Environmental Footprints of Switzerland

Developments from 1996 to 2015

Extended summary of the publication «Umwelt-Fussabdrücke der Schweiz»
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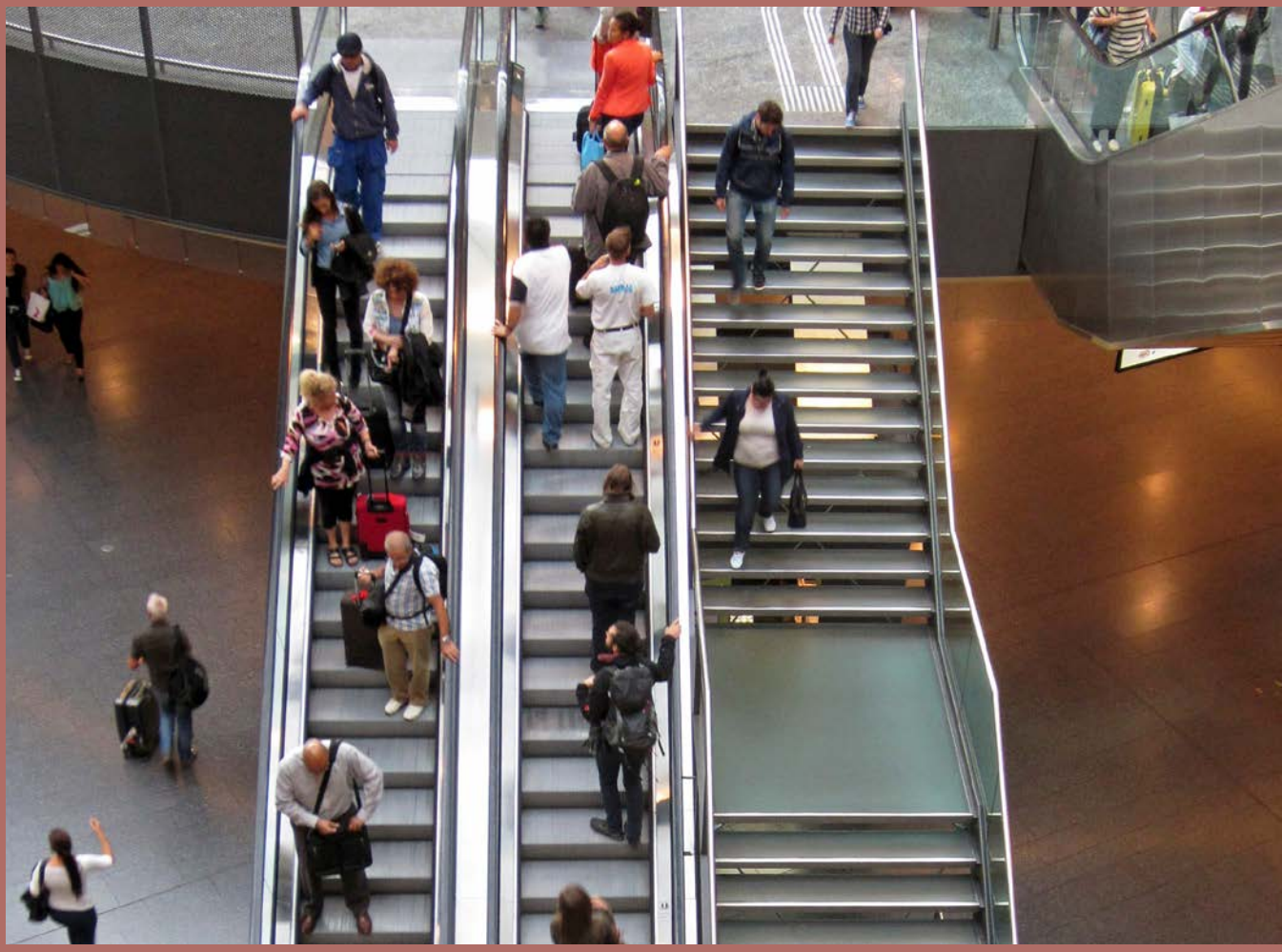

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This extended summary is also available in German and French.

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Abstracts

This study shows the development of Switzerland's consumption-based environmental impact from 1996 to 2015 (environmental footprints). It is based on a combination of emissions, trade, and life cycle assessment data. The latter were regionalised for the biodiversity and water footprint for the first time.

Switzerland's resulting footprints are not in line with the planetary boundaries, and while the share of the environmental impact caused within the country is decreasing, the share of the impact caused abroad is sharply rising. Estimates of possible future developments show considerable potential for improvement, such as in consumer behaviour and supply chains, but also make it clear that greater efforts are necessary in the areas of mobility, nutrition, and housing.

Keywords:
Consumption-based environmental impact, footprint indicators, greenhouse gas footprint, biodiversity footprint, life cycle assessment, environmental efficiency

Die vorliegende Studie zeigt die Entwicklung der konsumbedingten Umweltbelastung der Schweiz von 1996 bis 2015 (Umwelt-Fussabdrücke). Grundlage ist eine Kombination aus Emissions-, Handels- und Ökobilanzdaten. Letztere wurden neu für den Biodiversitäts- und den Wasserfussabdruck regionalisiert.

Die resultierenden Fussabdrücke der Schweiz sind mit den Belastbarkeitsgrenzen des Planeten nicht vereinbar, und einer Abnahme der Umweltbelastung im Inland steht ein stark ansteigender Auslandanteil gegenüber. Abschätzungen möglicher Zukunftsentwicklungen zeigen beachtliche Verbesserungspotenziale, z. B. beim Konsumverhalten und in Lieferketten, machen aber auch deutlich, dass verstärkte Anstrengungen in den Bereichen Mobilität, Ernährung und Wohnen nötig sind.

Stichwörter:
Konsumbedingte Umweltbelastung, Fussabdruck-Indikatoren, Treibhausgas-Fussabdruck, Biodiversitäts-Fussabdruck, Gesamtumweltbelastung, Ökobilanz, Umwelteffizienz

La présente étude montre comment l'impact de la consommation suisse sur l'environnement a évolué de 1996 à 2015 (empreintes environnementales) en s'appuyant sur une combinaison de données relatives aux émissions, au commerce et aux écobilans. Pour la première fois, l'empreinte biodiversité et l'empreinte hydrique reposent sur des écobilans régionalisés.

Il en ressort que les empreintes de la Suisse sont incompatibles avec les limites planétaires. Elles ont baissé à l'intérieur du pays, mais la part à l'étranger a fortement augmenté. Selon une appréciation des évolutions possibles, il existe des potentiels d'amélioration importants, par exemple en ce qui concerne les modes de consommation et les chaînes d'approvisionnement. Des efforts supplémentaires devraient toutefois être fournis, en particulier dans les domaines de la mobilité, de l'alimentation et du logement.

Mots-clés :
Impact environnemental de la consommation, indicateurs d'empreinte, empreinte gaz à effet de serre, empreinte biodiversité, impact environnemental total, écobilans, efficacité environnementale

Il presente studio mostra l'evoluzione dell'impatto ambientale dei consumi della Svizzera tra il 1996 e il 2015 (impronte ambientali). Alla base vie è una combinazione di dati relativi alle emissioni, al commercio e agli ecobilanci. Per l'impronta sulla biodiversità e l'impronta idrica, questi ultimi sono stati regionalizzati.

Le impronte ambientali della Svizzera che ne risultano non sono compatibili con i limiti di resistenza del pianeta. Inoltre, a una diminuzione dell'impatto ambientale all'interno dei confini nazionali si contrappone una quota estera in forte aumento. Le stime dei possibili sviluppi futuri mostrano potenziali di miglioramento considerevoli, per esempio circa i comportamenti di consumo e le catene di fornitura, ma mettono anche in evidenza la necessità di maggiori sforzi nei settori della mobilità, dell'alimentazione e dell'alloggio.

Parole chiave:
impatto ambientale dei consumi, indicatori di impronta ambientale, impronta di gas serra, impronta sulla biodiversità, impatto ambientale complessivo, ecobilancio, efficienza ambientale

Foreword

Switzerland can report successes in various areas of its environmental policy. Air quality has improved, and its population can swim in Swiss lakes without concern. Nevertheless, there are still challenges: Many goods consumed in Switzerland are produced in other countries, where a significant environmental impact can arise during the production process.

The so-called footprint indicators include the environmental impact of imports. Since 2006, the FOEN has ensured that the effects of Swiss consumption on the environment are analysed both domestically and abroad. In the years since this practice began, the methodology and available data for the footprints have been continuously improved both nationally and internationally.

This has made the following ever clearer: The advances achieved within Switzerland's borders are neutralised to some extent by the increase in the environmental impact abroad. Due to its comparatively high consumption level, Switzerland is one of the countries with disproportionately high environmental footprints per capita.

These signs need to be taken seriously against the backdrop of global well-being and population growth. After all, humans are still heavily damaging the climate and ecosystems that our lives depend on. International research on planetary boundaries proves this with clear evidence.

Every day, I meet committed people who are aligning their consumption patterns, business concepts or research activities with a future where the planetary boundaries are respected. Each and every one of us can do something. Actions taken in the areas of mobility, nutrition and housing, but also in foreign supply chains, are particularly effective. Switzerland's advanced technology and education levels, combined with the possibilities offered by digitalisation, provide ideal conditions.

Yet, we can only bring change to complex systems – such as the transport infrastructure or the energy supply – if we work together as a society. For that purpose, existing potentials should be exploited and new potentials should be developed through research and innovation. This will be a challenge not only for environmental policy, but for all policy areas, the economy and society as a whole. Environmental footprints, as they are examined in this study, help us keep an eye on our advances.

Karine Siegwart
Vice Director
Federal Office for the Environment (FOEN)

Summary

Background and goals

Pressure continues to mount on the natural environment worldwide. While many important local environmental problems are being effectively tackled in Switzerland, natural resources are being consumed and damaged in excess of the planetary boundaries from a global perspective: Thus, rain forests are being deforested, soils are losing their fertility, biodiversity is decreasing, oceans are polluted with nitrogen, and greenhouse gas emissions are influencing the climate. Our behaviour as consumers plays a part in this overuse, because it not only affects our immediate environment, but also has global and diverse effects across upstream and downstream supply chains as well as in the use and after-use phase of products. For instance, cocoa is cultivated for chocolate production in tropical countries, and coltan is extracted from African mines for smartphones. In a heavily service-based and globally connected economy like Switzerland's, the environmental impacts caused abroad are particularly relevant.

Resource-efficient and future-proof economy

Both the federal Sustainable Development Strategy and the federal government's efforts toward a green economy pursue the goal of conserving natural resources and strengthening the Swiss economy at the same time: They strive to reduce the environmental impact caused by Swiss consumption and production, while also taking into account the environmental impact caused abroad.

The environmental impact caused by Switzerland can be considered specifically from two complementary perspectives, which provide answers to different questions:

- In the so-called **production perspective,** the domestic environmental impact caused by businesses and households is the main focus. The environmental impact resulting from imported raw materials, intermediate products, and goods and services is not included.
- The **consumption perspective** (also called the footprint perspective in this summary), however, is based on products consumed in Switzerland. In this perspective, the environmental impact caused around the world by Swiss domestic consumption is attributed to Switzerland. It includes the entire supply chain of consumed products. This perspective is the main focus of this report.

Both perspectives are shown in Figure A.

Both approaches are necessary for a comprehensive examination of the environmental impact caused by Swiss consumption and economic activities. While the consumption (i.e. footprint) perspective includes supply chains and thus takes them into account, if an environmental impact is generated abroad, the production perspective is essential for measuring emissions and the state of the environment at home. The latter perspective is, for example, used in international climate negotiations and currently predominates in environmental monitoring – although the footprint perspective continues to gain more acceptance internationally. The results presented below in this report underscore the importance of a complementary use of the consumption and production perspectives.

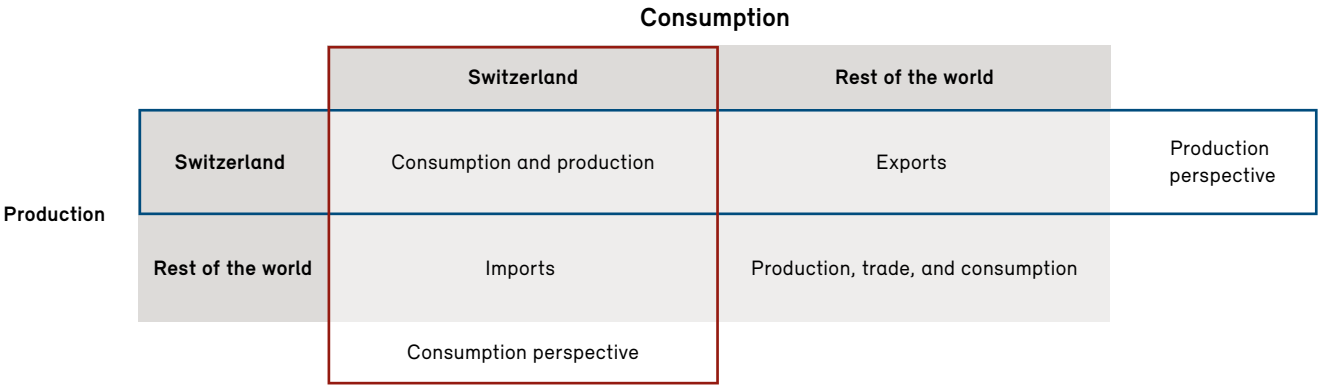
This report updates and expands earlier calculations (Frischknecht et al. 2014; Jungbluth et al. 2011) on the development of the domestic and foreign environmental impact caused by Swiss final consumption for the period from 1996 to 2015. These environmental impacts are analysed and discussed from an overall viewpoint and with regard to individual environmental aspects.

The net import of non-monetary gold, silver, and platinum metals is analysed in a separate excursus due to their extreme relevance. Non-monetary precious metals are imported particularly for value storage and investment purposes, which is why they are not allocated to Swiss consumption in the calculations. Gold mining in particular is linked to significant pressure on the environment. In fact, in one of the years concerned, the environmental impacts of net imported non-monetary gold even fall within the range of the absolute total environmental impact of Swiss consumption.

Figure A

Production perspective, foreign trade and consumption perspective

The chart shows the connection between the production and the consumption perspective. Production, consumption, and trade refer to goods and services.



According to Dao et al. (2015).

Methodology and approach

The TRAIL method[1] applied here uses information on domestic environmental impacts, on the one hand, and trade data, on the other, in combination with product life cycle assessments. The domestic environmental impacts are divided up and attributed to households or the economy based on their share of causation.

Calculation of the consumption-based environmental impact

Figure B shows the calculation method in the example of the total environmental impact, measured in eco-points (EPs, cf. below): The impact from imports is added to the environmental impact caused at home and the environmental impact from exports is deducted from it.

Data set

Data from official statistics[2] were used to determine the domestic emissions and resource consumption. The data on imports and exports of goods (volume, origin and transport method) came from trade statistics. They were combined with specific, partially regionalised and temporally differentiated life cycle assessment data to calculate the environmental impact at the level of individual groups of goods. The Swiss National Bank's (SNB) balance of payments and Swiss input-output tables were analysed to determine imports and exports of services. The environmental impact of trade in services was calculated using environmental intensities from Jungbluth et al. (2011). This calculation method made it possible to thoroughly measure the overall consumption-based environmental impact caused.

Indicators used

Impact assessment indicators

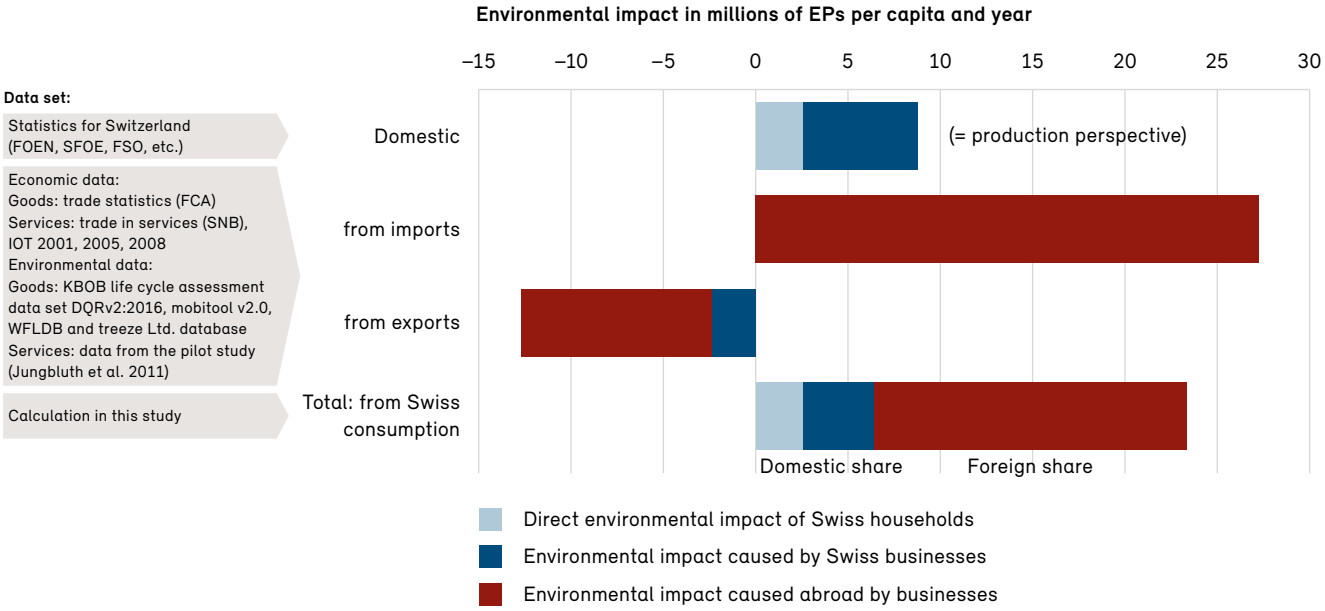
The ecological scarcity method 2013 usually used in life cycle assessments in Switzerland was employed to evaluate the total environmental impact. This method encapsulates a very broad range of environmental impacts (e.g. climate change, biodiversity losses due to land use, pollutant emissions, bodies of water and soil, energy, water and mineral resources) in one figure (EPs: eco-points). 2013 is mentioned in its reference because that was the year in which the method was last updated. The ecological scarcity method is geared towards Switzerland's environmental goals or international environmental goals supported by Switzerland. To verify how much the results depend on the selected assessment method, the overall

1 TRAIL stands for Trade Information and LCA (life cycle assessments) in reference to the fact that trade and life cycle assessment data are used.

2 Mainly from the Federal Offices for the Environment (FOEN), Energy (SFOE), Statistics (FSO) and Agriculture (FOAG).

Figure B

Consumption-based environmental impact calculation diagram and data set



Source: Updated from Frischknecht et al. (2014).

results are juxtaposed with other assessment methods, including the «ecological footprint.»[3]

The footprints of the following are quantified as well:

- greenhouse gases (greenhouse gas footprint[4]),
- biodiversity loss caused by land use (biodiversity footprint),
- nitrogen (marine eutrophication),
- air pollution,
- fresh water consumption,
- energy use,
- and material use.

In addition to the total environmental impact, the consumption-based environmental impacts for the headline indicators are shown below: greenhouse gas emissions, biodiversity loss, and freshwater consumption. The remaining environmental indicators are covered in the corresponding chapters of the main report (in German). The threshold values derived from the planetary boundaries are compared to the calculated footprints to the extent allowed by the data set.

The results shown are subject to a margin for error of +/– 20 % to 25 %. Therefore, small changes of a few percentage points in the footprints may not be interpreted as stable trends.

Development of the total environmental impact

Decrease in the consumption-based total environmental impact per capita

Although it fluctuates from year to year, the total environmental impact footprint per capita shows an overall declining trend (cf. Figure C): Between 1996 and 2015,

3 The well-known term «ecological footprint» expresses, from the consumer perspective, direct land use, fishing in the wild, and the forest area (theoretically) required to compensate for fossil CO_2 emissions in one number. The «ecological footprint» is not a comprehensive environmental indicator. The use of freshwater and other renewable and non-renewable natural resources and the loss of biodiversity or the environmental impact caused by air pollutants, heavy metals and persistent pollutants are not taken into account.

4 Other authors also refer to this footprint as the «carbon footprint»; here we use the term greenhouse gas footprint because «carbon footprint» is sometimes also used for a pure CO_2 footprint, which does not include other greenhouse gases.

it fell 19 % from **29.0 to 23.4 million EPs per capita.** Yet, this decline is insufficient to reach an impact level in line with the goals of Swiss environmental policy (cf. below).

The aforementioned development is partially attributable to the success of efforts toward air pollution control and protection of the ozone layer and bodies of water. Other important factors include the unquantified effects resulting from changes in volume and composition of the demand for goods and services (valid for all indicators). Figure C also shows the continuously decreasing domestic share of the consumption-based total environmental impact. In 2015, consumption in Switzerland caused around three-fourths of its environmental impact abroad.

Total environmental impact decreases slightly in absolute terms, Three-fourths of the environmental impacts are caused abroad
Due to the 17 % population growth in the period concerned, the absolute total environmental impact from 1996 to 2015 decreased significantly less than the environmental impact per capita (–6 % compared to –19 %).

Development of the greenhouse gas footprint

14.0 tonnes of CO_2-eq per capita and year
Consumption-based greenhouse gas emissions per capita are subject to fluctuations and amounted to 14 tonnes per capita in 2015 (cf. Figure D). Consumption-based greenhouse gas emissions are relatively stable, from a long-term perspective, while the domestic share is also subject to fluctuations caused by weather.

The greenhouse gas footprint shows a continuously decreasing domestic share. The reduction in domestic greenhouse gas emissions was largely offset by the additional emissions from foreign trade. In 2015, around 40 % of consumption-based greenhouse gas emissions were caused domestically.

The greenhouse gas footprint is still far in excess of a level that (extrapolated to the world's population) is in line with the planetary boundaries (cf. below).

Significant increase in the greenhouse gas footprint in absolute terms
Since the population in Switzerland grew 17 % during the period concerned, a significant absolute increase of around 12 % resulted from the nearly stable per capita development between 1996 and 2015.

Development of the biodiversity footprint

Biodiversity footprint: an indicator of the risk of global extinction for species
The biodiversity footprint is – according to the recommendations of the Life Cycle Initiative[5] – calculated as the potential for species loss due to land use. This indicator quantifies the long-term expected potential loss caused by a specific land use (such as agriculture or settlements) compared to an untouched, natural reference state. It takes the vulnerability of species into consideration and converts the regional decline of widespread species and the global extinction of endemic species into «globally completely extinct species.» Thus, it subsumes – similar to the way the greenhouse warming potential uses the «kg of CO_2-equivalent» unit for greenhouse gases – a varying impact intensity under one indicator. The equivalents of potentially globally extinct species are integrated over the years and quantified per million species (micro-PDF·a) and per trillion species (pico-PDF·a).[6] Using comparisons to a natural state, the indicator describes the likelihood that species will become irreversibly extinct due to land use.

Relationship between the biodiversity footprint and the Red Lists of Switzerland
Accordingly, the biodiversity footprint indicates the long-term potential species loss on a global level. Its approach differs substantially from that of the Red Lists. The Red Lists function as a sort of early warning system for species that are extinct, critically endangered, endangered or vulnerable in Switzerland. Therefore, the data on biodiversity in Switzerland published with the Red Lists are

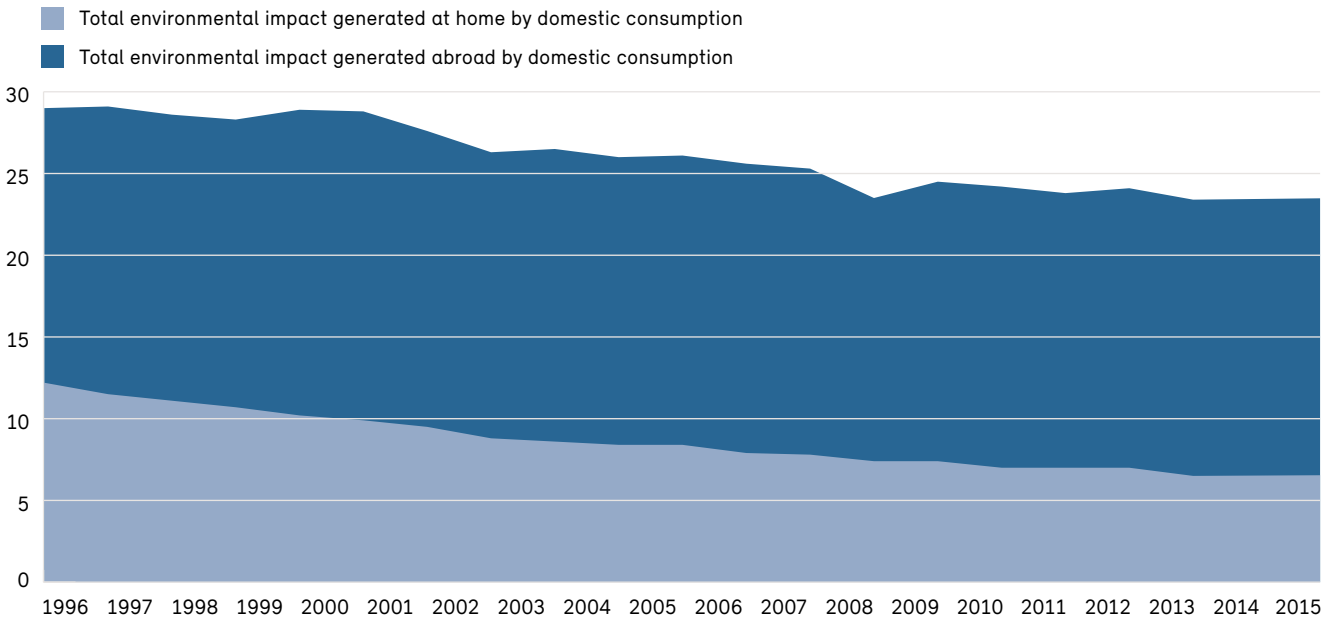
5 The Life Cycle Initiative is a programme hosted by the United Nations Environment Programme (UNEP) with global outreach, see www.lifecycleinitiative.org/applying-lca/lcia-cf/

6 1 pico-PDF·a = 10^{-12} PDF·a (i.e. a trillionth PDF·a); PDF = potentially disappeared fraction of species; the term «species-years» refers to this integration over time.

Figure C

Development of Switzerland's consumption-based total environmental impact per capita

Development of the total environmental impact generated by domestic final consumption in millions of eco-points (ecological scarcity method 2013) per capita, divided into the impact generated at home and abroad.

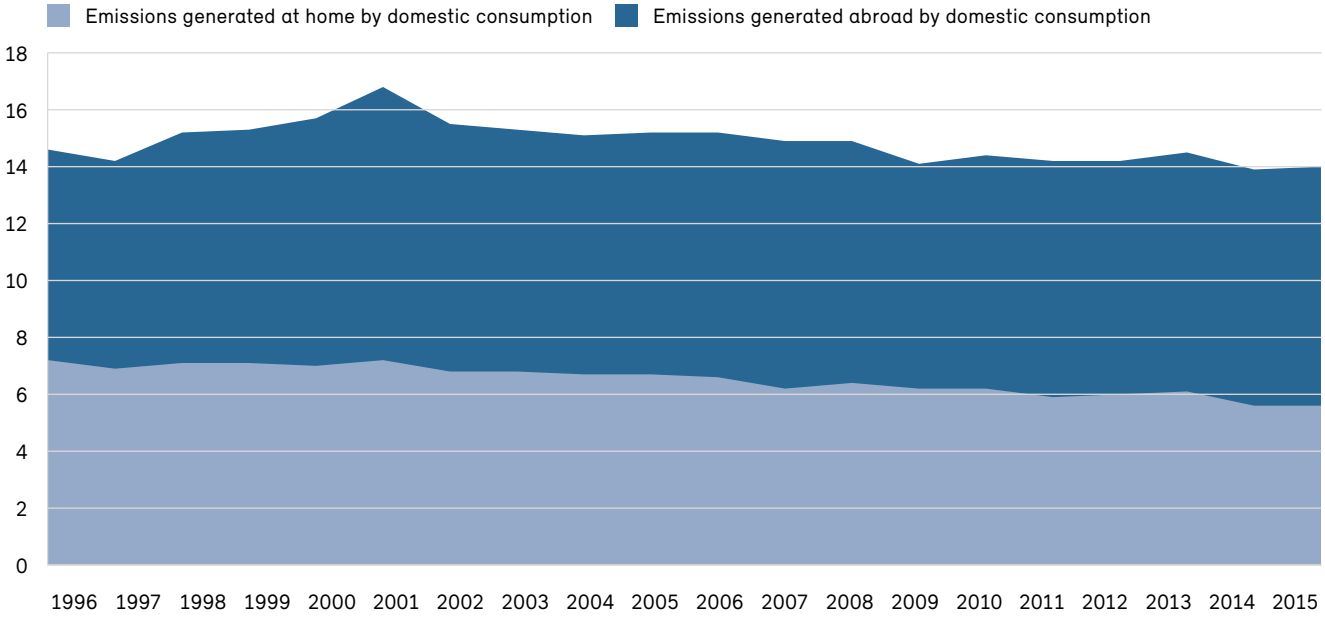


Source: Calculations treeze and Rütter Soceco.

Figure D

Development of Switzerland's consumption-based greenhouse gas footprint per capita

Development of greenhouse gas emissions in tonnes of CO_2-eq per capita, divided into consumption-based emissions in Switzerland and abroad.

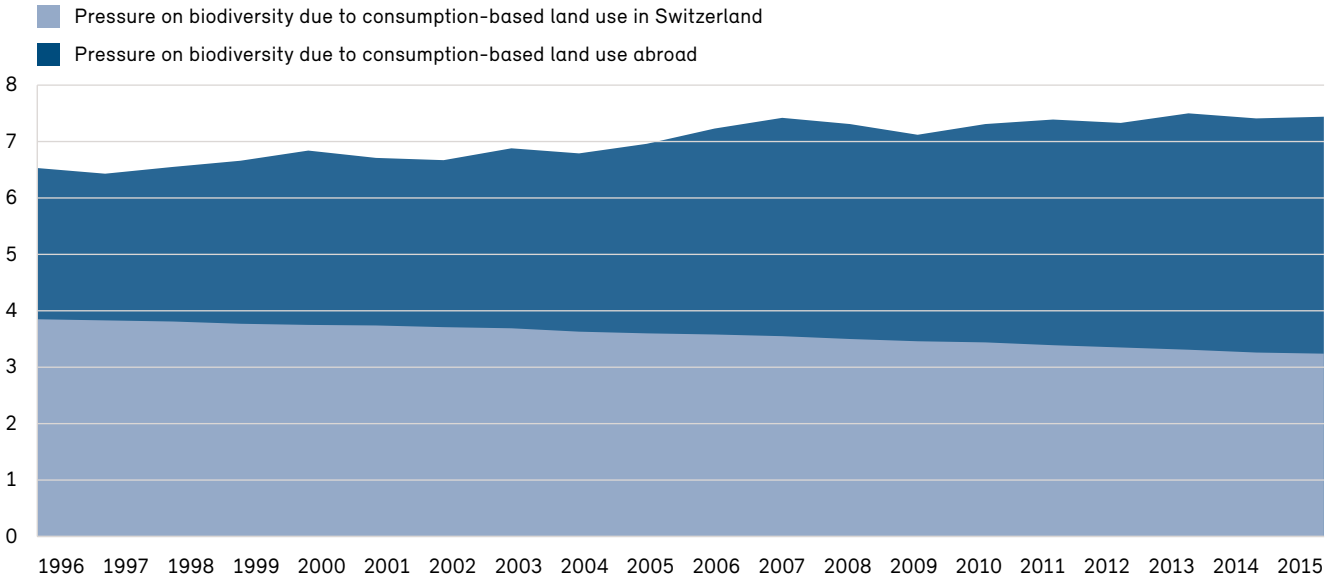


Source: Calculations treeze and Rütter Soceco.

Figure E

Development of Switzerland's consumption-based biodiversity footprint per capita

Development of consumption-based pressure on biodiversity due to land use in pico-PDF·a per capita, divided into the consumption-based impact caused in Switzerland and abroad. Other influential factors on biodiversity such as pollutant loads or fragmentation effects are not taken into account.



Source: Calculations treeze and Rütter Soceco.

not comparable to the biodiversity footprint presented here. Furthermore, the biodiversity footprint covers only the most important cause for species loss: land use. Other drivers of biodiversity loss such as climate change or nitrogen and pesticide inputs are not considered.

Sharp increase in consumption-based biodiversity loss caused by land use

The pressure exerted by Swiss consumption on biodiversity per capita from 1996 to 2015 increased by around 14 %. It totalled 7.44 pico-PDF·a in 2015 (cf. Figure E). The consumption-based pressure exerted on biodiversity abroad mounted sharply and continuously. The domestic share of the biodiversity footprint fell from 49 % to 35 % in the period concerned. In 2015, around two-thirds of the biodiversity footprint was caused by net imports. In that respect, at around 70 %, animal and plant products (especially foodstuffs and feedstuffs) by far make up the largest share of the imported biodiversity footprint. A comparison with the natural extinction rate shows that the biodiversity footprint is well above the threshold value, which – extrapolated to the world's population – is in line with the planetary boundaries (cf. below).

The biodiversity footprint is increasing even more sharply in absolute terms

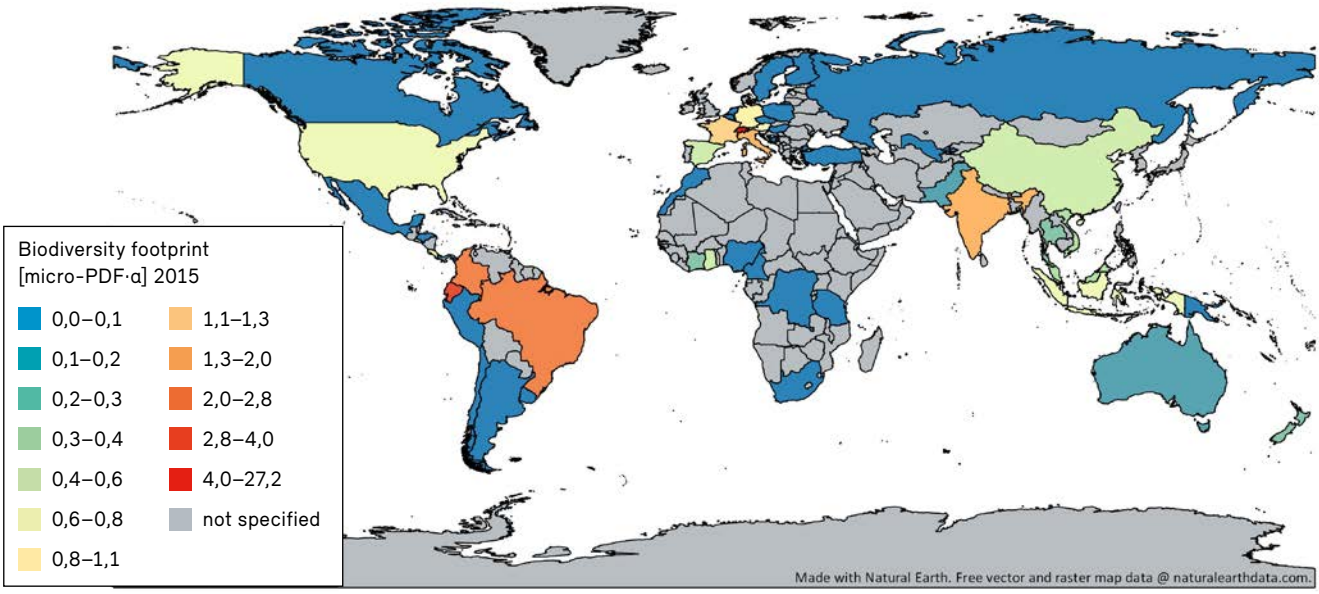
The absolute biodiversity footprint has increased even more sharply than the biodiversity footprint per capita due to the growth of Switzerland's resident population. The resulting absolute increase from 46.1 to 61.6 species-years per million species (micro-PDF·a) means that the current annual consumption level in Switzerland is leading to an additional global loss of 15.5 species per million species over the long term compared to annual consumption in 1996.

In 2015, the pressure exerted on biodiversity from consumption in Switzerland was caused especially in Europe (Switzerland, Italy, France, Germany), South America (Ecuador, Columbia, Brazil, Costa Rica), and Asia (India, Indonesia) (cf. Figure F). Conclusions on the development of biodiversity in Switzerland cannot be drawn from the biodiversity footprint (cf. above).

Figure F

Geographical distribution of biodiversity loss caused in Switzerland and abroad in 2015

Pressure exerted on biodiversity in Switzerland and abroad from land use in micro-PDF·a, divided into the consumption-based impact caused in individual countries. The map shows 83 % of the pressure exerted on biodiversity, while the remaining 17 % is caused by land use that cannot be geographically located.



Source: Calculations treeze.

Development of the water footprint

The consumption-based water footprint is increasing sharply

The water footprint is quantified with the AWARE (Available Water Remaining) indicator and takes national water scarcity into account. Similar to the biodiversity and greenhouse gas footprint, it is expressed in equivalents. The consumption-based water footprint per capita in Switzerland increased by 40 % between 1996 and 2015 and totalled 4,810 cubic metres of water-equivalent in 2015. Agricultural products from the USA, Spain, India, China, Italy, and Pakistan are together responsible for more than half of the Swiss water footprint.

Compatibility with the planetary boundaries

Environmental footprints exceed the planetary boundaries by 2 to 23 times

As research results worldwide show (synthesised in Rockström et al. 2009, Steffen et al. 2015), humanity has already exceeded the planetary boundaries in various areas such as biodiversity, ecosystem quality[7] and climate. In doing so, it is transgressing a range of conditions that are considered beneficial for its own development («safe operating space»).

Through its environmental footprints, Switzerland also contributes to the pressure on global environmental systems. Depending on the area of the environment, they are 2 to 23 times (extrapolated to the world's population) higher than the level (threshold value) considered in line with the planetary boundaries (cf. Figure G).

- Consumption-based greenhouse gas emissions in 2015 corresponded to 14.0 t of CO_2-eq per capita.[8] According to the calculations of Dao et al. (2015), the threshold level for greenhouse gas emissions is 0.6 t of CO_2-eq per capita and year for the period from 2015

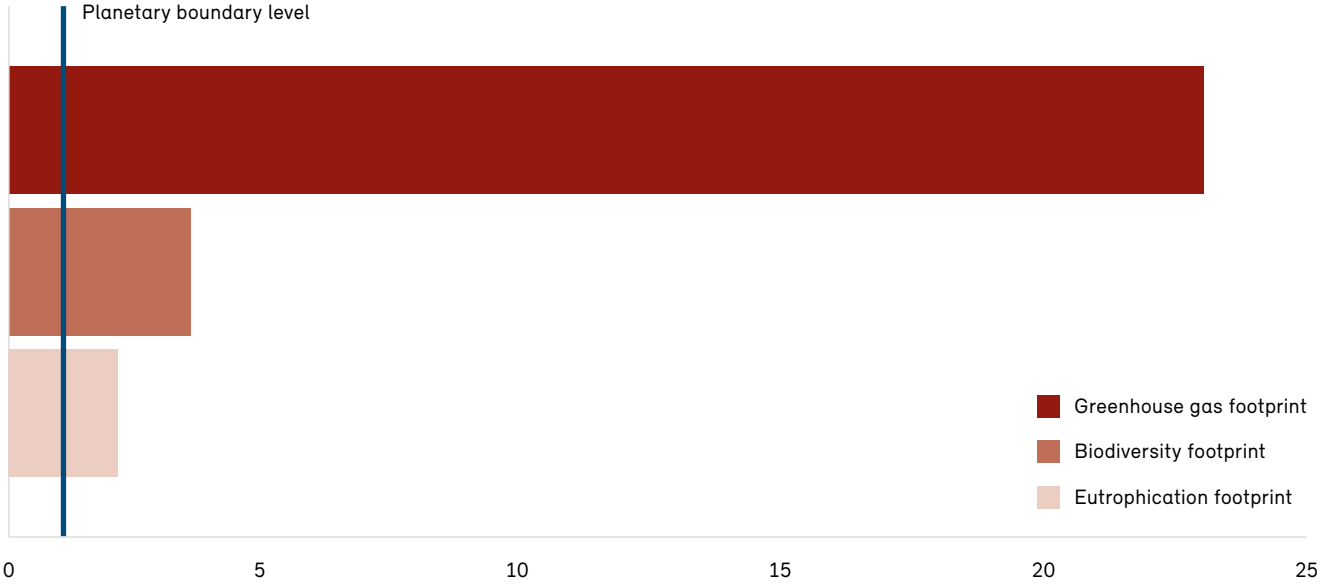
7 Nitrogen and phosphorus that end up in the environment through agriculture and other means largely contribute to disrupting ecosystem balance.

8 Greenhouse gases that are addressed in the UN Framework Convention on Climate Change and the Kyoto Protocol are taken into account.

Figure G

Footprints in comparison to the threshold value based on the planetary boundaries

Greenhouse gas, biodiversity and eutrophication footprint of Swiss consumption per capita in 2015, expressed as a multiple of the threshold value (planetary boundary level) of the corresponding environmental indicator.



to 2100. This is more than 95 % below the greenhouse gas footprint of 2015. Since the greenhouse gas footprint will be significantly higher than that value in the coming years, the remaining planetary boundary level for annual greenhouse gas emissions is falling. Ultimately, only complete decarbonisation is in line with the planetary boundaries.

- The biodiversity footprint quantifies the potential global species loss compared to a natural, untouched state. Since the first large-scale deforestations in Europe between AD 500 and 800, in the last 1,500 years in other words, around 1,500 species per million species have become extinct worldwide. Using the estimated planetary boundary level of Steffen et al. (2015) – an extinction rate of 10 species per million species and year over the last 1,500 years – 15,000 species per million species can be presumed to be the threshold value. Consumption in Switzerland in 2015 (1.13 ‰ of the world's population) caused a global loss of 61.6 species-years per million species compared to the natural reference state. If everyone consumed like the Swiss population, roughly 55,000 species per million species or 5.5 % of species would become extinct in the long term as a result of the current level of consumption. Therefore, the planetary boundary level (threshold value) is 73 % and the natural extinction rate is even 97 % below that value.
- The eutrophication footprint (nitrogen released in the environment due to Swiss consumption) amounted to 14.8 kg of nitrogen-equivalents (N-eq) per capita in 2015. The threshold value – the planetary boundary level for nitrogen emissions – equals 6.5 kg of N-eq per capita. According to Dao et al. (2015) it is derived from the naturally sustainable quantity of nitrogen per cubic metre of water. This threshold value is approximately 50 % lower than Switzerland's eutrophication footprint in 2015.

Estimation of the reduction required for the total environmental impact

The total environmental impact (in EPs) significantly exceeds the critical flow,[10] which results from the target values of domestic Swiss environmental policy. The criti-

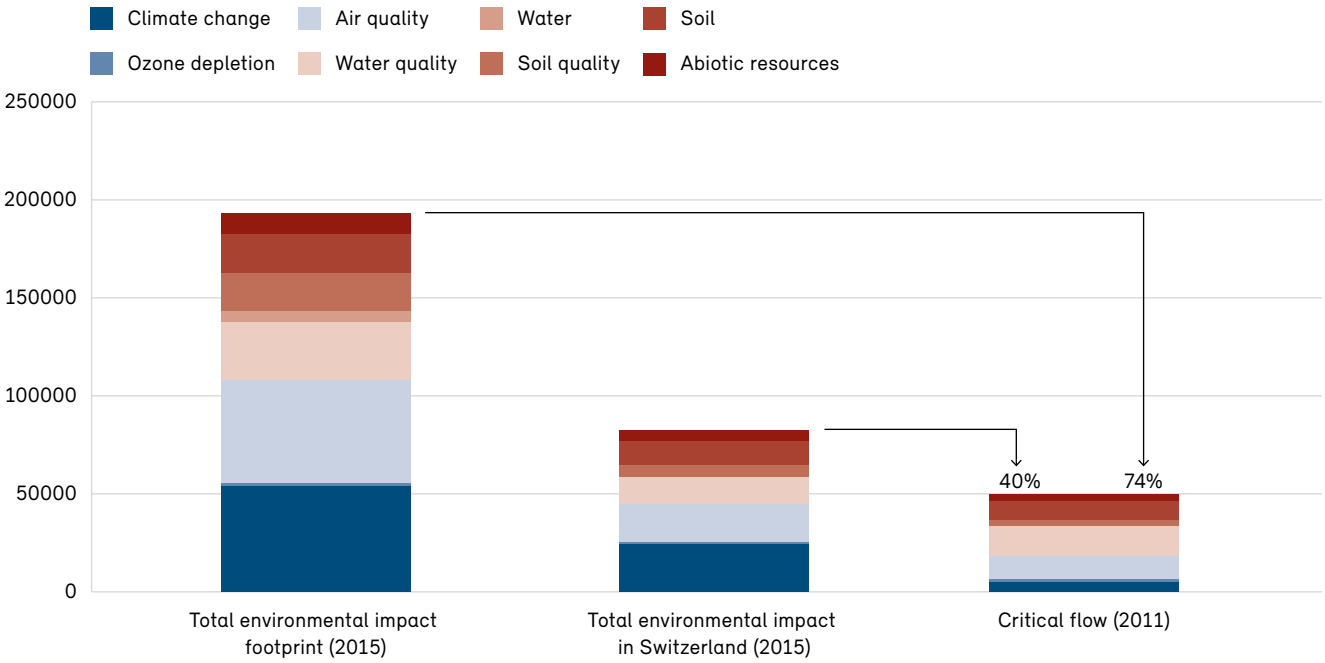
9 Critical flow of the ecological scarcity method 2013.

10 The critical flow quantifies the targeted situation sought by environmental policy. Example: The Swiss Federal Council seeks to reduce nitrogen oxide emissions by around 50 % from their 2005 level in order to comply with the ambient limit values for ozone and the limits for acidic depositions. This corresponds to an annual nitrogen load of 45,000 tonnes.

Figure H

Comparison of the current total environmental impact with the target values of Swiss environmental policy[9]

Comparison of the results of the total environmental impact footprint (in Switzerland and abroad) in 2015, the total environmental impact in Switzerland in 2015, and the critical flow (i.e. the target values of Swiss environmental policy), 2011 version, in billions of eco-points (2013 EP Method).



Source: Calculations treeze.

cal flow is 40 % lower than the total environmental impact in Switzerland (production perspective, current flow[11]) and 74 % lower than the total environmental impact footprint (consumption, i.e. footprint perspective) (cf. Figure H). For a comparison with the consumption perspective, Swiss environmental targets need to be applied to the environment abroad (or to the foreign supply chains).

Total environmental impact of consumption more than three times higher than sustainable over the long term

Based on the aforementioned reference values and in consideration of the planetary boundaries (cf. above), it must be assumed that the current total environmental impact of consumption by a person living in Switzerland is over **three times** higher than the long-term sustainable level indicated in Swiss environmental policy.[12]

Switzerland has incorporated the planetary boundaries into its Sustainable Development Strategy (Swiss Federal Council 2016a) and green economy measures (FOEN 2016a). The EU has adopted a similar vision with its 7th Environment Action Programme entitled «Living Well within the Limits of Our Planet.»[13] The comparison of Swiss footprints with the planetary boundaries and Swiss environmental goals has shown: The measures implemented to date are not enough to reduce the total environmental impact to a level within the limits of our planet.

11 The current flow quantifies the environmental situation within Switzerland's borders at this time. For instance, the annual nitrogen load in 2015 totalled around 83,000 tonnes.

12 Note: The «ecological footprint» can be compared to the biocapacity (e.g. forest area absorbing CO_2 emissions) available per person worldwide. If everyone around the world consumed as much as the Swiss population, it is (likewise) projected that about three Earths would be necessary.

13 http://ec.europa.eu/environment/pubs/pdf/factsheets/7eap/de.pdf, retrieved on 4 December 2017

Environmental impact and economic growth

In addition to the development of the absolute environmental impact and the environmental impact per capita, a comparison with economic growth is also interesting. This makes it possible, among other things, to draw a conclusion on whether consumption-based environmental efficiency, i.e. the economic performance compared to the environmental impact of the Swiss economy, has increased.

Increase in domestic final demand with simultaneous decrease in consumption-based total environmental impact per capita

The economic parameter directly comparable to the environmental impact in the consumption perspective is domestic final demand.[14] It is the sum of consumer spending by private households, national final demand and total economic investments. While the domestic final demand per capita between 1996 and 2015 increased by 13 % (cf. Figure I),

- the consumption-based biodiversity footprint per capita simultaneously rose 14 % during the period concerned,
- the greenhouse gas emissions per capita remained fairly stable,
- and the total environmental impact per capita fell 19 %.

Development of consumption-based environmental efficiency

The development of the consumption-based total environmental, greenhouse gas and biodiversity efficiency between 1996 and 2015 is shown in Figure J below. These efficiency indicators show the domestic final demand per unit of each footprint, i.e. of the consumption-based environmental impact caused. During the period concerned, consumption-based total environmental efficiency and greenhouse efficiency increased significantly, while biodiversity efficiency stagnated.

14 In contrast, territorial emissions are usually compared to the gross domestic product (GDP).

Impacts of potential future developments

Selected potential future developments in the areas of energy (E), housing (H), mobility (M), nutrition (N) and industry (I) were analysed based on existing studies with a view to their impacts on selected environmental footprints. However, these are neither predictions, nor exhaustive scenarios. They assess rather the influence of individual, significant variables on the environmental footprints.

Energy and housing

E1) Reference values of the Energy Strategy (based on the referendum on the Energy Act): The (domestic) targets for 2035 set out in the revised Energy Act can reduce the total environmental impact per capita by around 9 % and the greenhouse gas footprint per capita by around 12 %.

H1) Changes in relation to living space and heat energy consumption (based on a guiding principle of intercantonal policy)[15]: Improvements in the building stock (higher energy efficiency and increased use of renewable energy sources) can reduce the total environmental impact per capita by approximately 4 % and the greenhouse gas footprint per capita by roughly 9 %, taking into account the increase in the living space per capita.

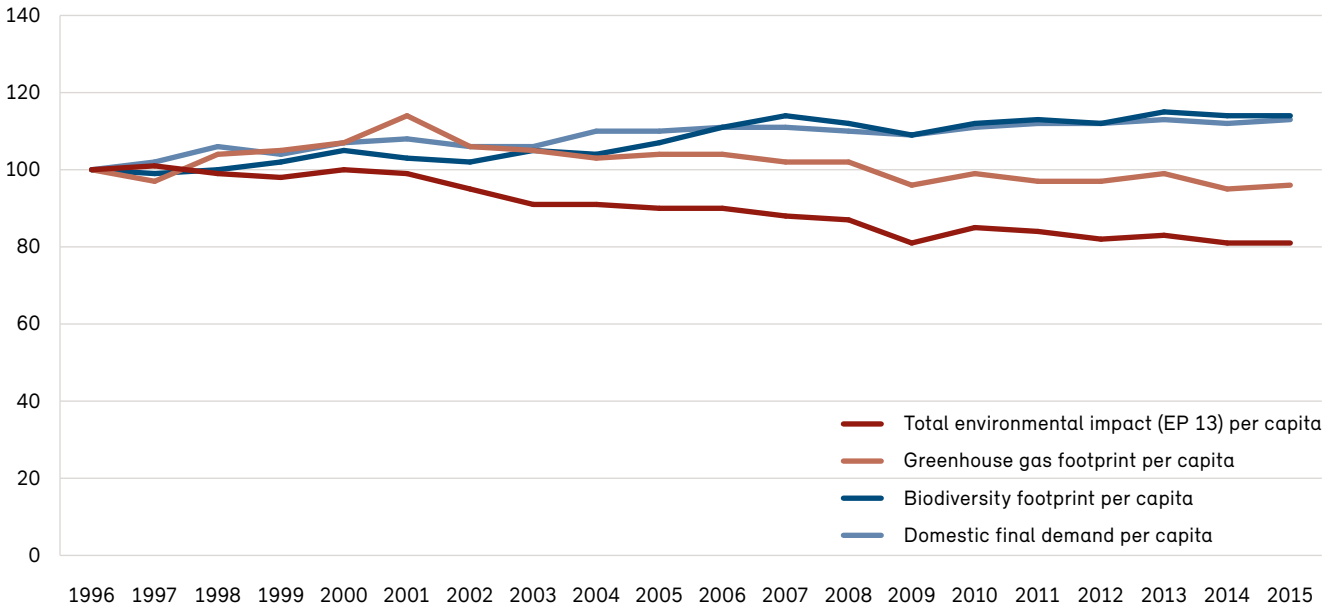
H2) Change in the building materials used in the building stock (based on a combination of the expected and desirable development): Building materials per capita used in construction will generally decrease in the coming decades. Building trends are transitioning toward materials that are harsher on the environment such as concrete, metals, insulation materials and plastics. Therefore, the environmental impact, greenhouse gas emissions, and energy consumption of the building materials used in the building stock per capita will remain virtually unchanged. However, better insulation is making a considerable contribution to the H1 reduction potential.

15 This future development is a thematic subset of future development E1. However, the common elements with E1 are not aligned with the standard values provided in the Energy Act currently in force.

Figure I

Development of the total environmental impact, greenhouse gas and biodiversity footprint as well as economic performance

Development of the consumption-based total environmental impact (ecological scarcity method 2013 in eco-points, EPs), the greenhouse gas emissions, and the biodiversity losses per capita as well as the domestic final demand per capita between 1996 and 2015, indexed (1996 = 100).

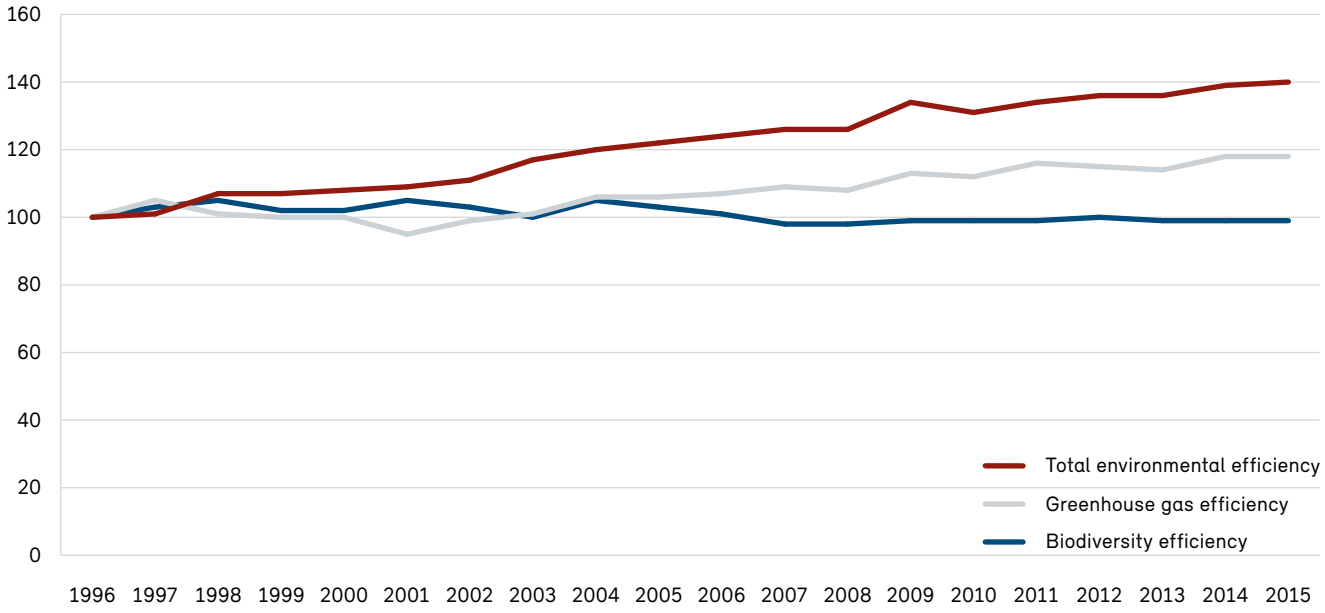


Source: Calculations treeze and Rütter Soceco.

Figure J

Total environmental, greenhouse gas and biodiversity efficiency

Development of the efficiency related to the consumption-based total environmental impact (ecological scarcity method 2013), greenhouse gas emissions, and biodiversity losses between 1996 and 2015, indexed (1996 = 100).



Source: Calculations treeze and Rütter Soceco.

Mobility

M1) Transport perspectives (based on the expected development): The anticipated fuel efficiency improvements and moderately rising share of electric vehicles according to the federal government's transport perspectives will lead to a reduction in the specific environmental impact caused by road transport. However, the reduction will be largely offset by the expected increase in transport performance, which means that the total environmental impact will decrease by only 1 % and the greenhouse gas footprint by only 2 % (each per capita). To achieve a significant improvement in (land) transport, it is necessary to rapidly transition to alternative engine systems and/or stabilise/reduce vehicle-kilometres and vehicle weight.

M2) Development of air transport (based on the expected development): The expected significant rise in demand for air travel by 2030 discussed in the air transport policy report will cause the greenhouse footprint per capita to increase by more than 5 % and the total environmental impact per capita to increase by 2 %, if the energy efficiency of airplanes remains the same. This makes it clear that changes in the volume of air traffic are extremely significant to the greenhouse gas footprint and that the scale of the challenge is considerable for airlines and aircraft manufacturers.

Nutrition

N1) Change in eating habits (hypothetical, desired from an environmental perspective): A reduction in the quantity of meat consumed toward the recommended amount[16] under health guidelines will decrease the individual total environmental impact footprint (cf. e.g. Figure H) by about 4 %. The reduction potential of other significant aspects of nutrition such as food waste (e.g. nose-to-tail eating) the farming method (e.g. fertilisers and pesticides; conventional or organic) and seasonal eating could not be estimated as part of this study.

Industry and its supply chains

I1): Efficiency increase across supply chains (hypothetical, desirable from an environmental perspective): Foreign supply chains constitute an important leverage for the reduction of Swiss environmental footprints: On average, each percent of environmental impact that is reduced in foreign supply chains will be accompanied by a 0.73 % decrease in the total environmental footprint. Supply chain improvements will be achieved by reducing the material and energy required (increased material and energy efficiency) for products consumed in Switzerland, improving environmental efficiency through retention measures (filters) at foreign production sites, or switching to more environmentally-efficient suppliers.

The assessments show: Switzerland's environmental footprints can only be reduced to a level within the limits of the planet if all relevant consumption areas (nutrition, housing, mobility, etc.) and all levels (supply chains, technology, production, and consumption patterns) are tackled at the same time.

Conclusions

Decrease in the domestic and increase in the imported environmental impact

The above calculations make it clear that domestic environmental protection efforts are having a tangible effect and that the domestic total environmental impact has decreased significantly both per capita and in absolute terms in the last 20 years, while the population has grown. However, these achievements – particularly as concerns air pollution control and the reduction of ozone-depleting substances – are neutralised partly by the rising environmental impacts caused abroad.

Annual fluctuations

In contrast to the domestic environmental impact (from the production perspective), the total environmental impact in the consumption perspective is subject to heavier fluctuations. The annual differences cannot reliably indicate changes in the consumption-based environmental impact. To assess the development, attention should therefore be given to the identifiable differences in 10-year periods instead of annual fluctuations.

Action required

It must be assumed that natural resource consumption within the «safe operating space», i.e. within the plan-

16 toward the recommendations of the Swiss Nutrition Society (SGE) and the Federal Food Safety and Veterinary Office (FSVO), cf. www.sge-ssn.ch/ich-und-du/essen-und-trinken/ausgewogen/schweizer-lebensmittelpyramide/

etary boundaries, is at least two-thirds lower than the current total environmental impact of consumption – and a lot lower for the key environmental issue of climate protection. If the previous trends continue their course, the footprints will not be in line with the planetary boundaries. Isolated improvements are not enough to reduce the environmental footprints to the required level. A comprehensive approach that takes into account consumption behaviours in the areas of nutrition, housing, and mobility as well as environmental efficiency in production is necessary. Due to the high and rising share of the impact caused abroad, hot spots along the entire supply chain must be taken into account.

The business community, civil society and government have already introduced a broad range of sensible measures. One example is voluntary standards that vary in terms of their strictness and credibility in the area of commodities (cacao, soy, palm oil, biomaterial, timber, fish and peat) and in the area of buildings (SNBS – the Swiss sustainable building standard – Minergie-Eco and SuRe for infrastructures). The various actors are all responsible for increasing participation in order to

- promote the development of more innovative, resource-efficient, rapidly scalable niche technologies and support their market introduction;
- ensure that voluntary standards for particularly environmentally-relevant products meet high qualitative requirements;
- help resource-efficient approaches gain widespread recognition;
- align investment decisions in private and public infrastructures (e.g. building stock, transport infrastructures) with resource-efficient, decarbonised, and circular economic patterns.

Comprehensive target framework and progress measurement

Accordingly, a clear target framework and consistent progress measurement are necessary. The footprint indicators discussed in this study provide a complementary, crucial perspective to the existing domestically-orientated monitoring system. For that reason, they should be used increasingly as a reference for policy and corporate roadmaps (cf. i. a. Potting et al. 2017). The Sustainable Development Goals (United Nations 2030 Agenda) are important and valuable policy guidelines that should also be applied with a view to the entire supply chain so that they can be used to guide Switzerland's development toward resource-efficient and future-proof economic activities.

This study provides foundations for expanding classic environmental indicators to include the increasingly larger share of impacts caused abroad (footprint perspective). The first footprint indicators were already taken into account in various areas (nationally, such as in the Green Economy Action Plan and in the MONET sustainable development indicator system; internationally, such as in the reporting of the European Environment Agency (EEA) and in the Green Growth Indicators of the OECD). We recommend that they be implemented more intensively and systematically in the future, especially in environmental policy-making and corporate decision-making processes, to measure the progress of the global 2030 Agenda (Sustainable Development Goals).

Further research required

The chosen methodology of combining national environmental statistics, trade statistics, and life cycle assessment data (termed as the «TRAIL method» here) has proven itself. The recommendations of the UNEP-hosted Life Cycle Initiative concerning regionalised footprint indicators have been implemented for the first time to ascertain the consumption-based environmental impacts of a country. Thanks to advances in regionalised environmental indicators and regionalised life cycle inventory data in the areas of land and water use, it is possible to provide a comprehensive and differentiated view of consumption-based impacts on water stress and biodiversity.

Further research is required in the area of temporally and regionally differentiated life cycle assessment data on industrial products and consumer goods from outside the European continent in order to characterize the development of environmental impacts abroad in the production of goods or the changes in the environmental intensity of services through time. Although assumptions and simplifications are always involved in environmental footprint modelling, footprint indicators have become more reliable thanks to further developments in methodology.

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