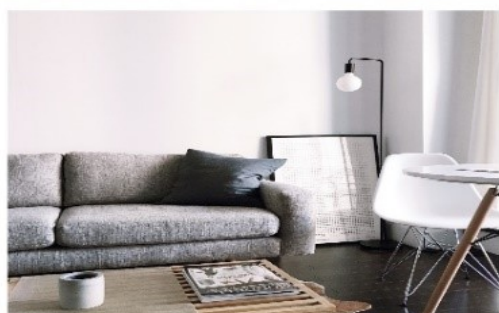


Analysis of the environmental impacts of 218 consumption items

Greenhouse gas emissions, land use and water use per SEK and kg.

Annika Carlsson Kanyama
Noha Baraka
Reneé Benders
Mårten Berglund
Fredrik Dunér
Rixt Kok
Raul Lopez I Losada



**KTH, Royal Institute of Technology
Sustainable development, Environmental Science and Engineering (SEED)
Teknikringen 10B
11428 Stockholm**

ISBN: 8-91-7873-398-9

TRITA: TRITA-ABE-RPT-1926

Referens till rapporten: Carlsson Kanyama, A., Baraka, N., Benders, R., Berglund, M., Dunér, F., Kok, R., Lopez I Losada, R. (2019). *Analysis of the environmental impacts of 218 consumption items. Greenhouse gas emissions, land use and water use per SEK and kg*. Mistra Sustainable Consumption, Rapport 1:4. Stockholm: KTH.

Summary

A software application combining process and input–output analysis (EAP) was used to analyze 218 consumer products and services for environmental impacts over their life cycle. The results are available as carbon dioxide equivalents, land use and water use per kg and per SEK. The products and services were chosen either because they are consumed by many Swedish consumers today or because they may be consumed to a large extent in the future. This report presents the results from these calculations along with an explanation of how the software (EAP) works, as well as a description of where the data for the database update and the analyses came from. The report includes five appendixes containing the collected data, assumptions and results.

Preface

The need for a transition to environmentally sustainable consumption patterns has intensified in recent years, highly motivated by an increasing concern for the impacts of climate change but also out of concern for the extensive use of land and water required to sustain current consumption practices. The research program “Mistra Sustainable Consumption – from niche to mainstream” (sustainableconsumption.se) addresses these challenges under its overall aim to contribute with knowledge that will enable society to make sustainable consumption practices that are rare today, so-called niche practices, more common. As a part of this research, the life-cycle environmental impacts of a large number of goods and services consumed by Swedish households were calculated. This report presents the results of these calculations as well as explanations for how the results were obtained.

The target group for this report is anyone interested in calculating the environmental impacts of private consumption as well as those interested in methods for such calculations. The Dutch software (EAP) that was used for a large part of the calculations is owned by the University of Groningen in the Netherlands. For more information about EAP and license opportunities, please contact René Benders at r.m.j.benders@rug.nl.

Content

- Summary 3
- Preface 4
- Content..... 5
- 1 Introduction and aim 5**
- 2 The Energy Analysis Program, EAP 6**
 - 2.1 Introduction..... 6
 - 2.2 Description of the method..... 6
 - 2.3 Remarks concerning the method 9
 - 2.4 Calculation of environmental intensities of residual goods..... 10
- 3 Updating the databases in EAP..... 11**
 - 3.1 Basic goods, packaging, transport and waste processing..... 11
 - 3.2 Manufacturing, wholesale and retail..... 13
- 4 Analyses of 218 consumption items 15**
 - 4.1 Analyses performed in EAP 16
 - 4.2 Analyses performed outside EAP 17
- 5 Suggestions for improvements and further application of the results..... 18**
 - 5.1 Suggestions for improvements..... 18
 - 5.2 Further application of the results..... 18
- 6 List of Appendices..... 29**
- 7 References 30**

1 Introduction and aim

Including consumers and consumption patterns in the quest to lower human-induced environmental impacts has been on the agenda for decades (see, e.g., Agenda 21 chapter 4 from 1992 as one of the first documents) (UN, 1992). Consumption patterns, particularly among rich people, remain problematic, however, not least from an environmental perspective. Over time, much new knowledge about consumption and consumption patterns has been revealed by scientists using a multitude of methods (e.g. Wang et al, 2019). The global sustainable development goals (UN, 2015) include the goal to ensure sustainable consumption patterns but in an update of these goals made in 2019 the conclusion was that an ever-increasing amounts of natural resources is used to support our economic activity and that the efficiency with which such resources are used remains unchanged at the global level (UN, 2019).

One of the research topics in the field of sustainable consumption that has evolved since the 1990s are ways of estimating the environmental impacts from consumption given a cradle-to-grave or a life-cycle perspective. This means that the environmental impacts of products and services consumed are considered during the entire production chain from mine or farm to waste handling. Such detailed calculations usually require large sets of data describing various emissions and resource use during processing, transport, packaging, etc. for each product and can be quite labor-intensive (Curran, 2016). Simplified methods, such as input-output analyses, have therefore been developed, and used for calculating, e.g., total emissions of greenhouse gases from household consumption (e.g. Palm et al. 2019).

One drawback of these simplified methods, however, is their lack of detail, which means that small changes in consumption cannot be environmentally monitored (Steinbach et al, 2018). Examples of such changes include buying less meat and more soy strips or buying more second-hand clothes and fewer new ones. In order to detect such changes, other methods are needed that can capture environmental impacts on a relatively detailed level while still not imposing a tremendous workload on those making the calculations.

This report presents results obtained through the use of a tool that enables these types of detailed but not too labor-intensive calculations. The resulting greenhouse gas emissions, land use and water use are presented for 218 consumption items, along with explanations about the methods and data used. The calculations have been selected based on available statistics of what Swedish households consume and will at a later stage be used for estimating how much the environmental load would change if consumption patterns change according to different assumptions. To this end, a number of calculations have also been made for products and services that can be considered more environmentally and/or socially sustainable in comparison with what is mainstream today in a country like Sweden. These are called niche products and practices and are further described in three reports (Kamb et al., 2018; Lehner et al. 2018; Thorson et al. 2018).

The report is structured as follows:

Chapter 2 contains a description of the software used for most of the calculations, EAP, as well as its history.

Chapter 3 contains a description of the data used to update the EAP databases prior to the analysis presented in this report. All the data used for the update are included in Appendix 1.

Chapter 4 summarizes the assumptions made for the calculations, both inside and outside of EAP. A detailed account of the assumptions and results is presented in Appendices 2 and 3 while Appendix 4 contains a summary of all analyses. A summary of the results per SEK only is also presented in Table 4 at the end of the report.

Chapter 5 contains some suggestions for how the calculations could be improved as well as a description of further applications.

2 The Energy Analysis Program, EAP

2.1 Introduction

The EAP computer program was developed at the University of Groningen (the Netherlands) in the 1990s (Wilting, 1996). Originally, it was a tool to calculate direct and indirect energy consumption for the Netherlands. Later, greenhouse gas emissions as well as other emissions and land use were added. In the early 2000s, a Swedish version was developed in the context of an EU project. In 2006 and 2012, two updates for Sweden were developed in which energy and CO₂ emissions were implemented. For the 2019 update, three indicators are implemented: CO₂-equivalents, land use, and water use. The text below explains the hybrid method as used in the EAP computer program. The term “environmental impacts” is used to describe the three environmental indicators.

This section describes the method that is implemented in the EAP computer program to calculate the direct and indirect environmental impacts of an item of consumptive expenditure. There are, in principle, two methods for calculating the total life-cycle use of an item of consumptive expenditure: process analysis and input-output analysis. Process analysis makes use of a description, in physical terms, of the processes involved in the production cycle of the consumptive expenditure under consideration (IFIAS, 1974; Boustead and Hancock, 1979). The environmental impacts in the processes are then investigated in a detailed manner. Accordingly, process analysis is quite precise but also rather labor-intensive. Input-output analysis uses so-called input-output tables in which the transactions between economic sectors are expressed in monetary terms. One of the results of environmental impact input-output analysis is the cumulative environmental impact intensity of a sector. This intensity depicts the amount of direct and indirect environmental impacts that a sector “needs” per financial unit worth of supplies (Wilting, 1996). Input-output analysis is less accurate than process analysis, but it provides the opportunity to calculate complete cycles.

The method that is described here makes use of a hybrid approach; for a comprehensive justification, see Van Engelenburg (1994). The components of production cycles that are important in terms of environmental impacts are measured by means of process analysis. The rest of the cycle is calculated completely by means of input-output analysis. A proposal was previously made to develop a hybrid approach (Bullard et al., 1978).

2.2 Description of the method

The method used here can determine the life-cycle environmental impacts during the entire life cycle of an item of consumptive expenditure. The method has been streamlined into a step-by-step scheme. The eleven steps are:

First step: the cycle flow chart

First, the life cycle of the item of consumptive expenditure has to be established. In the flow chart, all activities that are expected to reasonably contribute to the total environmental impacts are separately recorded. Figure 1 shows an example of a flow chart for the life cycle of a product.

In the manufacturing stages, when dealing with non-capital goods, a distinction is made between basic goods and residual goods. Basic goods are raw materials that are used in production whose nature and size are known. Residual goods are raw materials whose precise nature or size is unknown¹. The residual goods also include products and services that are indirectly used in production, such as office supplies and maintenance of the premises.

1 The residual goods also include materials whose environmental load is not known (see the fourth step for a definition of “environmental load”).

Second step: the mass balance

In this step, an inventory is made of the basic goods used for production. As mentioned, basic goods concern raw materials and any other materials both for the product and for packaging. Basic goods can be registered in a mass balance. Particularly when the composition of an item of consumptive expenditure can be analyzed in terms of materials, it is possible to check whether the weight of the basic goods reasonably conforms to the total weight of the item of consumptive expenditure. For example, the weight of a refrigerator is determined by the combined weight of the materials present in it. Correspondingly, the mass balance can also be used to control the waste analysis. A check can be made to examine whether or not all basic goods are included in the waste processing.

Third step: the financial balance

Certain components of production cycles cannot be expressed in physical units. To determine the environmental impacts of these components, the method makes use of financial units. A price is given to all components of the cycle, on the basis of the consumer price of the item of consumptive expenditure. Taking the margins of the relevant trade or service sectors into consideration, the selling price from the manufacturer can be fixed. This selling price is made up as follows:

- purchase price of the basic goods (see step 2)
- purchase price of energy
- depreciation
- net added value
- purchase price of residual goods (residual costs)

In the next steps, the appropriate environmental impacts are ascribed to the various components.

Fourth step: determining the environmental impacts of basic goods and packaging materials

In the second step, the quantities of basic goods and materials that are used in the production of an item of consumptive expenditure are established. The environmental impacts as a consequence of the production of these basic goods is represented by the environmental impacts of these basic goods (in CO₂-eq., m² and liters per kilo). The environmental impact of a material is the total amount of environmental impacts emitted/used to generate one kilogram of that material, calculated from the raw materials to the final production of the material. For each of the basic goods in the mass balance, the environmental impact is calculated by multiplying the quantity by the environmental impacts. The total environmental impacts of the basic goods are obtained by summing up all of the basic goods in the mass balance.

Fifth step: determining the environmental impacts of the residual goods

The value of the residual goods is established in step 3. This value is multiplied by the environmental intensity of the residual goods (in CO₂-eq., m² and liters per SEK) in order to ascertain the environmental impacts of the residual goods. The environmental intensity of the residual goods is calculated from input-output analysis on the basis of the deliveries to the producing sector. In this calculation, a correction is made for those goods that are regarded as basic goods. (Wilting, 1996) describes the method for calculating the environmental impacts of residual goods (see also the last section: Calculation of environmental intensities of residual goods).

Sixth step: determining the environmental impacts of capital goods

Creation of the capital goods that are required to ensure production (buildings, machines, etc.) also have a certain environmental impact. The environmental impacts for the capital goods are determined via the environmental intensity of the depreciation on the capital goods (in CO₂-eq., m² and liters per SEK). This environmental intensity is determined by means of input-output analysis. The value of the depreciation is calculated at the financial balance (step 3).

Seventh step: determining the direct environmental impacts during production

In the manufacturing sector, the direct environmental impact to produce the item of consumptive expenditure can be established by means of process analysis. If this cannot be ascertained, production statistics or the direct environmental intensity of the manufacturing sector (in CO₂-eq., m² and liters per SEK) can be used.

Eighth step: determining the environmental impacts of transport and trade

The route from the manufacturer to the consumer normally takes place via a number of steps: transport and one or more intermediary organizations (trade, catering, repair firms, etc.). The environmental impacts of these organizations must also be established. In the case of transport, the weight of the item of consumptive expenditure and the distance travelled by each means of transport are taken into consideration. By using environmental intensities for each means of transport (in CO₂-eq., m² and liter per metric ton per km), the total environmental impact of the transport is calculated. Furthermore, the intermediary organizations (wholesale, retail trade, catering, etc.) have their environmental impact for delivering the item of consumptive expenditure to the consumer. In the financial balance (step 3), the margins for the various intermediary organizations are determined. By multiplying these margins by the respective environmental intensities (in CO₂-eq., m² and liters per SEK of margin), the total environmental impacts for the intermediary organizations can be calculated.

The cycle flow chart (step 1)

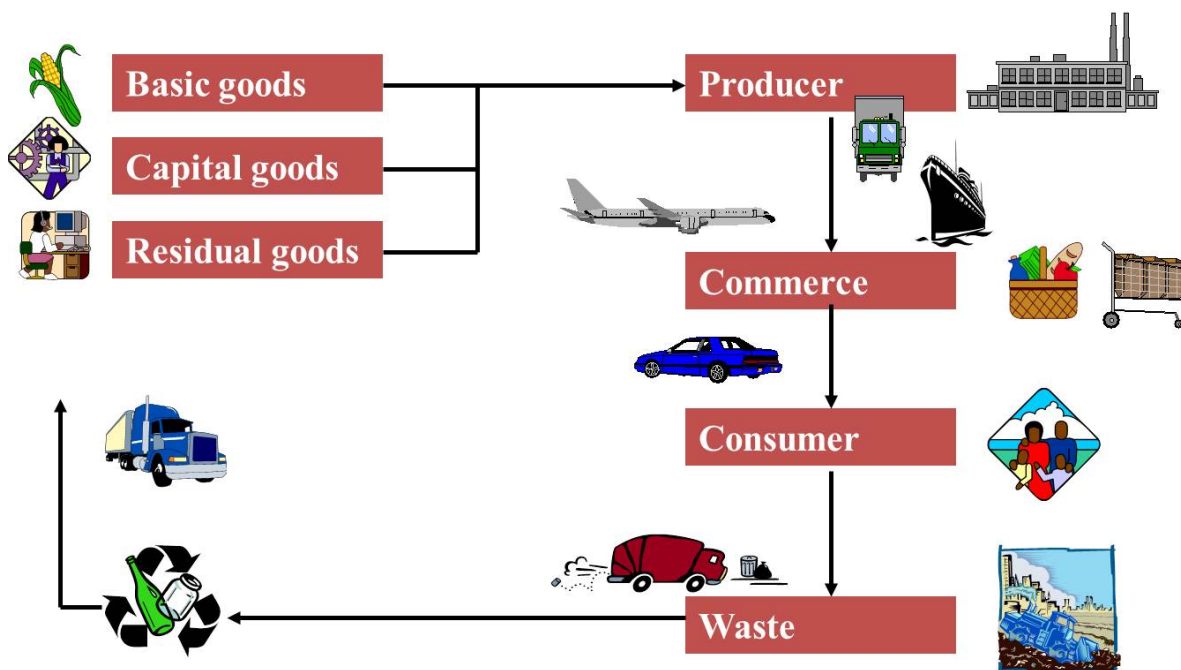


Figure 1. The product life cycle

Ninth step: determining the environmental impacts during domestic usage

Some items of consumptive expenditure also have an environmental impact during their active working life in the household. A refrigerator uses electricity, a stove uses gas, a car uses gasoline and oil, which emit CO₂, and so on. The total domestic environmental impact is determined via the use per unit and the economic life span of the item. The term "unit" can refer to a unit of time (year, month, etc.) or also to a laundry session or a meal.

Tenth step: determining the environmental impacts of waste processing

During and after the domestic use of the item of consumptive expenditure, garbage is created. The processing of this waste has its environmental impact (collecting, dumping, etc.), but may also produce energy (burning, recycling), which has a negative impact on the CO₂-equivalent. For the separate components of the item of consumptive expenditure, it is necessary to examine how the waste processing takes place. The quantities are multiplied by the environmental impacts (positive or negative) per type of waste processing (in CO₂-eq., m² and liters per kilograms).

Eleventh step: determining the total environmental impacts

The total environmental impacts during the entire life span of the item of consumptive expenditure can be determined by adding up all the figures for environmental impacts obtained in the previous steps. To show this, the environmental impacts in the various steps can be entered into the flow chart of the cycle (Figure 1).

2.3 Remarks concerning the method

We have discussed a method to calculate the life-cycle environmental impacts of an item of consumptive expenditure. The method can be applied to most items without any difficulty. However, the method appears to be less applicable to some items of consumptive expenditure, particularly those in the services sector. In such cases, an *ad hoc* method would seem to be required to determine the environmental impacts.

It should be noted that in composing the financial balance, sector data are applied to an item of consumptive expenditure. This may lead to errors, since values for an average product from a sector will not be valid for all products from that sector.

In the formulation of the mass balance (step 2), the weight of the basic goods does not have to be equal to the weight of the item of consumptive expenditure (including packaging) in all cases. For a refrigerator, the total weight will correspond, within reasonable limits, to the weight of the materials used. However, to make a kilo of sugar, almost eight kilos of sugar beet are necessary.

The same point applies to the processing of waste.

In the method, the manufacturer's price is determined by means of the consumer price and the margins of the trade and services sectors. Since probably not all transport costs are included in these margins, the manufacturer's price can be too highly estimated. Therefore, it is advisable to compare the manufacturer's price that has been established in this way with the price recorded in the production statistics where possible. Taking into consideration the fact that a part of the margins may concern transport costs, a double counting may occur in the environmental impacts of transport. We assume, however, that the transport cost share is very small, and that any double counting will therefore be negligible in comparison to the whole.

2.4 Calculation of environmental intensities of residual goods

In the calculation of the environmental impacts of an item of consumptive expenditure, the hybrid method discriminates between basic goods and residual goods. Together, both types of goods constitute the inputs required in the production stage of that consumption item. Process analysis determines the environmental impacts of the basic goods. The environmental impacts of residual goods are determined by the contribution of the monetary value of the residual goods in the financial balance of the consumption item and by the environmental intensity of the residual goods of the production sector. The contribution of the residual goods in the financial balance of the product is a remainder. This remainder is the price of the product decreased by the purchase costs of the basic goods, inclusive energy, and the gross value added. The environmental intensity of the residual goods is a result of input-output analysis. The method for calculating this environmental intensity is described by Wilting (1996). Also see Figure 2 for a schematic overview.

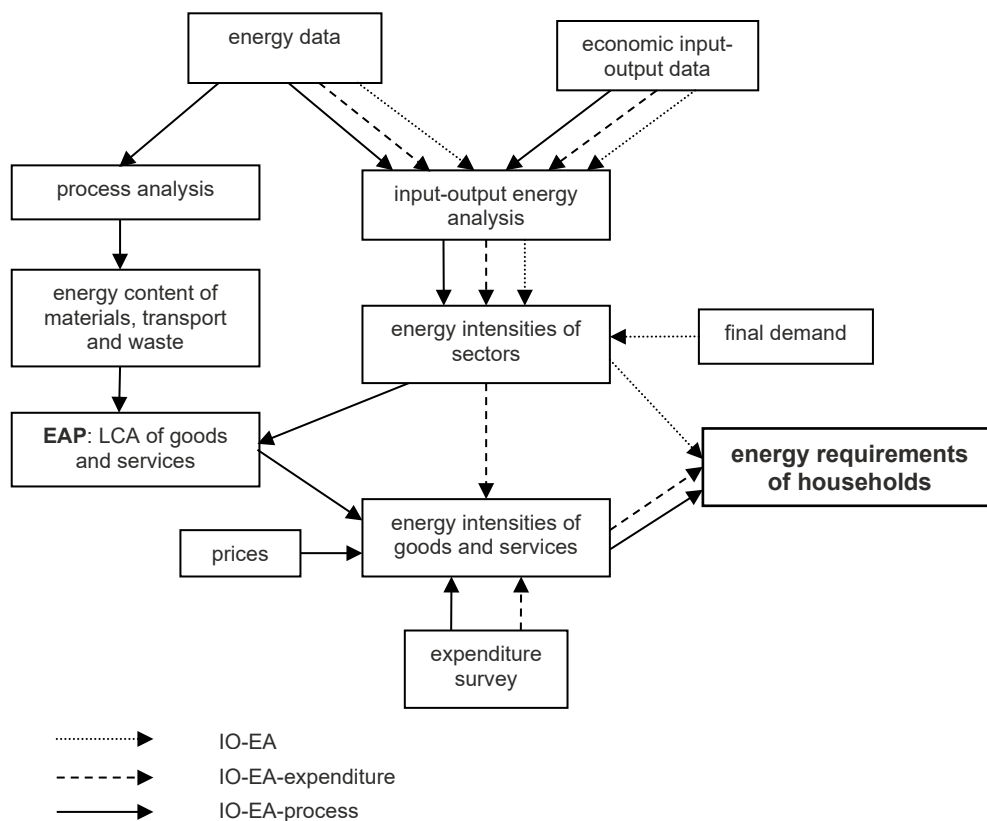


Figure 2 EAP Calculation scheme (Kok et al. 2006)

3 Updating the databases in EAP

A substantive effort was made to collect information for updating the databases in EAP with data from 2016 whenever possible. These updates are described below.

The databases updated were:

- Basic goods (278 options)
- Packaging (11 options)
- Manufacturers (59 options)
- Transport (26 options)
- Trade and services (149 options)
- Households (direct) (5 options)
- Waste processing (22 options)

For all these options, the environmental impacts in terms of greenhouse gas emissions, water use and land use were entered. All the data gathered for updating the EAP databases can be found in Appendix 1.

3.1 Basic goods, packaging, transport and waste processing

The main source for gathering information about environmental impacts from basic goods, packaging, transport and waste processing was the databases Ecoinvent, IDEMAT, Agribalyse and LCA food Denmark. Several of these databases were accessed by the LCA software SimaPro.

A set of criteria was established to ensure data comparability through different sources. These criteria were understood as the desired characteristics of the modelling choices behind each data point to ensure comparability. Occasionally, data points were selected that did not comply with one or more of these criteria due to data availability and data need. The list of criteria was as follows:

- A cradle-to-gate approach was used for basic goods, where gate is defined as the earliest manufacturing step for which data has been found available. This means that the data about environmental impacts from basic goods does not include processing, transport, etc. The environmental impacts from infrastructure, etc. until gate is included in the impacts.
- For packaging, manufacturing of the packaging materials was included.
- For transport, environmental impacts from energy use and infrastructure were included.
- Data older than year 2000 were not considered.
- The spatial representability in the *Basic goods* table took into account that the results aim at describing the impacts of consumption in Sweden. For numerous basic goods, Sweden relies on imports from other countries with, e.g., more suitable farming conditions. Consequently, data about both Swedish production and main countries of origin for Swedish imports were relevant to this study. Global or EU-wide data were also considered when country-specific data were not available, but the item was deemed to be particularly relevant for this project. Efforts were made to include data that would enable calculations of all products that are consumed in Sweden, e.g. common materials for furniture, clothing, food, drinks and other household goods. As a result, it was possible to prioritize certain types of wood products and tree species.
- In addition to considering data relevant to current Swedish household consumption patterns, data needed for making calculations of the environmental impacts from niche products were also included. This meant that we included data about a number of basic goods such as legumes and seeds in order to make calculations of vegan or vegetarian products. The choice of basic goods to include was based on a survey of niche practices made within the research program (Kamb et al, 2019, Thorsson et al, 2019, Lehner et al, 2019).
- Economic allocation was chosen when the allocation method could be selected.

- The functional unit was set at 1 kg for *Basic goods, Packaging and Waste*. For *Transport*, the functional unit was 1 metric ton-km. In some cases, we converted the numbers in the databases to the desired functional unit.

The impact categories chosen were global warming potential, land use and water resources depletion; see Table 1.

Table 1 – Impact methodologies chosen for each impact category

Impact category	Method	Unit of measurement	Source
Global warming potential	Recipe 2016	Kg CO ₂ equivalents	Huijbregts et al., 2016
Land use	Recipe 2008	m ² agricultural land occupation	Goedkoop et al., 2013
Water resources depletion	Recipe 2016	m ³ water	Huijbregts et al., 2016

According to these methodologies (Table 1), the climatic effect of the greenhouse gas emissions is assessed as their global warming potential, using CO₂ as a benchmark, and effects are considered over a 100-year period of time. This is the recommended approach by IPCC (IPCC, 1996). Land use impact is given as area of agricultural land occupation. Only rural land is considered and no differences are taken into account based on the type of usage (e.g. intensive farming, greenhouses or organic). Values under the impact category *water resources depletion* are calculated as the difference between the withdrawal of water volume from a certain water body for a given process and the volume that is returned into the environment after said process comes to an end. Different fractions of water returned into the environment are defined for different activities. Effluent water quality is not considered under this impact category. Further information on how this method works can be obtained from the primary source (Huijbregts et al., 2016).

In order to obtain comparable data about the environmental impacts from different types of edible meat in the *Basic goods* table, the data in some of the databases used were converted. In the databases, the environmental impacts were sometimes related to the live weight of the animal and sometimes to the carcass weight. Table 2 contains a list of the conversion factors used, along with their sources:

Table 2 Conversion factors expressed as [%] for different types of meat. Live weight (LW)

Animal	LW to carcass	Carcass to boneless	Carcass to bone-in	Sources
Pork	71	67.5	77.5	Raines, xxxx
Beef	61	57.5	67.5	Raines, xxxx
Lamb	50		72.5	Raines, xxxx
Chicken	70	to breast: 25		Swanson et al., 1964
Duck	Eviscerated: 73			Swanson et al., 1964
Rabbit	60			Mississippi State University, xxxx

Metal products were understood as intermediate products provided by the metallurgic industry in order to facilitate further transportation and processing, mainly as coils of rolled metal. In the particular case of steel, several different types were included. The environmental impacts of metal products vary greatly depending on whether the raw material is obtained from mined ores or from scrap metal (Grimes et al., 2008). Under our database, both options are provided respectively as primary and secondary metals, and current market shares also are specified.

Gathering data about producer prices was necessary for updating the databases on *Basic goods* and *Packaging*. Producer prices are defined as “*the amount receivable by the producer inclusive of taxes on products except deductible value added tax and exclusive of subsidies on products*” (World Bank, 2019).

Several databases were screened for data that matched the gathered data set on environmental impacts for basic goods and packaging. Main databases on this section come from FAO (FAO, 2019) and Statistics Sweden (SCB, 2019a). In most cases, matches between both sets were not perfect, meaning that either country of origin, manufacturing processes or end product might not coincide identically. These differences were tracked.

In a few exceptional cases, producer price information was not found for a Basic Goods that was deemed particularly relevant for this study. In those cases, data was derived by averaging from supermarket prices and deducting a 25% margin.

3.2 Manufacturing, wholesale and retail

For environmental data regarding manufacturing, wholesale and retail environmental-economic accounts data were collected from the environmental accounts and the national accounts at Statistics Sweden. The functional unit for these data was 1 SEK. Data refer to year 2016 if not otherwise indicated. The following environmental data was used:

- Greenhouse gas emissions, production-based (Statistics Sweden, 2019b). Greenhouse gas emissions in CO₂ equivalents per industry. Includes CO₂, CH₄, N₂O, and F-gases. For CH₄, N₂O and F-gases, GWP factors with a hundred-year time horizon from IPCC's fourth assessment report are used (Forster et al., 2007).
- Land use and water use for year 2014, production-based (Statistics Sweden, 2019c). Land use and water use per industry. Land use and water use data come from the PRINCE model (Steinbach et al., 2018), which in turn used data from the Exiobase model (Stadler et al., 2018). Land use means cropland, pastures, forest areas and infrastructure land (roads and buildings). Water use means consumption of blue water in the agricultural, manufacturing, electricity and domestic sectors.
- Final use of electricity, fossil fuels and district heating, production-based (Statistics Sweden, 2019d). Final use (i.e., energy that is not further transformed) per industry. Greenhouse gas emissions, production-based (Statistics Sweden, 2019b). Greenhouse gas emissions per industry. Includes CO₂, CH₄, N₂O, and F-gases.
- Land use and water use for year 2014, production-based (Statistics Sweden, 2019c). Land use and water use per industry.
- Final use of electricity, fossil fuels and district heating, production-based (Statistics Sweden, 2019d). Final use (i.e., energy that is not further transformed) per industry.

The following economic data was used:

- Input-output tables, products times products (Statistics Sweden, 2019e). Two types of tables were used: a domestic input-output table, reflecting the inputs per product group of domestically produced products, and an imports input-output table, reflecting the inputs per product group of imported products. From these tables, data on the production value, the value added and the depreciation per product group were also used.
- Gross fixed-capital formation (Statistics Sweden, 2019f). This data refers to the total amount of assets or products invested in, per industry.
- Costs of electricity, fuels and district heating (Statistics Sweden, 2019g). Costs in purchaser's prices per industry of electricity (product group D35.1), fuels (product group C19, refinery

products, exclusive of lubricants, and product group D35.2, gas), and district heating (product group D35.3).

- Margins from the wholesale and retail trade industries (Statistics Sweden, 2019h; Statistics Sweden, 2019i). Data from Structural Business Statistics regarding income by goods for resale, and regarding goods for resale. Income by goods for resale refers to the money the trader gets from selling goods, and goods for resale refers to the money the trader needs to pay for the goods that are later sold. The margin is the difference between these two.

4 Analyses of 218 consumption items

The 218 consumption items were analyzed by a single researcher in an effort to make the results comparable by e.g. using similar ways to assume disposal of waste for different products and similar transportation modes from similar countries. The results per SEK are displayed in Table 4 at the end of the report and all the data gathered in order to perform the analyses are presented along with the results in Appendices 2 and 3. Appendix 4 shows a summary all results per kg and per SEK. Most of the analyses (199) were performed in EAP but 19 analyses (see section 4.1) were performed outside of EAP (see section 4.2).

The selection of which items to analyze was determined by scrutinizing information in the Swedish household budget survey (HBS) (SCB, 2019j). In this survey, a large number of households were asked about how they spend their money and the expenditures were categorized according to COICOP codes (classification of individual consumption by purpose) (UN, 2018). We bought data from the latest household budget survey (2012) from Statistics Sweden, and then identified items with relatively large expenditures in the average Swedish household. Another criterion was that the chosen goods and services differed in environmental impacts according to our prior understanding. We added analyses of products and services that represent niche practices in the areas of food, furnishing and vacation according to previous surveys (Kamb et al., 2019; Lehner et al. 2019; Thorson et al. 2019). All in all, 17 analyses were performed on niche products and services.

Table 3: Results from calculations of the environmental impacts of 218 consumption items per SEK

Category	Number of analyses	Kg CO2 ekv per SEK			Land use m2 per SEK			Water use liters per SEK		
		Average	Min	Max	Average	Min	Max	Average	Min	Max
Alcohol and tobacco	6	0.0215	0.0149	0.0358	0.0089	0.0051	0.0138	6.2466	0.0494	23.4023
Clothes and shoes	30	0.0083	0.0013	0.0169	0.0040	0.0000	0.0172	1.1740	0.0000	6.7222
Food	69	0.0744	0.0012	0.3763	0.0527	0.0000	0.6058	7.2977	0.0015	80.5677
Furnishings	24	0.0418	0.0013	0.2270	0.0166	0.0000	0.1554	12.8766	0.0000	180.6519
Health	4	0.0192	0.0132	0.0267	0.0020	0.0014	0.0030	0.1266	0.0026	0.4122
Information and communication	5	0.0108	0.0003	0.0151	0.0012	0.0000	0.0016	0.0482	0.0000	0.2308
Miscellaneous goods and services	27	0.0186	0.0046	0.0514	0.0024	0.0002	0.0202	3.0657	0.0012	32.0663
Recreation, sports and culture	28	0.0265	-0.0163	0.2043	0.0099	-0.0211	0.1580	12.7277	0.0001	112.9729
Restaurants and accomodation	4	0.0209	0.0070	0.0280	0.0254	0.0120	0.0610	0.1507	0.0050	0.5160
Transport	16	0.0675	0.0002	0.1190	0.0293	0.0000	0.3216	5.0546	0.0000	1.8440
Water and rent	5	0.0384	0.0122	0.0744	0.0008	0.0001	0.0021	0.0583	0.0001	0.2643

Category	Number of analyses	Kg CO2 ekv per SEK			Land use m2 per SEK			Water use liters per SEK		
		Average	Min	Max	Average	Min	Max	Average	Min	Max
SUM	218									
AVERAGE		0.0316			0.0139			4.4388		
MIN			-0.0163			-0.0211			0.0000	
MAX				0.3763			0.6058			180.6519

4.1 Analyses performed in EAP

It is possible to make analyses of both products and services in EAP. The analyses of products require information about price, taxes, transportation weight, materials and their weights, product origin, packaging and waste handling. After this information has been collected, an analysis can be performed quite quickly to provide assumptions about plausible manufacturing and trade sectors as well as transportation distances and modes. EAP can also be used to analyze services, which is much less time-consuming than analyzing products. In this case, only information about taxes must be collected beforehand and then a suitable sector(s) is chosen. In the case of products, results can be compared on a per-kg or per-SEK basis, while for the analyses of services, they can only be compared on a per-SEK basis. Appendix 2 contains all data gathered for analyzing products and services in EAP as well as the results. Below is a brief account of how we secured data for the analyses of products in EAP. The analyses in EAP start by giving the analyses an identity number. We used the COICOP numbers for the expenditure survey and made up our own numbers for niche products and services.

- Consumer *prices* were collected from relevant retailers and the prices were converted to 2016 values using a suitable consumer price index (Statistics Sweden, 2019k). Whenever official statistics about consumer prices for the selected items were found, we used those. For prices of clothes and shoes, we used data from a survey carried out in 10 different stores in Stockholm.
- *Consumer taxes* were found at the Swedish Tax Authorities (Swedish tax Authorities, 2019).
- *Transportation weight* was calculated as the weight of the product plus the consumer packaging. Many consumer products were weighed on a scale if the product packaging did not show the weight or the producer could not provide information. For the weight of the packaging materials, see below.
- The most suitable *manufacturer* was selected from the list of 59 options (see section 3).
- One of the most labor-intensive steps in the analyses was finding the types and weights of *basic goods* for the selected items. For some kinds of foods (such as tomatoes, beef, etc.) this was easy, but most consumer products are made up of many materials or basic goods. To identify these we used several methods: acquiring information from the producers; buying, disassembling and weighing products by ourselves; or using data from various published studies, including various life-cycle assessments. The analyses in EAP do not require that 100% of the basic goods known to have environmental impacts are also allocated in the calculation of residual goods (see section 2). As part of the analysis of basic goods, we had to perform some extra analyses on basic goods not included in the original table (see Appendix 1). This was most common for foods composed of e.g. flour (but not grains) and oil (but not olives or sunflower seeds). We performed 20 such extra analyses in total.
- Packaging (consumer packages) also required some substantive investigation and the same methods as those used for basic goods were used for collecting information.
- *Transports* were calculated using default assumptions about distances and transportation modes. The assumptions made can be found in Appendix 2 under the sheet called Transportation. Transports by airplane were not included as our understanding was that these are very rare for the goods we analyzed.

- *Trade* included picking suitable wholesalers and retailers from the EAP database.
- *Consumption emissions were not included.* This is because such emissions would be covered anyway when matching the EAP results (per SEK) with household expenditures for electricity and fuel.
- *Waste handling* included both packaging and the products themselves, apart from items that are eaten, smoked or drunk. Assumptions about waste handling options (etc. recycle or burn) were based upon what the researcher making the analyses considered to be a plausible option for her own consumption.

4.2 Analyses performed outside EAP

For the analyses outside of EAP, a number of data sources were used (see below). Appendix 3 contains all of the calculations and assumptions used for the analyses made outside of EAP.

- *Consumer prices* were sought from official statistics whenever possible and were available for items such as fuels, rent and electricity. Other prices were collected from companies selling the items analyzed.
- *Environmental data* due to emissions for fuels and various forms of electricity generation were collected from the database IDEMAT and from the Swedish Environmental Agency (SEPA). This allowed both direct and indirect environmental impacts to be included.
- *Conversion factors* were collected from various reliable conversion calculators.
- In addition to this, a number of other data sources were used (see more in Appendix 3).

5 Suggestions for improvements and further application of the results

5.1 Suggestions for improvements

The work presented here, which includes updating the EAP database and calculating the environmental impacts of 218 consumer items, can certainly be improved. Some suggestions for improvements are provided below:

- More detailed environmental data from the food manufacturing sector. In the current version of EAP, all food manufacturing was calculated based on one dataset only.
- More updated household expenditure data. These data were used for selecting relevant items to analyze and are therefore important. Unfortunately, no such update is currently planned by Statistics Sweden.
- More environmental data about various plastics in the *Basic goods* table. When making the analyses presented here, we often had to choose a proxy for the many types of plastics used as inputs in manufacturing.
- More thorough analyses of items such as TVs, computers and cellular phones. In this study, the data about basic goods for such items were based on published studies dated some years back. Given that the turnover of electronic items is high, more up-to-date data about basic goods for such items would be desirable.
- A comprehensive sensitivity analyses of the results.

5.2 Further application of the results

Within the research program Mistra from Niche to Mainstream, the results presented here will be used to estimate the environmental impacts from household consumption in Sweden, from both the average household and households with different incomes, as well as single households with persons of different genders. These results will be compared to those that could be realized if all niche products and services were bought instead of the conventional ones, e.g., buying second-hand furniture instead of new furniture, buying plant-based foods instead of animal-based foods, or going on a charter tour by train instead of by plane. The aim is also to calculate the environmental impacts from consumption given current trends for food, furnishings and vacation.

The results above will show whether or not consuming those niche products and services that have been identified will suffice to lower environmental impacts from consumption to levels that can be considered sustainable.

Table 4: Results from analyses per SEK (Greenhouse gas emissions, land use and water use).

NACE code/nisch product	Description and EAP code if not the same as NACE code	Kg CO2 ekv per SEK	Land use m2 per SEK	Water use liters per SEK
ALCOHOL AND TOBACCO				
02111	Spirits and liqueurs	0.0211	0.0138	12.6018
02121	Wine from grapes	0.0149	0.0122	23.4023
0213102	Beer	0.0358	0.0114	0.3350
02211	Cigarettes	0.0179	0.0055	0.8502
02213	Other tobacco products	0.0179	0.0051	0.2409
0221303	Snus	0.0213	0.0055	0.0494
CLOTHES AND SHOES				
031220109	Code 031220d. Jackets. women	0.0169	0.0172	2.659
031210109	Code: 0312101b. Jackets. men	0.0145	0.0100	1.479
031210115	Code 0312101e Socks. men	0.0132	0.0073	1.970
031220104	Code: 0312201a. Dresses. women.	0.0116	0.0007	0.246
031210114	Code 0312101d. T-shirt. men	0.0113	0.0040	0.958
031310104	Code: 031310c Scarves	0.0110	0.0120	1.710
031210116	Code 0312101f Jeans. men	0.0104	0.0071	1.580
031210113	Code 0312101c. Shirts men	0.0097	0.0026	0.528
031220107	Code 031220b. Skirts. women	0.0094	0.0011	0.351
031220110	Code 031220e. Sporting clothes women	0.0088	0.0001	0.143
031230115	Code.032130d Childrens socks	0.0086	0.0036	0.970
031230111	Code:031230b Childrens pyjamas	0.0086	0.0047	1.146
031230114	Code.031230c: Childrens t-shirt	0.0083	0.0031	0.780
031220116	Code 031220i. Jeans. women	0.0083	0.0085	1.977
031220115	Code 031220h. Underwear. women	0.0082	0.0035	0.877
0313101	Code:031310a. cloth. IO analysis	0.0081	0.0014	0.016
0321103	0321103 Shoes. men	0.0081	0.0012	6.722
031210108	Code: 0312101a. Trousers. men	0.0077	0.0080	1.831

NACE code/nisch product	Description and EAP code if not the same as NACE code	Kg CO2 ekv per SEK	Land use m2 per SEK	Water use liters per SEK
031230117	Code: 032130e Baby clothes	0.0074	0.0065	1.474
0321303	Code: 0321303 Shoes children	0.0074	0.0014	2.426
031220114	Code 031220g. T-shirts. women	0.0072	0.0035	0.766
031220112	Code 031220f. Blouses. women	0.0071	0.0024	0.528
031230108	Code: 031230a. Childrens pants	0.0071	0.0051	1.144
031310202	Code: 031310d Belts	0.0069	0.0010	0.020
031220108	Code 031220c. Pants. women	0.0067	0.0041	0.898
031310103	Code: 031310b. Hats	0.0066	0.0009	0.025
0321203	Code: 0321203 Shoes Ladies	0.0061	0.0005	1.999
0314	Code: 0314. Cleaning. repairing clothes. IO analysis 1	0.0014	0.0000	0.000
0322	Code: 0322 Shoe repair	0.0014	0.0000	0.000
NISCH PRODUCT	Code: N013: Second hand shoes and clothes	0.0013	0.0000	0.000
FOOD				
0111101	Rice	0.3129	0.0872	13.4178
0111204	Soft bread	0.0282	0.0420	0.0664
0111301	Macaroni. noodles. and similar pasta products	0.0923	0.1329	0.2533
0111302	Pre-cooked dishes based on pasta and cereals	0.0556	0.0836	15.5005
0111401	Pastries	0.0477	0.0450	4.0900
0111404	Cakes and biscuits	0.0413	0.0418	8.4962
0111405	Sweet cake	0.0426	0.0406	6.4491
0111408	Sandwiches. pizzas. quiches. meat or fish pies. frozen or not	0.0667	0.0303	2.6294
0111501	Flours and other cereals	0.0854	0.2304	7.5393
0111503	Breakfast cereals	0.0467	0.0792	18.7124
01121	Beef and veal	0.1408	0.1160	1.6215
01122	Pork	0.0670	0.0665	2.0944
01123	Lamb and goat	0.3763	0.6058	0.9588

NACE code/nisch product	Description and EAP code if not the same as NACE code	Kg CO2 ekv per SEK	Land use m2 per SEK	Water use liters per SEK
01124	Poultry	0.0854	0.1580	3.3370
0112502	Meat of pigs. cuts. salted. dried or smoked (bacon and ham)	0.0426	0.0524	2.6182
0112506	Meat. offal. blood and other parts of slaughtered animals' preparations	0.1202	0.0704	0.7357
0112601	Pre-cooked dishes based on meat	0.1888	0.0839	20.5611
0113102	Cod	0.0648	0.0016	4.5313
0113104	Flatfish	0.0487	0.0000	1.2314
01132	Other seafood. fresh. chilled or frozen	0.0801	0.0001	5.0057
0113401	Other fish. prepared or preserved	0.0545	0.0029	12.9981
0113403	Livers. roes and offal of fish and of other seafood in all forms	0.0316	0.0152	1.2129
0113404	Pre-cooked dishes based on fish	0.0343	0.0089	7.2603
01142	Low fat milk	0.1807	0.0437	20.6820
0114401	Yoghurt. containing added sugar or other sweetening matter or flavoured or containing added fruit. nuts or cocoa	0.1046	0.0313	10.9231
0114402	Yoghurt	0.1413	0.0334	14.2273
0114501	Hard cheese	0.1393	0.0225	0.8044
0114502	Curd cheese	0.2595	0.0418	1.4848
0114601	Other milk products	0.1230	0.0239	0.6856
0114701	Eggs	0.1218	0.1163	10.8862
0115101	Butter	0.1647	0.0309	1.7342
0115102	Other butter products	0.1185	0.0386	2.3142
0115201	Margarin. not liquid	0.0513	0.0371	1.5994
01153	Oliveoil	0.0413	0.1583	48.9936
01161	Citrus fruits. fresh. chilled or frozen	0.0252	0.0120	2.9008
01162	Bananas. fresh. chilled or frozen	0.0406	0.0140	5.6481
01163	Apples. fresh chilled or frozen	0.0073	0.0081	2.0314

NACE code/nisch product	Description and EAP code if not the same as NACE code	Kg CO2 ekv per SEK	Land use m2 per SEK	Water use liters per SEK
01165	Stone fruits fresh or chilled	0.0110	0.0050	3.3860
0116601	Berries (excluding grapes)	0.0230	0.0054	3.7946
0116602	Grapes	0.0147	0.0158	0.1273
0116802	Nuts and seeds. in shell or shelled	0.0484	0.0512	6.7713
01171	Leafy or stem vegetables. fresh. chilled or frozen	0.0643	0.0487	0.8131
01172	Cabbage. fresh or chilled	0.0053	0.0019	0.0406
01173	Fruit-bearing vegetables. fresh. chilled or frozen	0.0247	0.0017	0.5706
1174	Other vegetables. fresh. chilled or frozen	0.0109	0.0089	0.2039
01176	Canned vegetables	0.1910	0.0495	2.1899
01177	Potatoes	0.0119	0.0197	0.6418
0117803	Potatochips	0.0338	0.0310	0.4619
01181	Sugar. cane and beets	0.0697	0.0724	5.4448
01183	Chocolate	0.0747	0.0756	3.2836
01184	Confectionary products	0.0421	0.0217	1.0295
01185	Edible ices and ice cream	0.1604	0.0408	1.0206
01191	Sauces and condiments	0.0452	0.0429	0.1510
01192	Salt. spices and culinary herbs	0.0340	0.0001	80.5677
01193	Other food products	0.0389	0.0147	0.2054
01211	Coffee	0.0998	0.1356	12.3763
01212	Tea	0.0401	0.0944	52.0761
01221	Mineral or spring waters	0.0762	0.0164	1.0866
01222	Soft drinks	0.0558	0.0125	0.4417
01223	Fruit and vegetable juices	0.0613	0.0505	24.1422
NISCHPRODUCT	Code: N001 Tofu	0.0149	0.0262	0.4650
NISCHPRODUCT	Code: N002 Vegetarian pieces soya protein	0.0406	0.0416	3.3172
NISCHPRODUCT	Code: N003 Vegetarian pieces pea protein	0.0380	0.0375	7.4287
NISCHPRODUCT	Code: N004 Oat milk	0.0382	0.0393	15.0792
NISCHPRODUCT	Code: N005 Soya milk	0.0418	0.0346	9.9538
NISCHPRODUCT	Code: N006 Cooking class	0.0075	0.0012	0.0015
NISCHPRODUCT	Code: N010 Vegan cheese	0.0369	0.0237	0.0775

NACE code/nisch product	Description and EAP code if not the same as NACE code	Kg CO2 ekv per SEK	Land use m2 per SEK	Water use liters per SEK
NISCHPRODUCT	Code: N011 Locally produced veggies outdoors	0.0054	0.0083	0.1522
NISCHPRODUCT	Code: N012 Veggies in urban basement	0.0012	0.0000	0.0033
FURNISHINGS				
051110301	Code: 0511103a Chairs	0.0131	0.0039	2.89
0511105	Beds	0.0192	0.0158	2.87
0511107	Wardrobes, chests of drawers and bookcases	0.0054	0.0213	7.56
0511108	Garden furniture	0.0505	0.0056	2.96
0511112	Pots, vases	0.0074	0.0005	0.09
05121	Carpets and rugs	0.0974	0.1554	26.68
05131	Repair of furniture, furnishings and floor coverings	0.0122	0.0015	0.00
0521101	Sheets and pillowcases	0.1195	0.0165	3.80
0521102	Blankets, pillows and bedspreads	0.2270	0.0000	9.00
0531201	Dishwashers	0.0252	0.0041	2.04
0531202	Clothes washing machines	0.0477	0.0046	8.61
05313	Panels, hobs, spit roasters, ovens, combined cookers and micro wave ovens	0.0301	0.0059	4.37
0531501	Vaccum cleaners	0.0218	0.0050	3.15
0541103	Cups and mugs	0.0081	0.0005	0.09
0541104	Bowl	0.0076	0.0005	0.05
05413	Kitchen utensils and articles	0.0179	0.0010	15.30
0541	Glassware, tableware, cutlery and household utensils	0.0444	0.0178	12.07
0551	Major tools and equipment	0.0502	0.0015	17.99
0552	Small tools and miscellaneous accessories	0.0148	0.0011	0.14
0561	Non-durable household goods	0.0713	0.1278	180.65
05612	Other non-durable small household articles	0.0764	0.0042	8.73
NISCH SERVICE	Code: N014 Repairing furnishing	0.0122	0.00149	0.00149

NACE code/nisch product	Description and EAP code if not the same as NACE code	Kg CO2 ekv per SEK	Land use m2 per SEK	Water use liters per SEK
NISCH SERVICE	Code: N015 Renting furnishings	0.02184	0.00233	0.00391
NISCH PRODUCT	Code: N016 Second hand furnishings	0.00134	0	0
HEALTH				
0611101	Pharmaceutical products	0.0267	0.0030	0.0231
0613101	Corrective eye-glasses	0.0166	0.0014	0.4122
0613102	Corrective contact lenses	0.0201	0.0017	0.0684
062	Out-patient services	0.0132	0.0018	0.0026
INFORMATION AND COMMUNICATION				
081	Postal services	0.0003	0.0000	0.0000
082	Telephone and telefax equipment	0.0110	0.0014	0.2308
083110101	Code: 08311010 Wired telephone service	0.0151	0.0015	0.0037
083110102	Code: 083112 Wireless telephone services	0.0151	0.0015	0.0037
083110103	Code: 083113 Internet access provision services	0.0127	0.0016	0.0030
MISCELLANOUS GOODS AND SERVICES				
1211	Hairdressing salons and personal grooming	0.0133	0.0021	0.0048
1213101	Non-electronic appliances for personal care	0.0102	0.0008	0.1071
1213102	Personal hygiene	0.0234	0.0202	32.0663
1213103	Cosmetic products. cosmetics. perfume. deodorant	0.0110	0.0054	24.1191
1213104	Toiletpaper. paper tissues etc	0.0514	0.0030	8.7882
1213105	Feminine hygiene	0.0264	0.0010	2.3276
1213106	Diapers	0.0376	0.0070	14.9784
12321	Travel goods	0.0046	0.0002	0.0499
1232	Other personal effects	0.0055	0.0003	0.0271
12412	Child care services	0.0062	0.0009	0.0012
1252	Insurance connected with the dwelling	0.0161	0.0014	0.0021
1253	Insurance connected with health	0.0161	0.0014	0.0021

NACE code/nisch product	Description and EAP code if not the same as NACE code	Kg CO2 ekv per SEK	Land use m2 per SEK	Water use liters per SEK
1254	Insurance connected with transport	0.0161	0.0014	0.0021
1255102	Insurance for pets	0.0161	0.0014	0.0021
1262	Other financial services. not elsewhere classified	0.0092	0.0009	0.0016
211	Unemployment insurance and union membership fees	0.0161	0.0015	0.0031
212	Non-union membership fees	0.0119	0.0014	0.0025
221	Interest expenditures. accomodation	0.0115	0.0011	0.0020
223	Interest expenditures. study loan	0.0115	0.0011	0.0020
225	Interest expenditures. weekend cottage	0.0115	0.0011	0.0020
231	Cartax. road tax	0.0198	0.0020	0.0026
253	Repairs on weekend cottages	0.0122	0.0015	0.0028
25421	Garbage collection weekend cottages	0.0484	0.0020	0.0030
25431	Water and sewage weekend cottages	0.0387	0.0021	0.0028
25511	Heat. vacation house	0.0203	0.0002	0.2643
30	Taxable benefits	0.0166	0.0026	0.0060
266	Property tax	0.0198	0.0020	0.0026
RECREATION. SPORTS AND CULTURE				
09111	Equipment for the reception. recording and reproduction of sound	0.0087	0.0023	1.2541
09112	Equipment for the reception. recording and reproduction of sound and vision	0.0252	0.0039	95.7159
0913	Information processing equipment	0.0090	0.0004	36.9803
0914101	CD/DVD	0.0134	0.0019	0.4309
0921101	Camper vans. caravans and trailers	0.0176	0.0016	0.9674
09221	Musical instruments	0.0126	0.0031	1.4904

NACE code/nisch product	Description and EAP code if not the same as NACE code	Kg CO2 ekv per SEK	Land use m2 per SEK	Water use liters per SEK
0931101	Videogames	0.0109	0.0013	0.1749
0931102	Toys and hobby items	0.0172	0.0006	0.6251
0932101	Shoes intended for a specific sport	0.0139	0.0029	2.5136
0932103	Sporting goods. not fishing gear	0.0119	0.0022	1.1515
0932104	Fishing gear	0.0136	0.0001	0.1315
0932107	Charcoal	-0.0163	0.0106	14.1689
0934102	Products for pets	0.0051	0.0002	0.0605
0935102	Veterinary services. I/O analysis	0.0106	0.0014	0.0020
0941102	Recreational and sporting services - participation	0.0203	0.0042	0.0059
09421	Cinemas. theatres. concerts	0.0167	0.0018	0.0030
09423	Television and radio licence fees and hire of equipment	0.0122	0.0015	0.0028
0943	Loteries etc	0.0155	0.0016	0.0028
0951	Books	0.0090	-0.0080	35.6064
0952101	Newspapers	0.0158	-0.0211	112.9729
0952102	Magazines and periodicals	0.0124	-0.0166	51.9814
096110102	Package domestic holiday	0.0796	0.0002	0.0001
0966102	Package international holiday	0.2043	0.0068	0.0426
NISCH SERVICE calculated outside of EAP	Package tour in Sweden. 50% renewable fuel	0.0344	0.0930	0.0002
NISCH SERVICE calculated outside of EAP	Package tour in Sweden. train with hotel	0.0149	0.0143	0.0050
NISCH SERVICE calculated outside of EAP	Package tour abroad. 50 % renewable fuel	0.1177	0.1580	0.0427
NISCH SERVICE calculated outside of EAP	Train abroad with hotel	0.0214	0.0060	0.0385
NISCH SERVICE calculated outside of EAP	Stay at home holyday	0.0150	0.0019	0.0039
RESTAURANTS AND ACCOMODATION				
1111	Resturants . cafés and the like	0.02423	0.01428	0.00496
1121101	Hotels	0.02423	0.01428	0.00496

NACE code/nisch product	Description and EAP code if not the same as NACE code	Kg CO2 ekv per SEK	Land use m2 per SEK	Water use liters per SEK
Extra analyses based on information from Statistics Sweden on Hotels and Meals abroad. Results from an multiregional IO analysis.	Hotels abroad	0.007	0.012	0.077
Extra analyses based on information from Statistics Sweden on Hotels and Meals abroad. Results from an multiregional IO analysis.	Meals abroad	0.028	0.061	0.516
TRANSPORT				
07111	New motor cars	0.0356	0.0026	1.8440
07112	Second-hand motor cars	0.0002	0.0000	0.0000
0712	Motor cycles. mopeds. scooters	0.0434	0.0023	7.7049
0713	Bicycles	0.0208	0.0012	0.8442
0721	Parts and accessories for personal transport equipment	0.0250	0.0019	60.3441
0722101	Petrol	0.2512	0.0005	0.0005
0722102	Diesel	0.2753	0.0006	0.0005
0722103	Lubricants	0.0285	0.0001	0.0001
0723101	Repair. car	0.0176	0.0016	0.0201
0724101	Other transportation services	0.0218	0.0023	0.0039
0731102	Trainticket	0.0005	-	-
0732102	Busticket	0.0796	0.0002	0.0001
0732103	Taxi	0.0070	0.0000	0.0000
0735101	Combined trip	0.0093	-	-
NISCH PRODUCT calculated outside of EAP	petrol (85% ethanol from swedish wood)	0.1450	0.0754	0.0006
NISCH PRODUCT calculated outside of EAP	Diesel with 50% ethanol	0.1190	0.3216	0.0007
WATER AND RENT				
0411	Rentals paid by tenants	0.0162	0.0002	0.0214
043	Maintenance and repair of the dwelling	0.0122	0.0015	0.0028
044	Water supply and miscellaneous services relating to the dwelling	0.0381	0.0021	0.0028

NACE code/nisch product	Description and EAP code if not the same as NACE code	Kg CO2 ekv per SEK	Land use m2 per SEK	Water use liters per SEK
451	Electricity	0.0511	0.0002	0.2644
0455	Heat energy	0.0744	0.0001	0.0001

6 List of Appendices

Appendix 1: Data for updating the EAP software

Appendix 2: Assumptions for analyses in EAP

Appendix 3: Analyses made outside of EAP

Appendix 4: Summary of analyses

7 References

- Boustead, I. and Hancock, G.F. (1979), *Handbook of Industrial Energy Analysis*, Chichester, Groot Brittannië
- Bullard, C.W., Penner, P.S., Pilati, D.A. (1978). *Net energy analysis: Handbook for combining process and input-output analysis*, Resources and Energy, Vol 1, pp. 267-313.
- Curran M.A. (2016). *Life-Cycle Assessment*. Encyclopedia of Ecology, (4) 359-366.
- Goedkoop M., Heijungs R., Huijbregts M., De Schryver A., Struijs J. and van Zelm R. (2013). *ReCiPe 2008 A life cycle impact assessment method which comprises harmonised category indicators at the midpoint and the endpoint level* First edition (version 1.08) Report I: Characterisation.
- Grimes S., Donaldson J and Cebrian Gomez G. (2008). Report on the Environmental Benefits of Recycling. Centre for Sustainable Production & Resource Efficiency (CSPRE), Imperial College London, UK.
- FAO, Food and Agricultural Organization. (2019). <http://www.fao.org/faostat/en/#search/producer%20price> accessed January 2019.
- Forster, P., V. Ramaswamy, P. Artaxo, T. Berntsen, R. Betts, D.W. Fahey, J. Haywood, J. Lean, D.C. Lowe, G. Myhre, J. Nganga, R. Prinn, G. Raga, M. Schulz and R. Van Dorland. (2007). Changes in Atmospheric Constituents and in Radiative Forcing. In: *Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change* [Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor and H.L. Miller (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA
- Huijbregst M.A.J. et al. (2016). ReCipe 2016. A harmonized life cycle impact assessment method at midpoint and endpoint level: Report 1: Characterization. RIVM report 2016:0104, National Institute for Public Health and the Environment, Netherlands.
- IFIAS (1974). *Energy analysis: workshop on methodology and conventions*. Report No 6. International Federation of Institutes for Advanced Studies, Stockholm.
- IPCC (1996) Overview of the IPCC guidelines for national greenhouse gas inventories.
- Kamb, A., Svenfelt, B., Carlsson-Kanyama, A., Parekh, V., & Bradley, K. (2019). *Att öta hallbart? En kartläggning av vad hallbar matkonsumtion kan innebära*. KTH, Stockholm.
- Kok, R., Benders, R.M.J., Moll, H.C. (2006). *Measuring the environmental load of household consumption using some methods based on input-output energy analysis: A comparison of methods and a discussion of results*. Energy Policy, Vol. 34, issue 17, November 2006, pp. 2744-2761.
- Kok, R., R.M.J. Benders H.C. Moll (2001). *Energie-intensiteiten van de Nederlandse consumptieve bestedingen anno 1996*, IVEM research report No. 105, University of Groningen.
- Lehner, M., Schoonover, H., Mont, O., Bradley, K., Kamb, A., & Svenfelt, B. (2019). *Att inreda hallbart? En kartläggning av vad hallbar heminredning kan innebära*. KTH, Stockholm. Mississippi State University Extension Service (xxxx) *Slaughtering and Dressing Rabbits*.
- Notarnicola B., Tassielli G., Renzulli P.A., Castellani V., Sala S. (2016). Environmental impacts of food consumption in Europe. *Journal of Cleaner Production*.
- Palm V., Wood R., Berglund M., Dawkins E., Finnveden G., Schmidt S. and Steinbach N. (2019). Environmental pressures from Swedish consumption-A hybrid multiregional input-output approach. *Journal of Cleaner Production* (228) 634-644.

Raines C. R. (xxxx). The butcher kept your meat? Penn State University, Department of Dairy and Animal Science.

Stadler, K., Wood, R., Bulavskaya, T., Södersten, C.-J., Simas, M., Schmidt, S., Usubiaga, A., Acosta-Fernández, J., Kuenen, J., Bruckner, M., Giljum, S., Lutter, S., Merciai, S., Schmidt, J.H., Theurl, M.C., Plutzer, C., Kastner, T., Eisenmenger, N., Erb, K.-H., de Koning, A. and Tukker, A. (2018), EXIOBASE 3: Developing a Time Series of Detailed Environmentally Extended Multi-Regional Input-Output Tables. *Journal of Industrial Ecology*, 22: 502-515

Statistics Sweden. (2019a). <http://www.cnwebb.scb.se>.

Statistics Sweden, 2019b. Unpublished data from the environmental accounts.

Statistics Sweden, 2019c. Unpublished data from the environmental accounts, data from the PRINCE model.

Statistics Sweden, 2019d. Analysis tool for environmental accounts data.

<https://www.scb.se/en/finding-statistics/statistics-by-subject-area/environment/environmental-accounts-and-sustainable-development/system-of-environmental-and-economic-accounts/pong/tables-and-graphs/analysis-tool-for-environmental-accounts-data/analysis-tool-for-environmental-accounts-data>. Accessed 2019-01-07.

Statistics Sweden, 2019e. Symmetric input-output tables, 2008-

2016. https://www.scb.se/contentassets/053fc3e90d064aafbbd2038ea4bf648f/nrio_siot_181108.xlsx. Accessed 2019-03-14.

Statistics Sweden, 2019f. Unpublished data from the national accounts.

Statistics Sweden, 2019g. Unpublished data from the national accounts.

Statistics Sweden, 2019h. Income by goods for resale by kind-of-activity unit according to Structural Business Statistics, SEK million by industrial classification NACE Rev. 2 and year.

http://www.statistikdatabasen.scb.se/pxweb/en/ssd/START_NV_NV0109_NV0109L/IntVEngs07. Accessed 2019-04-04.

Statistics Sweden, 2019i. Goods for resale by kind-of-activity unit according to Structural Business Statistics, SEK million by industrial classification NACE Rev. 2 and year.

http://www.statistikdatabasen.scb.se/pxweb/en/ssd/START_NV_NV0109_NV0109L/KostVEngs07. Accessed 2019-04-04. SCB,

Statistics Sweden, 2019j. <https://www.scb.se/en/finding-statistics/statistics-by-subject-area/household-finances/household-expenditures/household-budget-survey-hbs/>.

Statistics Sweden, 2019k. <https://www.scb.se/hitta-statistik/statistik-efter-amne/priser-och-konsumtion/konsumentprisindex/konsumentprisindex-kpi/> Accessed May 2019.

Steinbach N., Palm V., Cederberg C., Finnveden G., Persson L., Persson M., Berglund M., Björk I., Faure E., and Trimme C. (2018) *Miljöpåverkan från svensk konsumtion – nya indikatorer för uppföljning* Slutrapport för forskningsprojektet PRINCE. Swedish Environmental Protection Agency, Report 6842.

Swanson M.H., Carlson C.W. and Fry (1964) Factors affecting poultry meat yields. University of Minnesota, station bulletin 476.

Swedish Tax Authorities. (2019).

<https://www.skatteverket.se/foretagochorganisationer/moms/saljavarorochtjanster/momssatspavarochtjanster.4.58d555751259e4d66168000409.html> Accessed during 2019.

Thorson, M., Larsson, J., Nässén, J., Bradley, K., Kamb, A., & Svenfelt, Å. (2019). *Att semestra hållbart? En kartläggning av vad hållbart semestrande kan innebära*. KTH, Stockholm.

UN, United Nations. 1992. *Agenda 21*. United Nations Conference on Environment & Development. Rio de Janeiro, Brazil, 3 to 14 June 1992.

UN, United Nations. 2015. *TRANSFORMING OUR WORLD: THE 2030 AGENDA FOR SUSTAINABLE DEVELOPMENT*. A/RES/70/1.

UN, United Nations. (2018). *Classification of Individual Consumption According to Purpose (COICOP) 2018*. Department of Economic and Social Affairs Statistics Division, Statistical Papers Series M No. 99.

UN, United Nations. (2019). *The Sustainable Development Goals Report 2019*.

Wang C., Ghadimi P., Lim M.K. and Tseng M-L. 2019. *A literature review of sustainable consumption and production: A comparative analysis in developed and developing economies*. *Journal of Cleaner Production* (206) pp 741-754.

van Engelenburg, B.C.W., Van, Rossum, T.F.M., Blok, K., Vringer, K. (1994). *Calculating the energy requirements of household purchases: a practical step by step method*, *Energy Policy*, Vol. 22, pp. 648-656.

Wiltling, H.C. (1996). *An energy perspective on economic activities*, *PhD Thesis*, Groningen.

World Bank. 2019. <https://datahelpdesk.worldbank.org/knowledgebase/articles/114947-what-is-the-difference-between-purchaser-prices-p>. Accessed on the 27th of February 2019.

About the research program

Mistra Sustainable Consumption – From niche to mainstream is a transdisciplinary research program consisting of:

Researchers from the KTH Royal Institute of Technology, Lund University, Chalmers University of Technology, the Swedish University of Agricultural Sciences, Luleå Technical University, Karolinska Institute, Uppsala University and Statistics Sweden. KTH is the programme host.

Societal partners: Camino, ICA, Oatly, Food for Progress, Max burgers, IKEA Sweden, Hemtex, ReTuna, Stena Line, Ving, Centralens Resebutik, Visita, The City of Gothenburg, The City of Malmö, The City of Lund, The West Sweden Tourist Board, Region Västra Götaland, The Swedish Consumer Agency, The Swedish Environmental Protection Agency, The National Food Agency, The Swedish Society for Nature Conservation, The Swedish Tourist Association, and The National Museums of World Culture.



FINANSIERAT AV

