Data Article

Urban sprawl in Canada: Values in all 33 Census Metropolitan Areas and corresponding 469 Census Subdivisions between 1991 and 2011

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\textbf{A B S T R A C T}

The dataset presented here provides the degree of urban sprawl across 33 Census Metropolitan Areas (CMAs) in Canada of 2011 together with the 469 Census Subdivisions (CSDs) located within the 2011 boundaries of the CMAs, for the years 1991, 2001, and 2011. The dataset contains the values of weighted urban proliferation (WUP) and weighted sprawl per capita (WSPC) and their components. The landscape-oriented value of WUP indicates how strongly the landscape within the boundaries of a reporting unit is sprawled per square meter, while WSPC is inhabitant-oriented and reveals how much on average an inhabitant or workplace is contributing to urban sprawl in the reporting unit. The values of the components of the WUP and WSPC metrics are provided as well: percentage of built-up area (PBA), urban dispersion (DIS), land uptake per person (LUP), and urban permeation (UP). The values of full-time equivalents for the numbers of jobs, which were considered in the

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calculation of LUP values (pertaining to the number of inhabitants and jobs) are also included in order to facilitate future research.

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Specifications Table

| Subject                                      | Nature and Landscape Conservation |
|----------------------------------------------|-----------------------------------|
| Specific subject area                        | Urban Planning, Landscape Planning, Landscape Ecology, Environmental Monitoring, Urban Sprawl, Urban Growth |
| Type of data                                 | Tables, Excel files               |
| How data were acquired                       | Instruments/Software: ArcGIS, Urban Sprawl Metrics toolset (USM toolset). Raw data were obtained from Statistics Canada [1,2]. The analyzed data were calculated using ArcGIS version 10.3/10.7, USM toolset, and Excel. |
| Data format                                  | Raw; Analyzed                     |
| Parameters for data collection               | Data were collected for the years 1991, 2001, and 2011 on all 33 Census Metropolitan Areas (contiguous settlements of over 100,000 defined by Statistics Canada) that existed in 2011 and using the 2011 Census Subdivision boundaries. |
| Description of data collection              | A few corrections were applied to the already-processed remote sensing data made available by Statistics Canada [1] using CanMap 2018 produced by DMTI Spatial (e.g., by excluding waterbodies and parks from the layer of the built-up areas), using NAD_1983 Albers as a projected coordinate system. The modified data were entered into the USM toolset to calculate the WUP metric and its components. Numbers of full-time equivalents were derived from information about part-time and full-time employment provided by Statistics Canada [2]. The values of WSPC were calculated in Excel based on the components of WUP. |
| Data source location                         | Concordia University, Montréal (Québec), Canada |
| Data accessibility                           | The data are available with this article and in Mendeley Data, DOI: 10.17632/r3z83jb292.1, https://data.mendeley.com/datasets/r3z83jb292/1 [3]. |

Value of the Data

- This research provides quantitative data about the levels and temporal changes in urban sprawl in Canada’s 33 metropolitan areas with over 100,000 residents to assess the sustainability of land-use trends and to assist in efforts to curtail urban sprawl.
- The data provided here are useful for environmental scientists, geographers, planners, and decision-makers and can be applied for environmental monitoring, sustainability monitoring, landscape quality monitoring, and biodiversity monitoring.
- The data can be used by researchers for statistical analysis to identify potential drivers and effects of urban sprawl and they can be used by urban planners and decision-makers to establish targets and limits to urban sprawl in Canada.
- Data collection can be continued in the future to reveal changes in trends, e.g., an acceleration or slowing down of the increase in urban sprawl as a consequence of the Covid-19 pandemic. They can be applied for performance evaluation of measures intended to limit urban sprawl.
- This dataset can be applied to identify effective strategies for reducing urban sprawl and to substantially reduce its adverse effects in Canada: The density, location, and contribution to dispersion resulting from alternative scenarios of newly proposed urban areas can be analyzed and compared so as to diminish sprawl.
1. Data Description

We used the built-up area layers for Canada for the years 1991, 2001, and 2011 from the report titled “Human Activity and the Environment. The changing landscape of Canadian Metropolitan Areas” released by Statistics Canada in 2016 [1]. In this dataset, built-up area is considered as “land that is predominantly built-up or developed, including the vegetation associated with these land covers, such as gardens and parks. It is characterized by a high percentage of impervious surfaces including roadways, parking lots and roof tops. Low-density dwellings and small structures or buildings in rural areas outside core built-up areas may not be captured due to the resolution of the data and overlying tree canopy” ([1: p. 331]).

To create these datasets, Agriculture and Agri-food Canada’s Land Use raster datasets were used for the years 1990, 2000 and 2010. These land use maps cover all of Canada south of 60°N at a spatial resolution of 30 m. The raw data source for the land cover was remote sensing imagery acquired from Statistics Canada, which had previously obtained (and modified) data acquired from Agriculture and Agri-Food Canada [1]. For the settlement class (i.e., the built-up class), the accuracy was above 80% for all three years. The overall accuracy of all the maps was also greater than 80% [1: p. 328]. The maps of the built-up areas were provided in a shapefile format. Fig. 1a presents an example of the built-up areas and the corresponding reporting units of the Toronto Census Metropolitan Area (CMA) in 1991, 2001, and 2011. An increase of built-up areas is clearly noticeable in the Toronto CMA between 1991 and 2011.

In 2011, Canada had 33 CMAs, but since the CMA of Ottawa-Gatineau straddles a provincial boundary and is located in two provinces (Ontario and Quebec), we used the two separate datasets to be consistent with this dataset, i.e., the tables consistently report 34 values of the variables for the CMAs (Table 1). The dataset for each province can be used separately for future studies to analyze the different effect of differing policies in the two provinces. While Ottawa-Gatineau is one CMA, Statistics Canada [1] divided this CMA into two and presented data separately for the Ontario portion and Quebec portion of the CMA for reporting purposes since land use management and urban planning are mainly provincial and municipal processes.

The data provided in the Excel file include the values of Weighted Urban Proliferation (WUP) (Fig. 1b) and Weighted Sprawl per Capita (WSPC) (Fig. 1c). The values of the three components used to calculate these two metrics are available as well, i.e., the information about the number of inhabitants, areas of the reporting units, and the full-time equivalents were included in this file. The meaning of the column headings is as follows:

- ‘Year’ refers to the year to which the data apply (1991, 2001, 2011).
- ‘CMA’ refers to the names of the Census Metropolitan Areas.
- The column ‘Area_Reporting unit_m²’ provides the area of each reporting unit in square meters.
- The column ‘Urban_Area_m²’ shows the areas of the built-up areas in each CMA in square meters.
- ‘PBA’ refers to the proportion of built-up areas (between 0 and 1).
- The column ‘DIS (UPU/m²)’ provides the values of urban dispersion (in urban permeation units per m²).
- ‘w1DIS’ distinguishes the weighting function1 of dispersion (values between 0.5 and 1.5).
- ‘TS’ refers to the total sprawl (in UPU).
- ‘UP’ is the value of urban permeation, expressed in urban permeation units per m² of land (UPU/m²).
- ‘FTPT’ in several columns identifies the total number of jobs (Full-Time and Part-Time), i.e., without considering full-time equivalents. The ‘FTPT’ abbreviation after a component or metric indicates the values that were found by using the total number of full-time and part-time jobs (rather than full-time equivalents).
- The column ‘Sum_inhFTPT’ provides the sum of the number of inhabitants and the total number of jobs (full-time and part-time), i.e., without considering the full-time equivalents.
Fig. 1. (a) Example of built-up areas in the Toronto CMA in 1991–2011 (including corrections made). (b) Urban sprawl (WUP) at the level of Census Subdivisions in the Toronto CMA in 1991–2011. (c) Sprawl per person (WSPC) at the level of Census Subdivisions in the Toronto CMA in 1991–2011 (sources: a. [1] and own corrections; b. and c. own calculations.).
Fig. 1. Continued

- ‘UD’ refers to the value of utilization density (sum of inhabitants and total number of jobs / area of the reporting unit).
- ‘w2(UD)’ refers to the weighting function of utilization density (values between 0 and 1).
- The column ‘LUP (m\(^2\)/inhFTE)’ provides the values of land up-take per person (m\(^2\)/ the number of inhabitants and jobs (full-time + part-time). In cases where the number of inhabitants + jobs was 0, we use the value 7,777,777 in this cell (because the corresponding value of the weighting function for 0 inhabitants and jobs is 1, and a value of 7,777,777 m\(^2\)/ inhabitant or job entered into the weighting function for LUP also results in 1, while a division by 0 is impossible).
- ‘WUP’ refers to the Weighted Urban Proliferation in urban permeation units per square meter of built-up area (UPU/m\(^2\)).
- ‘FTE’ in several columns refers to the number of full-time equivalents of jobs. The ‘FTE’ abbreviation after each component or metric indicates the values that were found by using the number of full-time equivalents (rather than the sum of full-time and part-time jobs).
- ‘LUP (m\(^2\)/inhFTE)’ corresponds to the values of land up take per person (m\(^2\) / the number of inhabitants and full-time equivalents).
- ‘w2(LUP)’ refers to the weighting function of land up-take per inhabitant or job (between 0 and 1).
- ‘WSPC’ denotes Weighted Sprawl per Capita in urban permeation units per inhabitant or job (UPU/ (inh. or job)). In cases in which the number of inhabitants + jobs was 0, the content of the cell was set to INF (to indicate ‘infinity’).
- The heading ‘CSD-codes’ refers to the 2011 Census Subdivision (CSD) codes. This three-digit code is based on the Standard Geographical Classification (SGC). In order to uniquely identify each CSD in Canada, the two-digit province/territory (PR) code and the two-digit Census Division (CD) code must precede the CSD code.
Table 1
The names of the 33 Census Metropolitan Areas (CMAs) in Canada, their sizes, number of inhabitants in 2011, and the number of CSDs located in each CMA (in alphabetical order). (Source: [1]).

| Name of CMA              | Size of CMA (km²) | Size of built-up area (km²) in 2011 | Number of inhabitants in 2011 | Number of CSDs located in the CMA |
|--------------------------|------------------|-------------------------------------|-------------------------------|----------------------------------|
| Abbotsford - Mission     | 649.76           | 136.89                              | 170,191                       | 4                                |
| Barrie                   | 967.49           | 144.72                              | 187,013                       | 3                                |
| Brandon                  | 1086.24          | 146.95                              | 135,501                       | 3                                |
| Calgary                  | 5242.89          | 631.72                              | 1214,839                      | 9                                |
| Edmonton                 | 9853.51          | 1051.07                             | 1159,869                      | 35                               |
| Greater-Sudbury          | 3853.46          | 253.52                              | 160,770                       | 3                                |
| Guelph                   | 604.05           | 97.30                               | 141,097                       | 3                                |
| Halifax                  | 5963.03          | 432.31                              | 390,328                       | 5                                |
| Hamilton                 | 1404.63          | 389.08                              | 721,053                       | 3                                |
| Kelowna                  | 3144.90          | 175.10                              | 179,839                       | 9                                |
| Kingston                 | 2142.45          | 195.65                              | 159,561                       | 4                                |
| Kitchener                | 840.44           | 256.90                              | 477,160                       | 5                                |
| London                   | 2681.14          | 393.38                              | 474,786                       | 8                                |
| Moncton                  | 2471.09          | 173.94                              | 138,644                       | 14                               |
| Montreal                 | 4293.67          | 1460.42                             | 3824,221                      | 91                               |
| Oshawa                   | 907.89           | 219.04                              | 356,177                       | 3                                |
| Ottawa–Gatineau-ON       | 3401.78          | 582.25                              | 921,823                       | 3                                |
| Ottawa–Gatineau-QC       | 3262.60          | 278.15                              | 314,501                       | 12                               |
| Peterborough             | 1636.74          | 153.27                              | 118,975                       | 7                                |
| Québec                   | 3415.90          | 447.11                              | 765,706                       | 28                               |
| Regina                   | 3483.89          | 211.71                              | 210,556                       | 17                               |
| Saguenay                 | 2876.84          | 178.89                              | 157,790                       | 8                                |
| Saint John               | 3645.76          | 234.68                              | 127,761                       | 17                               |
| Saskatoon                | 5504.87          | 310.84                              | 260,600                       | 24                               |
| Sherbrooke               | 1522.43          | 187.65                              | 201,890                       | 11                               |
| St. Catharines           | 1425.29          | 380.95                              | 392,184                       | 10                               |
| St. John's               | 850.38           | 172.24                              | 196,966                       | 13                               |
| Thunder Bay              | 2617.84          | 185.31                              | 121,596                       | 8                                |
| Toronto                  | 6269.96          | 1957.08                             | 5583,064                      | 24                               |
| Trois-Rivières           | 1053.50          | 141.62                              | 151,773                       | 7                                |
| Vancouver                | 3041.42          | 934.44                              | 2313,328                      | 39                               |
| Victoria                 | 704.37           | 219.42                              | 344,615                       | 22                               |
| Windsor                  | 1032.47          | 240.86                              | 319,246                       | 5                                |
| Winnipeg                 | 5409.26          | 521.85                              | 730,018                       | 12                               |

The first sheet in the Excel file (CMAs1991_2011) includes all the above information at the CMA level. The second (CSD2011), third (CSD2001), and forth (CSD1991) sheets contain the same information at the CSDs level for the years 2011, 2001, and 1991, respectively. The fifth sheet (Job-Equivalence-Ratio) indicates the conversion factors for full-time equivalence and the relevant data that we used to calculate these factors, for each province, and for the years 1991, 2001, and 2011.

2. Experimental Design, Materials and Methods

A number of definitions of urban sprawl have been suggested in the literature [4], but there is no general agreement about what defines urban sprawl. However, most definitions of urban sprawl proposed in the literature consider three dimensions of urban sprawl: (1) percentage of built-up area, (2) dispersion of the built-up area, and (3) low density [4,5]. The method applied for measuring urban sprawl is based on the following definition: The degree of urban sprawl increases with (1) the size of the built-up areas in a given landscape (i.e., the percentage of built-up area), (2) the dispersion of the built-up area (spatial configuration), and (3) the uptake of built-up area per inhabitant or job [6,7,4]. The Weighted Urban Proliferation (WUP) method mea-
sures urban sprawl by integrating these three dimensions into a single metric \[6,8,7\] (Table 2; Fig. 2):

\[
WUP = (PBA \cdot DIS) \cdot w_1(DIS) \cdot w_2(LUP),
\]

where \(PBA\) = percentage of built-up areas, \(DIS\) = dispersion of built-up areas, \(LUP\) = land up take per person, \(w_1(DIS)\) = weighting function \(_1\)(Dispersion), and \(w_2(LUP)\) = weighting function \(_2\)(Land up take per inhabitant or job). Dispersion is weighted by the \(w_1(DIS)\) function to make those parts of the landscape where built-up areas are more dispersed more clearly perceived (\(w_1(DIS) > 1\), while compact settled areas are multiplied by a lower weighting (i.e., \(< 1\) ) and 1 when the dispersion equals the 1960 Swiss average). The values of \(w_1(DIS)\) are between 0.5 and 1.5 [6]. The weighting factor \(w_2(LUP)\) is always smaller than 1. When \(LUP < 150 \, \text{m}^2\) per inhabitant or job (e.g., in downtown areas), the weighting factor is nearly 0 because such areas are not considered to be sprawled. The value of 222 \(\text{m}^2\) per inhabitant of job corresponds to the limit of 400 \(\text{m}^2\) of urban area per inhabitant (without taking jobs into consideration) suggested by the Swiss Federal Council in 2002 as a maximum acceptable average value [9], and \(w_2(222 \, \text{m}^2)\) per inhabitant of job) = 0.8 [6]. The two weighting functions are illustrated in Fig. 2a.

Since the land uptake per person and dispersion are weighted with the weighting functions \(w_1(DIS)\) and \(w_2(LUP)\), this metric of urban sprawl is referred to as Weighted Urban Proliferation (WUP).

We also provide the values of urban permeation and total sprawl:

**Urban Permeation:** Urban permeation \((UP)\) is the product of \(PBA\) and \(DIS\) in each reporting unit: \(UP = (\text{size of built-up area} / \text{size of reporting unit}) \cdot \text{dispersion}. Its value indicates the extent of permeation of urban areas into the landscape. It is an intensive metric and is expressed in urban permeation units \((\text{UPU})\) per square meter of landscape \((\text{UPU/m}^2)\) [10].

**The value of Total Sprawl \((TS)\)** is the result of multiplication of \(DIS\) and the total amount of built-up areas \((TS = DIS \cdot \text{Area of built-up area})\). It is an extensive metric.

Among these metrics, **Weighted Urban Proliferation \((WUP)\)** is the main metric used to quantify urban sprawl.

Information about full-time and part-time jobs was combined by using full-time equivalents to better reflect the actual number of hours worked as these locations. The conversion factors for full-time equivalents were found by dividing the hours of part-time employment (all jobs, both sexes, and 15 years and over) by the hours of full-time employment (all jobs, both sexes, and 15 years and over). This resulted in conversion factors between 0.35 and 0.47. We obtained job data from Statistics Canada, 2019 (Special tabulation, based on the 1971, 1991, 2001 censuses of population and the 2011 National Household Survey [2]). The data provide information of the

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**Table 2**
Overview of the metrics and their units.

| Name of the variable | Name of the metric | Unit | Mathematical homogeneity | Name of the column heading in the Excel table |
|----------------------|-------------------|------|--------------------------|---------------------------------------------|
| WUP                  | Weighted Urban Proliferation | UPU per m\(^2\) of landscape | Intensive | WUP |
| PBA                  | Percentage of Built-up Area | – | Intensive | PBA |
| DIS                  | Dispersion | UPU per m\(^2\) of built-up area | Intensive | DIS (UPU/m\(^2\)) |
| LUP                  | Land Uptake per Person (per inhabitant or job) | m\(^2\) per inhabitant or job | Intensive | LUP (m\(^2\)/inhFTE) |
| UD                   | Utilization Density | Inhabitants and jobs per km\(^2\) of built-up area | Intensive | UD |
| UP                   | Urban Permeation | UPU per m\(^2\) of landscape | Intensive | UP |
| TS                   | Total Sprawl | UPU | Extensive | TS |
| WSPC                 | Weighted Sprawl per Capita | UPU per inhabitant or job | Intensive | WSPC |
numbers of total type of work, the numbers of total employees who did not work during the reference week of the census and those who worked during the reference week separately, and finally the number of employees who worked full-time and those who worked part-time for all Census Subdivisions in Canada in 1991, 2001 and 2011. Reference week is defined as “the entire calendar week (from Sunday to Saturday) covered by the Labor Force Survey each month. It is usually the week containing the 15th day of the month. The interviews are conducted during the following week, called the Survey Week, and the labor force status determined is that of the reference week.” ([2], p. 16).

However, the numbers of the part-time and full-time employees, respectively, who did not work during the reference week was missing. To calculate the numbers of part-time employees who did not work during the reference week, we assumed that the number of part-time employees who did not work during the reference week was proportional to their share of the total workforce. Based on this assumption, we applied the following equation:

The number of part-time employees who did not work during the reference week = \( \frac{PT}{FT+PT} \cdot NW \), where \( PT \) = the number of employees who worked part-time, \( FT \) = the number of employ-
ees who worked full-time, and $NW = \text{the number of total employees who did not work during the reference week.}$

Accordingly, we estimated the numbers of full-time employees who did not work during the reference week by calculating the difference of the numbers of total employees who did not work during the reference week and the numbers of part-time employees who did not work during the reference week. Finally, we summed the numbers of part-time employees who did not work during the reference week to the number of employees who worked part-time to find the best possible estimate for part-time jobs. To discover the best estimate for full-time jobs, we summed the numbers of full-time employees who did not work during the reference week to the numbers of employees who worked full-time.

One of the main advantages of the WUP method is that it meets all 13 suitability criteria for measuring urban sprawl, outlined by [4]. Some of the criteria are necessary conditions while others represent desirable additional criteria. The ideal metric would meet all 13 criteria. The criteria are: (1) intuitive interpretation, (2) mathematical simplicity, (3) modest data requirements, (4) low sensitivity to very small patches of urban area, (5) monotonous response to increases in urban area, (6) monotonous response to increasing distance between two urban patches when within the scale of analysis, (7) monotonous response to increased spreading of three urban patches, (8) same direction of the metric's responses to the processes in criteria 5, 6 and 7, (9) continuous response to the merging of two urban patches, (10) independence of the metric from the location of the pattern of urban patches within the reporting unit, (11) continuous response to increasing distance between two urban patches when they move beyond the scale of analysis, (12) mathematical homogeneity, and (13) additivity [4].

In the built-up area shapefiles, most of the parks and green spaces were identified as built-up areas, such as Parc du Mont-Royal, Parc La Fontaine, and Parc Jean Drapeau in the Montreal CMA. Some small water bodies were also included in the built-up area shapefiles. To increase the accuracy of the built-up area shapefiles and exclude the green spaces, parks and water bodies from them, we applied some corrections (Tables 3 and 4).

To apply the WUP method, the railways and roads outside of cities should be excluded since they are not included in the definition of built-up areas and are not considered as a part of urban sprawl [7]. Nevertheless, the built-up area data that have been used in this work include all the roads of the CMAs (inside and outside of cities). This choice was particularly made because in the built-up area shapefiles, roads were recorded in a single field, it would have been challenging to identify, and separate, all the roads, in each of the CMAs for each year. Therefore, the roads remained part of the built-up area shapefiles.

We used the USM toolset, which was developed for the calculation of Weighted Urban Proliferation (WUP) by Miroslav Kopecky, Erika Orliitova, and Tomas Soukup at GISat in Prague, Czech Republic [11,12]. This geographic information system (GIS) toolset is freely available on the website of the Swiss Federal Institute for Forest, Snow and Landscape Research (WSL) (https://www.wsl.ch/de/services-und-produkte/software-websites-und-apps/urban-sprawl-metrics-tool-usm.html). Before using this toolset, the polygon layers of built-up areas were converted to 15 m raster cells in accordance with [13].

The value of WUP indicates how strongly the landscape within the boundaries of a reporting unit is sprawled. This research also presents Weighted Sprawl per Capita (WSPC), which quantifies how much on average each inhabitant or workplace contributes to urban sprawl in a reporting unit [14], i.e., this metric refers to the number of inhabitants and jobs in the reporting unit instead of the area of the reporting unit: $WSPC = WUP \cdot \frac{A_{\text{reporting unit}}}{N_{\text{inhabitants+jobs}}}.$

Accordingly, $WSPC = w_1(DIS) \cdot w_2(LUP) \cdot DIS \cdot \frac{A_{\text{built-up}}}{N_{\text{inhabitants+jobs}}} = w_1(DIS) \cdot w_2(LUP) \cdot DIS \cdot \frac{LUP}{LUP}$

Therefore, WSPC is the combination of LUP, DIS, the weighting of LUP (in $w_2(LUP)$), and the weighting of DIS ($w_1(DIS)$).

Fig. 1b and c present the changes of WUP and WSPC values at the level of CSDs in the Toronto CMA between 1991 and 2011. While the value of WUP answers the question of how much urban
Table 3
Information of data, sources, and the corrections that were applied when calculating urban sprawl.

| Data | Source | Corrections |
|------|--------|-------------|
| Built-up areas 1991, 2001, 2011 and Reporting units 2011: | “Human Activity and the Environment - The changing landscape of Canadian metropolitan areas”, released by Statistics Canada [1]. This data was provided to Statistics Canada by Agriculture and Agri-Food Canada. | 1. We excluded waterbodies from being counted as built-up areas (River shapefiles from Statistics Canada 2019). 2. The park layer was used from CanMap 2018, a product of DMTI Spatial, to identify parks that were then removed from built-up area layers (Table 4). 3. The projected coordinate system was changed to: NAD_1983_Albers. |
| Census Metropolitan Areas and Census Subdivisions in Canada 2011 Census Metropolitan Area (CMA) boundaries shapefiles were used for the years 1991, 2001, and 2011. Shapefiles of the 2011 Census Subdivision boundaries were used for the three years. | Census Metropolitan Area (CMA) boundaries shapefiles were used for the years 1991, 2001, and 2011. Shapefiles of the 2011 Census Subdivision boundaries were used for the three years. | |
| Population data | Censuses of Canada (for 1991, 2001, 2011) and “Human Activity and the Environment - The changing landscape of Canadian metropolitan areas”, released by Statistics Canada [1]. | No corrections |
| Job Data The number of full-time and part-time jobs | Statistics Canada. 2019, Special tabulation, based on the 1971, 1991, 2001 censuses of population and the 2011 National Household Survey [2]. | To calculate full-time equivalents, conversion factors were found by dividing the hours of part-time employment by the hours of full-time employment [6, 7]. We applied the same steps separately for the years 2011, 2001, 1991 for Canada, and also separately for the provinces. |

Table 4
Types of parks that were excluded or not excluded, respectively, from the layer of built-up areas. The areas of these parks were obtained from CanMap 2018 (produced by DMTI Spatial).

| Types of parks | Excluded | Not excluded |
|----------------|----------|--------------|
| AMUSEMENT PARK | ✓ | ✓ |
| BOTANICAL GARDEN | ✓ | ✓ |
| CAMPGROUND | ✓ | ✓ |
| CEMETERY | ✓ | ✓ |
| DRIVE-IN THEATER | ✓ | ✓ |
| ECOCLOGICAL RESERVE | ✓ | ✓ |
| EXHIBITION GROUND | ✓ | ✓ |
| GOLF | ✓ | ✓ |
| HISTORIC SITE | ✓ | ✓ |
| LOOKOUT | ✓ | ✓ |
| NATIONAL PARK | ✓ | ✓ |
| NATIONAL WILDLIFE AREA | ✓ | ✓ |
| NATURAL AREA | ✓ | ✓ |
| PARK RESERVE | ✓ | ✓ |
| PARK/SPORTS FIELD | ✓ | ✓ |
| PROTECTED AREA | ✓ | ✓ |
| PROVINCIAL PARK | ✓ | ✓ |
| RECREATION AREA | ✓ | ✓ |
| SANCTUARY | ✓ | ✓ |
| SPORTS/RACE TRACK | ✓ | ✓ |
| SWIMMING POOL | ✓ | ✓ |
| TERRITORIAL PARK | ✓ | ✓ |
| WILDERNESS AREA | ✓ | ✓ |
| WILDERNESS PARK | ✓ | ✓ |
| WILDLAND PARK | ✓ | ✓ |
| ZOO | ✓ | ✓ |
sprawl there is in a reporting unit per square meter, i.e., it is landscape-oriented, WSPC is an inhabitant-oriented measure of urban sprawl [14,15].

Ethics Statement

Where necessary all appropriate ethics and other approvals were obtained for the research. (Our work did not involve human subjects, did not involve animal experiments, and did not involve any data from social media platforms.)

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

CRediT Author Statement

Mehrdokht Pourali: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Visualization, Writing – original draft; Craig Townsend: Validation, Writing – review & editing; Angela Kross: Resources, Software, Writing – review & editing; Alex Guindon: Data curation, Resources, Writing – review & editing; Jochen A.G. Jaeger: Conceptualization, Data curation, Methodology, Project administration, Supervision, Validation, Writing – review & editing.

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Supplementary Materials

Supplementary material associated with this article can be found in the online version at doi:10.1016/j.dib.2022.107941.

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