Locatus 2016 – food environment per neighborhood

Spatial scale / resolution: Neighborhoods

Spatial coverage: Netherlands

Temporal range: 2016

Data format input data: Points / ESRI shape file (shp)

Data format output data: Polygons / ESRI shape file (shp)

Data source input data: Locatus – Peter Nieland / GECCO

Data storage inputdata:

..\Geodata\Data_aanvragen\Thao_Lam\Locatus\Locatus_2016_FEHI.shp

Data storage outputdata:

..\Geodata\Data_aanvragen\Thao_Lam\Locatus\Locatus_2016_FEHI_kerneldens_neighborhood.shp

Description in-/output data:

This dataset presents the food environment healthiness index (FEHI) per neighborhood in 2016, based on Locatus point data of the food environment in 2016 (see Metadatasheet - Locatus food environment 2016). To prevent the MAUP (Modifiable Areal Unit Problem) issue when aggregating data to neighborhoods the Locatus point data was mapped as a point density kernel with 1000 meter search radius, prior to summarizing index values to neighborhoods (see section 'data-processing' and the 'Metadatasheet - Address level food environments 2004 – 2012' for further details). The FEHI Index has values between -5 and + 5 according to the FEHI score list by Poelman et al., 2018.

Locatus collects information about stores, shopping areas and footfall. The Locatus database provides property-level information, such as the name of each outlet, its retail floor area and the retail sector in which it operates. Furthermore, information is recorded about shopping and catchment areas and footfall. To keep the data up to date all 2.500 shopping areas (150.000 addresses) are visited each year. Scattered shops are visited once per every 2 or 3 years. Data is available of reach year starting from 2004.

Variables

Table 1 provides an overview of variables that are available in the dataset Locatus_2016_FEHI_kerneldens_neighborhood.

Table 1: Overview of attribute data in Locatus_2016_FEHI_kerneldens_neighborhood.shp

Variable name	Description	Original dataset
BU_CODE	Neighborhood code	Buurt2016
BU_NAME	Neighborhood name	Buurt2016
FEHI_score	Summed FEHI scores per neighborhood	Locatus_2016_FEHI_neighborhood
Ha	Neighborhood area in hectares	Buurt2016
FEHI_ha	Average FEHI neighborhood score per hectare	Locatus_2016_FEHI_neighborhood
Id		
Gridcode	Mean 1000 meter kernel density (x 1000)	This dataset
FEHIkrndns	FEHI kernel density (= Gridcode / 1000)	This dataset
ORIG_FID		

Data processing:

Calculate FEHI point density kernels

For purposes of comparison we first aggregated FEHI scores from the input data (Locatus_2016_FEHI.shp, see Metadatasheet - Locatus food environment 2016) to neighborhoods (see appendix 1 for procedure applied). We expect however that in general the aggregation of point data to administrative neighborhoods will suffer from the so called ‘Modifiable Areal Unit Problem’ (MAUP), The Modifiable Areal Unit Problem is the problem / bias that occurs when point-based measures of spatial phenomena are aggregated into administrative units in which summary values (e.g., totals, rates, proportions, densities) are influenced by both the shape and scale of the aggregation unit.

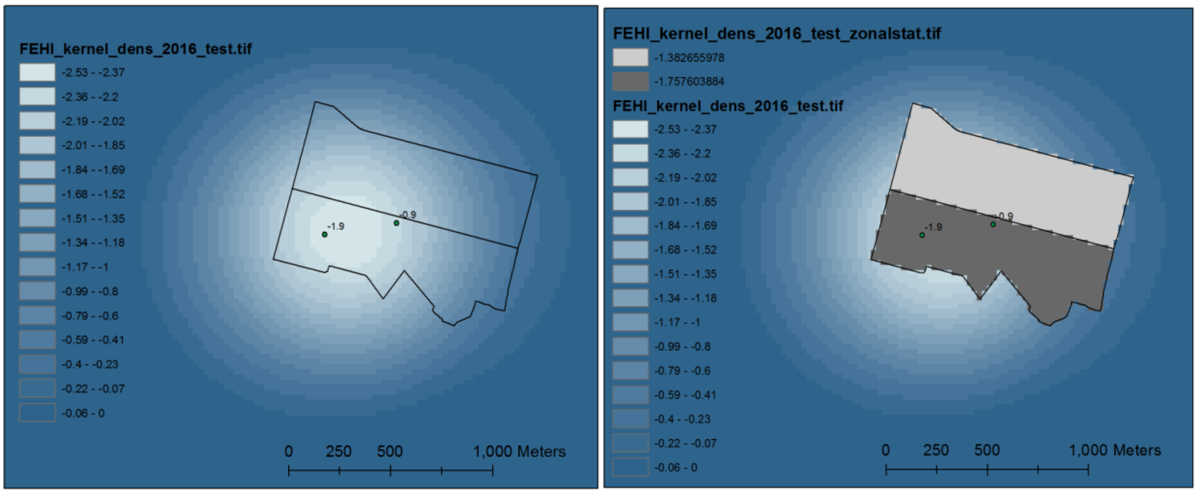
To overcome the here above mentioned MAUP effect as much as possible, we have calculated a point density kernel[1] for the FEHI prior to the data aggregation to neighborhoods. Doing this takes care that distance based environment information around each data-point is gathered and summed up in a regular spaced raster and subsequently averaged over the corresponding neighborhoods.

We have illustrated this concept with the figures underneath. In the first figure you see the point density kernels of imaginary food stores X and Y in a neighborhood A near to the border between neighborhood A and B. If we assume for both stores some kind of score (the ‘population field value’) of 1000 (which is therefore not a FEHI score) the kernel density values in the resulting raster will start from 1000 at the score location and will diminish to a value of 0 at a 1000 meter distance. Were

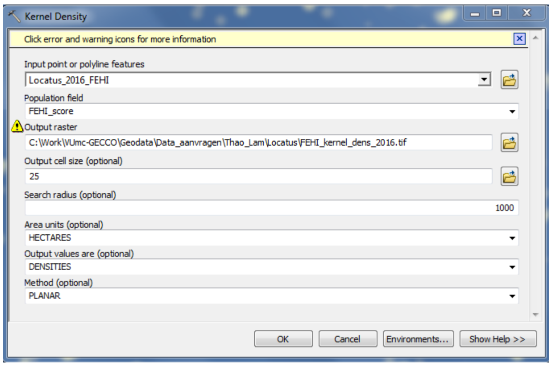
[1] We used a simple custom made kernel density function (inverse distance) instead of the standard kernel function provided in the ESRI ArcMap software, see metadata sheet ‘Metadatasheet - Address level food environments 2004 – 2012’ for further details. The ESRI function is based on the quartic kernel function described in Silverman (1986, p. 76, equation 4.5) where the volume under the surface equals the Population field value for the point. The surface value is highest at the location of the point and diminishes with increasing distance from the point, reaching zero at the Search radius distance from the point.

search radii overlap however, values will sum up and will be higher. The effect is therefore that also in neighborhood B were no store is located kernel density values will be found that are higher the nearer to the border with neighborhood A. Of course this neighborhood effect will only manifest itself for stores in the adjacent neighborhood at a distance to the border than smaller than the search radius used for the kernel density function.

A practical example of the kernel density method in relation to neighborhood borders is given in the subsequent figures underneath where it is clearly visible how the location and FEHI values influence the average FEHI scored assigned to the neighborhoods. In the first (left) figure only the kernel density values are visible, while in the second (right) figure you can see the averaged kernel values (mean) for the two neighborhoods that were assigned via a zonal statistics operation.

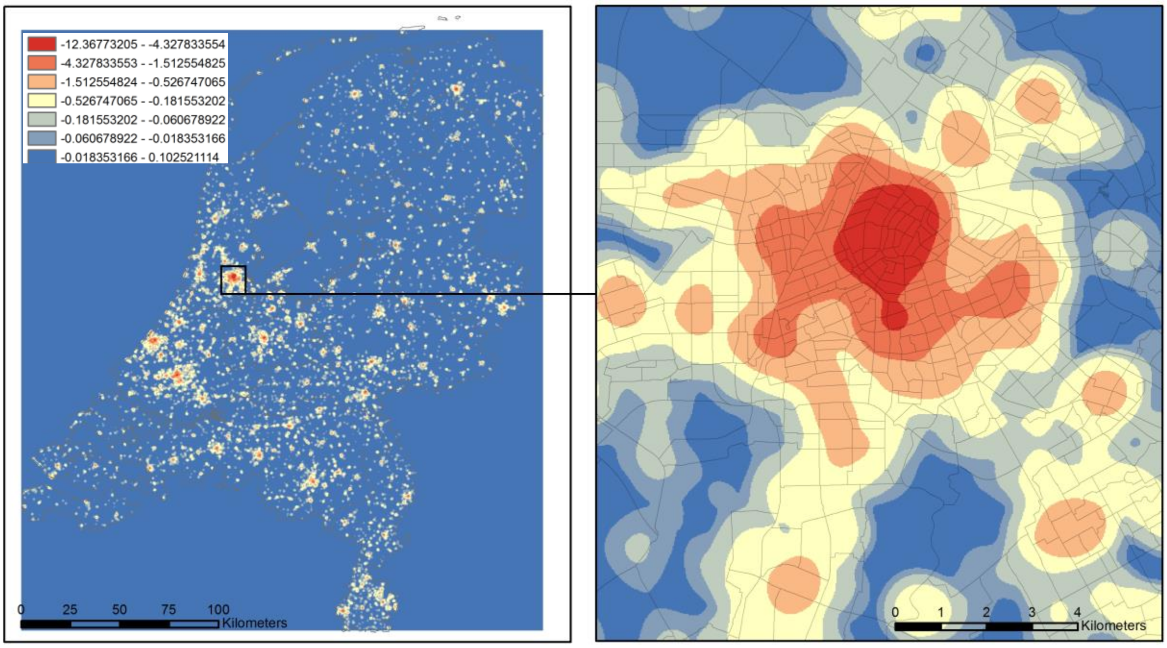


For the kernel density calculation of the complete dataset with the Locatus FEHI scores we used the following settings in the kernel density analysis (see figure below).



The map underneath shows the result of this kernel density analysis for the two scale levels.

Map example: FEHI kernel density 2016 with 1000 meter search radius



Aggregate kernel density of FEHI scores to neighborhoods

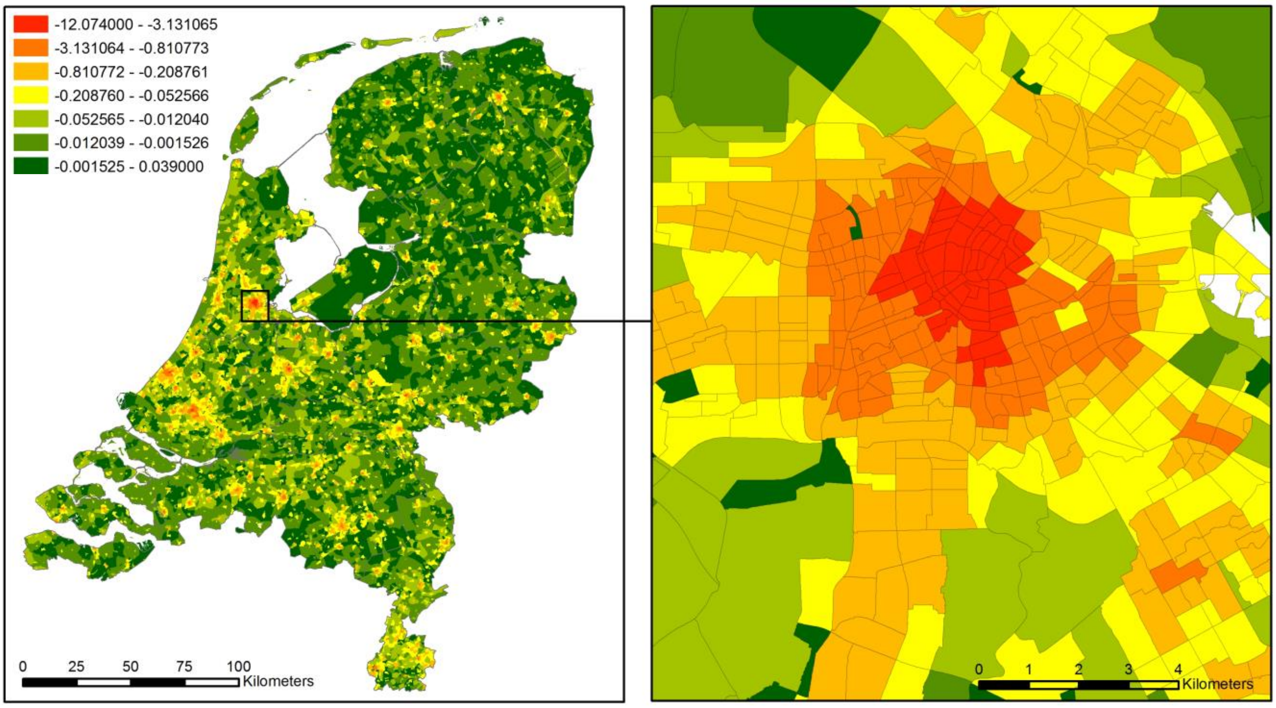
In the last steps average kernel density values are assigned to all neighborhoods.

- First a zonal statistics operation (with statistic type: MEAN) is carried out with the neighborhood map as the feature zone data and the kernel density map as the input value raster. The result is a raster with 25 meter cells with values corresponding to the mean kernel density value per neighborhood.
- Next, the raster is resampled to 100 meter cells to avoid long processing times in the next step
- Next, the raster with floating values is converted to an integer raster as the subsequent operations only work with integer values.
- Next, the integer raster is multiplied by 1000 (to avoid loss of accuracy) and converted to integers: Int("Zonalstat_Kerneldens_FEHI_neighborhood2016.tif" * 1000)
- Subsequently, a raster to polygon operation is carried out (which needs integers as input)

- A table field is added and the integer values are divided by 1000 to get back the original FEHI scores: [gridcode]/1000
- Polygons are converted to points (this step is necessary to guarantee a correct spatial join operation in the next step, as the raster based polygons have different polygon borders than the original neighborhood polygons)
- Carry out a spatial join (match option: Intersect) between the original neighborhood polygons of 2016 (target features) and the kernel density point values (Locatus_2016_FEHI_kerndens_neighborhood_point) with the average kernel density values per neighborhood

The resulting map of these steps is displayed here below.

Map example: FEHI kernel density 2016 with 1000 meter search radius per neighborhood



Data provider

Locatus is market leader in the field of independently sourced retail information in Europe. It gathers its own data on all shops and consumer-oriented service companies and makes this information accessible for its clients through an online database. Locatus started in the year 2000 with the registration of all stores in the Netherlands and is expanding its databases now to other European countries.

Locatus data is commercial data and needs therefore to be purchased if to be used for commercial purposes. For research purposes other special arrangements can be made with Locatus. Both Amsterdam UMC / Department E&B and GGHDC in Utrecht have specific contracts for the use of Locatus data.

URL: https://locatus.com

Data quality

See information provided by locatus

Contact information

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Terms and conditions

See contract Amsterdam UMC – Locatus and contract GGHDC - Locatus

Suggested or required way of data referencing

No indications for referencing have been provided.

List of references

n.a.

Appendix 1 Aggregate FEHI scores to neighborhoods (alternative dataset)

Even though we expect that the aggregation of point data to administrative neighborhoods will suffer from the so called 'Modifiable Areal Unit Problem' (MAUP), we produced this dataset for purposes of comparison. The Modifiable Areal Unit Problem is the problem / bias that occurs when point-based measures of spatial phenomena are aggregated into administrative units in which summary values (e.g., totals, rates, proportions, densities) are influenced by both the shape and scale of the aggregation unit. Steps:

- Aggregate FEHI scores (sum) per neighborhood using the spatial join function in ArcGIS (match option: Intersect, merge rule on field FEHI_score (float): SUM)
- Add a table field (FEHI_ha) and divide summed scores by neighborhood area (calculate field FEHI_ha: [FEHI_score] / [Ha]) to get a FEHI density score per ha

The map example underneath shows the result of these steps. As can be seen, in most areas the summed score has a negative sign and highest (negative scores) can be found, as expected, in town centers.

Map example: FEHI density per ha / per neighborhood 2016

C:\Work\VUmc-GECCO\Geodata\Data_aanvragen\Thao_Lam\Locatus\Metadatasheet map overview

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