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ECOLOGICAL FOOTPRINT

Trend Analysis and Interpretation of Luxembourg's Consumption Footprint NFA 2010 edition, data years 2000 – 2007

MINISTÈRE DE L'ÉCONOMIE
ET DU COMMERCE EXTÉRIEUR
Observatoire de la compétitivité

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of Luxembourg's Consumption Footprint
NFA 2010 edition, data years 2000 – 2007

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Ecological Footprint:
Trend Analysis and Interpretation of Luxembourg's Consumption Footprint from 2000 to 2007

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List of Abbreviations

BE	Belgium
CRTE	Resource Centre for Environmental Technologies / Public Research Centre Henri Tudor (Luxembourg)
CO_2	Carbon dioxide
CSDD	National Advisory Council for Sustainable Development / Conseil Supérieur pour un Développement Durable (Luxembourg)
DE	Germany
EF	Ecological Footprint
EU	European Union
FR	France
e.g.	exempli gratia
FAO	Food and Agriculture Organization of the United Nations
GDP	Gross Domestic Product
GFN	Global Footprint Network
gha	global hectares
i.e.	id est (that is)
LU	Luxembourg / Luxembourg's
m^3	cubic meter(s)
MAX	maximum
MDDI	Ministry of Sustainable Development and Infrastructures (Luxembourg)
MDF	Medium Density Fibreboard
MECE	Ministry of the Economy and External Trade / Ministère de l'Économie et du Commerce Extérieur (Luxembourg)
MIN	minimum
NFA	National Footprint Accounts
road fuel exports	road fuel consumption of commuters, fuel tourism and transit
STATEC	Government Statistics Service of Luxembourg
UK	United Kingdom

1. Framework of the study

In the summer of 2010, Luxembourg's Ecological Footprint was published for the first time. This study was commissioned by Luxembourg's National Advisory Council for Sustainable Development (CSDD) and conducted by the Public Research Centre Henri Tudor. In this study, the Ecological Footprint calculations for Luxembourg, which were done by Global Footprint Network, were evaluated with respect to Luxembourg's national particularities. The aim was to correctly define the boundaries of the Ecological Footprint assessment for Luxembourg and to address methodological issues, which are relevant at the national level, including data quality identification. One of the main outcomes of this study was a methodology to identify the share of three different consumers (a) residents,[1] (b) commuters,[2] and (c) gasoline tourism[3] & transit[4] hold in Luxembourg's Footprint.

The 2010 study is based on the 2008 version of the National Footprint Accounts (NFA) for Luxembourg and discusses Luxembourg's Ecological Footprint for the reference year 2005. The final report is available for free on the CSDD website: www.myfootprint.lu.

In complementarity to the first study, the present report discusses Luxembourg's Ecological Footprint for the years 2000 to 2007. This 2011 study is based on the methodology developed in 2010 to identify the consumers and consumption categories of relevance for Luxembourg's Ecological Footprint and the 2010 edition of the National Footprint Accounts (NFA) for Luxembourg. The work was conducted within the framework of a research collaboration between the Ministry of Economy and External trade (MECE), under the coordination of the Observatory of Competiveness, and the Public Research Centre Henri Tudor.

In this present study, Luxembourg's Ecological Footprint for the years 2000 to 2007 is analysed in detail. In chapter 2, the Ecological Footprint methodology is shortly introduced; then, in chapter 3, the results for Luxembourg are put in a European context. In chapter 4, the trend of Luxembourg's Ecological Footprint for the years 2000 to 2007 is analysed with respect to (a) the different land uses covered by the methodology and (b) the residents, commuters and gasoline tourism & transit share in the total Footprint. In chapter 5, finally, the Ecological Footprint is discussed in the framework of Luxembourg's environmental competitiveness indicators.

[1] Residents are the Inhabitants of Luxembourg, who are officially taken into account in the population statistics.

[2] Commuters are persons who travel regularly, especially by automobile, bus or train, between their residence and their place of employment in Luxembourg. The commuters share on Luxembourg's consumption represents their consumption in Luxembourg, but does not reflect their total consumption footprint.

[3] Gasoline tourism refers to the fuel taken up by cars that specifically go to Luxembourg for the purpose of filling up [MEV, 2008]. The fuel consumed by the commuters is not taken into account; their fuel consumption accounts for the commuters' footprint.

[4] Transit traffic passing through Luxembourg [MDDI, 2009] is dominated by professional logistics transports consuming diesel.

2. Quantifying the environmental impacts of a country's consumption: the Ecological Footprint approach

The Ecological Footprint concept was formally introduced by Mathis Wackernagel and William Rees in the early 1990s [Kitzes et al., 2009a]. It measures human consumption of products and services from different ecosystems in terms of the amount of bioproductive land and sea area needed to supply these products and services. In other words, the Ecological Footprint calculates the land area needed to produce food, provide resources, produce energy, and absorb the pollution (CO_2 emissions) generated by the supply chains. As this land is nowadays distributed globally (e.g. products and services in Luxembourg are imported from all around the world), the Ecological Footprint is expressed in global hectares (gha) [WWF, 2007], i.e., hectares of land with a world average productivity.

The area of land or sea available to serve a particular use is called biocapacity, and represents the biosphere's ability to meet human demand for material consumption and waste disposal. In other words, the biocapacity represents the capacity of an area or ecosystem to generate an on-going supply of resources and to absorb its waste (CO_2 emissions). Un-sustainability occurs if the ecological footprint, i.e. the demand on the system, exceeds its biocapacity.[5]

The Ecological Footprint and biocapacity calculations cover six land use types: cropland, grazing land, fishing grounds, forest land, built-up land and carbon uptake land. According to the 2010 edition of the National Footprint Accounts developed by the Global Footprint Network, humanity demanded the resources and services of 1.5 planets in 2007. This situation, in which total demand for goods and services exceeds the available supply, is known as overshoot. On the global scale, overshoot indicates that stocks of ecological capital are depleting or that waste (CO_2 emissions) is accumulating [Ewing et al., 2010; Ewing et al., 2008; GFN, 2005].

The most reported type of Ecological Footprint is the Consumption Footprint.[6] It is the area needed to support a defined population's consumption. The Consumption Footprint (in gha) includes the area required to produce the materials consumed and the area needed to absorb the waste (CO_2 emissions). In the National Footprint Accounts, the Consumption Footprint of a nation is calculated as the nation's production Footprint plus the Footprint of imports minus the Footprint of exports, and thus, is strictly speaking a Footprint of apparent consumption. The national average or per capita Consumption Footprint is equal to a country's Consumption Footprint divided by its population [GFN, 2009b].

In the following report, Luxembourg's Ecological Footprint for the years 2000 to 2007 is presented in detail, starting with the comparison of Luxembourg's Consumption Footprint to the footprints of other member states of the European Union (chapter 3).

[5] www.science.org.au

[6] The Production, Imports and Exports Footprints could be additionally reported. As explained in the following, the Consumption Footprint is made up of these footprints: Consumption Footprint = Production Footprint + Imports Footprint – Exports Footprint.

3. Luxembourg's Footprint in comparison to the European Union

Luxembourg has with 11.1 global hectares (gha) the highest per capita Ecological Footprint within the European Union (see Figure 1, based on the 2010 National Footprint Accounts provided by Global Footprint Network) [NFA, 2010]. The average Ecological Footprint for 24 European countries[7], without taking into account Luxembourg, is about 5.4 gha/capita. This is thus below Belgium's footprint of 8.0 gha/capita, but above the footprints of Luxembourg's remaining neighbours: Germany (5.1 gha/capita) and France (5.0 gha/capita).

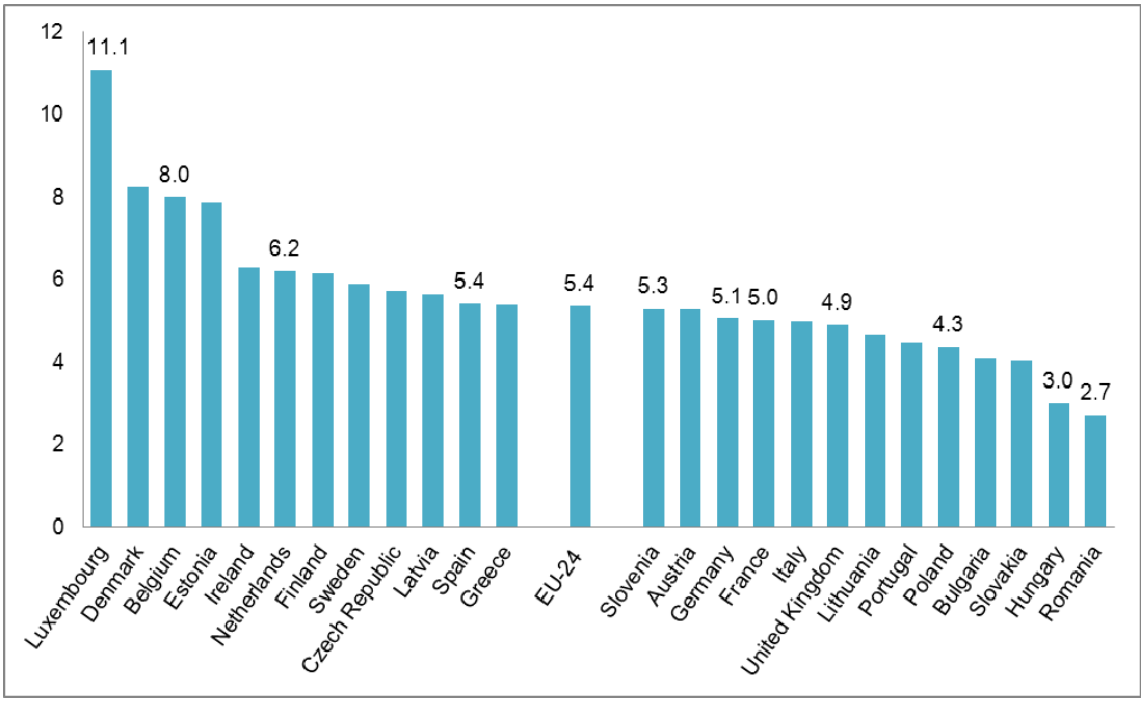

Figure 1: Ecological Footprints of European nations in 2007 in gha per capita (the average EU-24 does not account for Luxembourg)

Luxembourg's Ecological Footprint (EF) is not only the highest within Europe, but the country also has the highest carbon footprint with 7.6 gha/capita; representing 69% of its total EF (see Table 1). In fact, an important carbon footprint generally stands for a high consumption of fossil fuels; the case of Luxembourg will later discussed in chapter 4.2.2. On average, the carbon footprint represents 50% of the Ecological Footprint of an EU country. In the context of the Ecological Footprint methodology, the carbon footprint calculated here refers to the forest land needed for the uptake of the CO_2 emissions of a nation produced directly and indirectly over one year, for which the details are presented in chapter 4.1.1 of the present report.

[7] The EU-24 average accounts for the following member countries: Austria, Belgium, Bulgaria, Czech Republic, Denmark, Estonia, France, Finland, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, The Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, United Kingdom.

Table 1: Ecological and Carbon Footprints of European nations in 2007 (the average EU-24 does not account for Luxembourg)

Country	Ecological Footprint	Carbon Footprint		Remaining Footprint[8]	
	[gha/capita]	[gha/capita]	[%]	[gha/capita]	[%]
Luxembourg	11.1	7.6	69%	3.5	31%
Denmark	8.3	3.5	42%	4.8	58%
Belgium	8.0	3.9	48%	4.1	52%
Estonia	7.9	3.3	42%	4.6	58%
Ireland	6.3	3.7	59%	2.6	41%
Netherlands, The	6.2	3.0	48%	3.2	52%
Finland	6.2	4.3	70%	1.9	30%
Sweden	5.9	2.7	46%	3.2	54%
Czech Republic	5.7	3.2	57%	2.5	43%
Latvia	5.6	1.4	25%	4.2	75%
Spain	5.4	2.7	50%	2.7	50%
Greece	5.4	2.9	54%	2.5	46%
EU-24	**5.4**	**2.7**	**50%**	2.7	50%
Slovenia	5.3	3.4	64%	1.9	36%
Austria	5.3	3.1	59%	2.2	41%
Germany	5.1	2.7	53%	2.4	47%
France	5.0	2.5	50%	2.5	50%
Italy	5.0	2.7	53%	2.3	47%
United Kingdom	4.9	2.9	59%	2.0	41%
Lithuania	4.7	1.7	35%	3.0	65%
Portugal	4.5	2.1	46%	2.4	54%
Poland	4.3	2.2	52%	2.1	48%
Bulgaria	4.1	1.7	42%	2.4	58%
Slovakia	4.1	2.3	57%	1.8	43%
Hungary	3.0	1.7	55%	1.3	45%
Romania	2.7	1.3	49%	1.4	51%

[8] The here mentioned remaining footprint includes the land uses footprints cropland, grazing land, built-up land and fishing grounds.

4. Luxembourg's Ecological Footprint from 2000 to 2007

Between the years 2000 to 2007, Luxembourg's total Consumption Footprint is only decreasing slightly, i.e. by 2% (see Table 2). In parallel, Luxembourg's Consumption Footprint per capita is decreasing by 10% from 12.3 gha in 2000 to 11.1 gha in 2007 (see Table 3). This means that the increase of the population in Luxembourg (+1.2%, see Table 6) was not followed by an increase of the consumption (see Figure 2).Despite this trend, a slight increase of the per capita Footprint to 12.6 gha can be noticed in 2002 as well as an important rise to 13.8 gha per capita in 2003 (see Table 3). This tendency is similar for the total Consumption Footprint (see Table 2). The variations of Luxembourg's Consumption Footprint over the years are discussed in detail in the following sections of this report.

Table 2: Luxembourg's total Consumption Footprint from 2000 to 2007

year	2000	2001	2002	2003	2004	2005	2006	2007	2000-2007
gha	5 359 983	5 318 331	5 627 653	6 243 565	5 446 066	5 522 899	5 455 161	5 267 185	-
variation	-1%	+6%	+11%	-13%	+1%	-1%	-3%		**-2%**

Table 3: Luxembourg's per capita Consumption Footprint from 2000 to 2007

year	2000	2001	2002	2003	2004	2005	2006	2007	2000-2007
gha / capita	12.3	12.0	12.6	13.8	11.9	11.9	11.6	11.1	-
variation	-2.5%	+5%	+10%	-14%	0%	-2.5%	-4%		**-10%**

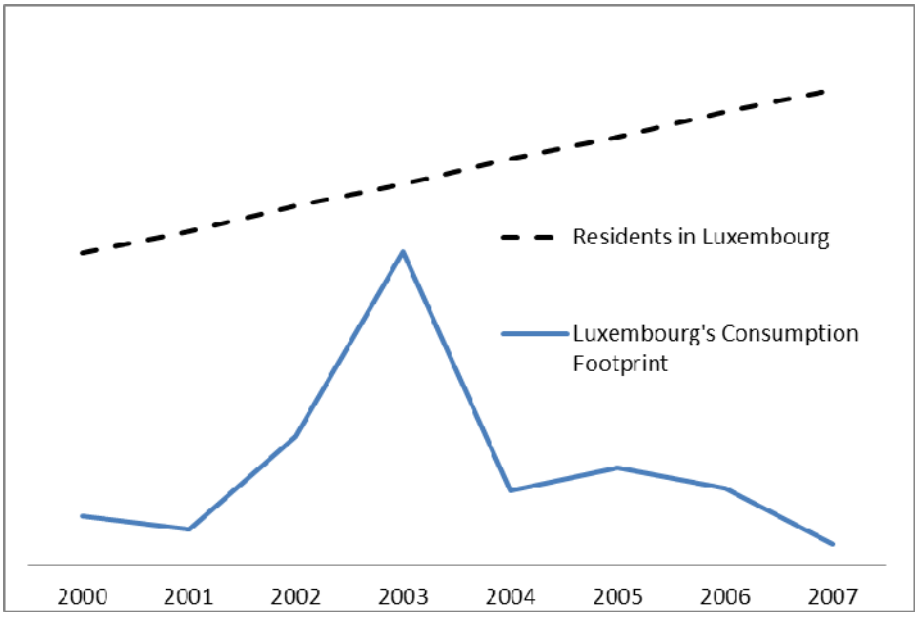

Figure 2: Population growth and Consumption Footprint trends in Luxembourg from 2000 to 2007

4.1. Luxembourg's Footprint at component or land use level

The Ecological Footprint identifies six different land use categories which are built-up land, fishing grounds, grazing land, cropland, forest land and carbon uptake land (or carbon footprint). Luxembourg's Consumption Footprint is highly dominated by the carbon footprint (see Figure 3), followed by the forest land and the cropland footprints (see Table 4). The trends of the cropland, grazing land, fishing grounds and built-up land footprints are relatively linear over the years with a total share in Luxembourg's consumption footprint of about 20%; on the other hand, the trends of the carbon and forest footprints remain non-linear (see Figure 4). These two footprints will be discussed in the next paragraphs.

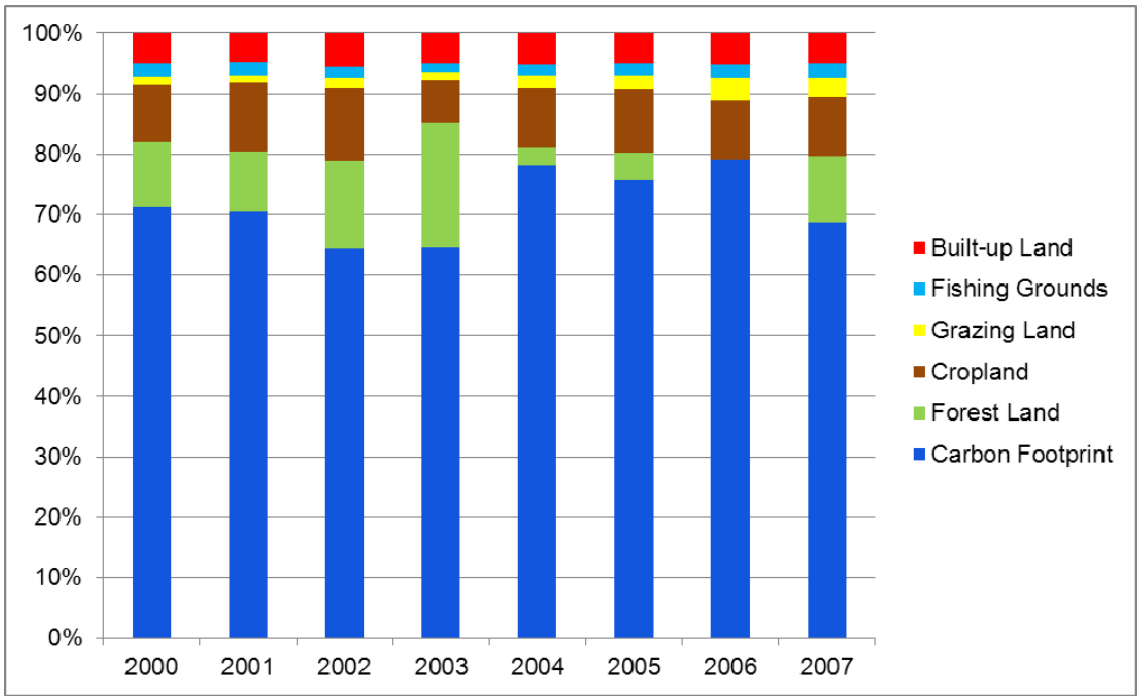

Figure 3: Composition of Luxembourg's Consumption Footprint from 2000 to 2007 by land use categories

Table 4: Composition of Luxembourg's Consumption Footprint from 2000 to 2007 by land use categories

Land use category	2000	2001	2002	2003	2004	2005	2006	2007
Carbon Footprint	71%	70%	64%	65%	78%	76%	79%	69%[9]
Cropland	9%	11%	12%	7%	10%	10%	10%	10%
Grazing Land	1%	1%	2%	1%	2%	2%	4%	3%
Fishing Grounds	2%	2%	2%	1%	2%	2%	2%	2%
Forest Land	**11%**	**10%**	**15%**	**21%**	**3%**	**5%**	**0%**	**11%**
Built-up Land	5%	5%	6%	5%	5%	5%	5%	5%
TOTAL	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**

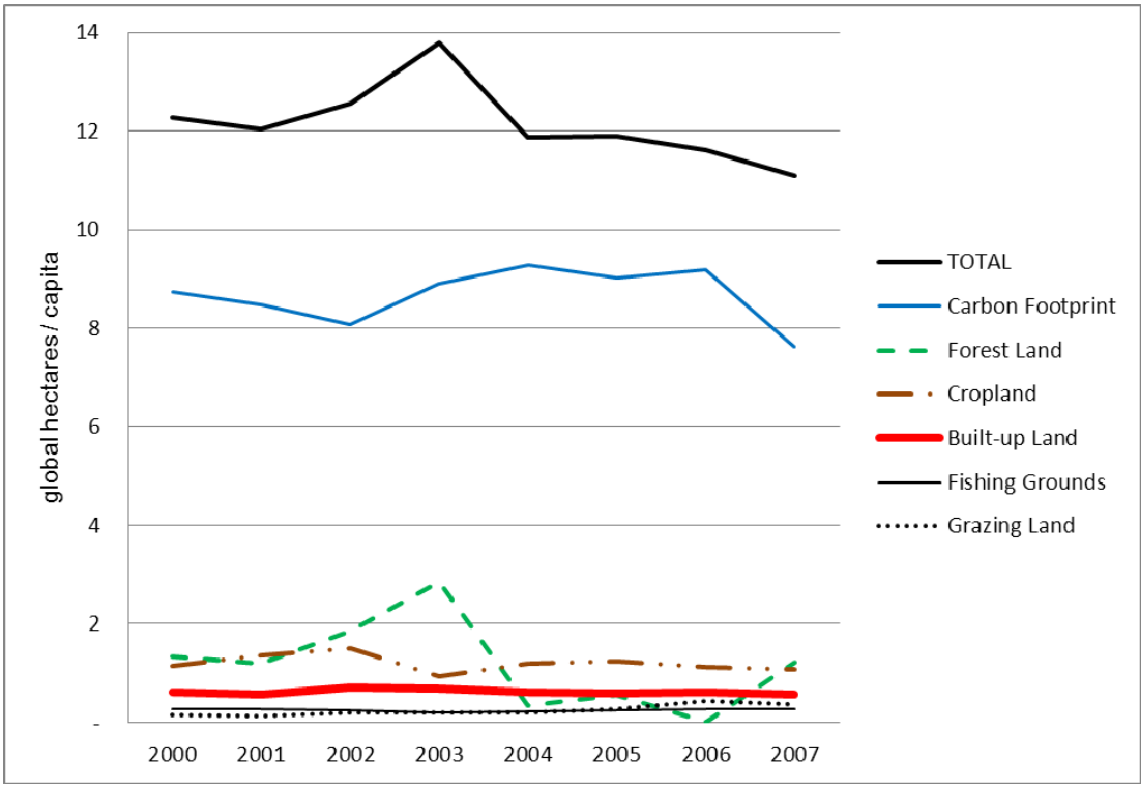

Figure 4: Luxembourg's per capita Consumption Footprint from 2000 to 2007 by land use categories

[9] In 2006, the forest footprint had no impact on Luxembourg's Consumption Footprint because the exports exceeded the production plus the imports, thus the impact of the carbon footprint increased proportionally. In 2007, the forest land category had an impact of 11% on the total result, thus the carbon footprint decreased by this proportion.

4.1.1. Luxembourg's Carbon Footprint

The Carbon Footprint represents the area of forest land required to take anthropogenic carbon dioxide emissions up, thus avoiding accumulation phenomena in the atmosphere. The Carbon Footprint takes into account carbon dioxide emissions from several sources: domestic fossil fuel combustion, embodied emissions in traded goods, services and electricity, and a country's share in global international transport emissions [Ewing et al., 2010; Kitzes et al., 2008a]. It can be seen that the share of the Carbon Footprint in Luxembourg's total Consumption Footprint decreased from 2000 to 2003 from 71% to 65% and increased in 2004, 2005 and 2006 to 78%, 76% and 79% respectively. Then, it declined again to 69% in 2007 (see Table 4).

The variability of the Carbon Footprint over the years becomes even more noticeable when it is compared independently from the other land use footprints (see Figure 5). It appears that in 2002 the Carbon Footprint reached a minimum of 3,617,000 gha (-5% compared to the year 2001), which was nearly met in 2007 with 3,621,000 gha (-20% compared to year 2006).

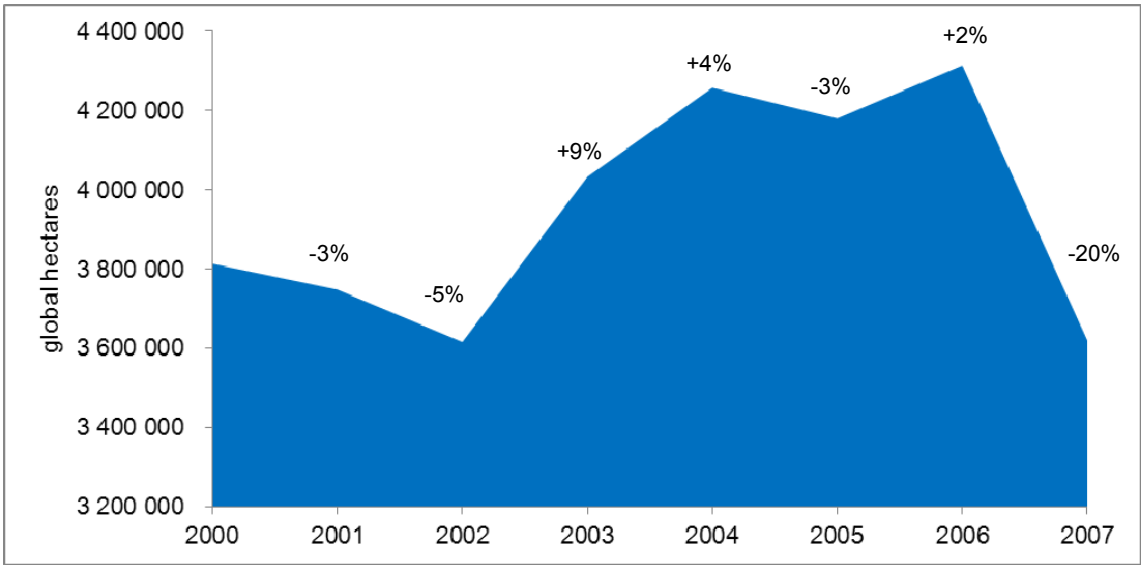

Figure 5: Luxembourg's Carbon Footprint from 2000 to 2007

For the detailed analysis of Luxembourg's Carbon Footprint, it is necessary to refer to the subcategories which have an impact on the result: direct and indirect emissions related to the production and transport of goods. The Carbon Footprint is composed by the following subcategories: international transports, traded electricity, embodied emissions in traded items, road transports and other fossil fuels (without road transports). In Luxembourg, the Carbon Footprint is highly dominated by direct carbon dioxide emissions due to the burning of fossil fuels (i.e. the categories road transports and fossil fuels without road transport; see Table 5).

The road transport category represents the total emissions due to fuel burning based on the fuel sales in Luxembourg. It can be seen that fuel sales constantly increased from 2000 to 2005 and are decreasing since 2005 (see Figure 6). This decrease is due to a higher taxation on fuels.[10]

Table 5: Composition of Luxembourg's Carbon Footprint from 2000 to 2007 by subcategories

Subcategory	2000	2001	2002	2003	2004	2005	2006	2007
International Transports	10%	10%	10%	9%	10%	9%	10%	12%
Traded electricity	23%	23%	17%	16%	15%	15%	16%	20%
Embodied emissions in traded items	13%	9%	6%	11%	6%	4%	4%	-13%
Road Transports	31%	34%	38%	38%	41%	44%	42%	49%
Fossil fuels (without road transport)	23%	24%	29%	26%	28%	28%	28%	32%
TOTAL	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**

The traded electricity category represents the impact due to the consumption of imported electricity in Luxembourg. An important part of the electricity consumed at national level is imported from neighbouring countries, such as are Germany and Belgium.[11] In 2002, Luxembourg's Carbon Footprint decreased significantly due to less electricity being imported from neighbouring countries (see Figure 5). This is due to the fact that during that year, the gas and steam turbine "Twinerg" in Esch-sur-Alzette started operating. The same year, the embodied emissions in traded goods decreased inter alia due to lower embodied emissions in the imports. In 2007, the embodied emissions in the exports even exceeded the emissions in the imports reducing significantly Luxembourg's Carbon Footprint (see Figure 6).

[10] In 2005, the taxation on fuels increased, but, compared to the European average price, fuels still remain cheap.

[11] The national institute of regulation (ILR – Institut Luxembourgeois de Régulation) is providing updated information on the national electricity mix, see :

http://www.ilr.public.lu/electricite/statistiques/releve_detaille_ilr/index.html and www.ilr.lu/electricite/etiquetage_electricite.

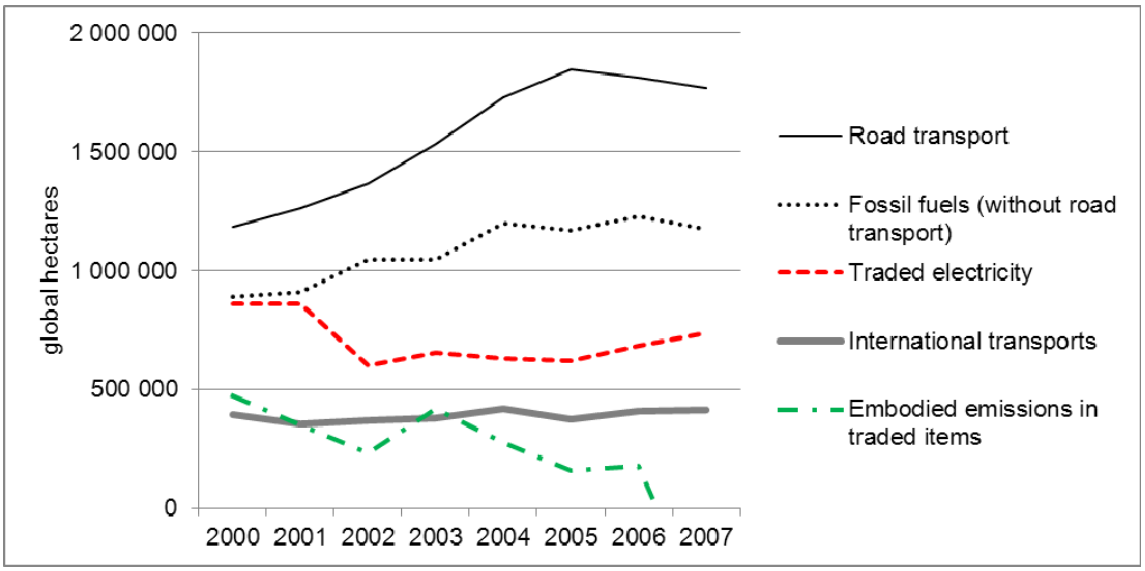

Figure 6: Luxembourg's Carbon Footprint by subcategories from 2000 to 2007

4.1.2. Luxembourg's Forest Footprint

The forest land Footprint assesses human demand for the regenerative capacity of the world's forests. It represents the area of world average forest land needed to supply wood for construction, fuel and paper [GFN, 2009b]. The forest land Footprint consists of two broad types of primary products[12]: wood used as a fuel and timber used as a raw material to produce secondary[13] timber products (for more details see: Hild et al., 2010).

The share of the forest footprint in Luxembourg's total Consumption Footprint is increasing from 11% in 2000 to 15% in 2002 and to 21% in 2003. Further, significant decreases can be observed in the years 2004, 2005 and 2006 to a share of only 3%, 5% and 0% respectively (see Table 4). In 2007, however, the proportion of the forest land footprint in Luxembourg's total Consumption Footprint rises again to 11%.

The production, imports and exports footprints of forest products are presented in Figure 7.[14] The graph shows that over the years from 2000 to 2007, the production footprint remains stable. In contrast, the imports footprint reached a peak in 2003 and a low point in 2004. These variations in the imports footprint are responsible for the enormous drop in the total Forest Footprint between 2003 and 2004. Additionally, in 2004 the exports footprint increased compared to 2003, reducing the total Forest Footprint even further. Moreover, in 2006 the exports footprint matches the combined footprint of the production and imports, resulting in a balanced overall footprint. These variations are mainly due to the production of customized Medium Density Fibreboards (MDF boards) that started to be produced in

[12] Primary products are raw materials that are 'extracted' from the land or ocean and include products of mining, agriculture, forestry and fisheries. These goods are either sold as is or used as raw materials in processing or manufacturing (Land Information New Zealand: www.linz.govt.nz).

[13] Secondary products are processed or manufactured from primary products.

[14] The Forest Footprint is based on statistics from the Food and Agriculture Organization of the United Nations (FAO): Statistical database of forest products [FAO, 2011].

Luxembourg in 2004.[15] In fact, in 2003 the imported quantity of industrial wood had already increased significantly, leading to a rise of the total Forest Footprint that year. Then, in 2004, the exports of MDF boards started reducing the total Forest Footprint considerably, reaching its minimum in 2006.

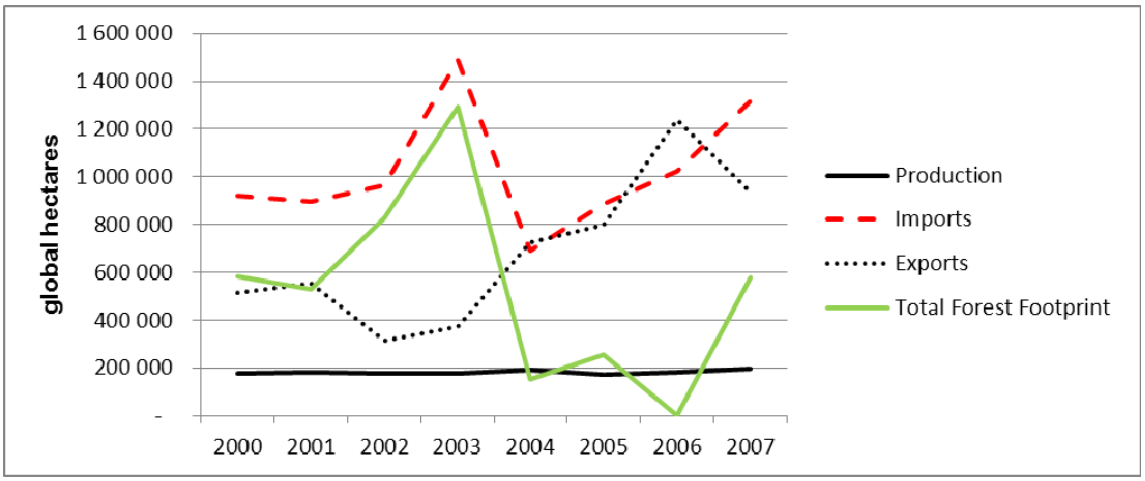

Figure 7: Luxembourg's Forest Footprint from 2000 to 2007 in gha

4.2. Luxembourg's Footprint at consumer level

The analysis of the Ecological Footprint methodology in 2010 revealed that Luxembourg's Footprint covers all the flows within the borders of the country, including the consumption of residents and non-residents [Hild et al., 2010]. In 2007, 475,000 residents and 139,200 commuters lived, worked and consumed in Luxembourg according to the Government Statistics Service of Luxembourg (STATEC). Since 2000 both figures have been increasing constantly by about 1% (residents) and 6% (commuters) on average (see Table 6). This means that in 2007, additionally to the official residents, a supplement of 29% (ratio of the commuters compared to the residents) consumed goods and services in Luxembourg. Its contribution is included in the per capita Footprint calculated by Global Footprint Network in the 2010 National Footprint Accounts. A national focus is, therefore, to illustrate both consumption Footprints (residents and commuters) in detail to achieve a better estimation of the residents Footprint and by doing this, allowing for a more realistic comparison with other countries on a per capita basis.

Table 6 : Population growth of Luxembourg from 2000 to 2007

	2000	2001	2002	2003	2004	2005	2006	2007	AVERAGE 2000-2007
Residents	437 000	442 000	448 000	453 000	459 000	464 000	470 000	475 000	-
Variation rate/year	1.1%	1.4%	1.1%	1.3%	1.1%	1.3%	1.1%		1.2%
Commuters	90 300	101 100	104 900	108 800	114 400	121 200	129 000	139 200	-
Variation rate/year	12.0%	3.8%	3.7%	5.2%	5.9%	6.4%	7.9%		6.4%

[15] In 2004, a wood panel press for customized MDF (Medium-Density Fibreboards) started operation in Luxembourg, and the production volume of MDF increased considerably at national level.

In the following sections, Luxembourg's Consumption Footprint for the years 2000 to 2007 will be illustrated with respect to national specifications:

- A subdivision into overall consumption categories;
- A subdivision into consumers, an allocation of the shares of the residents, commuters, and gasoline tourism & transit, for which a special focus on road fuel exports is given.

Firstly, the Consumption Footprints of the years 2000 to 2007 are analysed by consumption categories to identify overall consumption patterns for Luxembourg. Secondly, Luxembourg's Ecological Footprint is illustrated for different consumers over the same period of time. Finally, both approaches are combined and the different consumer footprints are analysed with respect to the before identified consumption categories.

4.2.1. Luxembourg's Consumption Footprint by consumption categories

In this section, Luxembourg's Consumption Footprint by land use categories, which was proposed by Global Footprint Network, is allocated to final consumption categories, which were identified by the Joint Research Centre as having the greatest overall impacts according to the Environmental Impact of Products (EIPRO) project [European Commission, 2006]. The final consumption categories proposed by the European Commission were slightly adjusted to Luxembourg's specifications: (a) non-food products and services; (b) road transport / mobility; (c) food products and (d) housing.[16]

Luxembourg's Footprint allocation to final consumption categories is a reallocation of the original Footprint by land use categories proposed by Global Footprint Network. Generally, the Ecological Footprint measures how much land is needed to provide the resources consumed and to take the waste (CO_2 emissions) produced by a nation up. With respect to the final consumption categories, the consumption category footprints represent the following 4 classifications (see Table 7, the subcategories allocation used in this study):

The category of **non-food products & services** covers the land needed to provide raw and processed wood and to take the embodied CO_2 emissions in non-food products up. Further it includes the direct CO_2 emissions due to the transport of non-food products, and due to the energy consumption of businesses, producing industries and the traded electricity.

The category of **road transport & mobility** covers the land needed to absorb the direct CO_2 emissions due to fossil fuel consumption in the road transport sector.

The **food** category includes the land areas necessary to provide agricultural, meat and dairy products as well as to absorb both the embodied CO_2 emissions in food products and the direct CO_2 emissions. The latter is due to the transport of food products, and the energy consumption of the agricultural sector and the food and tobacco industries. This category takes also account of the water areas needed to provide fish products.

The **housing** category covers the built-up land and the land needed to take the direct CO_2 emissions due to residential energy consumption up.

[16] The Joint Research Centre identified the following key consumption categories for the European Commission-funded Environmental Impact of Products (EIPRO) project: food and beverages; private transport; housing, including heating and hot water, electrical appliances and structural work [European Commission, 2006].

Table 7: Glossary of the consumption categories, subcategories and their definitions

Consumption category	Subcategories	Definition
Non-food products & services	Raw Wood	Raw wood consumed in Luxembourg
	Embodied Emissions in Non-Food Products	Embodied CO_2 emissions (grey energy) in non-food products consumed in Luxembourg
	International Transports	Transport of goods consumed in the country (shipping, aviation, by lorry): food products and non-food products
	Commercial Energy Consumption	CO_2 emissions due to commercial energy consumption
	Traded electricity	CO_2 emissions due to the electricity trade
Road transport & mobility	Road Transport	CO_2 emissions due to road transport in the country: national consumption and road fuel exports (commuters + gasoline tourism + transit)
Food	Fish Products	Fish products consumed in Luxembourg
	Agricultural Products	Crops consumed in Luxembourg
	Meat & Dairy Products	Grass and crops necessary to produce meat & dairy products consumed in Luxembourg
	Embodied Emissions in Food Products	CO_2 emissions embodied in food products consumed in Luxembourg
	Energy Consumption: Food Industry & Agriculture*	CO_2 emissions due to agriculture and food industry activities in Luxembourg
Housing	Building & Infrastructures	Land physically occupied by human activities
	Residential Energy Consumption	CO_2 emissions due to residential energy consumption

The year-by-year analysis between 2000 and 2007 by consumption categories shows that the non-food products & services category dominates Luxembourg's Consumption Footprint on average by 43%. It is followed by the road transport/mobility category with a share of 28% on average, then food (17% on average) and lastly housing (12% on average; see Figure 8).

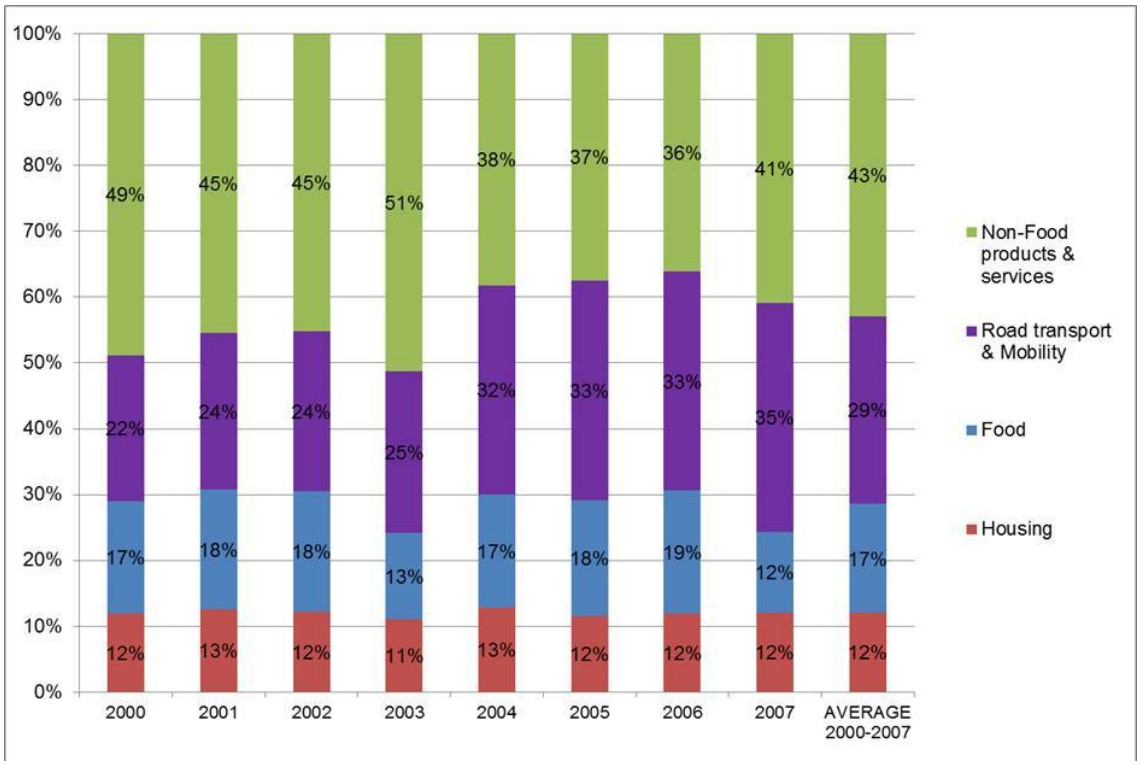

Figure 8: Composition of Luxembourg's Consumption Footprint from 2000 to 2007 by consumption categories

In Figure 9, the evolution of the different consumption categories is shown in global hectares per capita from 2000 to 2007. A substantial rise of the non-food products & services category occurred in 2003 and 2007, whereas the food category decreases during those years.

Between 2000 and 2005, the mobility category decreased constantly and is decreasing since 2005 (see Figure 9). This category represents the emissions of the road transport sector and is based on sales statistics. As the taxes on fuels are lower, per capita fuels sales in Luxembourg are higher than in other European countries and thus the related footprint too.

The housing category remains stable between 2000 and 2007, mainly because from one year to another, the physically occupied land in Luxembourg (buildings and infrastructures) does not change considerably.

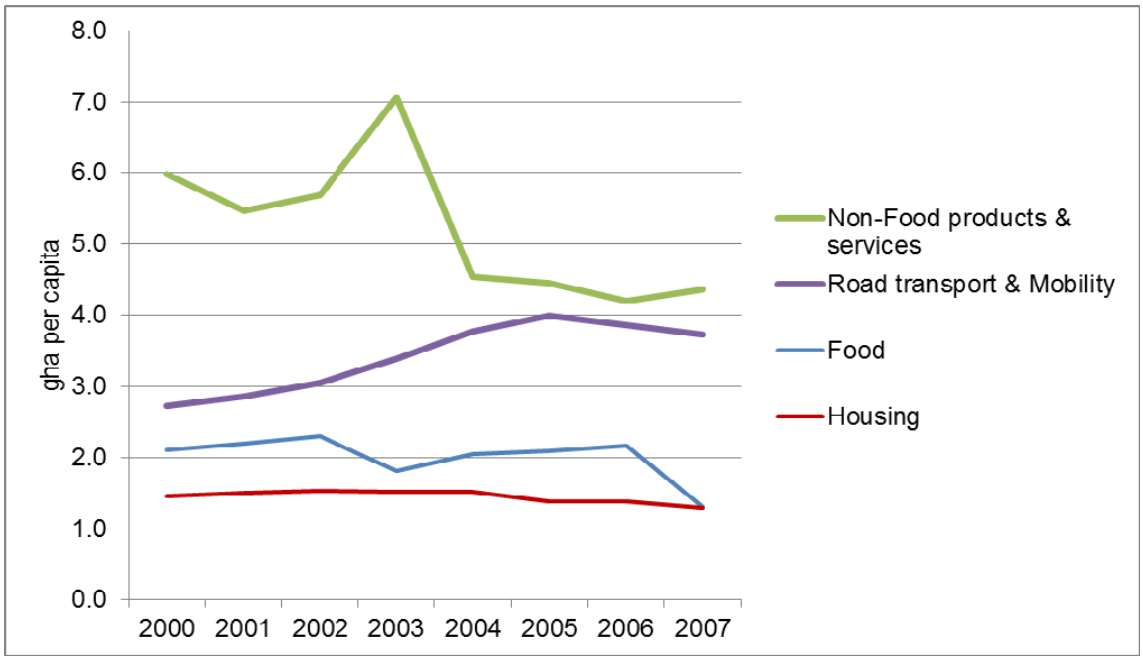

Figure 9: Luxembourg's per capita Consumption Footprint from 2000 to 2007 by consumption categories

The non-uniform trend of the non-food products & services category from 2000 to 2007 is due to the consumption of raw wood, one of the subcategories of this main consumption category (see Table 7 and Figure 10). As previously mentioned (see chapter 4.1.2), the production of Medium-Density Fibreboards (MDF) increased considerably in Luxembourg in 2004 leading to (a) an increase of the forest imports footprint in 2003 (purchasing of wood as raw material for the MDF production); and to (b) an increase of the forest exports footprint. Further details can be found in the chapter '4.1.2 Luxembourg's Forest Footprint' of this report.

4.2.2. Luxembourg's Consumption Footprint by consumers

The analysis of Luxembourg's Consumption Footprint by consumers consists of an assessment of the shares of Luxembourg's residents and commuters consumption, and the impact of the gasoline tourism & transit. The latter is of importance for Luxembourg because Luxembourg's Carbon Footprint is highly dominated by road transport and the related CO_2 emissions (see chapter 4.1.1 Luxembourg's Carbon Footprint). The identified consumption patterns of the residents and commuters are based on a study about the consumption expenditures for food products as well as non-food products and services. Their fuel consumptions for road transport purposes are based on approaches of the Ministry of sustainable Development and Infrastructures [MDDI, 2009; Thöne, 2008] and are described in detail in the 2010 study on Luxembourg's Ecological Footprint for the year 2005 [Hild et al., 2010].

The composition of Luxembourg's Consumption Footprint by consumers (residents, commuters, gasoline tourism & transit) from 2000 to 2007 is illustrated in Figure 11. It can be seen that the share of the residents is highly dominating Luxembourg's Footprint by two-thirds and that the commuters and the fuel tourism & transit are responsible for the remaining one-third in equal parts (see Figure 11).

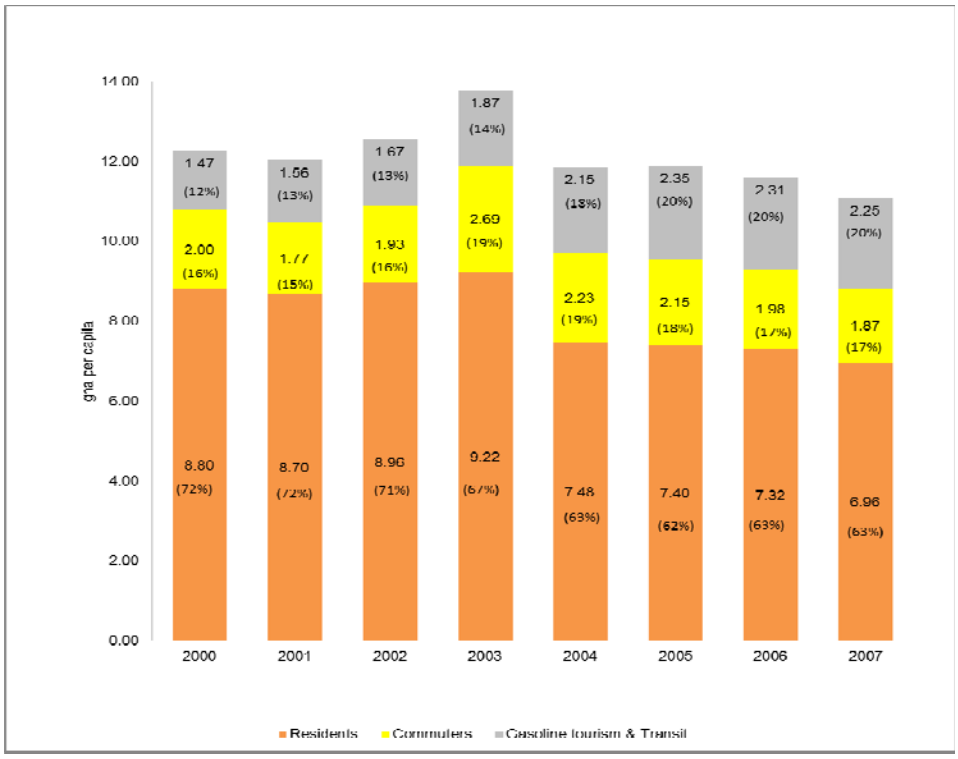

Figure 10: Luxembourg's Consumption Footprint from 2000 to 2007 by consumers in gha per capita and the composition in %

However, the trend of the composition of Luxembourg's Consumption Footprint shows a decrease of the residents' share by -3% on average per year from 2000 to 2007, while the commuter's share is slightly rising by +0.6% over the same period of time. The only share that is evidently increasing since 2000 is the gasoline tourism & transit consumer with an average yearly rising rate of +6.1% (see Table 8).

Table 8: Luxembourg's Consumption Footprint from 2000 to 2007 by consumers

	2000	2001	2002	2003	2004	2005	2006	2007	AVERAGE 2000-2007
Residents [gha/capita]	8.8	8.7	9.0	9.2	7.5	7.4	7.3	7.0	
Variation rate/year	-1.2%	3.0%	2.9%	-18.8%	-1.1%	-1.2%	-4.3%		-3.0%
Commuters [gha/capita]	2.0	1.8	1.9	2.7	2.2	2.2	2.0	1.9	
Variation rate/year	-11.1%	8.9%	39.2%	-17.1%	-3.4%	-7.8%	-4.7%		+0.6%
Gasoline tourism & Transit [gha/capita]	1.5	1.6	1.7	1.9	2.2	2.3	2.3	2.2	
Variation rate/year	6.3%	7.0%	12.1%	14.8%	9.0%	-1.6%	-4.7%		+6.1%

A detailed view of the road fuel consumption by consumers shows that the proportion of exported road fuels is in steady rise (see Figure 12) [STATEC, 2007; Thöne, 2008]. The gasoline tourism and transit traffic are responsible for the constantly increasing road fuel consumption (mentioned in chapter 4.1.1) and thus the share in Luxembourg's Footprint is increasing (see Table 8).

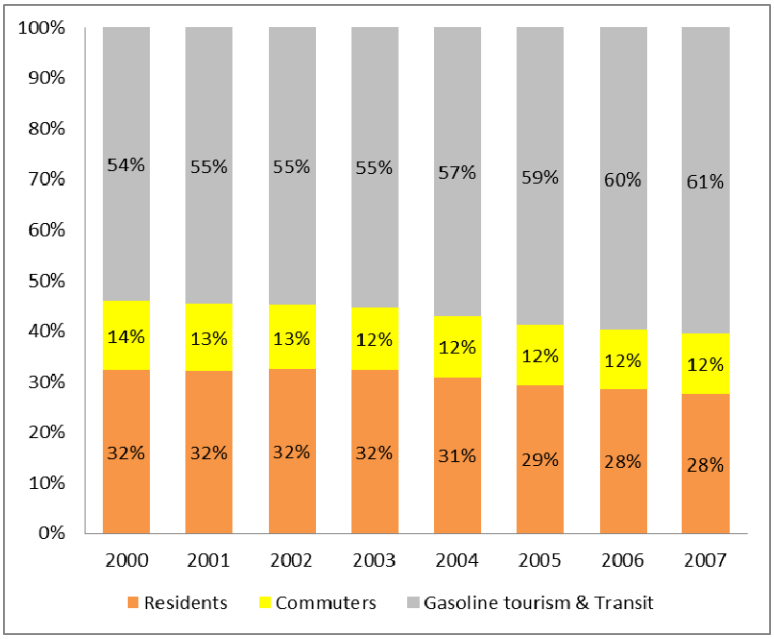

Figure 11: Road fuel consumption in Luxembourg from 2000 to 2007 by consumers

4.2.3. Luxembourg's Consumption Footprint by consumers and consumption categories

The shares of Luxembourg's residents and commuters consumption concerning the final consumption of food, non-food products and housing was assessed with expenditure statistics. The road fuel consumption distribution is based on an emission calculation model. More details on the methodology can be found in [Hild et al., 2010], freely available on the www.myfootprint.lu website.[17] Effectively, Luxembourg's Consumption Footprint can be attributed by 67% to the residents, by 17% to the commuters and by 16% to fuel tourism & transit (values are means for the period from 2000 to 2007).

The residents' Consumption Footprint is dominated on average by 51% of non-food products and services; food, mobility and housing are responsible for 19%, 18% and 13% on average respectively (see Figure 14). The commuters' Consumption Footprint is dominated by non-food products and services[18], too, with a contribution of 61% on average; food and mobility are contributing 23% and 16% on average respectively (see Figure 14).

[17] http://www.myfootprint.lu/files/download.php?file=RAP-20100614-EF_Lux_Phase_2-v.4.0.pdf

[18] The Ecological Footprint methodology provided by Global Footprint Network does not enable to identify significant sub-categories within the non-food products and services category.

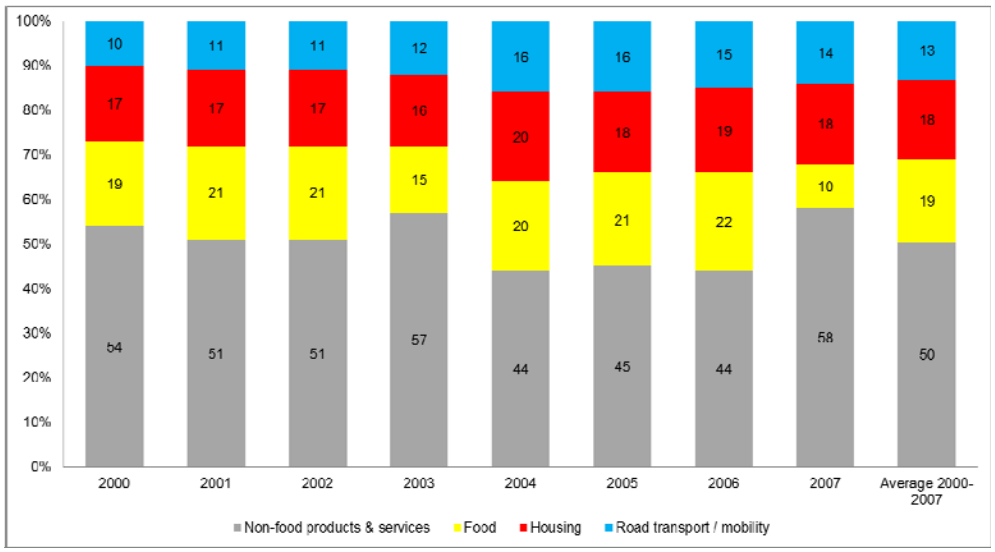

Figure 12: Composition of Luxembourg's residents Consumption Footprint from 2000 to 2007 by consumption categories

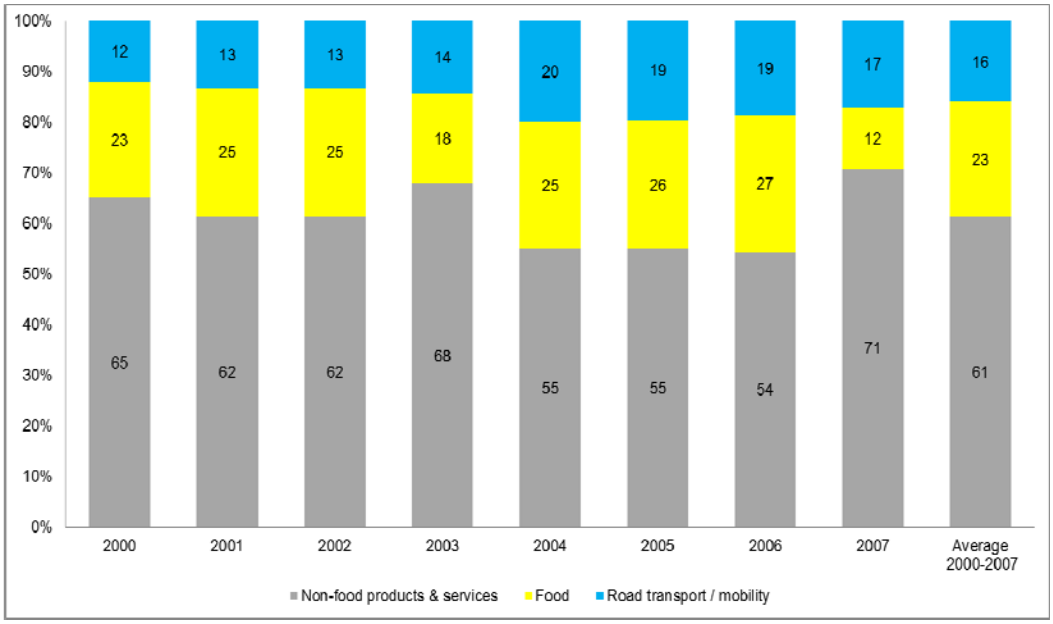

Figure 13: Composition of Luxembourg's commuters Consumption Footprint from 2000 to 2007 by consumption categories

5. Luxembourg's Ecological Footprint in comparison to the environmental competitiveness scoreboard indicators

The Ecological Footprint methodology by Global Footprint Network measures human consumption of products and services from different ecosystems in terms of the amount of bioproductive land and sea area needed to supply these products and services. In other words, the Ecological Footprint calculates the land area needed to produce food, provide resources, produce energy, and absorb the CO_2 emissions generated by the supply chains within one year at country level. For the calculations of Luxembourg's Ecological Footprint, international statistical databases are used to identify the quantities of produced, imported and exported goods and services. Then, Global Footprint Network applies different factors to the quantities to assess the area needed to supply these products and services. Finally, the Consumption Footprint of a nation is divided by the number of inhabitants and compared to other countries at a per capita level (global hectares per capita). This means that the Ecological Footprint can be used as an indicator for the sustainability of a national consumption by assessing human land uses.

In the following paragraph, Luxembourg's Ecological Footprint is discussed in the framework of the environmental indicators of Luxembourg's competitiveness scoreboard (see Table 9) [MECE, 2010]. Luxembourg's ranking is rather low for all of the scoreboard indicators: number of ISO 9001 certifications per billion of inhabitants (21 out of 27); number of ISO 14001 certifications per billion of inhabitants (15 out of 27); total greenhouse gas emissions (15 out of 27); renewable energy ration (23 out of 27); quantity of municipal waste per capita per year (24 out of 27); energetic intensity (8 out of 27); transport by car (17 out of 27); Ecological Footprint in gha per capita per year (27 out of 27).

Based on the environmental competiveness scoreboard indicators, it can be concluded that in general, Luxembourg's environmental performance is low compared to the other countries of the European Union. With respect to Luxembourg's Ecological Footprint, it can be said that Luxembourg's consumption is not sustainable. The number of planets that would be needed if the world's population lived like the population of Luxembourg in 2007 is about six[19]. However, per year, the biocapacity (bioproductive land) of the planet can only regenerate once.

[19] Luxembourg's total Ecological Footprint is about 11 gha per capita per year. This value divided by 1.8 gha, bioproductive land available per capita per year, results in a consumption of 6 planets (11/1.8 = 6).

Table 9: Luxembourg's environmental indicators of competitiveness including the Ecological Footprint

In Table 9, Luxembourg's environmental performance is compared to the average UE-27 performance and its neighbouring countries: France (FR), Germany (DE), and Belgium (BE). The Minimum and Maximum scores (due to further countries) are also illustrated.

Category J : Environment									
Code	**Indicator**		**LU**	**UE-27**	**DE**	**FR**	**BE**	**MIN**	**MAX**
J1	Certification number ISO 9001 by millions of inhabitants (2008)	↑	503.48	806.23	588.46	371.75	458.95	LV 220.65	IT 1977.34
	Certification number ISO 14001 by millions of inhabitants (2008)	↑	102.33	143.6	69.52	54.30	68.73	MT 19.40	SE 485.74
J2	Total greenhouse gas emissions (baseline of 1990=100) (2007)	↑	95.2	88.7	87.8	93.6	92.9	LV 44.4	CY 198.9
J3	Fraction of renewable energies (2007)	↑	4.1	16.7	15.4	14.4	5.3	MT 0.0	AT 62
J4	Municipal waste in kg per person per year (2007)	↓	701	524	581	543	493	CZ 306	DK 802
J5	Energy intensity in kg petroleum equivalent per thousand euros (2007)	↑	158.53	169.39	151.48	165.38	198.76	IR 103.13	BU 1016.29
J6	Division by way of transport of travellers – fraction as percentage of car transport (in passenger-kilometres: pkm) (2007)	↓	91.8	93.5	93.1	92.3	96.4	SK 61.8	LT 129.3
EcoFoot	Ecological Footprint in gha per person per year (gha/capita) (2007)	↑	11.08	5.34	5.08	5.01	8.00	RO 2.71	LU 11.08

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A-1. Overview of Luxembourg's Consumption Footprint by consumers

in [gha/capita]	2000	2001	2002	2003	2004	2005	2006	2007
Residents	8.80	8.70	8.96	9.22	7.48	7.40	7.32	6.96
Commuters	2.00	1.77	1.93	2.69	2.23	2.15	1.98	1.87
Gasoline tourism & Transit	1.47	1.56	1.67	1.87	2.15	2.35	2.31	2.25
TOTAL	**12.27**	**12.03**	**12.56**	**13.78**	**11.87**	**11.90**	**11.61**	**11.09**
in [%]	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**
Residents	72	72	71	67	63	62	63	63
Commuters	16	15	16	19	19	18	17	17
Gasoline tourism & Transit	12	13	13	14	18	20	20	20

A-2. Glossary

The following glossary on relevant terms related to the assessment of a country's Ecological Footprint was elaborated by the Global Footprint Network for the participants of the technical training in Brussels on the 14th and the 15th of May 2009. [GFN, 2009b] Please notice that this glossary is not fully integrated here; in case of any substantial adaptation, the changes are mentioned. According to the Draft Standards 2009 [GFN, 2009a], it is appropriate to incorporate definitions originally provided by the Network. The glossary has been updated with relevant terms for Luxembourg; the new references are mentioned.

biological capacity or biocapacity: The capacity of ecosystems to produce useful biological materials and to absorb waste materials generated by humans, using current management schemes and extraction technologies. "Useful biological materials" are defined as those used by the human economy, hence what is considered "useful" can change from year to year (e.g. use of corn (maize) stover for cellulosic ethanol production would result in corn stover becoming a useful material, and so increase the biocapacity of maize cropland). The biocapacity of an area is calculated by multiplying the actual physical area by the yield factor and the appropriate equivalence factor. Biocapacity is usually expressed in units of global hectares.

biological capacity available per person (or **per capita):** There were 13.4 billion hectares of biologically productive land and water on this planet in 2005. Dividing this by the number of people alive in that year, 6.5 billion, gives 2.1 global hectares per person. This assumes that no land is set aside for other species that consume the same biological material as humans.

biologically productive land and water: The land and water (both marine and inland waters) area that supports significant photosynthetic activity and biomass accumulation used by humans. Non-productive areas as well as marginal areas with patchy vegetation are not included. Biomass that is not of use to humans is also not included. The total biologically productive area on land and water was approximately 13.4 billion hectares in 2005.

carbon uptake land: The demand on biocapacity required to sequester (through photosynthesis) the carbon dioxide (CO_2) emissions from fossil fuel combustion. Although fossil fuels are extracted from the Earth's crust and are not regenerated in human time scales, their use demands ecological services if the resultant CO_2 is not to accumulate in the atmosphere. The Ecological Footprint therefore includes the biocapacity, typically that of unharvested forests, needed to absorb that fraction of fossil CO_2 that is not absorbed by the ocean.

consumption: Use of goods or services. The term consumption has two different meanings, depending on context. As commonly used in regard to the Footprint, it refers to the use of goods or services. A consumed good or service embodies all the resources, including energy, necessary to provide it to the consumer. In full life-cycle accounting, everything used along the production chain is taken into account, including any losses along the way. For example, consumed food includes not only the plant or animal matter people eat or waste in the household, but also that lost during processing or harvest, as well as all the energy used to grow, harvest, process and transport the food.

As used in Input Output analysis, consumption has a strict technical meaning. Two types of consumption are distinguished: intermediate and final. According to the (economic) System of National Accounts terminology, intermediate consumption refers to the use of goods and services by a business in providing goods and services to other businesses. Final consumption refers to non-productive use of goods and services by households, the government, the capital sector, and foreign entities.

consumption components (also consumption categories): Ecological Footprint analyses can allocate total Footprint among consumption components, typically food, shelter, mobility, goods, and services, often with further resolution into sub-components. Consistent categorization across studies allows for comparison of the Footprint of individual consumption components across regions, and the relative contribution of each category to the region's overall Footprint. To avoid double counting, it is important to make sure that consumables are allocated to only one component or sub-component. For example, a refrigerator might be included in the food, goods, or shelter component, but not in all.

Consumption Footprint: The most commonly reported type of Ecological Footprint. It is the area used to support a defined population's consumption. The consumption Footprint (in gha) includes the area needed to produce the materials consumed and the area needed to absorb the waste (CO_2 emissions). The consumption Footprint of a nation is calculated in the National Footprint Accounts as a nation's primary production Footprint plus the Footprint of imports minus the Footprint of exports, and is thus, strictly speaking, a Footprint of apparent consumption. The national average or per capita Consumption Footprint is equal to a country's Consumption Footprint divided by its population.

Consumption Land Use Matrix: Starting with data from the National Footprint Accounts, a Consumption Land Use Matrix allocates the six major Footprint land uses (shown in column headings, representing the five land types and carbon uptake land) to the five Footprint consumption components (row headings). Each consumption component can be disaggregated further to display additional information. These matrices are often used as a tool to develop sub-national (e.g. state, county, city) Footprint assessments. In this case, national data for each cell is scaled up or down depending on the unique consumption patterns in the state, county or city.

conversion factor: A generic term for factors which are used to translate a material flow expressed within one measurement system into another one. For example, a combination of two conversion factors—"yield factors" and "equivalence factors"— translates hectares into global hectares. The extraction rate conversion factor translates a secondary product into primary product equivalents.

daughter product: The product resulting from the processing of a parent product. For example wood pulp, a secondary product, is a daughter product of round wood. Similarly, paper is a daughter product of wood pulp.

ecological debt: The sum of annual ecological deficits. Humanity's Footprint first exceeded global biocapacity in the mid-1980s, and has done so every year since. By 2005 this annual overshoot had accrued into an ecological debt that exceeded 2.5 years of the Earth's total productivity.

ecological deficit / reserve: The difference between the biocapacity and Ecological Footprint of a region or country. An ecological deficit occurs when the Footprint of a population exceeds the biocapacity of the area available to that population. Conversely, an ecological reserve exists when the biocapacity of a region exceeds its population's Footprint. If there is a regional or national ecological deficit, it means that the region is importing biocapacity through trade or liquidating regional ecological assets. In contrast, the global ecological deficit cannot be compensated through trade, and is therefore equal to overshoot.

Ecological Footprint: A measure of how much biologically productive land and water an individual, population or activity requires to produce all the resources it consumes and to absorb the waste (CO_2 emissions) it generates using prevailing technology and resource management practices. The Ecological Footprint is usually measured in global hectares.

Because trade is global, an individual or country's Footprint includes land or sea from all over the world. Ecological Footprint is often referred to in short form as Footprint (not footprint).

Ecological Footprint Standards: Specified criteria governing methods, data sources and reporting to be used in Footprint studies. Standards are established by the Global Footprint Network Standards Committee composed of scientists and Footprint practitioners from around the world. Standards serve to produce transparent, reliable and mutually comparable results in studies done throughout the Footprint Community. Where Standards are not appropriate, Footprint Guidelines should be consulted. For more information, consult www.footprintstandards.org.

embodied energy / embodied emissions factor: Embodied energy is the energy used during a product's entire life cycle in order to manufacture, transport, use and dispose of the product. Footprint studies often use embodied energy when tracking trade of goods. In the context of this study, the terms 'embodied energy' and 'embodied emissions' are equivalent. In fact, the 'embodied energy' is translated into 'embodied (CO_2) emissions' by a carbon intensity factor (the amount of carbon emitted per unit of power produced).

equivalence factor: A productivity based scaling factor that converts a specific land type (such as cropland or forest) into a universal unit of biologically productive area, a global hectare. For land types (e.g. cropland) with productivity higher than the average productivity of all biologically productive land and water area on Earth, the equivalence factor is greater than 1. Thus, to convert an average hectare of cropland to global hectares, it is multiplied by the cropland equivalence factor of 2.64. Pasture lands, which have lower productivity than cropland, have an equivalence factor of 0.5. See also yield factor.

extraction rate: A processing factor comparing the quantity of a parent product to the quantity of the resulting daughter product. When a parent product is processed its mass changes. For example, when wheat is processed into white flour, the bran and germ are stripped lessening its mass. Therefore, in order to calculate the number of hectares needed to produce a given mass of flour, an extraction rate is needed. This extraction rate in this example is the ratio of tonnes of flour divided by the tonnes of wheat processed to produce the flour.

Footprint Intensity: The number of global hectares required to produce a given quantity of resource or absorb a given quantity of waste, usually expressed as global hectares per tonne. The National Footprint Accounts calculate a primary Footprint Intensity Table for each country, which includes the global hectares of primary land use type needed to produce or absorb a tonne of product (i.e., global hectares of cropland per tonne of wheat, global hectares of forest per tonne carbon dioxide).

Footprint neutral or negative: Human activities or services that result in no increase or a net reduction in humanity's Ecological Footprint. For example, the activity of insulating an existing house has a Footprint for production and installation of the insulation materials. This insulation in turn reduces the energy needed for cooling and heating this existing house. If the Footprint reduction from this energy cutback is equal to or greater than the original Footprint of insulating the house, the latter becomes a Footprint neutral or negative activity. On the other hand, making a new house highly energy efficient does not by itself make the house Footprint neutral, unless at the same time it causes reduction in other existing Footprints. This Footprint reduction has to be larger than the Footprint of building and occupying the new house.

gasoline tourism: The fuel taken up by cars that specifically go to Luxembourg for the purpose of filling up [MEV, 2008].

global hectare (gha): A productivity weighted area used to report both the biocapacity of the earth, and the demand on biocapacity (the Ecological Footprint). The global hectare is normalised to the area-weighted average productivity of biologically productive land and water in a given year. Because different land types have different productivity, a global hectare of, for example, cropland, would occupy a smaller physical area than the much less biologically productive pasture land, as more pasture would be needed to provide the same biocapacity as one hectare of cropland. Because world bioproductivity varies slightly from year to year, the value of a gha may change slightly from year to year.

Guidelines (for Footprint studies): Suggested criteria governing methods, data sources and reporting for use when Footprint Standards are not appropriate or not yet developed.

hectare: 1/100th of a square kilometre, 10,000 square meters, or 2.471 acres. A hectare is approximately the size of a soccer field. See also global hectare and local hectare

IO (Input-Output) analysis: Input-Output (IO, also I-O) analysis is a mathematical tool widely used in economics to analyse the flows of goods and services between sectors in an economy, using data from IO tables**.** IO analysis assumes that everything produced by one industry is consumed either by other industries or by final consumers, and that these consumption flows can be tracked. If the relevant data are available, IO analyses can be used to track both physical and financial flows. Combined economic-environment models use IO analysis to trace the direct and indirect environmental impacts of industrial activities along production chains, or to assign these impacts to final demand categories. In Footprint studies, IO analysis can be used to apportion Footprints among production activities, or among categories of final demand, as well as in developing Consumption Land Use Matrices.

IO (Input-Output) tables: IO tables contain the data that are used in IO analysis. They provide a comprehensive picture of the flows of goods and services in an economy for a given year. In its general form an economic IO table shows **uses**--the purchases made by each sector of the economy in order to produce their own output, including purchases of imported commodities; and **supplies--**goods and services produced for intermediate and final domestic consumption, and exports. IO tables often serve as the basis for the economic National Accounts produced by national statistical offices. They are also used to generate annual accounts of the Gross Domestic Product (GDP).

land type: The Earth's approximately 13.4 billion hectares of biologically productive land and water are categorised into five types of surface area: cropland, grazing land, forest, fishing ground, and built-up land. It is also called ‘area type’.

Life Cycle Analysis (LCA): A quantitative approach that assesses a product's impact on the environment throughout its life. LCA attempts to quantify what comes in and what goes out of a product from “cradle to grave,” including the energy and material associated with materials extraction, product manufacture and assembly, distribution, use and disposal and the environmental emissions that result. LCA applications are governed by the ISO 14040 series of standards (http://www.iso.org).

local hectare: A productivity weighted area used to report both the biocapacity of a local region, and the demand on biocapacity (the Ecological Footprint). The local hectare is normalised to the area-weighted average productivity of the specified region's biologically

productive land and water. Hence, similar to currency conversions, Ecological Footprint calculations expressed in global hectares can be converted into local hectares in any given year (e.g. Danish hectares, Indonesian hectares) and vice versa. The amount of Danish hectares equals the amount of bioproductive hectares in Denmark – each Danish hectare would represent an equal share of Denmark's total biocapacity.

National Footprint Accounts: The central data set that calculates the Footprints and biocapacities of the world and roughly 150 nations from 1961 to the present (generally with a three year lag due to data availability). The on-going development, maintenance and upgrades of the National Footprint Accounts are coordinated by Global Footprint Network and its 70 plus partners.

overshoot: Global overshoot occurs when humanity's demand on nature exceeds the biosphere's supply, or regenerative capacity. Such overshoot leads to a depletion of Earth's life supporting natural capital and a build-up of waste. At the global level, ecological deficit and overshoot are the same, since there is no net-import of resources to the planet. Local overshoot occurs when a local ecosystem is exploited more rapidly than it can renew itself.

parent product: The product processed to create a daughter product. For example wheat, a primary product is a parent product of flour, a secondary product. Flour, in turn, is a parent product of bread.

Planet Equivalent(s): Every individual and country's Ecological Footprint has a corresponding Planet Equivalent, or the number of Earths it would take to support humanity's Footprint if everyone lived like that individual or average citizen of a given country. It is the ratio of an individual's (or country's per capita) Footprint to the per capita biological capacity available on Earth (2.1 gha in 2005). In 2005, the world average Ecological Footprint of 2.7 gha equals 1.3 Planet Equivalents.

primary product: In Footprint Studies a primary product is the least processed form of a biological material that humans harvest for use. There is a difference between the raw product, which is all the biomass produced in a given area, and the primary product, which is the biological material humans will harvest and use. For example, a fallen tree is a raw product that, when stripped of its leaves and bark, results in the primary product of round wood. Primary products are then processed to produce secondary products like wood pulp, paper, and so on. Other examples of primary products are potatoes, cereals, cotton, or forage. Examples of secondary products are kWh of electricity, bread, clothes, beef, or appliances.

primary production Footprint (also primary demand): In contrast to the consumption Footprint, a nation's primary production Footprint is the sum of the Footprints for all of the resources harvested and all of the waste generated within the defined geographical region. This includes all the area within a country necessary for supporting the actual harvest of primary products (cropland, pasture land, forestland and fishing grounds), the country's built-up area (roads, factories, cities), and the area needed to absorb all fossil fuel carbon emissions generated within the country. In other words, the forest Footprint represents the area necessary to regenerate all the timber harvested (hence, depending on harvest rates, this area can be bigger or smaller than the forest area that exists within the country). Or, for example, if a country grows cotton for export, the ecological resources required are not included in that country's consumption Footprint; rather, they are included in the consumption Footprint of the country that imports the t-shirts. However, these ecological resources **are** included in the exporting country's primary production Footprint.

productivity: The amount of biological material useful to humans that is generated in a given area. In agriculture, productivity is called yield.

road fuel exports: The Luxembourg's Ministry of Sustainable Development speaks about 'road fuel exports' when considering fuel emissions of non-residents. By definition of the Ministry, 'road fuel exports' include the commuters' part, gasoline tourism and transit. [MDDI, 2009]

secondary product: All products derived from primary products or other secondary products through a processing sequence applied to a primary product.

transit: transit traffic passing through Luxembourg [MDDI, 2009]

yield: The amount of regenerated primary product, usually reported in tonnes per year, that humans are able to extract per area unit of biologically productive land or water.

yield factor: A factor that accounts for differences between countries in productivity of a given land type. Each country and each year has yield factors for cropland, grazing land, forest, and fisheries. For example, in 2005, German cropland was 2.3 times more productive than world average cropland. The German cropland yield factor of 2.3, multiplied by the cropland equivalence factor of 2.6 converts German cropland hectares into global hectares: one hectare of cropland is equal to 6.0 gha.

Note that primary product and primary production Footprint are Footprint specific terms. They are not related to, and should not be confused with the ecological concepts of primary production, gross primary productivity (GPP) and net primary productivity (NPP).

A-3. Key Words Dictionary: English – German – Luxembourgish - French

English	German	Luxembourgish	French
Biocapacity	Naturkapital / Biokapazität	Naturkapital	Capital naturel / biocapacité
Ecological Footprint	Ökologischer Fußabdruck	Ökologesche Foussofdrock	Empreinte écologique
Consumption Footprint	Verbrauchsfußabdruck / Konsumfußabdruck	Verbrauchs-foussofdrock / Konsum-foussofdrock	Empreinte du consommateur / Empreinte de la consommation
Production Footprint	Produktionsfußabdruck	Produktiouns-foussofdrock	Empreinte de la production
Food Footprint	Fußabdruck Ernährung / Nahrungsmittel / Lebensmittel	Nahrungsmëttel Foussofdrock / Foussofdrock Ernährung	Empreinte de la nourriture
Non-Food Products & Services	Non-Food Produkte & Dienstleistungen	Non-Food Produkter & Servicer	Produits non-alimentaires & services
Transport / Mobility	Transport / Mobilität	Transport / Mobilitéit	Transport / Mobilité
Road Fuel Exports	Kraftstoffexport	Bensinsexport	Export de carburant
Fuel Tourism	Tanktourismus	Bensinstourissem / Tanktourismus	Tourisme à la pompe