9 Energy savings in homes due to shelter provided by trees

9.1 Overview

Trees reduce wind speed. As a result, less energy is required for the heating of houses and buildings (van Moppes & Klooster 2008; Ruijgrok et al., 2006; Swaagstra et al. 2003; Prendergast 2003). A map for energy savings in homes due to shelter provided by trees has been produced for the Atlas of Natural Capital, based on the TEEB-Stad methodology and using the same input values as the TEEB-Stad tool (see www.teebstad.nl). The output map has been produced by combining existing spatial data for the Netherlands with maps developed by RIVM for the Natural Capital Model. Tables 9.1 and 9.2 provide an overview of the input and output maps to model the ecosystem service 'energy savings in homes due to shelter provided by trees'.

Table 9.1. Output maps generated for the ecosystem service 'energy savings'.

Output map	Unit
Energy savings homes due to shelter provided by trees	[€]

Table 9.2. Input maps applied to estimate the ecosystem service 'energy savings'.

Input	Unit	Short description	Source
Ecosystem unit map	Ecosystem unit classes	Ecosystem unit classes map for the Netherlands in 2013	CBS 2017
Inhabitants	# inhabitants per cell	Shows the number of inhabitants per cell	RIVM (Appendix II)
Tree height	[m]	90 percentile of cells covered with trees	RIVM (Appendix I)

9.2 Modelling the ecosystem service

The influence of sheltering trees on the energy budget of homes is estimated based on the LCEU map, the map showing inhabitants and defining the location of residential cells and the map showing the height of the trees. Figure 9.1 provides a schematic overview of the way input data has been modelled in order to produce the output maps for this ecosystem service.

9.2.1 *Energy savings due to sheltering by trees within 50m*

The energy savings are estimated according to:

$$\boldsymbol{EnergySavings} = \boldsymbol{AvailabilityOfTrees} \times \boldsymbol{ResidentialCell} \times \boldsymbol{frSaving} \times \boldsymbol{GasConsumption} \times \boldsymbol{Price} \times \boldsymbol{frWindDirection}$$

Where:

- *AvailabilityOfTrees* is the relative availability of trees in the neighbourhood, estimated as the total sum of the trees' height (for trees taller than 10m) within a distance of 50m divided by the number of cells within that neighbourhood.
- *ResidentialCells*, the cells for which the number of inhabitants > 0 [-] based on the inhabitants map (Appendix II).
- *frSaving* is the fraction of the gas consumption saved due to sheltering by trees: 0.1 [-] (Swaagstra et al. 2003, van Moppes & Klooster, 2008)
- *GasConsumption* is the average annual gas consumption of a household: 1,600 m^3/year (van Moppes & Klooster, 2008).
- *Price* is the average gas price: €0.66/m^3 (Milieucentraal.nl, 2016)
- *frWindDirection,* the correction for wind direction, the proportion of days on which the wind blows from the direction in which trees shelter adjacent houses; 0.3 [-] (Swaagstra et al. 2003, van Moppes & Klooster, 2008)

9.3 Remarks and points for improvement

- In the current model, no distinction is made between the types of houses. Therefore, high-rise buildings that may not be affected by shelter provided by trees are currently included. Additional information on building height should be included in the model to more accurately estimate the sheltering effects.
- Dominant wind direction has not been taken into account in the model.
- Currently, a single value for average gas consumption in the Netherlands is applied. However, CBS has disaggregated data on gas consumption that could be included in an update of the model.

9.4 References

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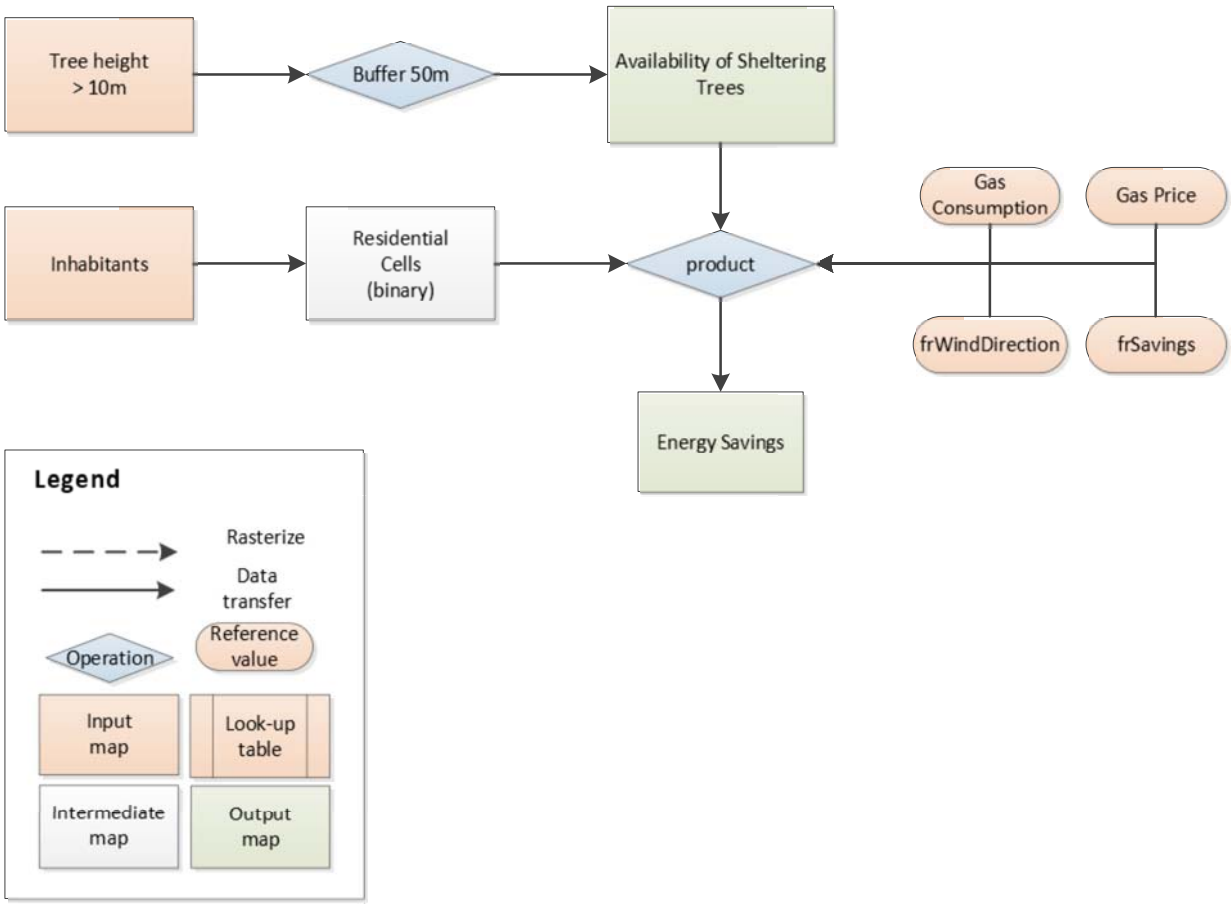

Figure 9.1 Schematic overview of the increase in property value due to urban green and water.