

## Summary

Footprint indicators measure the ecological sustainability of production and consumption within a country. They measure the use or pollution of scarce resources such as bioproductive land (the ecological footprint), available fresh water (the water footprint), material resources (the material footprint) or atmospheric greenhouse gas capacity (the carbon footprint).

For most footprint indicators, Belgium performs worse than neighboring countries (table below): this is true for the ecological, carbon, water and material footprints and also for different data years and different calculation methods. This suggests a structural explanation is needed: in other words, what are the policy relevant economic variables and consumption activities that policy-makers should look at in order to reduce the Belgian footprints?

Indicator	Ecological footprint				Carbon footprint		Waterfootprint (agriculture)		Waterfootprint (total)	Domestic Material Consumption
	gha/cap				ton CO2/cap/yr	ton CO2-eq/cap/yr	m <sup>3</sup> /cap/yr		m <sup>3</sup> /cap/yr	ton/cap/yr
Unit										
Source	GFN	GFN	GFN	Eureapa	Davis-Caldera	Eureapa	WFN	WFN/WWF	Eureapa	OECD
Data Year	2006	2007	2008	2004	2004	2004	2004	2008	2004	2005
Methodological edition	2009	2010	2011	2011	2010	2011	2005	2009	2011	2005
<b>Belgium</b>	5,7	8,0	7,0	7,8	16,0	19,8	1613	2529	3756	16,3
France	4,6	5,0	4,9	5,2	9,3	12,3	1331		2796	13,4
Germany	4,0	5,1	4,6	6,1	12,7	15,7	1038	1424	2729	15,4
Netherlands	4,6	6,2	6,3	6,7	14,0	17,8	617	1541	3623	20,0
UK	6,1	4,9	4,7	5,9	13,6	16,6	805	1268	2471	11,6

Sources: Ecological footprint: GFN 2009, 2010, 2011; Eureapa OPEN:EU 2011; carbon footprint: Davis & Caldeira 2010; Water footprint: Water Footprint Network (WFN) published in Chapagain & Hoekstra 2004; WFN/WWF De Caritat et al. 2011, Chapagain & Orr 2008, Sonnenberg et al. 2009, Van Oel et al. 2008; Domestic Material Consumption: OECD 2008a

The purpose of this study was to find the structural causes of the higher values of footprint indicators for Belgium, in particular the National Footprint Accounts (NFA) of the Global Footprint Network (GFN). According to the NFA (2011 edition, data year 2008) the Belgian ecological footprint was 1.84 gha/person higher than the average of the neighboring countries. Eleven possible explanations were found, some of them could be more strongly supported than other explanations.

### Strongly supported explanations

There are two more substantiated explanations, based on relatively reliable data.

- 1) **Household energy consumption:** Belgium has on average older buildings with lower energy performance, resulting in a high energy consumption for heating. This might explain 9% of the higher Belgian ecological footprint (the aforementioned 1.84 gha/person).
- 2) **Road transport passenger cars:** the low occupancy rate of Belgian passenger cars, the dense network of roads and the low fuel taxes (especially diesel) all contribute to higher Belgian vehicle kilometers per person, and thus a higher carbon footprint. This might also explain 9% of the higher Belgian footprint.

### Weakly supported explanations

- 3) **Food waste:** According to some data the Belgian food industry and service sectors (trade and commerce) generate more waste than in neighboring countries. A rough estimation of food losses in the manufacturing sector might explain 9% of the higher Belgian footprint. We note that we have to be careful with this calculation because there are no clear criteria for what is considered as food waste.
- 4) **Surface of homes and gardens:** according to some land use data Belgium has higher built-up land footprint than neighboring countries, possibly due to a larger surface area for dwellings (including gardens). It is not

clear whether the larger footprint of built-up land is caused by either larger buildings or larger gardens. However, the current land use data are not detailed enough and too unreliable (too rough, different data sources use different land use types). The surface area of dwellings might explain 8% of the higher Belgian footprint.

- 5) **Construction of buildings and infrastructure:** the direct and indirect energy and materials used in the construction of infrastructure and buildings is an important factor in the higher ecological footprint and material footprint of Belgium, and might explain 6% of the higher Belgian footprint. Although the data of construction are based on many assumptions and are therefore less reliable, the Belgian high values of direct energy (in the construction sector and industrial sectors for metals and minerals), is in accordance with the higher Belgian values for materials.
- 6) **Fish consumption:** According to the NFA, Belgians would not consume more fish than their neighbors, but would consume relatively more fish species at higher trophic levels. Those fish species have higher ecological footprint values than species lower in the trophic chain. This might explain 4% of the higher Belgian footprint. The footprint calculation is very sensitive to variations in species and trophic levels, so this result is also less reliable.
- 7) **Vegetable oils and animal fats:** Belgians have probably a higher consumption of oil crops and animal fats, both for (processed) foods and for industrial applications.<sup>1</sup> This might explain 4% of the higher Belgian footprint. The calculation took into account the vegetable oils used in imported and exported products, but this trade data may generate a small error in the result. The vegetable oils that contribute most to the higher Belgian ecological and water footprint are: palm oil (high level of consumption), sunflower oil (high footprint value per unit of weight) and rapeseed (high consumption rates, which are used for various applications).
- 8) **Coffee, beer (barley) and sugar:** other food products that contribute to the high footprint of Belgium are coffee (high water footprint value per unit weight and high consumption level), sugar (high consumption) and beer (high consumption). Together they might explain 6% of the higher Belgian footprint. This calculation took into account estimates of the sugar and processed barley in imported and exported products, which may generate a small error on the result.

## Other hypotheses

In this study, we can identify other explanatory factors that were not clearly supported by the different data sets from this analysis. Some data sources are mutually (highly) inconsistent. Therefore, we formulate these factors as hypotheses that need to be further clarified in the future.

- 9) **Goods:** according to some data, Belgians would consume relatively more electronic equipment, machinery, chemical products, plastics and wood products. But the high Belgian footprint of goods is to a large extent explained by capital investments. Households play a smaller role than capital investment goods in the explanation of the higher Belgian footprint. The NFA calculation should be refined to determine whether goods actually contribute to a higher footprint for Belgium than in neighboring countries.
- 10) **Animal products from grazing animals:** some data suggest a slightly higher Belgian consumption of beef, dairy and leather, and those higher consumption levels would generate a higher footprint for Belgium in comparison with neighboring countries. But also here there are inconsistencies in data.

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<sup>1</sup> Vegetable oils are used in e.g. lubricating oil, detergents, cosmetics, linoleum ... It is not clear which of these products are responsible for the high consumption footprint of vegetable oils in Belgium.

## Methodological deviations

The NFA (according editions in 2010 and 2011) contain a number of methodological choices which, for a small and open country like Belgium, can lead to overestimates of the footprint. The three main overestimations that generate a virtual higher Belgian footprint due to methodological errors are:

- 11) A problem arises in the calculation of traded animal products, disadvantaging countries like Belgium. The export of animal products uses a weighted average footprint intensity of grazing land and feed used for the production of these livestock products. Belgium has an open economy with a lot of import and export of animal feed and animal products, as well as a relatively high domestic production efficiency in livestock farming, which implies that Belgium is vulnerable to an overestimation according to the NFA methodology. In future NFA-editions this error could be corrected. We suspect that this effect might explain 30% of the higher Belgian footprint.
- 12) Bunker Fuels of international freight (shipping and aviation) are assigned to a country by total weight of imported goods. An allocation key based on import weight generates a disadvantage for countries with a lot of international trade. Since Belgium is an open economy with a lot of import and export of goods, it may be that the NFA to Belgium overestimates the CO<sub>2</sub>-emissions from bunker fuels. It is hard to tell how big this overestimation is for a country like Belgium, but it might explain up to 25% of the higher Belgian footprint.
- 13) For European countries, some land use data used in the NFA are unreliability. The data might contain erroneous estimates, especially for a small country like Belgium. This may result in an overestimation of the yield factor and footprint of built-up land in Belgium. This overestimation might explain 6% of higher Belgian footprint.