

# Supplementary Material

## Evaluating the Environmental Consequences of Swedish Food Consumption and Dietary Choices

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### A1 Scenarios

Scenarios were created to assess the environmental implications of dietary choices on the aggregated impacts of Swedish food consumption. These included increased organic food consumption, increased Swedish foods, reduced meat consumption and diets based on recommendations from Livsmedelsverket (*Swedish National Food Agency*). These scenarios are split into those considered “transition” diets requiring small changes to those requiring large changes, as described in the following sections. The following sections provide a short review of these scenarios.

For the study, a reference year of 2011 was used based on the latest data available from the FAO food balance data sheets. Thereafter, scenarios for different dietary choices were assessed for the years 2015 and 2020 in order to review how the impacts may change with increased population; See Table S1.

Table S1: Population for years 2012, 2015 and 2020 in thousand persons [1]

2011	2015	2020
9 482	9 879	09

#### A1.1 Transition Diets

##### Scenario 0 –Default Scenario

In order to model consumption in 2015 and 2020 using per capita consumption figures from 2011, Scenario 0 (Default Scenario) was created to allow for comparisons with other scenarios for 2015 and 2020 respectively. Therefore, Scenario 0 (for both 2015 and 2020) does not take into account increases or decreases in per capita consumption of foods and is used to also understand how population affects the environmental impacts of food production and consumption.

##### Reduced Meat Consumption

The *Reduced Meat* scenarios in 2015 and 2020 will review reductions in meat consumption. These are assumed to include meat consumption reductions of 25% and 50% in 2015 and 2020 respectively per capita. While meat consumption is reduced, the consumption of vegetables and pulses are increased by 25% and 50% respectively in 2015 and 2020, to make up for this reduction in meat to allow for a protein substitute, despite current levels of high protein consumption. Final consumption of food is kept similar to Scenario 0 and other scenarios (except for the Nutritional scenario) as outlined in this section.

Table S2: Increase and Decrease of RFPs in the *Reduced Meat* scenario

RFP	2015	2020
Meat	25% reduction	50% reduction
Vegetables	25% increase	50% increase
Pulses	25% increase	50% increase

### Increased Organic Food Consumption (Scenarios ECO and Eco-Sweden)

According to Ecoweb we can expect an increase in the sales of organic food with 2 billion SEK yearly between 2015 and 2025 [2]. Based on figures provided by Ekoweb, an increase in organic food sales of 100% can be seen from figures in 2011 to 2015. Thereafter, for 2020, a corresponding increase of 200% is outlined from 2011.

As the scenarios investigated an increase in organic food consumption, a reduction in conventional food consumption was also taken into account. In *Scenario ECO* a reduction in both conventional foods from imports and Swedish foods were considered. In several cases the increase in organic foods included more food than the per capita amounts for 2011. Therefore, in order for the per capita amounts to hold, the increase was reduced in only a few cases.

*Scenario ECO-Sweden* reviews the potential for an increase in Swedish organic food production and consumption. In this scenario, conventional food production in Sweden is replaced with the increased amount of organic food as it assumes a shift toward organic production in Sweden.

### Increase Swedish Food Production

Scenarios were created to understand the implications of increased Swedish food production. No recommendations could be found in the literature, although a number of gray literature reports provide support for more Swedish production of foods. Therefore, in order to review the potential for Swedish food production, the scenarios included increases of 10% and 30% for each respective food product with Swedish origin, labelled as *Swedish Increase (Sweden Incr.* in the figures) respectively for 2015 and 2020. In some cases there is no increase, as certain food products do not originate in Sweden (e.g. bananas, coffee, etc.). The increase only included conventional foods and not organic food production in Sweden as this was reviewed separately.

#### A1.2 Profoundly Changed Diets

The following scenarios review hypothetical scenarios where the entire population ate a vegetarian diet, ate based on nutritional recommendations and diets based on only conventional and organic foods to understand how these hypothetical diets could affect the environmental performance of Swedish food consumption.

### Vegetarian Diet

This scenario was created to understand the implications of widespread vegetarianism in Sweden. In the scenario, no meat was considered to be consumed, although eggs, fish and milk products remained in the diet<sup>1</sup>. Relative consumption figures take inspiration from work conducted by [3]. In the aforementioned study, the consumption of root vegetables and beans were roughly 4 times greater than an average diet and vegetables were roughly the same. In order to keep the amount of calories similar to Scenario 0, the following assumptions were made:

- 4x Increase in Soy Products, Beans and Peas
- 3x Increase in Potatoes

<sup>1</sup> Demi-vegetarianism refers to individual who do not eat meat or poultry, but consume fish, eggs and milk products.

### 1.5x Increase in Vegetable Consumption

All other representative food product amounts were kept similar to Scenario 0 for the respective years. See the Appendix for the final amounts of food in the Vegetarian scenarios for 2015 and 2020.

### Vegan Diet

Based on the consumption figures of the semi-vegetarian diets outlined above and comparing with the figures provided in [4] diet with Vegan diets, the following changes (factors) in the diets were noted. Notably, the increase of soya beans was increased by 600%.

Table S3: Changes in Food Consumption for Vegan Diets

Product	Factor
Milk - Excluding Butter	0
Sugar Crops	1.0
Cereals - Excluding Beer	1.3
Fruits - Excluding Wine	1.4
Vegetables	1.3
Meat	0
Alcoholic Beverages	1.0
Starchy Roots	1.2
Sugar & Sweeteners	1.0
Oil crops	1.0
Fish, Seafood	0
Animal fats	0
Vegetable Oils	1.0
Stimulants	1.0
Eggs	0
Treenuts	3
Pulses	4
Spices	1.3
Offals	0
Miscellaneous	1.0

### Nutritional Recommendations

The importance of a nutritional diet has become increasingly important for many consumers. A scenario was created to take into account healthy diets and assuming that consumers roughly follow the guidelines from the Swedish Food Agency (Livsmedelsverket).

In this scenario, labelled *Nutrition*, dietary guidelines from Livsmedelsverket were used. The guidelines are based on the "Nordic Nutritional recommendations 2012;" see Table S4 below for a summary of the recommended daily and weekly consumption figures and the Appendix for values used for yearly consumption.

The recommendations were used to calculate the total consumption (including waste) of food in 2015 and 2020 respectively. When doing so, the calorie count was below the recommended values. Therefore, in order to account for the range of nutritional intake guidelines based on age, sex and activity levels, 130% of the recommended amount was used. As such, the final consumption figures based on values from Livsmedelsverket were used to calculate wastes from production, retail and households, as considered in other scenarios. For food products where there are no guidelines, the amounts per capita and year are kept similar to amounts provided per capita as used in other scenarios. This scenario resulted in a reduced overall food consumption in comparison with that used in the other scenarios; see the Appendix.

Table S4: Recommendations from Livsmedelsverket on Food Consumption given in Amounts per day, week respectively

Foodstuff	Amount
Green vegetables, root vegetables, legumes, fruit and berries	A total of at least 500 grams vegetables and fruit per day
Nuts and seeds	A couple of tablespoons a day (30 grams)
Bread, grains, pasta, rice	about 70 grams per day for women and 90 grams for men upholds.
Dairy products	2-5 dl milk, curdled milk and yoghurt per day, or enriched plant-based drinks
Fish and shellfish	Fish 2-3 times a week, of which one a fatty fish, one portion is about 125 grams.
Meat from cows, pigs, lambs, reindeer and game, and processed meats	No more than in total 500 grams of meat from cows, pigs, lambs, reindeer and game a week

### A1.3 All Organic vs. All Conventional

In order to show the differences captured for comparing organic and conventional foods, scenarios were created to understand the differences between the two systems. In Scenario *All ECO*, all outlined consumption of conventional food was replaced with an equivalent amount of organic food in each category (i.e. Swedish and imports). Scenario *All Conv.* replaces all organic food in each category with conventional foods.

### A2 Method and other Assumptions

Table S5: Food Categories and Products Included in Study based on FAO Stat Food Balance Sheets

Food Category	Product	Food Category	Product
Milk- Excluding Butter	Milk	Fish, Seafood	Crustaceans
Sugar Crops	Sugar beet		Freshwater Fish
Cereals - Excluding Beer	Wheat and products		Demersal Fish
	Rye and products		Pelagic Fish
	Barley and products	Animal fats	Cream
Fruits - Excluding Wine	Oranges, Mandarines		Butter, Ghee
	Fruits, Other	Vegetable Oils	Palm Oil
	Apples and products		Rape and Mustard Oil
	Bananas		Sunflower Oil
Vegetables	Vegetables, Other	Stimulants	Coffee and products
	Tomatoes and products		Cocoa Beans and products
Meat	Pork	Eggs	Eggs
	Bovine	Tree nuts	Nuts and products
	Poultry	Pulses	Peas
Alcoholic Beverages	Beer		Beans
	Wine	Spices	Spices, Other
Starchy Roots	Potatoes and products		Pepper
Sugar & Sweeteners	Sugar (Raw Equivalent)		Pimento
Oilcrops	Rape and Mustard seed	Offals	Offals, Edible

	Oil crops, Other	Miscellaneous	Infant food
	Soya beans		

Table S6: Per Capita Consumption for different Representative Food Products in 2011, measured in kg per year (FAOStat, 2015), see Appendix for final amounts used in the reviewed scenarios.

Category	RFP	Amount per RFP [kg/yr]	Amount per Category [kg/yr]
Milk - Excluding Butter	Milk	341.07	341.07
Sugarbeet	Sugarbeet	240.98	240.98
Cereals - Excluding Beer	Wheat	108.37	131.20
	Rye	12.43	
	Barley	10.40	
Fruits - Excluding Wine	Oranges	64.43	143.88
	Fruits_Other	31.40	
	Apples	30.30	
	Bananas	17.75	
Vegetables	Vegetables_Other	68.94	93.53
	Tomatoes	24.58	
Meat	Pig	39.62	82.78
	Bovine	25.34	
	Poultry	17.82	
Alcoholic Beverages	Beer	56.87	77.52
	Wine	20.65	
Starchy Roots	Potatoes	61.22	61.22
Sugar & Sweeteners	Sugar	42.82	42.82
Oilcrops	Rapeseed	36.54	41.43
	Oilcrop_Other	2.50	
	Soyabeans	2.40	
Fish, Seafood	Crustaceans	8.03	30.70
	Freshwater	7.81	
	Demersal	7.72	
	Pelagic	7.14	
Animal fats	Cream	16.05	20.45
	Butter	4.40	
Vegetable Oils	Palm Oil	11.29	16.87
	Rapseed Oil	2.98	
	Sunflower Oil	2.61	
Stimulants	Coffee	10.57	12.97
	Cocoa	2.40	
Eggs	Eggs	12.34	12.34
Treenuts	Nuts	4.53	4.53

<b>Pulses</b>	Peas	1.52	1.90
	Beans	0.38	
<b>Spices</b>	Spices_Other	0.53	0.95
	Pepper	0.21	
	Pimento	0.21	
<b>Offals</b>	Offals	0.84	0.84
<b>Miscellaneous</b>	Infant Food	0.32	0.32

Table S7: Scaling factors for the different diets to denote increases or reductions

	Scen. 0	Reduce Meat	Eco <sup>1</sup>	Eco SWE <sup>2</sup>	SWE Incr. <sup>3</sup>	Veget.	Vegan	All Conv <sup>4</sup>	All Eco <sup>5</sup>
Milk	1.0	1.0	2.0	2.0	1.1	1.0	0.0	1.0	1.0
Sugar Crops	1.0	1.0	2.0	2.0	1.1	1.0	1.0	1.0	1.0
Cereals	1.0	1.0	2.0	2.0	1.1	1.0	1.3	1.0	1.0
Fruits	1.0	1.0	2.0	2.0	1.1	1.0	1.4	1.0	1.0
Vegetables	1.0	1.3	2.0	2.0	1.1	1.5	1.3	1.0	1.0
Meat	1.0	0.75	2.0	2.0	1.1	0.0	0.0	1.0	1.0
Alcoholic Beverages	1.0	1.0	2.0	2.0	1.1	1.0	1.0	1.0	1.0
Starchy Roots	1.0	1.0	2.0	2.0	1.1	2.0	1.2	1.0	1.0
Sugar & Sweeteners	1.0	1.0	2.0	2.0	1.1	1.0	1.0	1.0	1.0
Oilcrops	1.0	1.0	2.0	2.0	1.1	1.0	1.0	1.0	1.0
Fish, Seafood	1.0	1.0	2.0	2.0	1.1	1.0	0.0	1.0	1.0
Animal fats	1.0	0.8	2.0	2.0	1.1	0.0	0.0	1.0	1.0
Vegetable Oils	1.0	1.0	2.0	2.0	1.1	1.0	1.0	1.0	1.0
Stimulants	1.0	1.0	2.0	2.0	1.1	1.0	1.0	1.0	1.0
Eggs	1.0	1.0	2.0	2.0	1.1	1.0	0.0	1.0	1.0
Treenuts	1.0	1.0	2.0	2.0	1.1	1.0	3.0	1.0	1.0
Pulses	1.0	1.3	2.0	2.0	1.1	4.0	4.0	1.0	1.0
Spices	1.0	1.0	2.0	2.0	1.1	1.0	1.3	1.0	1.0
Offals	1.0	1.0	2.0	2.0	1.1	1.0	0.0	1.0	1.0
Miscellaneous	1.0	1.0	2.0	2.0	1.1	1.0	1.0	1.0	1.0

### A3 Waste from Production, Retail and Households

At each stage of the life cycle, there are differences in the amount of wastes assumed for each RFP. The assumptions are based on figures provided in Martin et al. (2015); see Table S8. The figures are calculated based on the amount of food wastes arising from accumulated inputs to the different life

cycle stages. As an example, of the foods from produced from cereals, 16% of the food produced is destined as waste from the production phases, thereafter 2% of that entering the retail sector is destined as waste and finally 25% is destined as waste from that available to households. Although food waste and the production of food to produce this waste leads to large environmental impacts, changes in food waste handling and mitigation were not reviewed in this study.

Table S8: Waste from Different Stages of the Life Cycle Accounted for in this study based on information from (Martin et al, 2015)

	Production	Retail	Households
Cereals	16%	2%	25%
Roots and Tubers	38%	7%	17%
Oilseeds and Pulses	15%	1%	4%
Fruit & Veg	26%	10%	19%
Meat	9%	4%	11%
Fish/Seafood	15%	9%	11%
Milk	9%	0.5%	7%
Beverages, Other	16%	0.50%	7%

#### A4 Data Sources for Origin and LCI Data

Table S9: Percentage of Conventional vs. Organic in Each Food Category (see references)

Product	% Conventional vs Organic	Reference	Details/Report Number
Milk-ROW	93.6%		
Milk-ROW ECO	6.4%	SCB 2013	HA 24 SM 1301
Milk-Swedish	87.3%		
Milk-Swedish ECO	12.7%	SCB, 2014	Production of organic and non-organic
Sugarbeet-ROW	98.2%		
Sugarbeet-ROW	1.8%	SCB 2013	HA 24 SM 1301
Sugarbeet-Swedish	98.2%		
Sugarbeet-Swedish	1.8%	SCB 2013	HA 24 SM 1301
Wheat-ROW	97.5%		
Wheat-ROW ECO	2.5%	SCB 2013	HA 24 SM 1301
Wheat-Swedish	96.2%		
Wheat-Swedish ECO	3.8%	SCB, 2014	Production of organic and non-organic
Rye-ROW	97.5%		
Rye-ROW ECO	2.5%	SCB 2013	HA 24 SM 1301
Rye-Swedish	96.7%		
Rye-Swedish ECO	3.3%	SCB, 2014	Production of organic and non-organic
Barley-ROW	97.5%		
Barley-ROW ECO	2.5%	SCB 2013	HA 24 SM 1301
Barley-Swedish	97.7%		
Barley-Swedish ECO	2.3%	SCB, 2014	Production of organic and non-organic
Oranges-ROW	94.7%		
Oranges-ROW ECO	5.3%	SCB 2013	HA 24 SM 1301
Oranges-Swedish	100.0%		
Oranges-Swedish	0.0%		Not Swedish Product
Fruits Other-ROW	94.7%		
Fruits Other-ROW	5.3%	SCB 2013	HA 24 SM 1301
Fruits Other-	90.2%		

Fruits Other-	9.8%		Willer et al, 2015
Apples-ROW	94.7%		
Apples-ROW ECO	5.3%	SCB 2013	HA 24 SM 1301
Apples-Swedish	90.2%		
Apples-Swedish	9.8%		Willer et al, 2015
Bananas-ROW	75.0%		
Bananas-ROW ECO	25.0%	SCB, 2014b	
Bananas-Swedish	100.0%		
Bananas-Swedish	0.0%		<i>Not Swedish Product</i>
Vegetables Other-	94.1%		
Vegetables Other-	5.9%	SCB 2013	HA 24 SM 1301
Vegetables Other-	93.8%		
Vegetables Other-	6.2%		Willer et al, 2015
Tomatoes-ROW	94.1%		
Tomatoes-ROW	5.9%	SCB 2013	HA 24 SM 1301
Tomatoes-Swedish	100.0%		
Tomatoes-Swedish	6.2%		Willer et al, 2015
Pig-ROW	98.6%		
Pig-ROW ECO	1.4%	SCB 2013	HA 24 SM 1301
Pig-Swedish	98.5%		
Pig-Swedish ECO	1.5%	SCB, 2014	Production of organic and non-organic
Bovine-ROW	98.6%		
Bovine-ROW ECO	1.4%	SCB 2013	HA 24 SM 1301
Bovine-Swedish	86.3%		
Bovine-Swedish	13.7%	SCB, 2014	Production of organic and non-organic
Poultry-ROW	100.0%		
Poultry-ROW ECO	0.0%		<i>Chose to keep this zero</i>
Poultry-Swedish	99.7%		
Poultry-Swedish	0.3%	SCB, 2014	Production of organic and non-organic
Beer-ROW	99.0%		
Beer-ROW ECO	1.0%		Systembolaget, 2014
Beer-Swedish	99.0%		
Beer-Swedish ECO	1.0%		Systembolaget, 2014
Wine-ROW	94.8%		
Wine-ROW ECO	5.2%		Systembolaget, 2014
Wine-Swedish	100.0%		
Wine-Swedish ECO	0.0%		<i>Not Swedish Product</i>
Potatoes-ROW	94.1%		
Potatoes-ROW ECO	5.9%		
Potatoes-Swedish	98.0%		
Potatoes-Swedish	2.0%	SCB, 2014	Production of organic and non-organic
Sugar-ROW	98.2%		
Sugar-ROW ECO	1.8%	SCB 2013	HA 24 SM 1301
Sugar-Swedish	98.2%		
Sugar-Swedish ECO	1.8%	SCB 2013	HA 24 SM 1301
Rapeseed-ROW	95.1%		
Rapeseed-ROW ECO	4.9%	SCB 2013	HA 24 SM 1301
Rapeseed-Swedish	98.7%		
Rapeseed-Swedish	1.3%	SCB, 2014	Production of organic and non-organic
Oilcrop Other-ROW	95.1%		
Oilcrop Other-ROW	4.9%	SCB 2013	HA 24 SM 1301
Oilcrop Other-	98.7%		
Oilcrop Other-	1.3%		Assumed same as rapeseed
Soyabeans-ROW	94.1%		
Soyabeans-ROW	5.9%	SCB 2013	HA 24 SM 1301
Soyabeans-Swedish	94.1%		
Soyabeans-Swedish	5.9%	SCB 2013	HA 24 SM 1301
Crustaceans-ROW	91.9%		
Crustaceans-ROW	8.1%	SCB 2013	HA 24 SM 1301
Crustaceans-	91.9%		
Crustaceans-	8.1%	SCB 2013	HA 24 SM 1301



Freshwater-ROW	91.9%		
Freshwater-ROW	8.1%	SCB 2013	HA 24 SM 1301
Freshwater-Swedish	83.0%		
Freshwater-Swedish	17.0%	SCB, 2014b	
Demersal-ROW	91.9%		
Demersal-ROW ECO	8.1%	SCB 2013	HA 24 SM 1301
Demersal-Swedish	83.0%		
Demersal-Swedish	17.0%	SCB, 2014b	
Pelagic-ROW	91.9%		
Pelagic-ROW ECO	8.1%	SCB 2013	HA 24 SM 1301
Pelagic-Swedish	83.0%		
Pelagic-Swedish	17.0%	SCB, 2014b	
Cream-ROW	93.6%		
Cream-ROW ECO	6.4%	SCB 2013	HA 24 SM 1301
Cream-Swedish	93.6%		
Cream-Swedish	6.4%	SCB 2013	HA 24 SM 1301
Butter-ROW	95.1%		
Butter-ROW ECO	4.9%	SCB 2013	HA 24 SM 1301
Butter-Swedish	95.1%		
Butter-Swedish ECO	4.9%	SCB 2013	HA 24 SM 1301
Palm Oil-ROW	100.0%		
Palm Oil-ROW ECO	0.0%	Chose not to classify this as ECO.....	
Palm Oil-Swedish	100.0%		
Palm Oil-Swedish	0.0%	<i>Not Swedish Product</i>	
Rapeseed Oil-ROW	95.1%		
Rapeseed Oil-ROW	4.9%	SCB 2013	HA 24 SM 1301
Rapeseed Oil-	98.7%		
Rapeseed Oil-	1.3%	SCB, 2014	Production of organic and non-organic
Sunflower Oil-ROW	95.1%		
Sunflower Oil-ROW	4.9%	SCB 2013	HA 24 SM 1301
Sunflower Oil-	100.0%		
Sunflower Oil-	0.0%	<i>Not Swedish Product</i>	
Coffee-ROW	92.8%		
Coffee-ROW ECO	7.2%	SCB 2013	HA 24 SM 1301
Coffee-Swedish	100.0%		
Coffee-Swedish ECO	0.0%	<i>Not Swedish Product</i>	
Cocoa-ROW	98.2%		
Cocoa-ROW ECO	1.8%	SCB 2013	HA 24 SM 1301
Cocoa-Swedish	100.0%		
Cocoa-Swedish ECO	0.0%	<i>Not Swedish Product</i>	
Eggs-ROW	93.6%		
Eggs-ROW ECO	6.4%	SCB 2013	HA 24 SM 1301
Eggs-Swedish	90.4%		
Eggs-Swedish ECO	9.6%	SCB, 2014	Production of organic and non-organic
Nuts-ROW	94.7%		
Nuts-ROW ECO	5.3%	SCB 2013	HA 24 SM 1301
Nuts-Swedish	94.7%		
Nuts-Swedish ECO	5.3%	SCB 2013	HA 24 SM 1301
Peas-ROW	94.1%		
Peas-ROW ECO	5.9%	SCB 2013	HA 24 SM 1301
Peas-Swedish	90.3%		
Peas-Swedish ECO	9.7%	SCB, 2014	Production of organic and non-organic
Beans-ROW	94.1%		
Beans-ROW ECO	5.9%	SCB 2013	HA 24 SM 1301
Beans-Swedish	94.1%		
Beans-Swedish ECO	5.9%	SCB 2013	HA 24 SM 1301
Spices Other-ROW	94.1%		
Spices Other-ROW	5.9%	SCB 2013	HA 24 SM 1301
Spices Other-	94.1%		
Spices Other-	5.9%	SCB 2013	HA 24 SM 1301
Pepper-ROW	94.1%		

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Pepper-ROW ECO	5.9%	SCB 2013	HA 24 SM 1301
Pepper-Swedish	100.0%		
Pepper-Swedish	0.0%		<i>Not Swedish Product</i>
Pimento-ROW	94.1%		
Pimento-ROW ECO	5.9%	SCB 2013	HA 24 SM 1301
Pimento-Swedish	100.0%		
Pimento-Swedish	0.0%		<i>Not Swedish Product</i>
Offals-ROW	98.6%		
Offals-ROW ECO	1.4%	SCB 2013	HA 24 SM 1301
Offals-Swedish	98.6%		
Offals-Swedish ECO	1.4%	SCB 2013	HA 24 SM 1301
InfantFood-ROW	60.0%		
InfantFood-ROW	40.0%	SCB, 2014b	
InfantFood-Swedish	60.0%		
InfantFood-Swedish	40.0%	SCB, 2014b	
ECO			

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## A5 LCI Data

Table S10: LCI data references and assumptions

Product	Reference	Data Set Modelled System	Note	Data Set Coverage
Milk-ROW	Guerci et al., 2013	Milk	modeled in kg	C-T-F
Milk-Swedish	Cederberg and Flysjö, 2004	Milk-Swedeish	modeled in kg	C-T-F
Milk-ROW ECO	Guerci et al., 2013	Milk-Organic	modeled in kg	C-T-F
Milk-Swedish ECO	Cederberg and Flysjö, 2004	Milk-Swedish Organic	modeled in kg	C-T-F
Sugarbeet-ROW	Agribalyse	Sugarbeet, Conventional	no data available for organic	C-T-F
Sugarbeet-Swedish				
Sugarbeet-ROW ECO				
Sugarbeet-Swedish ECO				
Wheat-ROW	Ecoinvent	market for wheat grain		C-T-F
Wheat-Swedish	Ecoinvent	market for wheat grain, CH		C-T-F
Wheat-ROW ECO	Ecoinvent	market for wheat grain, organic	assumed same for Sweden and imports	C-T-G
Wheat-Swedish ECO				
Rye-ROW	Ecoinvent	market for rye	assumed same for Sweden and imports	C-T-G
Rye-Swedish				
Rye-ROW ECO	Ecoinvent	market for rye, organic	assumed same for Sweden and imports	C-T-G
Rye-Swedish ECO				
Barley-ROW	Ecoinvent	market for barley	assumed same for Sweden and imports	C-T-G
Barley-Swedish				
Barley-ROW ECO	Ecoinvent	market for barley, organic	assumed same for Sweden and imports	C-T-G
Barley-Swedish ECO				
Oranges-ROW	Agribalyse	Peach, conventional	modeled as peach	C-T-F
Oranges-Swedish ECO	-	-		-

Oranges-ROW ECO	Agribalyse	Peach, organic	modeled as peach	C-T-F
Oranges-Swedish ECO	-	-		-
Fruits_Other-ROW	Agribalyse	Peach, conventional	modeled as peach	C-T-F
Fruits_Other-Swedish				
Fruits_Other-ROW ECO	Agribalyse	Peach, organic	modeled as peach	C-T-F
Fruits_Other-Swedish ECO				
Apples-ROW	Agribalyse	Apple, Conventional	assumed same for Sweden and imports	C-T-F
Apples-Swedish				
Apples-ROW ECO	Agribalyse	Apple, Organic	assumed same for Sweden and imports	C-T-F
Apples-Swedish ECO				
Bananas-ROW	Ecoinvent	Market for banana		C-T-G
Bananas-Swedish	-	-		-
Bananas-ROW ECO	Ecoinvent	Market for banana	no data available for organic	C-T-G
Bananas-Swedish ECO	-	-		-
Vegetables_Other-ROW	Agribalyse	Carrot, Conventional	modeled as carrot	C-T-F
Vegetables_Other-Swedish				
Vegetables_Other-ROW ECO	Agribalyse	Carrot, Organic	modeled as carrot	C-T-F
Vegetables_Other-Swedish ECO				
Tomatoes-ROW	Agribalyse	Tomato, Conventional	assumed same for Sweden and imports	C-T-F
Tomatoes-Swedish				
Tomatoes-ROW ECO	Agribalyse	Tomato, Organic (Greenhouse)	assumed same for Sweden and imports	C-T-F
Tomatoes-Swedish ECO				
Pig-ROW	Williams et al., 2006			C-T-F
Pig-Swedish	Cederberg and Flysjö, 2004			C-T-F
Pig-ROW ECO	Williams et al., 2006			C-T-F
Pig-Swedish ECO	Carlsson, B. et al 2009			C-T-F

Bovine-ROW	Williams et al., 2010		70% DW to meat	C-T-F
Bovine-Swedish	Jordbruksverket, 2012			C-T-F
Bovine-ROW ECO	Williams et al., 2010		70% DW to meat	C-T-F
Bovine-Swedish ECO	Cederberg et al., 2009			C-T-G
Poultry-ROW	Williams, 2006			C-T-F
Poultry-Swedish	Cederberg et al., 2009			C-T-F
Poultry-ROW ECO	Williams, 2006			C-T-F
Poultry-Swedish ECO	Cederberg et al., 2009			C-T-F
Beer-ROW	EPD, 2014	Beer	no organic available	C-T-G
Beer-Swedish				
Beer-ROW ECO				
Beer-Swedish ECO				
Wine-ROW	EPD, 2015	Red Wine		C-T-G
Wine-Swedish	-	-		-
Wine-ROW ECO	EPD, 2013	Organic Red Wine		C-T-G
Wine-Swedish ECO	-	-		-
Potatoes-ROW	Ecoinvent	Market for potato	assumed same for Sweden and imports	C-T-G
Potatoes-Swedish				
Potatoes-ROW ECO	Ecoinvent	Market for potato, organic	assumed same for Sweden and imports	C-T-G
Potatoes-Swedish ECO				
Sugar-ROW	Ecoinvent	Market for sugar, Sugarcane		C-T-G
Sugar-Swedish	Ecoinvent	market for sugar, from sugar beet		C-T-G
Sugar-ROW ECO	Ecoinvent	Market for sugar, Sugarcane	no organic available	C-T-G

Sugar-Swedish ECO	Ecoinvent	market for sugar, from sugar beet	no organic available	C-T-G
Rapeseed-ROW	Ecoinvent	market for rapeseed	assumed same for Sweden and imports	C-T-G
Rapeseed-Swedish				
Rapeseed-ROW ECO	Ecoinvent	market for rapeseed, organic	assumed same for Sweden and imports	C-T-G
Rapeseed-Swedish ECO				
Oilcrop_Other-ROW	Ecoinvent	market for rapeseed	assumed same for Sweden and imports	C-T-G
Oilcrop_Other-Swedish				
Oilcrop_Other-ROW ECO	Ecoinvent	market for rapeseed, organic	assumed same for Sweden and imports	C-T-G
Oilcrop_Other-Swedish ECO				
Soyabeans-ROW	Ecoinvent	market for soy		C-T-G
Soyabeans-Swedish	-	-		-
Soyabeans-ROW ECO	Ecoinvent	market for soy, organic		C-T-G
Soyabeans-Swedish ECO	-	-		-
Crustaceans-ROW	Ecoinvent	Wild cod	Modeled as cod	C-T-G
Crustaceans-Swedish				
Crustaceans-ROW ECO				
Crustaceans-Swedish ECO				
Freshwater-ROW	Agribalyse	Large trout		C-T-F
Freshwater-Swedish				
Freshwater-ROW ECO	Agribalyse	Large trout		C-T-F
Freshwater-Swedish ECO				
Demersal-ROW	LCA Food Database	Wild cod		C-T-F
Demersal-Swedish				
Demersal-ROW ECO	LCA Food Database	Wild cod		C-T-F
Demersal-Swedish ECO				
Pelagic-ROW	LCA Food Database	Herring		C-T-F

Pelagic-Swedish				
Pelagic-ROW ECO	LCA Food Database	Herring		C-T-F
Pelagic-Swedish ECO				
Cream-ROW	Ecoinvent	market for cream		C-T-G
Cream-Swedish				
Cream-ROW ECO				
Cream-Swedish ECO				
Butter-ROW	Ecoinvent	market for butter	no data available for organic or Swedish butter	C-T-G
Butter-Swedish				
Butter-ROW ECO				
Butter-Swedish ECO				
Palm Oil-ROW	Ecoinvent	market for palm oil		C-T-G
Palm Oil-Swedish	-	-		-
Palm Oil-ROW ECO	Ecoinvent	market for palm oil (assumed same as conventional)		C-T-G
Palm Oil-Swedish ECO	-	-		-
Rapseed Oil-ROW	Ecoinvent	market for rape oil, ROW		C-T-G
Rapseed Oil-Swedish	Ecoinvent	market for rape oil, CH		C-T-G
Rapseed Oil-ROW ECO	Ecoinvent	market for rape oil, ROW		C-T-G
Rapseed Oil-Swedish ECO	Ecoinvent	market for rape oil, CH		C-T-G
Sunflower Oil-ROW	Ecoinvent	market for rape oil, ROW		C-T-G
Sunflower Oil-Swedish	Ecoinvent	market for rape oil, CH		C-T-G
Sunflower Oil-ROW ECO	Ecoinvent	market for rape oil, ROW		C-T-G
Sunflower Oil-Swedish ECO	Ecoinvent	market for rape oil, CH		C-T-G

Coffee-ROW	Agribalyse	Coffee bean (Robusta), depulped, Brazil, at farm gate		C-T-F
Coffee-Swedish	-	-	-	-
Coffee-ROW ECO	Agribalyse	Coffee bean (Robusta), depulped, Brazil, at farm gate	no data available for organic	C-T-F
Coffee-Swedish ECO	-	-	-	-
Cocoa-ROW	Agribalyse	Cocoa, conventional, Cabruca, at orchard		C-T-F
Cocoa-Swedish	-	-	-	-
Cocoa-ROW ECO	Agribalyse	Cocoa, conventional, Cabruca, at orchard	no data available for organic	C-T-F
Cocoa-Swedish ECO	-	-	-	-
Eggs-ROW	Leinonen et al., 2012	Eggs, conventional		C-T-F
Eggs-Swedish	Sonnesson et al.	Swedish Eggs		C-T-F
Eggs-ROW ECO	Leinonen et al. 2012	Eggs, Organic		C-T-F
Eggs-Swedish ECO	Carlsson et al. 2009	Swedish Organic Eggs		C-T-G
Nuts-ROW	de Figueirêdo et al., 2014	Cashew		C-T-F
Nuts-Swedish	-	-	-	-
Nuts-ROW ECO	de Figueirêdo et al., 2014	Cashew	no data for organic available	C-T-F
Nuts-Swedish ECO	-	-	-	-
Peas-ROW	Agribalyse	peas, conventional	assumed same for Sweden and imports	C-T-F
Peas-Swedish				
Peas-ROW ECO	Agribalyse	peas, organic	assumed same for Sweden and imports	C-T-F
Peas-Swedish ECO				



Beans-ROW	Ecoinvent	market for fava bean		C-T-F
Beans-Swedish	Hallström, 2015			C-T-F
Beans-ROW ECO	Ecoinvent	market for fava bean, organic		C-T-F
Beans-Swedish ECO	Ecoinvent	market for fava bean, organic		C-T-F
Spices_Other-ROW	Ecoinvent	Market for bell pepper	Assumed peper, pimento and spices same	C-T-G
Spices_Other-Swedish				
Spices_Other-ROW ECO				
Spices_Other-Swedish ECO				
Pepper-ROW				
Pepper-Swedish				
Pepper-ROW ECO				
Pepper-Swedish ECO				
Pimento-ROW				
Pimento-Swedish				
Pimento-ROW ECO				
Pimento-Swedish ECO				
Offals-ROW	Ecoinvent	Market for beef	(Assumed ¼ of impact from beef)	C-T-G
Offals-Swedish				
Offals-ROW ECO				
Offals-Swedish ECO				
InfantFood-ROW	Agribalyse	Apple, Conventional	modeled as apple	C-T-F
InfantFood-Swedish				
InfantFood-ROW ECO	Agribalyse	Apple, Organic	modeled as apple, organic	C-T-F
InfantFood-Swedish ECO				

## Nutritional Values

Nutritional values and protein content per kg were provided from the Swedish National Food Agency, (Livsmedelsverket, 2015).

Table S11: Nutritional values per kg food

Food	kCal/kg	Protein/kg
Milk	599.0	35.1
Sugarbeet	506.0	11.9
Wheat	3 521.0	4.0
Rye	3 521.0	84.7
Barley	3 413.0	92.0
Oranges	494.0	8.0
Fruits_Other	539.0	3.7
Apples	479.0	-
Bananas	1 011.0	10.0
Vegetables_Other	185.0	5.0
Tomatoes	175.0	8.1
Pig	1 546.7	191.9
Bovine	1 288.0	222.2
Poultry	1 484.0	215.0
Beer	342.0	2.5
Wine	773.0	176.3
Potatoes	786.0	17.4
Sugar	4 047.0	-
Rapeseed	8 843.0	-
Oilcrop_Other	8 843.0	-
SoyaBeans	1 304.0	108.7
Crustaceans	773.0	176.3
Freshwater	1 775.2	204.6
Demersal	1 775.2	204.6
Pelagic	1 775.2	204.6
Cream	3 745.0	21.0
Butter	7 288.0	4.0
Palm Oil	8 843.0	-
Rapseed Oil	8 843.0	-
Sunflower Oil	8 843.0	-
Coffee	20.0	1.0
Cocoa	5 768.0	100.0
Eggs	1 414.0	123.8
Nuts	5 901.0	153.0
Peas	717.0	54.0
Beans	1 304.0	108.7
Spices_Other	185.0	5.0
Pepper	185.0	5.0
Pimento	185.0	5.0
Offals	1 194.0	194.0
InfantFood	656.0	24.0

## A3 Results and Analysis

Contribution of Different Food Categories to Impact Categories

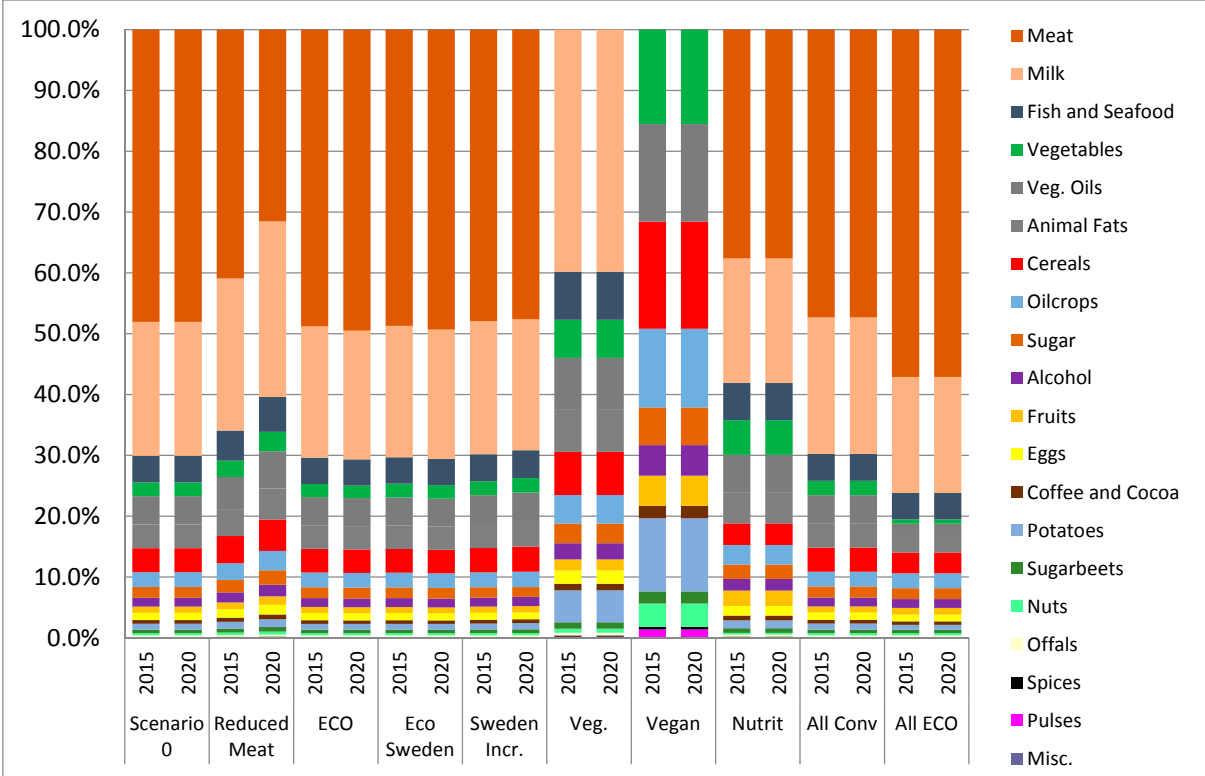


Figure S1: GHG emissions for different foods in 2015 and 2020.

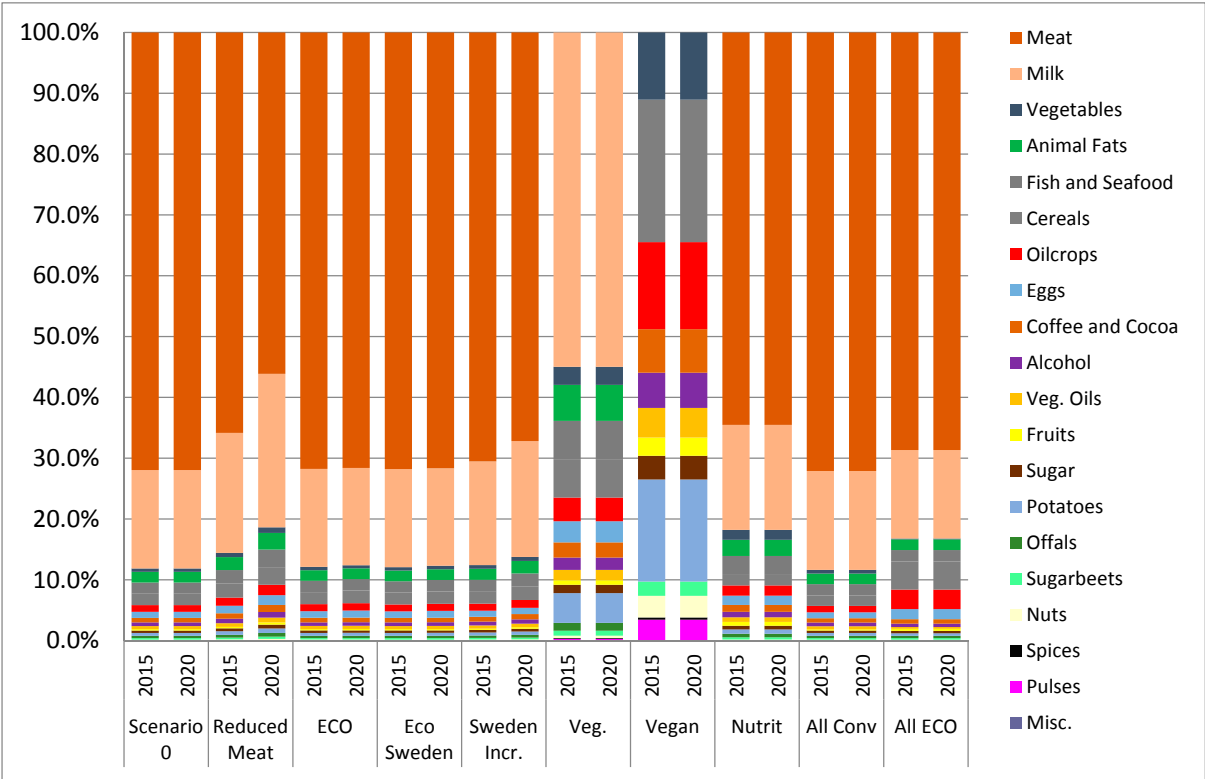


Figure S2: AP Contribution for different foods in 2015 and 2020

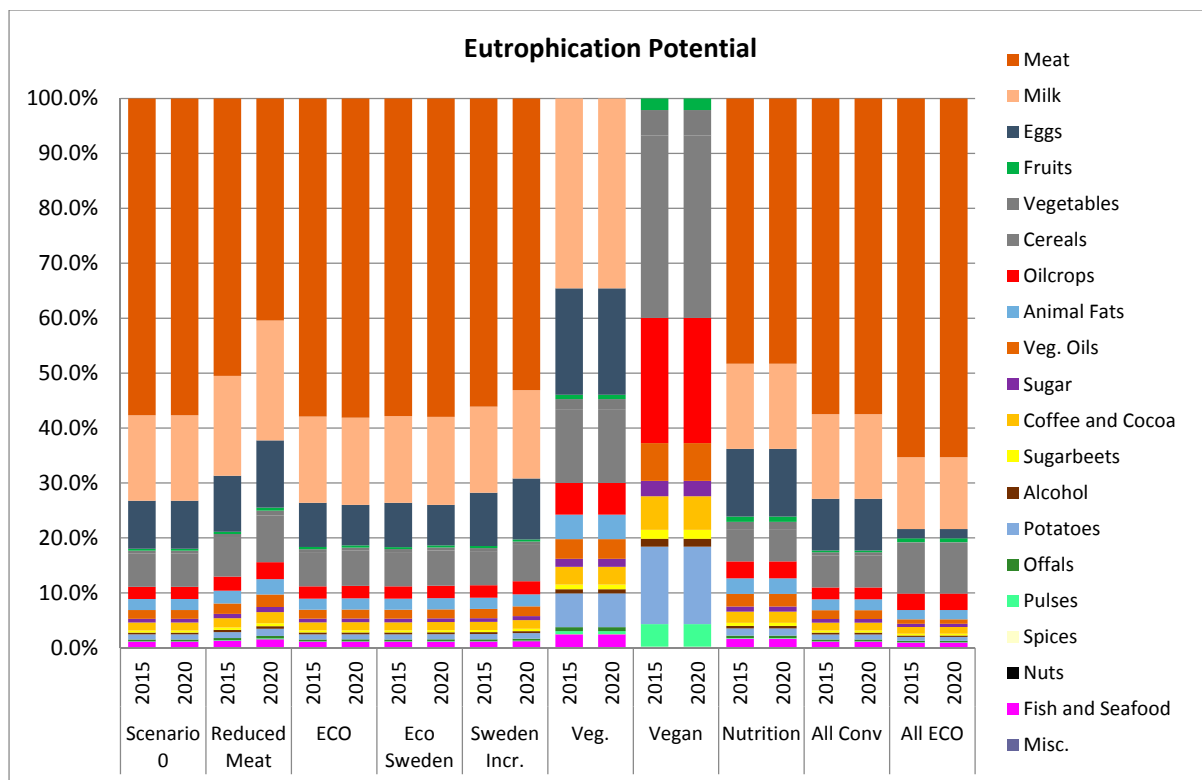


Figure S3: EP contribution for different foods in 2015 and 2020

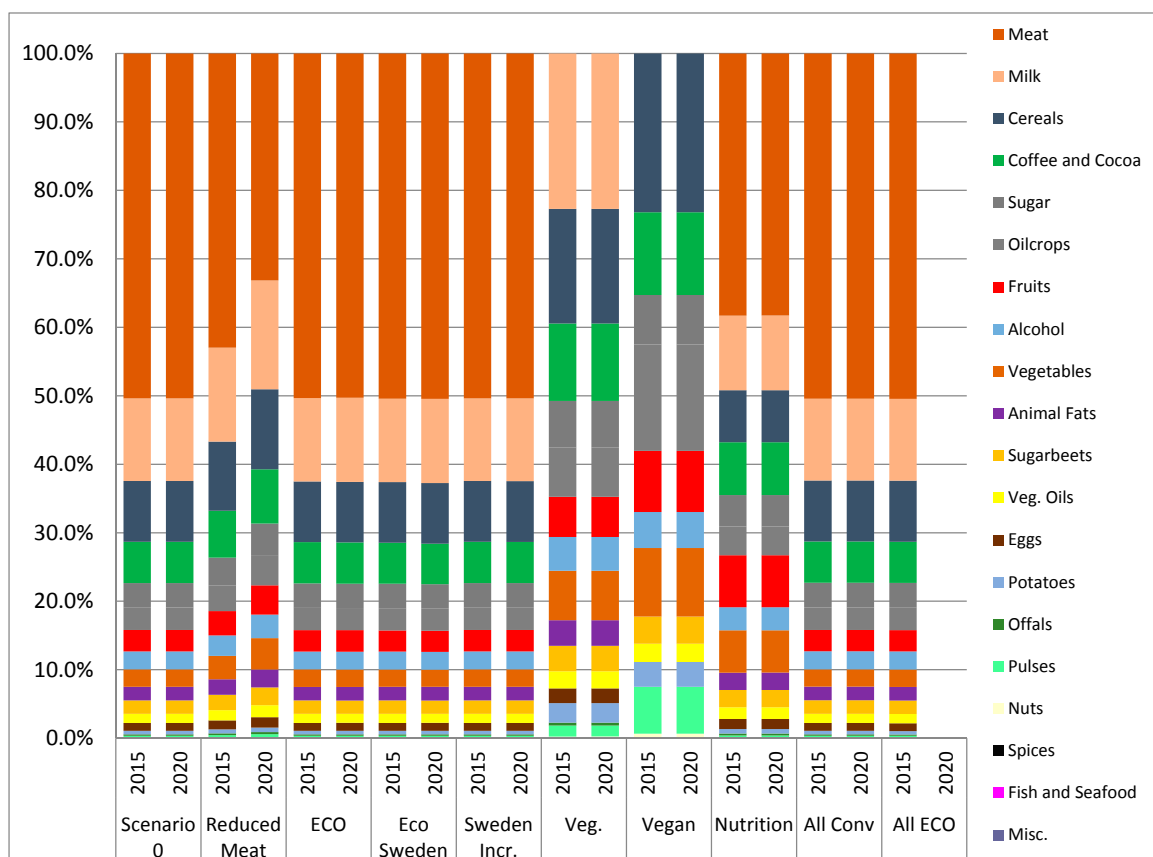


Figure S4: Land Use contribution for different foods in 2015 and 2020

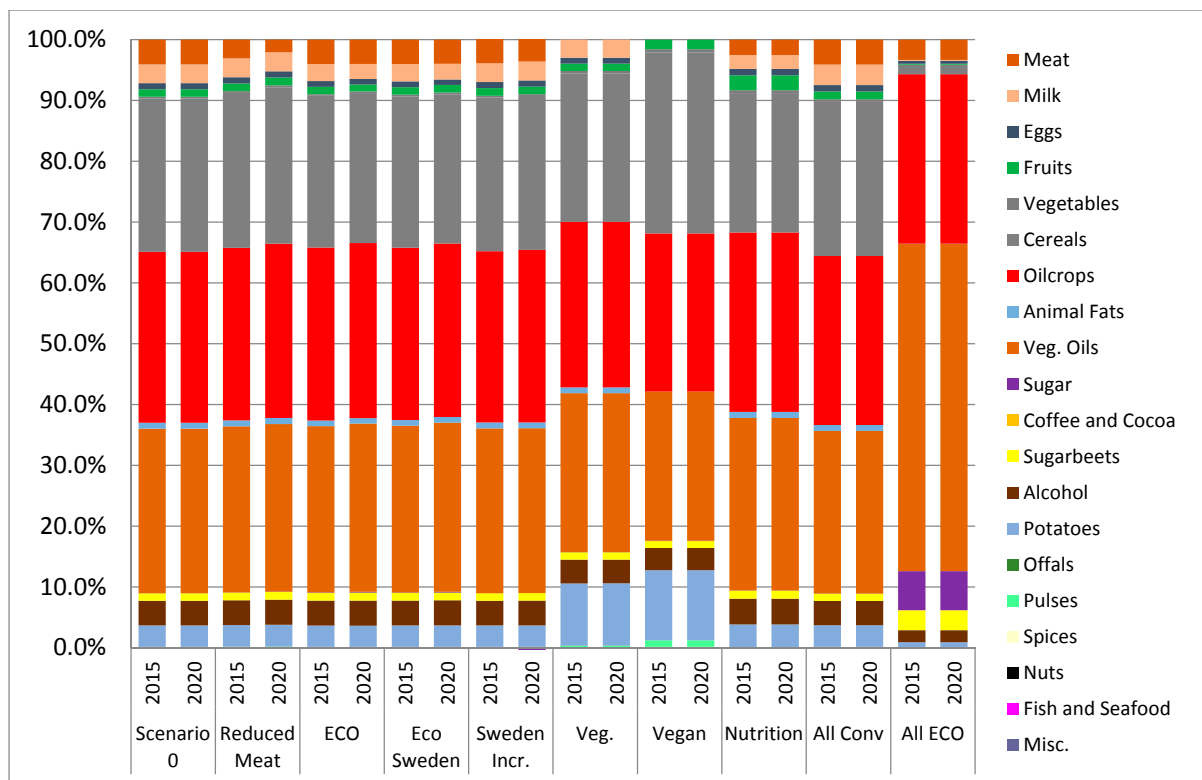


Figure S5: TETP Contribution for different foods in 2015 and 2020

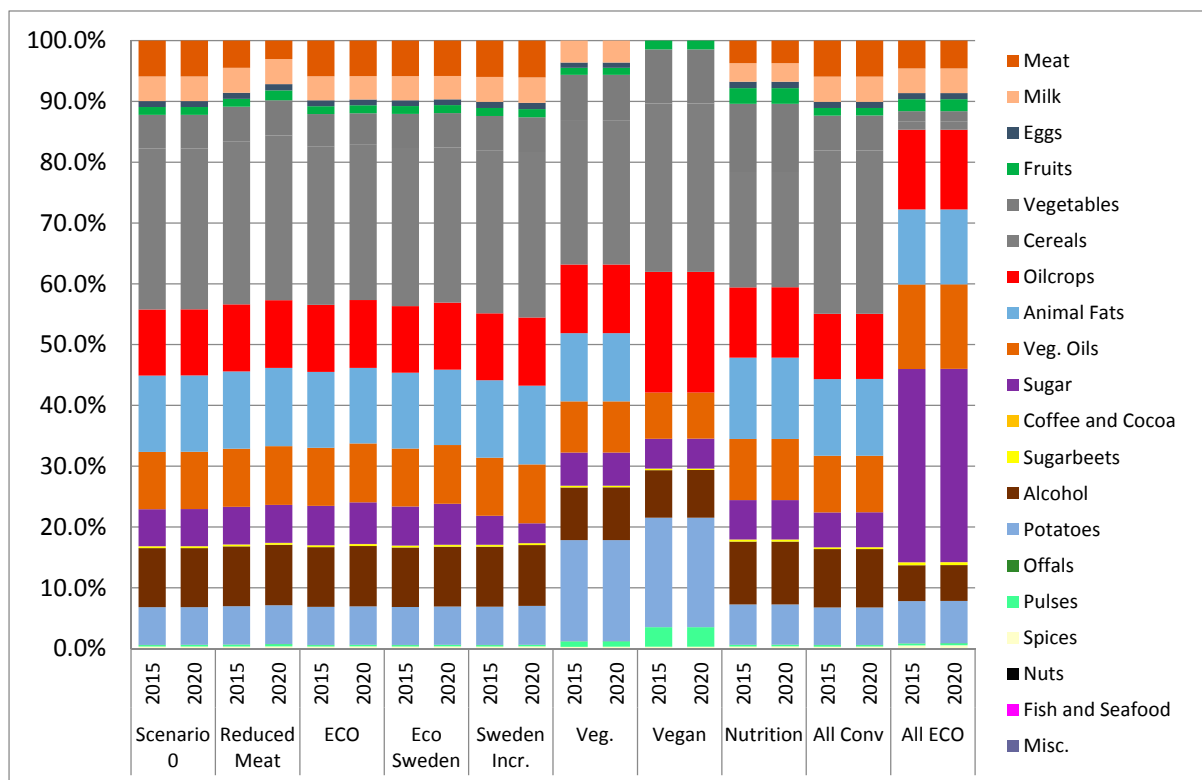


Figure S6: HTP contribution for different foods in 2015 and 2020

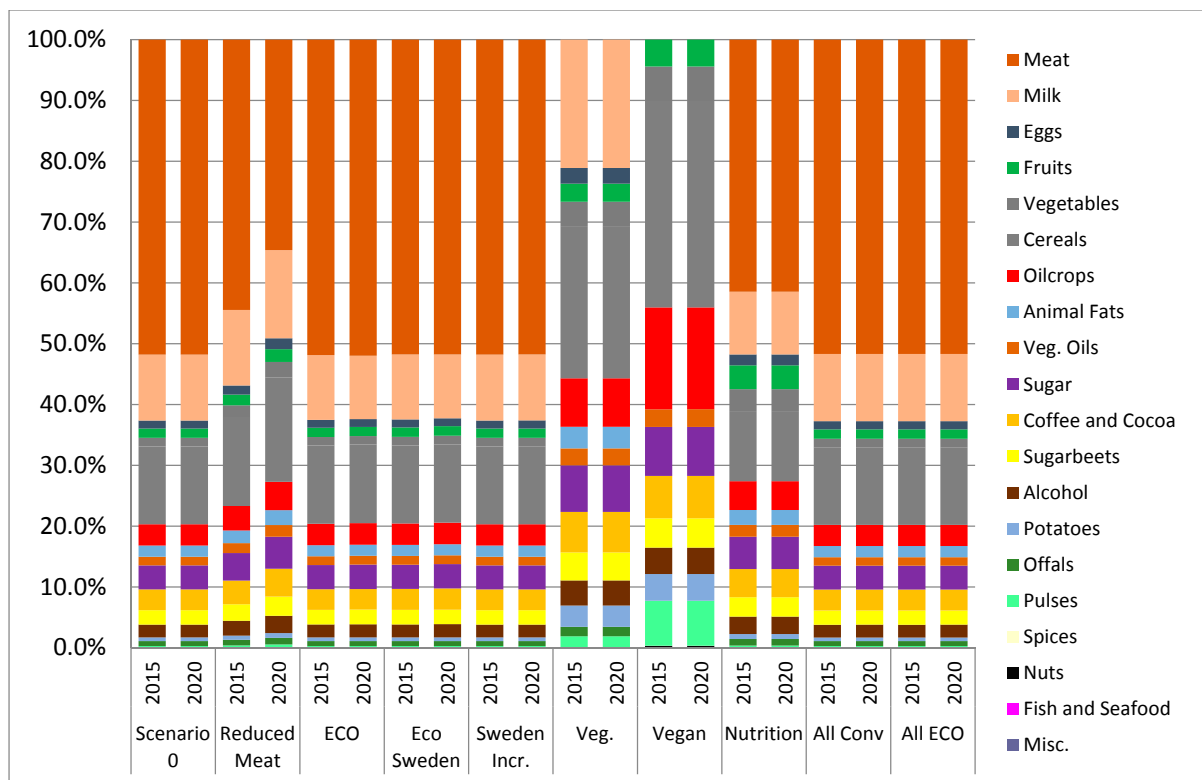


Figure S7: BDD contribution for different foods in 2015 and 2020

### Location of Created Impacts

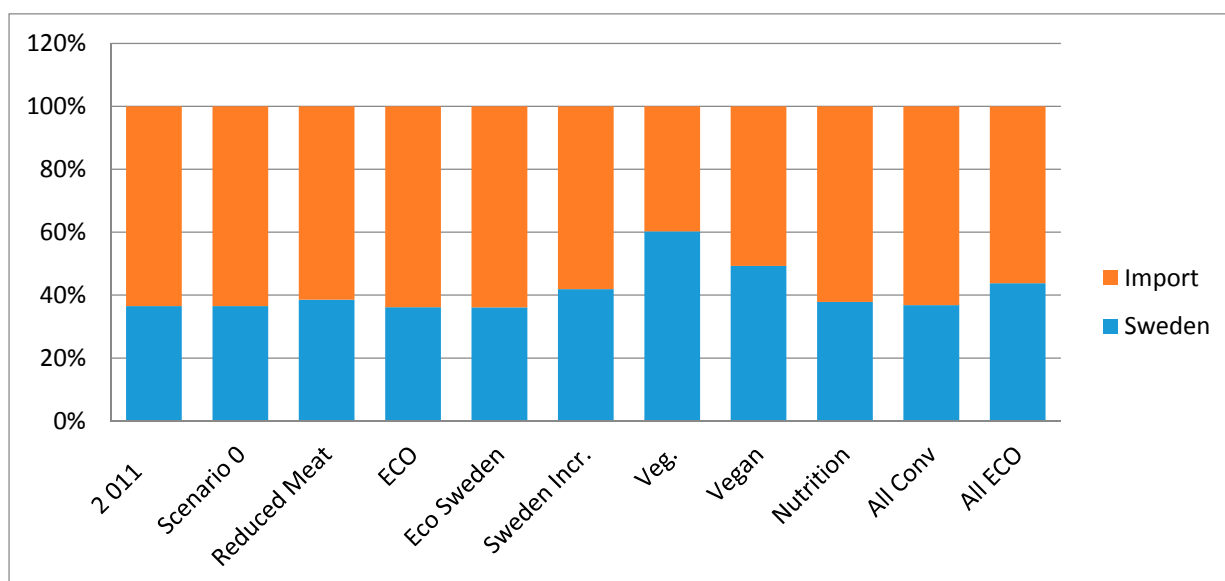


Figure S8: AP Contribution from Foods Produced in Sweden and Imports

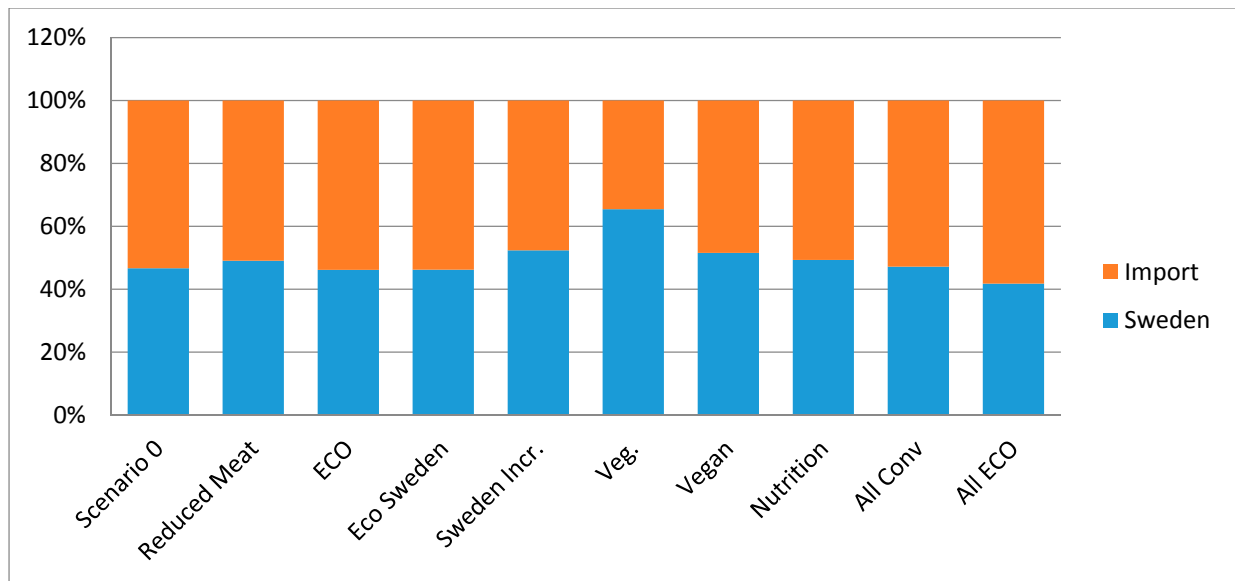


Figure S9: EP Contribution from Foods Produced in Sweden and Imports

## Scenario Comparisons across Impact Categories

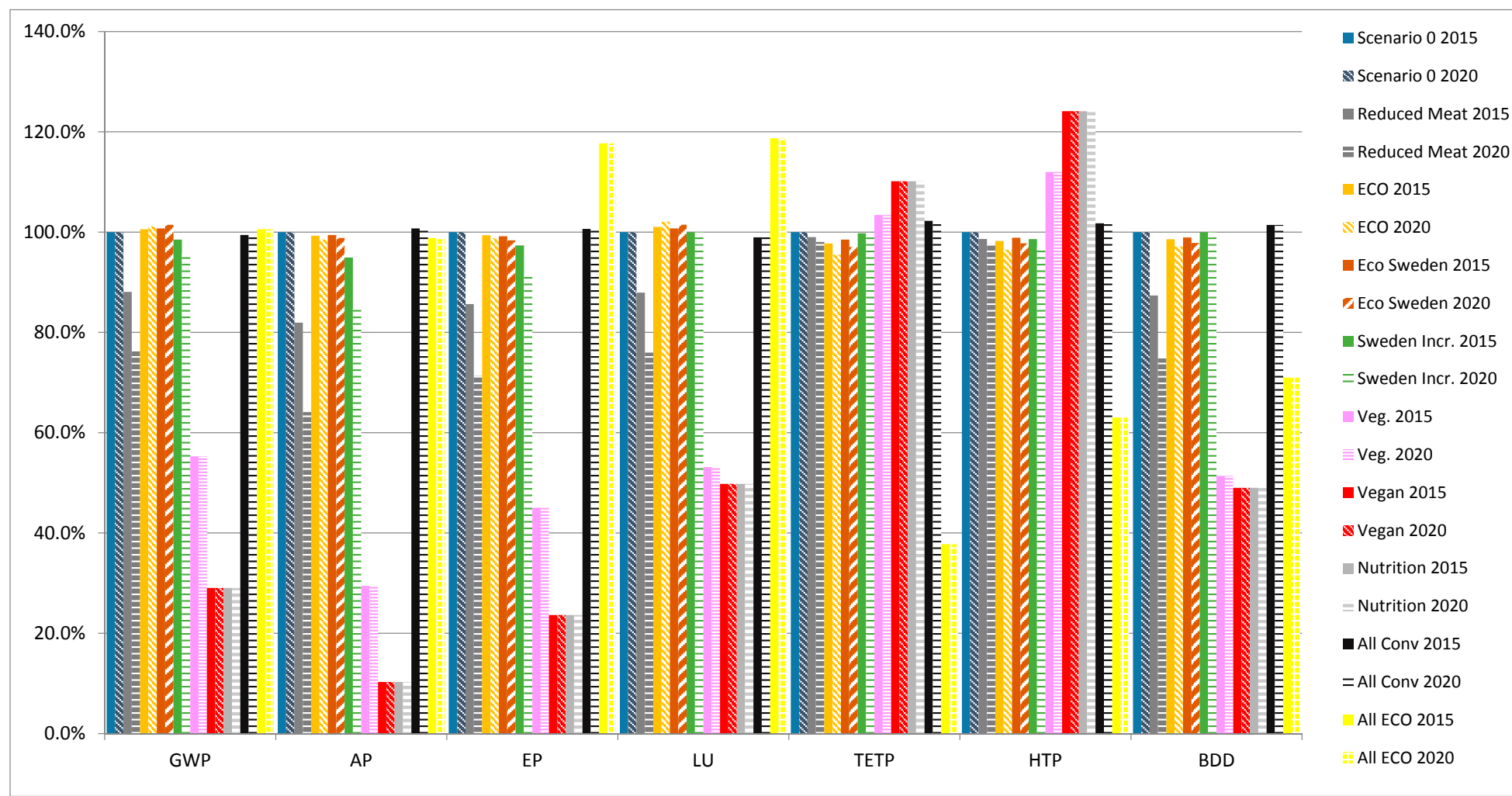


Figure S10: Comparing tradeoffs with impact categories for scenarios tested in 2015 and 2020



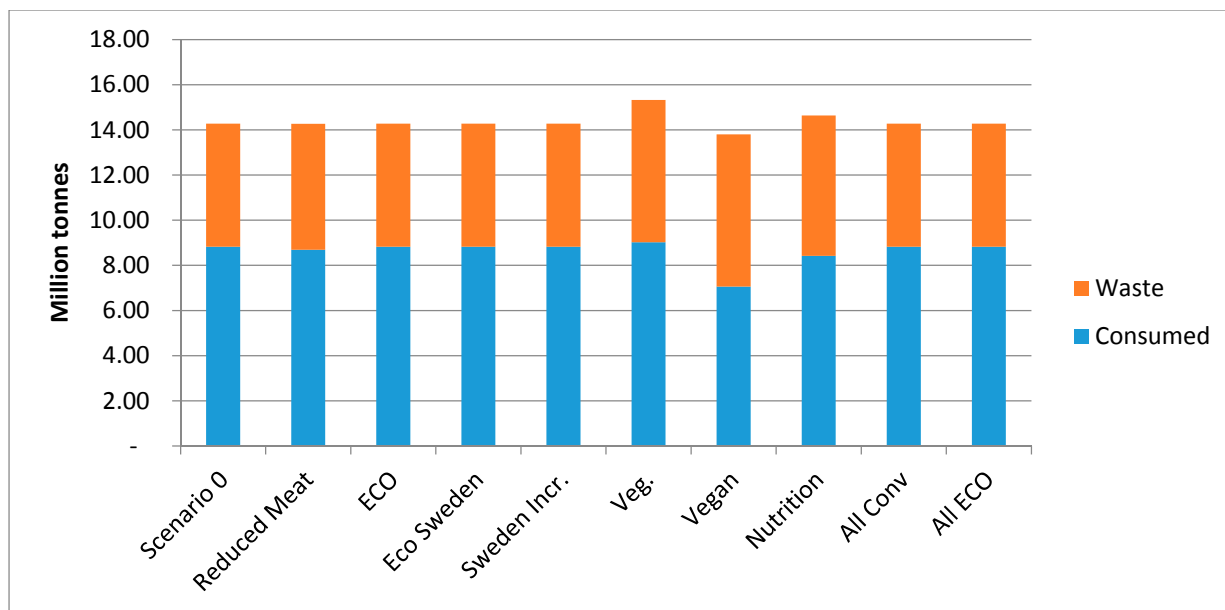


Figure S11: Food consumed and waste in 2015 for different scenarios

## References

- Agribalyse, 2015. AGRIBALYSE®, the French LCI Database for agricultural products: High quality data for producers and environmental labelling..
- Bernesson, S.; Nilsson, D.; Hansson, P.A. A limited LCA comparing large- and small-scale production of ethanol for heavy engines under Swedish conditions. *Biomass and Bioenergy* **2006**, *30*, 46-57.
- Cederberg, C., Flysjö, A., 2004. Life cycle inventory of 23 dairy farms in southwestern Sweden. Swed. Inst. Food Biotechnol. 59.
- Cederberg, C., Mattsson, B., 2000. Life cycle assessment of milk production: a comparison of conventional and organic farming. *J. Clean. Prod.* *8*, 49-60
- de Figueirêdo, et al., 2014. Life cycle assessment of Brazilian cashew. Proceedings of the 9th International Conference on Life Cycle Assessment in the Agri-Food Sector (LCA Food 2014), San Francisco, California, USA, 8-10 October, 2014 American Center for Life Cycle Assessment: Vashon, 2014; pp 395-404.
- Ekoweb, 2015. Ekologisk livsmedelsmarknad. Rapport om den ekologiska branschen sammanställd av Ekoweb.nu.
- EPD, 2013. Environmental Product Declaration (EPD) of Organic Wine Pietracalda Fiano di Avellino DOCG. Feudi San Gregorio SpA. Registration number S-P-00498.
- EPD, 2014. Environmental Product Declaration (EPD) of Carlsberg Beer. Carlsberg Italia SpA. Registration number S-P-00498.
- EPD, 2015. Environmental Product Declaration (EPD) of Recoveco Vendimia Seleccionada wine. Gil Berzal Winery. Registration number S-P-00650.
- Guerici, M.; Knudsen, M.T.; Bava, L.; Zucali, M.; Schoenbach, P.; Kristensen, T. Parameters affecting the environmental impact of a range of dairy farming systems in Denmark, Germany and Italy. *Journal of Cleaner Production* **2013**, *54*, 133-141.
- Hallström, E., Carlsson-Kanyama, A., Börjesson, P., 2015. Environmental impact of dietary change: a systematic review. *Journal of Cleaner Production* *91*, 1-11.
- Jordbruksverket, 2012. Ett klimatvänligt jordbruk 2050. Rapport 2012: 35.
- Knudsen, 2013. LCA of Organic Food. Online. Available at [http://pure.au.dk/portal/files/40217479/110905\\_Life\\_Cycle\\_Assessment\\_LCA\\_of\\_organic\\_food\\_.pdf](http://pure.au.dk/portal/files/40217479/110905_Life_Cycle_Assessment_LCA_of_organic_food_.pdf)
- LCA Food, 2003. LCA data on basic food products produced and consumed in Denmark.

- Leinonen et al., 2012 Predicting the environmental impacts of chicken systems in the United Kingdom through a life cycle assessment: egg production systems. *Poult. Sci.*, 91 (2012), 26-40.
- Orlich et al., 2014. Patterns of food consumption among vegetarians and non-vegetarians. *Br J Nutr* 112, 1644-1653.
- SCB. Statistics Sweden (SCB). The future population of Sweden 2015–2060. Sweden 2015.
- SCB, 2013. Livsmedelsförsäljningsstatistik 2012-Livsmedelsförsäljningen inom detaljhandeln.
- SCB, 2014. Livsmedelsförsäljningsstatistik 2013-Livsmedelsförsäljningen inom detaljhandeln.
- SCB, 2014b, Allt mer pengar läggs på ekologiska livsmedel Online. Available at <http://www.scb.se/sv/hitta-statistik/artiklar/okad-forsaljning-av-ekologiska-livsmedel/>
- Sonesson, U., Anteson, F., Davis, J., Sjoden, P.O., 2005. Home transport and wastage: environmentally relevant household activities in the life cycle of food. *Ambio* 34, 371-375.
- Systembolaget, 2014. Systembolagets försäljning, Ekologiskt odlade produkter, 2014.
- Williams, A.G., Audsley, E., Sandars, D.L., 2006. Determining the Environmental Burdens and Resource Use in the Production of Agricultural and Horticultural Commodities (Defra Project Report IS0205). Cranfield University and Defra, Bedford, p. 97.
- Willer, H.; Lernoud, J. The World of Organic Agriculture. Statistics and Emerging Trends.; Bonn, Germany, 2015.
- Williams, A., Audsley, E., Sandars, D., 2010. Environmental burdens of producing bread wheat, oilseed rape and potatoes in England and Wales using simulation and system modelling. *Int. J. Life Cycle Assess.* 15, 855e868.
- Åström, S.; Roth, S.; Wranne, J.; Jelse, K.; Lindblad, M. Food Consumption Choices and Climate Change. Report B2091. IVL-Swedish Environmental Research Institute: Stockholm, Sweden, 2013.