
Environmentally Extended Input-Output Table for Switzerland 2008 - Biodiversity Damage Potential due to Land Use (Biodiversity Footprint)

factsheet

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Environmentally Extended Input-Output Table

An input-output table (IOT) depicts the economic transactions between the different sectors and the final demand of a country and serves as an important instrument in empirical analyses. The monetary IOT can be extended with data on the pollutant emissions and resource uses of the individual economic sectors and the final demand to yield an environmentally extended input-output table (EE-IOT). The EE-IOT allows, among other things:

- the identification of key sectors and activities responsible for environmental impacts,
- the assessment of the economic and environmental impacts of a certain consumption pattern and
- the development of policies to proceed towards a more sustainable economy.

In the present project, an EE-IOT was estimated for the Swiss economy in the year 2008 with a special focus on the energy, transportation, agricultural and food sectors. The resulting EE-IOT is made available to the public and can be used for further analyses. In this factsheet, the biodiversity damage potential caused by the land use of the Swiss economy is evaluated.

Biodiversity Damage Potential due to Land Use

Biodiversity loss was identified by Rockström et al. (2009) as one of the planetary boundaries that has already been clearly transgressed. The main causes of biodiversity loss are land use and land use change, i.e., the conversion of natural ecosystems into cultivated and urban areas. The use of land area leads to land competition and may additionally result in changes in the biotic production potential, soil organic matter content, biodiversity and other ecosystem services (Frischknecht et al. 2013).

The biodiversity damage potential (BDP) proposed by de Baan et al. (2012) is the selected metric to quantify the environmental impacts of land use in the ecological scarcity method. The BDP evaluates different land use types based on global data on their biodiversity. Characterisation factors are derived by comparing the observed species richness of a land use type in a given biome to the expected biodiversity of that biome. Natural forests and settlement areas are used as the reference biomes with BDPs of 0 and 1, respectively (Frischknecht & Büsler Knöpfel 2013). The total BDP (in km²a settlement area-equivalents; km²a SA-eq) is determined by the sum of all land uses weighted by their characterisation factor.

The BDP quantifies the impacts of land use on plant and animal diversity. However, it is not able to take land competition or effects on ecosystem services into account.

Domestic and Foreign BDP

An overview of the total domestic and foreign BDP caused by Switzerland is given in Tab. 1. The Swiss domestic BDP is 12'704 km²a SA-eq. A fraction of 29 % (3'710 km²a SA-eq) thereof is related to the production of exported goods and services. The Swiss domestic final demand, i.e. consumption of private households, the government, non-profit institutions and by capital formation results in a BDP of 26'755 km²a SA-eq in Switzerland and abroad. Hence, a fraction of 66 % (17'761 km²a SA-eq) of the total BDP ultimately related to Swiss consumption is caused abroad. The net traded BDP, defined as the difference between land occupation abroad caused by domestic final demand and domestic BDP caused by exports, is 14'051 km²a SA-eq.

Tab. 1 Domestic and foreign BDP caused by Swiss domestic final demand and by exports.

	Biodiversity damage potential		
	Domestic land use	Land use abroad	Total land use
	km ² a settlement area-eq	km ² a settlement area-eq	km ² a settlement area-eq
Land use caused by domestic final demand	8'994	17'761	26'755
Land use caused by exports	3'710		
Total	12'704		
Net traded land use			14'051

Important Contributors to Domestic BDP

The ten most important contributors to the total domestic BDP are listed in Tab. 2. Only direct land use by households and industry sectors is considered for the identification of the ten most important contributors to the BDP. A share of 85 % of the total domestic BDP is caused by the ten most important contributors, which are strongly dominated by the agricultural subsectors.

Livestock farming (g01o, g01k and g01p) is responsible for more than one third of the total domestic BDP, with dairy and non-dairy cattle being of particular importance. The production of food cereals (g01a) and feed crops (g01b) causes 11 % and 10 % of the total domestic BDP, respectively. The forestry sector (g02) is the second most important contributor to the total BDP with a share of 13 %.

The direct BDP caused by the final demand of households contributes 6 % in the category housing and energy (c04) and 4 % in the category transport (c07). Neither industry nor service sectors are among the ten most important contributors to Switzerland's total domestic BDP.

Tab. 2 The ten most important contributors to the total domestic BDP. Only direct land use by households and sectors is taken into account.

			Biodiversity damage potential km ² a settlement area-eq	Share in total
1.	g01o	Dairy cattle and raw milk	2'626	21%
2.	g02	Products of forestry	1'607	13%
3.	g01a	Food cereals	1'451	11%
4.	g01b	Feed cereals	1'313	10%
5.	g01k	Non-dairy cattle	1'304	10%
6.	c04	Housing and energy	721	6%
7.	g01p	Other animal products	594	5%
8.	c07	Transport	452	4%
9.	g60f	Freight transport by road	356	3%
10.	g01h	Oil-bearing crops	355	3%
	Remaining contributors		1'926	15%
	Total		12'704	100%

Biodiversity Footprint: BDP due to Final Consumption

The domestic and foreign BDP attributable to Switzerland from the consumption perspective (biodiversity footprint) can be shown by final consumption category and by product group.

The biodiversity footprint by consumption category is shown in Tab. 3. The consumption of private households causes 87 % of the total BDP related to Swiss consumption. By far the most important category of household consumption with respect to the BDP is food and non-alcoholic beverage with a share of 51 % in the total BDP ultimately caused by Swiss consumption. Further important categories of final consumption are recreation and culture (c09, 8 %) as well as restaurants and hotels (c11, 7 %). Capital formation is responsible for 7 % of the consumption related BDP and the consumption of the government and of non-profit institutions causes 5 %.

The major share of the consumption related biodiversity footprint (66 %) is caused by imports outside Switzerland, the remaining 34 % of BDP occur domestically. Consumption categories with particularly high shares of BDP caused abroad are clothing and footwear (c03) with 98% of total impacts, household equipment and maintenance (c05) with 94%, alcoholic beverages, tobacco and narcotics (c02) with 88 % as well as recreation and culture (c09) with 85%.

Tab. 3 Disaggregation of the biodiversity footprint by consumption category: BDP in Switzerland and abroad caused by consumption of private households, the government and non-profit institutions as well as by capital formation. The consumption of private households is further divided into twelve categories (c01 to c12).

			Biodiversity damage potential			
			Domestic land use	Land use abroad	Total land use	Share in total
			km ² a settlement area-eq	km ² a settlement area-eq	km ² a settlement area-eq	
Consumption of private households			7'758	15'620	23'379	87%
c01	Food and non-alcoholic beverage		4'501	9'107	13'608	51%
c02	Alcoholic beverages, tobacco and narcotics		100	723	823	3%
c03	Clothing and footwear		18	817	835	3%
c04	Housing and energy		1'068	295	1'363	5%
c05	Household equipment and maintenance		37	541	578	2%
c06	Health		400	636	1'036	4%
c07	Transport		565	106	672	3%
c08	Communications		12	33	45	0%
c09	Recreation and culture		308	1'818	2'127	8%
c10	Education		15	27	43	0%
c11	Restaurants and hotels		658	1'113	1'771	7%
c12	Misc. goods and services		77	403	480	2%
Consumption of the government and non-profit institutions			568	831	1'399	5%
Capital formation			668	1'309	1'977	7%
Total domestic final consumption (excl. exports)			8'994	17'761	26'755	100%

In a second analysis the contribution of the most important product groups to the consumption related BDP is shown. Tab. 4 shows the ten product groups, which cause the highest total BDP with a disaggregation into domestic land use and land used abroad. They cover a share of 67 % of the total BDP caused by Swiss consumption.

The biodiversity footprint is dominated by food products: three food product groups, namely processed meat (g15a), dairy products (g15e) and other food and tobacco products (g15jp16), account for a total of 30 % of the BDP caused by Swiss consumption. Hotel and restaurant services (g55) follow as the first non-food product group with 7% of the total, yet they need agricultural and food products as intermediate inputs. Product groups with a particularly high share of land use abroad are chocolate and confectionary (g15i), other food and tobacco products (g15jp16), grain mill and starch products (g15f) as well as bakery and farinaceous products (g15g). These product groups rely on agriculture that is mainly responsible for BDP.

Tab. 4 Disaggregation of the biodiversity footprint by product group: BDP in Switzerland and abroad caused by Swiss consumption.

			Biodiversity damage potential			
			Domestic land use	Land use abroad	Total land use	Share in total
			km ² a settlement area-eq	km ² a settlement area-eq	km ² a settlement area-eq	
1.	g15a	Processed meat	1'759	1'857	3'616	14%
2.	g15e	Dairy products	1'562	838	2'400	9%
3.	g15jp16	Other food products, tobacco products	110	1'859	1'970	7%
4.	g55	Serv. of hotels and restaurants	718	1'206	1'925	7%
5.	g15i	Chocolate and confectionery	79	1'682	1'761	7%
6.	g15g	Bakery and farinaceous products	168	1'481	1'649	6%
7.	g85	Health and social work services	494	777	1'271	5%
8.	g45	Construction services	1'173	0	1'173	4%
9.	g01j	Other vegetal products	398	715	1'113	4%
10.	g15f	Grain mill and starch products	54	867	921	3%
		Remaining product groups	2'478	6'478	8'956	33%
		Total	8'994	17'761	26'755	100%

Conclusions and Outlook

A fraction of two thirds of the total BDP ultimately caused by Swiss consumption, which is 26'755 km²a SA-eq in 2008, can be attributed to imported goods and services. Agriculture is by far the most important direct contributor to the BDP caused in Switzerland. The production of animal products accounts for a high share in the total biodiversity footprint from the consumption perspective (domestic and foreign land use). The environmentally-extended input-output table makes it possible to identify the key economic sectors and products ultimately responsible for the domestic and foreign BDP caused by Swiss consumption.

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