pack which contains various information like age, country of birth, religion of people in LCR. For Analysis of Population change between 2011 and 1991, Total population dataset from 1971 to 2015 has been used. For Boundaries of Liverpool City Region, it has been collected from Open Geography Portal (ONS), LAD (May 2020) Boundaries UK BFE. As Population Density depends on area of given land, Population Density distribution has been done by quantile data classification, so that we can consider Density as Ordinal Categorical variable rather than numeric in Identifying Potential Commute Patterns. In Analysis of Social Grade (Professional vs Non-Professional), Two Different Distributions for each type has been plotted within same workplace zone for comparison. Population Change Analysis is done using raster data for 2011 and 1991, Difference from National Mean and Max/Min values for each District has been tabulated. Using Background Map, Identified various Areas with Population Growth and Decline.

Maps

Workplace (Day-Time) Population Distribution

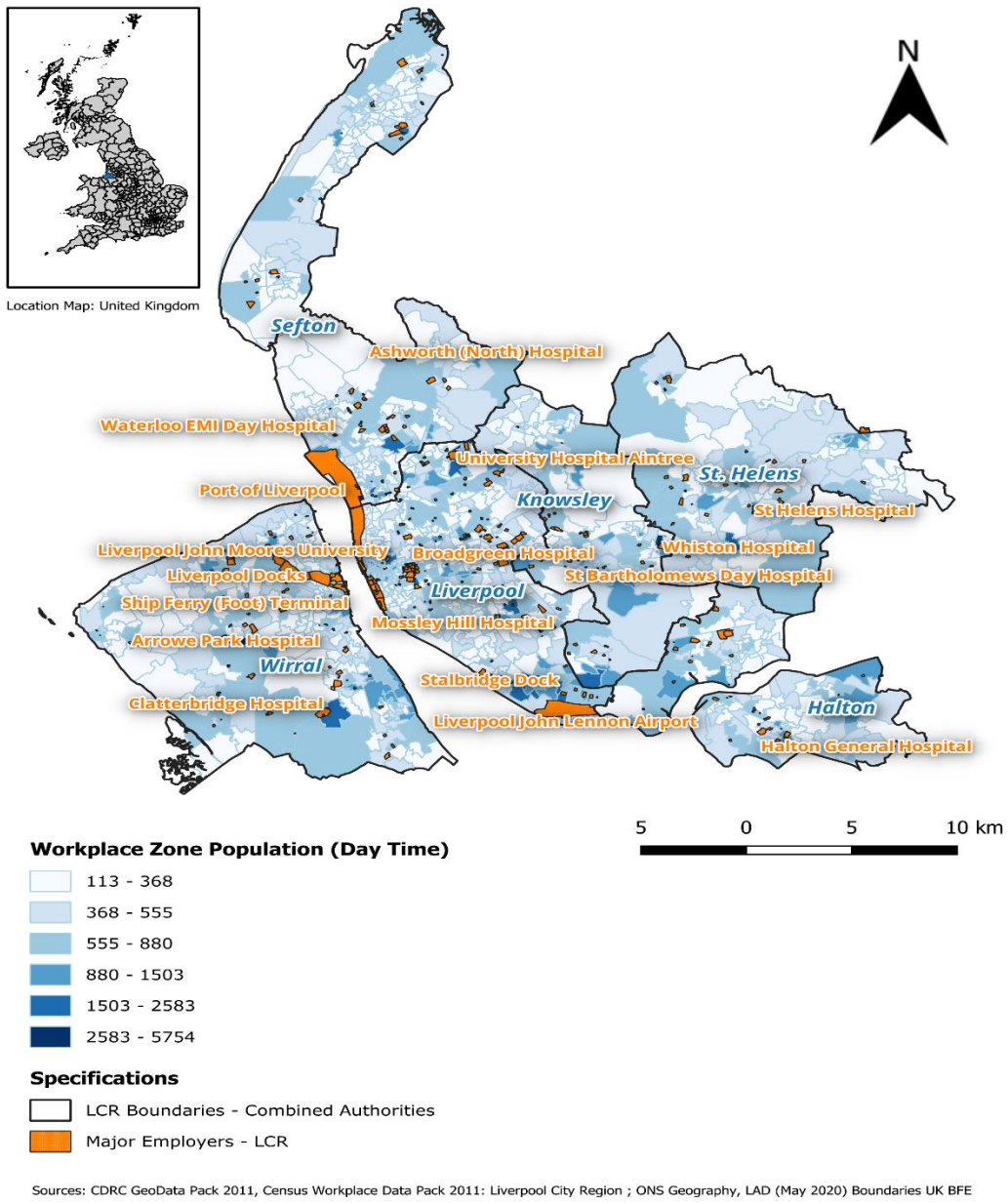
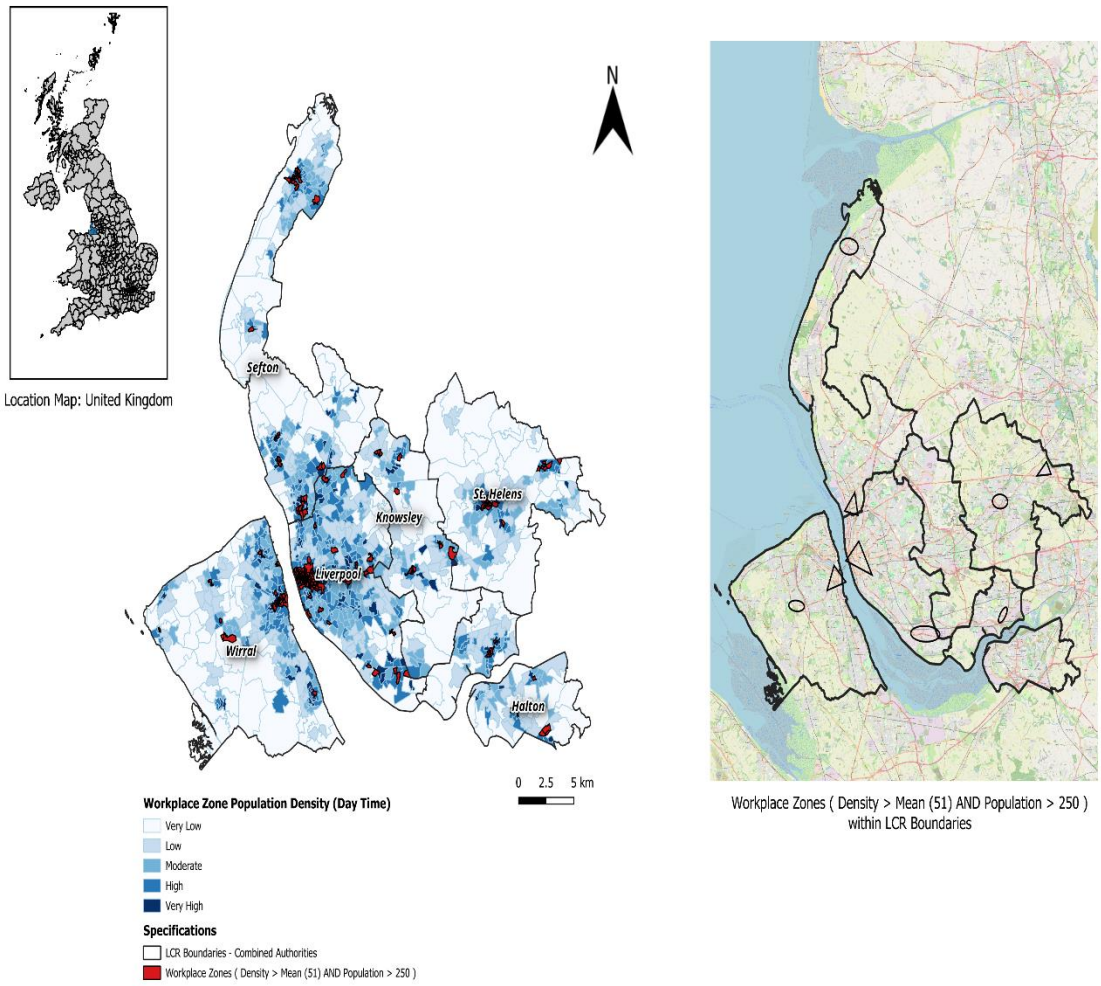


Figure 1 – Workplace (Day-Time) Population Distribution for 2011

Workplace (Day-Time) Zones are areas where average number of 400 people work. Workplace zones are generally made by splitting and merging the Output Areas (Office for National Statistics, 2012). Data is classified using Natural (Jenks) Breaks because of High Range (Max –Min). Major Employers who are located in workplace zones (>specific value) are identified.

Workplace (Day-Time) Population Density Distribution



Sources: CDRC GeoData Pack 2011, Census Workplace Data Pack 2011: Liverpool City Region ; ONS Geography, LAD (May 2020) Boundaries UK BFE

Figure 2 – Workplace (Day-Time) Population Density Distribution with Background Map for 2011

Workplace (Day-Time) Zones are areas where average number of 400 people work. Using Background Maps, we can identify Potential clusters of high-density workplace zones and also identify potential commute patterns when compared to residential population density. As density depends on area, data is classified as ordinal categorical variable using Equal Count (quantile) classification.

Residential (Night-Time) Population Distribution

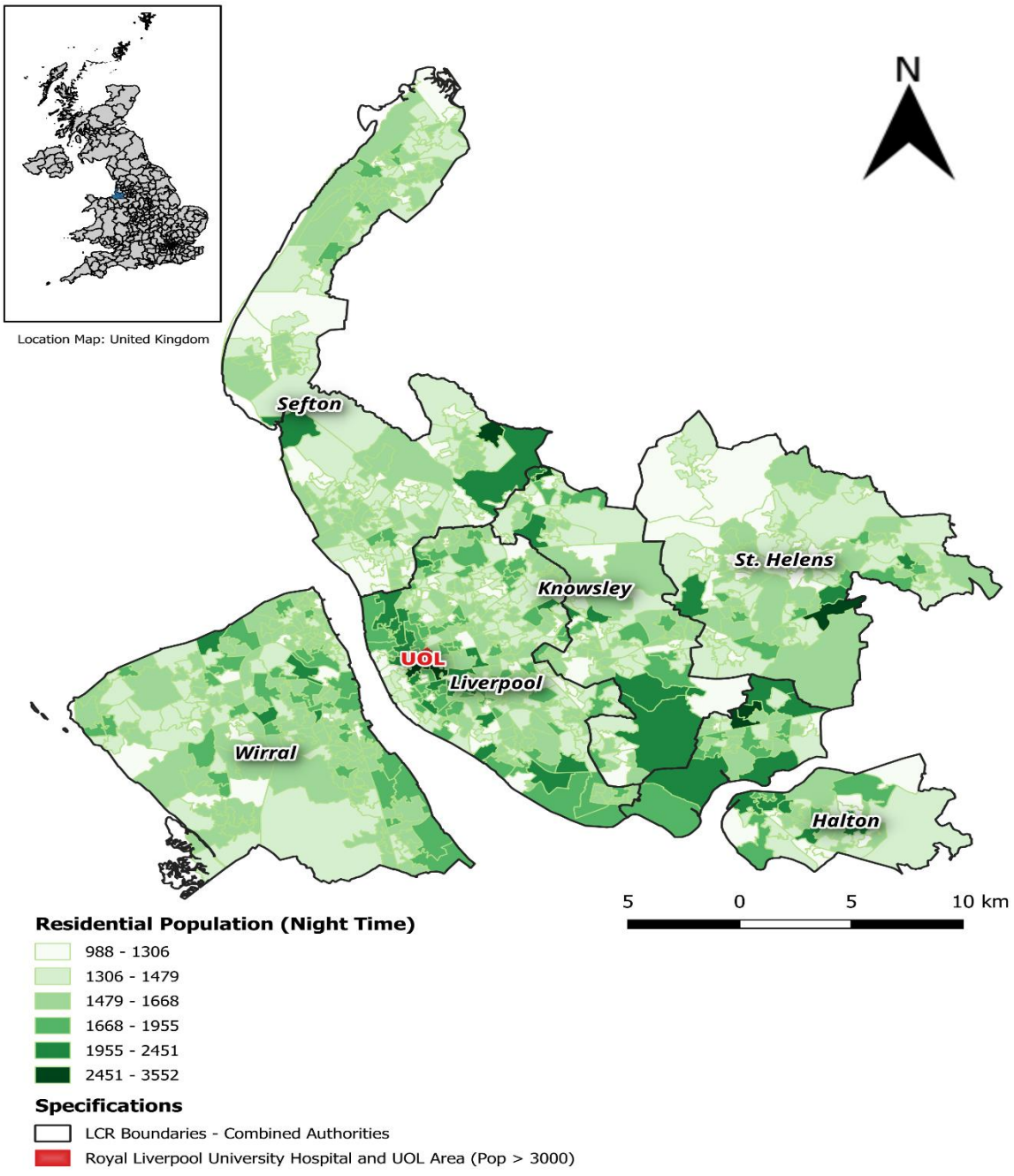
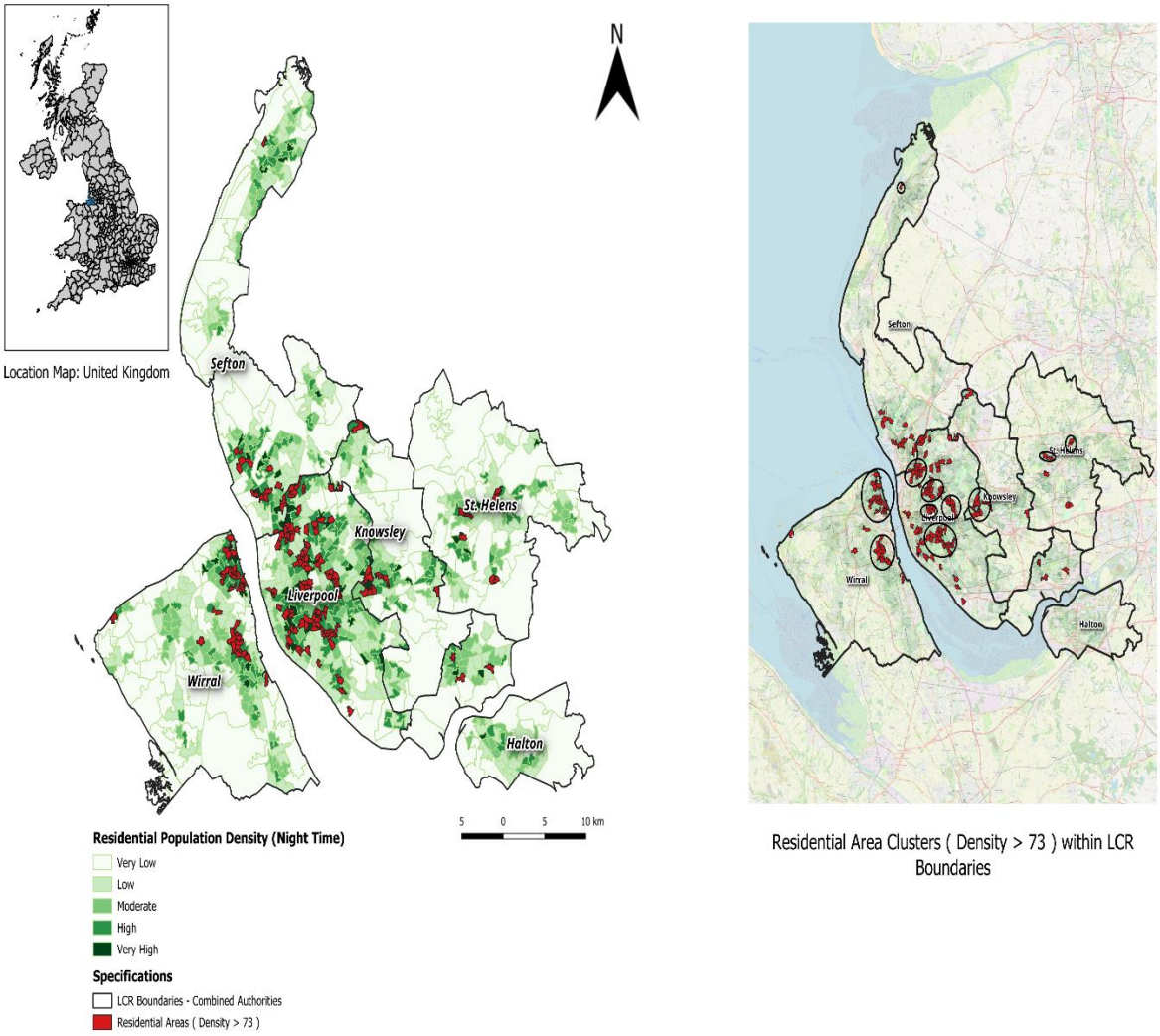


Figure 3 – Residential (Night-Time) Population Distribution for 2011

Residential (Night-Time) Places are areas where average of 1500 people live. They usually comprise between 400 and 1,200 households (Office for National Statistics, 2012). Data is classified using Natural (Jenks) Breaks because of High Range (Max – Min).

Residential (Night-Time) Population Density Distribution

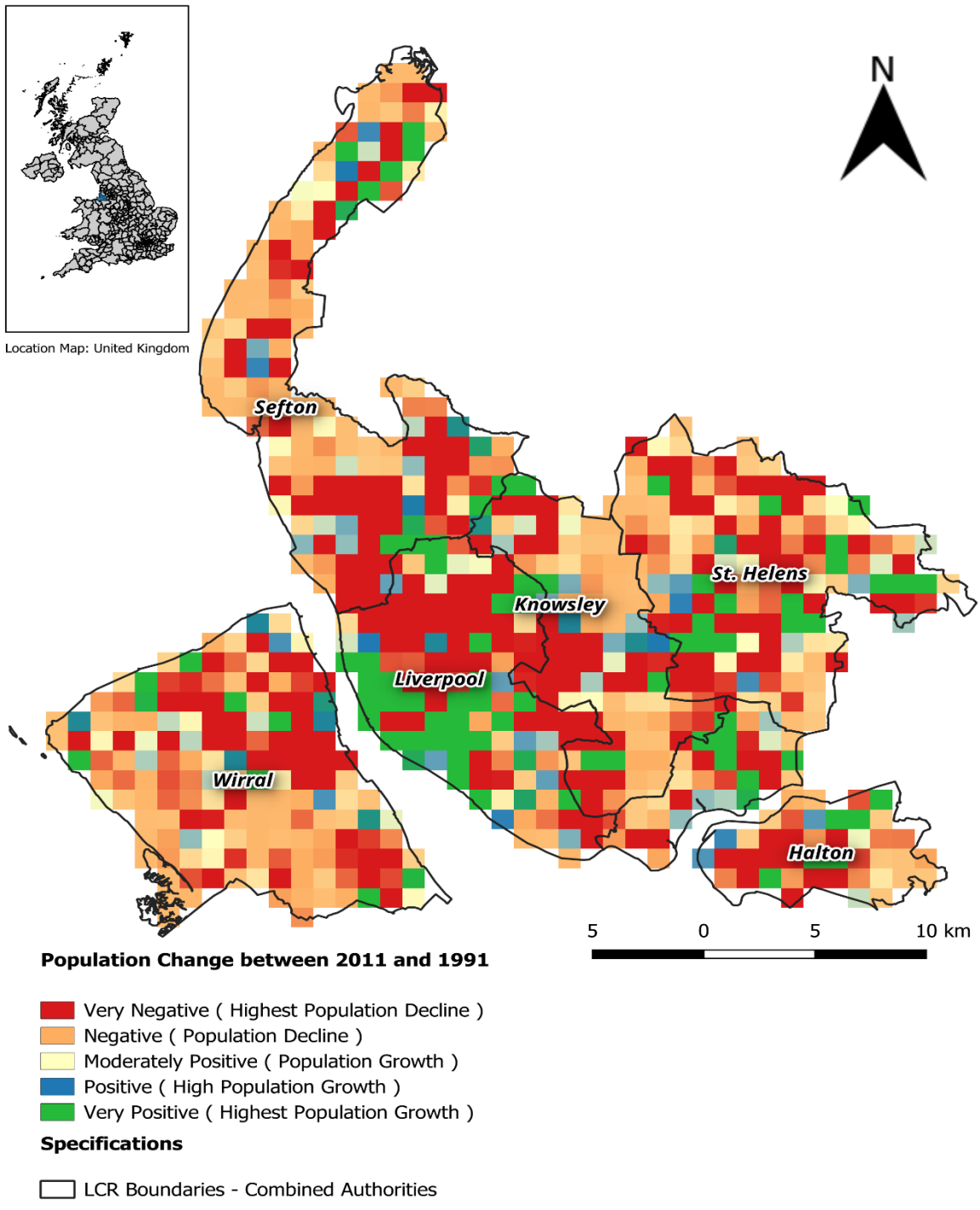


Sources: CDRC GeoData Pack 2011, Census Residential Data Pack 2011: Liverpool City Region; ONS Geography, LAD (May 2020) Boundaries UK BFE

Figure 4 – Residential (Night-Time) Population Density Distribution with Background Map for 2011

Residential (Night-Time) Places are areas where average number of 1500 people live. Using Background Maps, we can identify Potential clusters of high-density residential areas and also identify potential commute patterns when compared to workplace population density. As density depends on area, data is classified as ordinal categorical variable using Equal Count (quantile) classification.

Population Change between 2011 and 1991

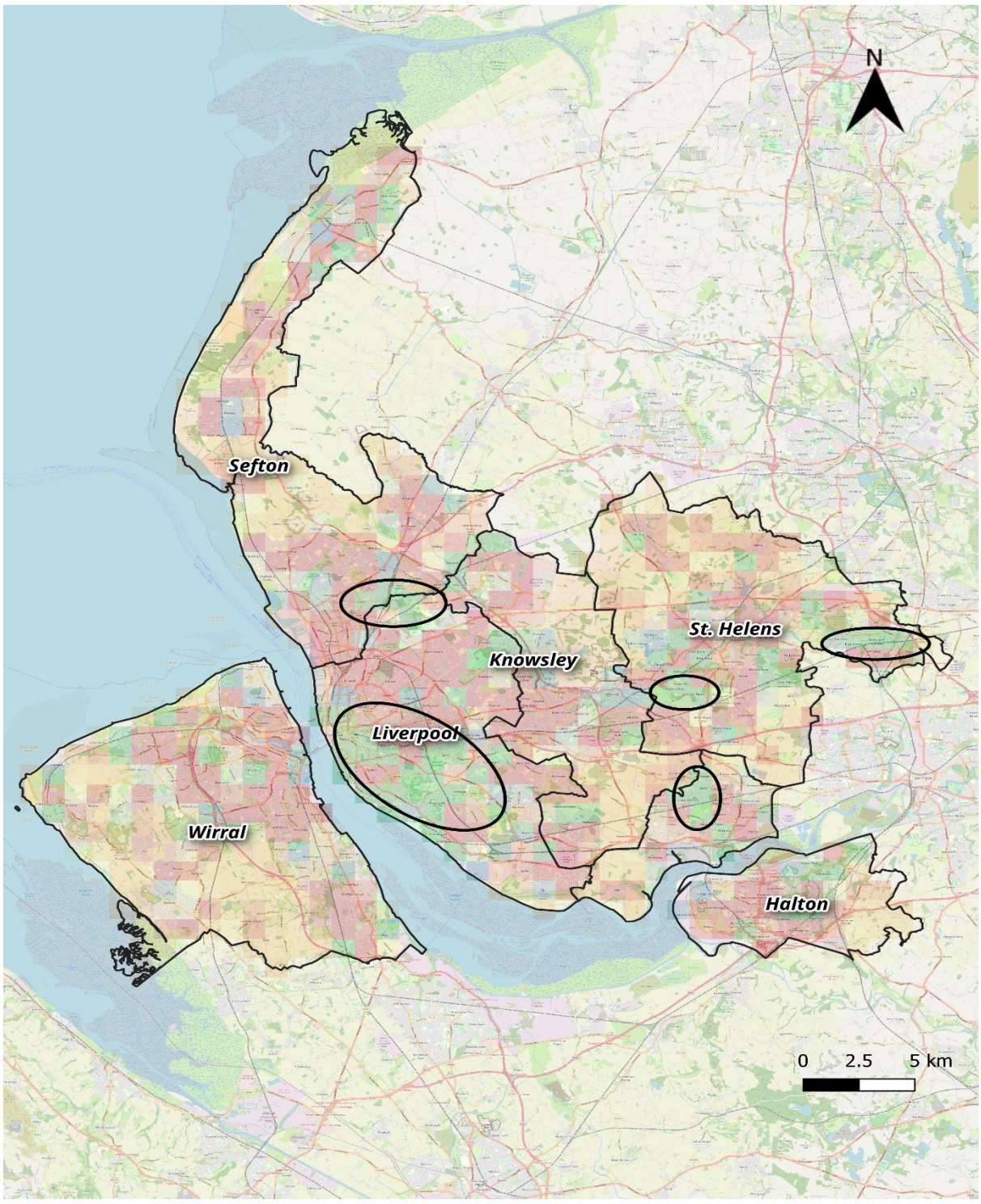


Source: UK Data Service, PopChange population grids for Britain, 1971-2011

Figure 5 – Population Change between 2011 and 1991

Population Change between 2011 and 1991 is calculated using the raster data of 2011 and 1991. Using Equal Interval classification, Data is classified into ordinal categorical population change variable to identify potential population growth clusters.

Using Background Map to Identify Potential Population Growth Clusters



Sources: Open Street Map; UK Data Service PopChange population grids for Britian, 1971-2011

Figure 6 - Background Map to Identify Population Growth Clusters

Social Grade Distribution

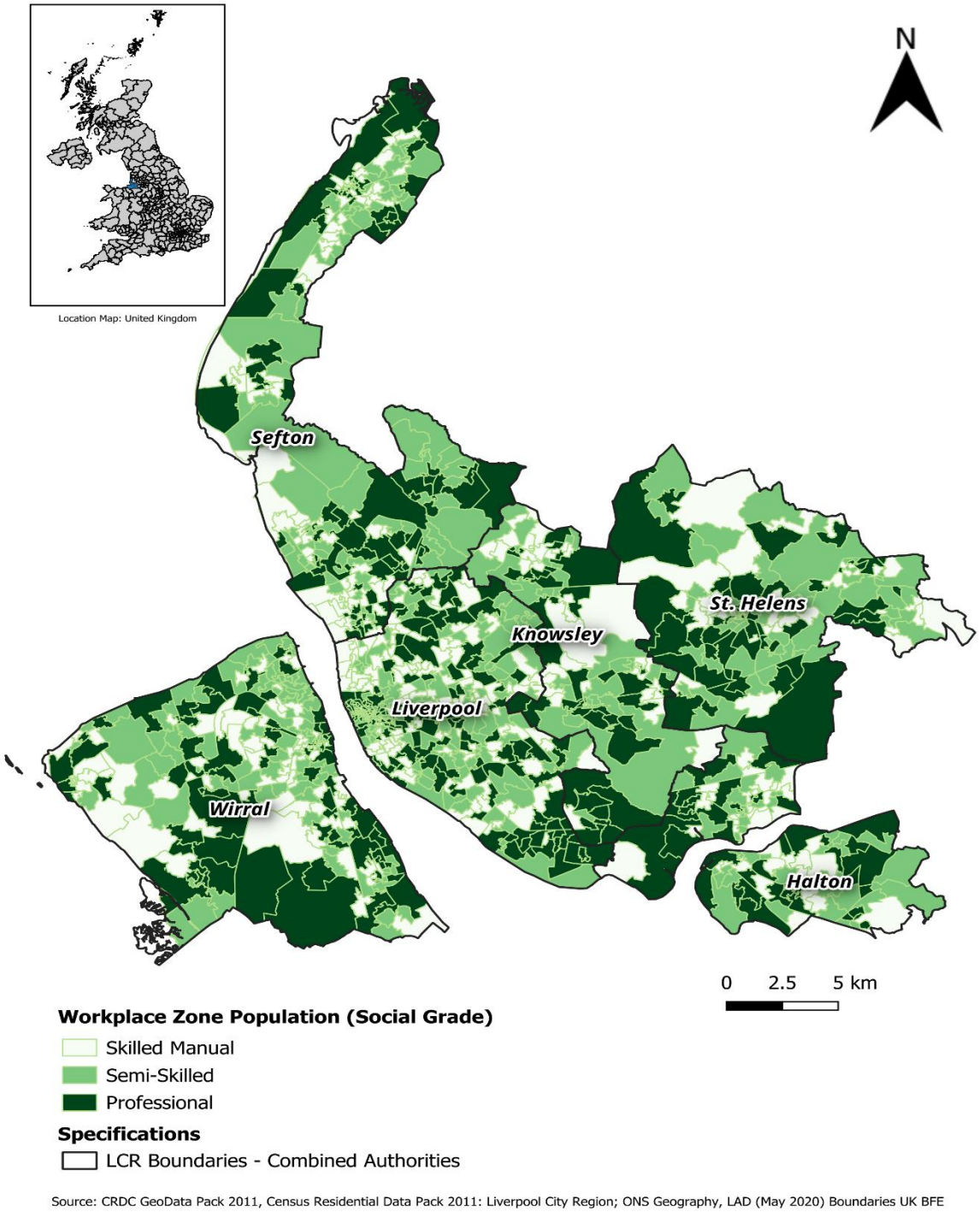


Figure 7 – Social Grade Distribution

Using Equal Interval classification, Data is classified into ordinal categorical social grade variable to identify High-Social Grade Zones.

Results

1. Major Employers in LCR are Port of Liverpool, Liverpool John Lennon Airport, Halton General Hospital, Liverpool Docks, Waterloo EMI Day Hospital etc.
2. Potential Clusters in Workplace Zones are Liverpool City Centre, Conway Street to Tranmere Area in Birkenhead, Vauxhall, Arrowe Park Hospital, Liverpool John Lennon Airport, ASDA Bootle Supermarket Area etc.
3. Potential Clusters in Residential Areas are Upper Parliament St. to Sefton Park Area, Bebington Area, New Brighton and Egremont Area, Stockbridge Village etc.
4. Potential Commute Patterns are Queensway Tunnel, Edge Ln, Liverpool Rd etc. as we can see migration happening from clusters in residential map into workplace zone map mostly in Liverpool District.
5. Total Population in workplace zones of Liverpool City Region is 987,210. Total Population in residential areas of Liverpool City Region is 1,506,940. Therefore, Maximum of 519,730 people may be moving out of the Liverpool City Region for Work. However, Residential population included all people (working and non-working) in an area.
6. Population Growth is seen in Wavertree Area, Litherland Area, Sutton Area, Widnes Area, New Boston Area etc.
7. Maximum and Minimum of Population Change Variable are 432.45 and -173.89
8. Population in the Liverpool was the highest at 31% of the Liverpool City Region followed by Wirral (21%), Sefton (18%), St Helens (12%), Knowsley (10%) and Halton (8%) (Christie, 2013).
9. Social Grade Variable is evenly disturbed among all districts of Liverpool City Region except for Knowsley District. Skilled-Manual is highest in Knowsley.

Tables

National Mean in 1991	National Mean in 2011	LCR Mean in 1991	LCR Mean in 2011
223.10	246.20	2087.17	2065.31

National Mean has been Increased, but overall mean of LCR has been decreased from 1991 to 2011.

Conclusions

Usage of QGIS in analysing spatial and temporal daytime and nighttime population and Population change between 2011 and 1991 was a learning curve for myself. Limitations of the analysis is data accuracy and data classification schemes. Identifying Major employers could have been more accurate id employment data for LCR in 2011 existed. Shading of Different Categories can sometimes create misinterpretations of actual story. Comparison of Day-Time and Night-Time Populations is difficult as LSOA's and WZ's have different geometry. There is Major Population Decline in most of the districts, expect in Liverpool and especially that population growth is in Liverpool City Centre Area.

References

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5. Longley, P. et al. (2015) Geographic Information Science and Systems. USA: Wiley