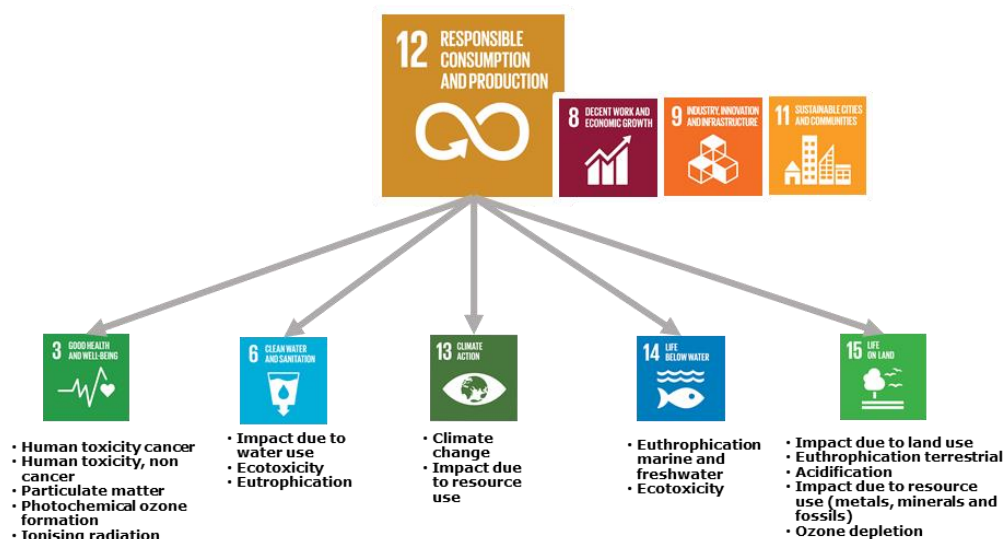
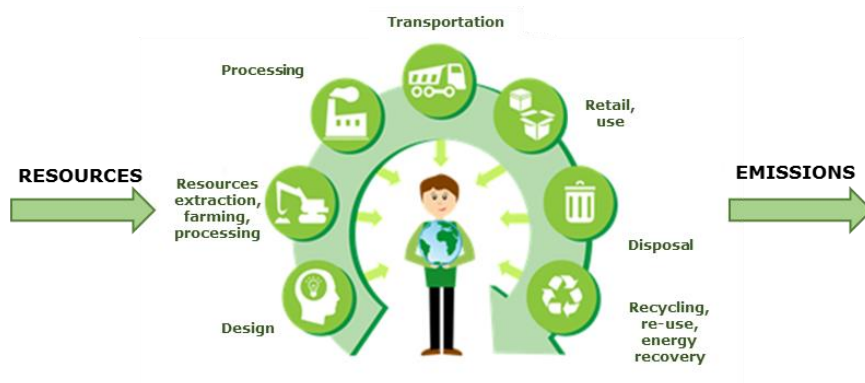


## Consumer and Consumption Footprint: assessing the environmental impacts of consumption in the EU

### Life Cycle Assessment (LCA) and Life cycle-based indicators for supporting policies:

- Assessing environmental impacts and the decoupling of impacts from economic growth
  - Monitoring trends over time
  - Unveiling trade-offs
  - Comparing alternatives
- Identifying interlinkages between Sustainable Development Goals (SDGs)



## Headlines

- Consumer Footprint and Consumption Footprint allow assessing environmental impacts of consumption, considering 16 impact indicators.
- The EU is a “net importer of environmental impacts”, in other words we have “outsourced” part of the impacts associated to our consumption.
- From 2005 to 2014, domestic environmental impacts in the EU have decreased showing an absolute decoupling. However, when including the impacts of trade, only limited decoupling is observed.
- Five areas of consumption have been assessed: food, mobility, housing, household goods, and appliances. Among them, the consumption of food emerged as one of the main drivers of environmental impacts, followed by mobility and housing.
- Between 2010 and 2015, the environmental impacts showed an average increase by more than 5%.
- When compared to planetary boundaries, the average consumption of an EU citizen is overcoming the boundaries in several impact categories, such as climate change and particulate matter.

## Policy context

As part of its commitment towards more sustainable production and consumption, the European Commission developed a Life Cycle Assessment (LCA)-based framework that allows assessing the environmental impacts related to EU consumption of goods and services. The results are presented with two newly developed indicators: the **Consumer Footprint**, aimed to assess the environmental impacts of an average EU citizen, and the **Consumption Footprint**, aimed to quantify the overall impacts of consumption in EU, at country level.

These indicators are relevant in the context of:

- achieving the Sustainable Development Goal on **Responsible consumption and production (SDG 12)** and on **Sustainable economic growth (SDG 8)**, adopted in the **2030 Agenda for Sustainable Development** (2015), and contributing to other SDGs;

- measuring to which extent EU is ensuring **living well within the limits of our Planet**, including assessing the appropriateness of the inclusion of a lead indicator and targets, as foreseen in the **7<sup>th</sup> Environment Action Programme** (2013);
- contributing to the **Better Regulation initiative** (2015), unveiling the potential role of LCA for defining baseline scenarios to be used in policy impact assessment;
- assessing the decoupling between environmental impacts and economic growth, serving the 2030 Agenda for Sustainable Development (SDG target 8.4), as well as the **Europe 2020 strategy** (2010), and its flagship initiative **A resource-efficient Europe** (2011);
- contributing to the implementation of the **Beyond GDP Roadmap** (2009);
- contributing to the transition towards **bioeconomy** (2018) and **circular economy** (2015) through the identification of the environmental hotspots, better policy options, and monitoring of progress over time.

### Better regulation

Assessing policy options against a baseline considering life cycle related implications of these options.

### Sustainable Development Goals

Assessing and monitoring SDG 12 responsible production and consumption, and its implications on other environmentally-relevant SDGs, e.g. SDG 3 (health), SDG 6 (water), SDG 13 (climate), SDG 14 (life below water), and SDG 15 (life on land). Assessing the decoupling of economic growth from environmental degradation (SDG 8).

### Circular economy

Assessing circular economy options, unveiling possible trade-offs. Assessing impacts at macro-scale when implementing such options. Monitoring environmental benefits of circular economy over time.

### Bioeconomy

Assessing bioeconomy options, unveiling possible trade-offs. Assessing impacts at macro-scale when implementing a bio-based solution substituting a fossil-based or a mineral-based one. Monitoring environmental benefits of bioeconomy over time.

### Product policies

Assessing and improving products, identifying hotspots of environmental impacts in terms of life cycle stage or main pressures. Assessing implications of product policies at macro-scale.

## Terms and methodology

**Life Cycle Assessment (LCA)** is a methodology aimed to assess burdens and benefits associated to products, sectors, and projects adopting a life-cycle perspective, from raw material extraction to end of life.

It considers 16 indicators, referring to different environmental impacts, namely climate change, ozone depletion, human toxicity cancer and non-cancer, particulate matter, ionising radiation, photochemical ozone formation, acidification, eutrophication (terrestrial, marine, and freshwater), ecotoxicity, land use, water use, use of fossil resources, and use of mineral and metal resources.

To enhance the comparability of LCA and remove potential market barriers due to the existence of different environmental communication schemes, the European Commission has proposed the Product Environmental Footprint (PEF) and the Organisation Environmental Footprint (OEF) methods (EC, 2013). The methodological approach was tested between 2013-2018 together with more than 280 volunteering companies and organisations. Results and reports of the pilot phase are currently available on the PEF and OEF website [http://ec.europa.eu/environment/eusssd/smgp/PEFCR\\_OEFSR\\_en.htm#final](http://ec.europa.eu/environment/eusssd/smgp/PEFCR_OEFSR_en.htm#final)

Compared to other methodologies, LCA has the advantage of accounting for potential burdens shifting between life cycle stages, regions, generations, and environmental impacts, allowing a comprehensive assessment, thereby unveiling trade-offs.

**Domestic Footprint** is a set of 16 LCA-based indicators (also available as a single score) aimed to quantify the environmental impacts due to resource extraction and emissions in the EU territory.

**Consumer Footprint** is a set of 16 LCA-based indicators (also available as a single score) whose purpose is to quantify the environmental impacts of an average EU citizen, based on the consumption of goods in 5 areas (food, mobility, housing, household goods, and appliances).

The **Consumption Footprint** is a set of 16 LCA-based indicators (also available as a single score) aimed to quantify the environmental impacts of apparent consumption in the EU, and at EU Member States level.

Consumption Footprint = Domestic Footprint + Import Footprint – Export Footprint.

## Key results

The project results allow answering the following questions:

### *What are the environmental impacts of consumption at EU and country level?*

The EU can be considered a **“net importer” of environmental impacts**, namely the impacts of imports are larger than impacts of exports. Adopting LCA, the impact may be calculated for the 16 impact indicators, according to the Environmental Footprint method (Recc. 2013/179/EU). By modelling the environmental impact of EU consumption (SDG 12), it is possible to assess the implication of consumption on 16 impact categories, such as climate change, eutrophication, acidification, toxicity-related, and use of resources. Those categories are linked with several sustainable development goals, namely SDG 3 – good health and well being, SDG 6 – clean water and sanitation, SDG 13 – climate action, SDG 14 – life below water, and SDG 15 – life on land.

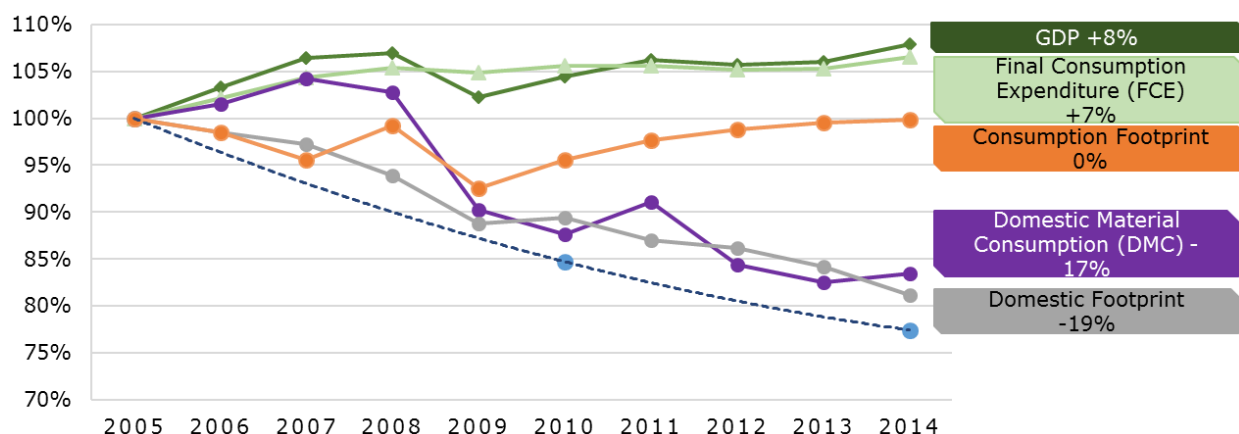
### *Is there a decoupling of environmental impacts from economic growth?*

When considering the **environmental impacts generated within EU boundaries** (Domestic Footprint) between 2005 and 2014, an **absolute decoupling** is observed in almost all impact indicators.

However, if accounting for the impacts of trade (Consumption Footprint), a **limited decoupling** is observed: **the reduction in domestic impacts is offset by the increased impacts of trade**, thus indicating no progress towards SDG target 8.4 related to sustainable economic growth.

Products with limited supply chains, i.e. including a limited number of transformation steps, are the main contributors to the impacts induced by imports, such as agricultural and food products (in particular meat products), fossil fuels, metals (in particular basic iron and steel) and other intermediate products (in particular rubber and plastic products).

Evolution of Domestic Footprint, Consumption Footprint, Gross Domestic Product (GDP), Final Consumption Expenditure (FCE), and Domestic Material Consumption (DMC) over time



### What are the main areas of consumption and products driving the impacts?

Consumption of **food** emerges as the **main driver of impacts** generated by an average EU citizen, and it is followed by **housing** (especially for space heating) and **mobility** (especially the use of private cars).

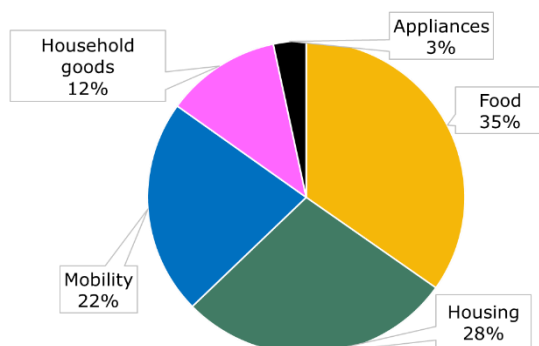
### What are the main products driving the impacts?

Within the consumption area of food, **animal-based products**, e.g. meat, dairy, and eggs, are responsible for the larger share of the impacts, due to the higher impact per unit of product. **Passenger cars** cause more than 50% of the impacts of the area of consumption mobility due to their larger use compared to other means of transport. **Dwellings in moderate climate** are responsible for more than 70% of the impacts of housing, because of the larger amount of dwellings in this climate area. For the areas of consumption of household goods and appliances, different products contribute to a similar extent to the overall impacts.

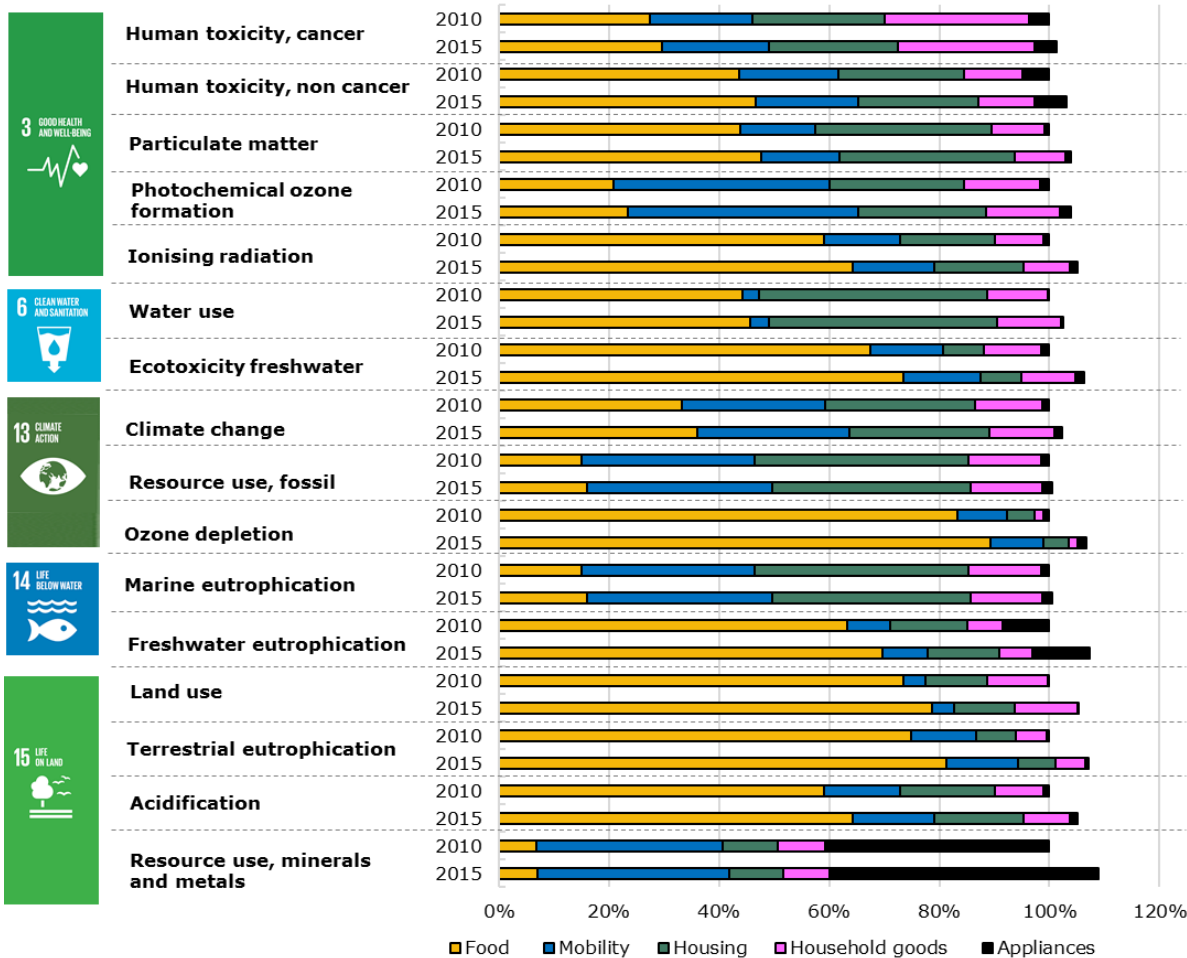
### How is the impact of consumption evolving over time?

In the timeframe 2010-2015, the amount of consumed goods increased in all the areas of consumption, with the exception of some food products and household goods. The growth of consumption, coupled with a slight rise in the population (+1%), resulted in an **overall increased environmental impacts** by more than 5%, reflected in almost all the analysed areas of consumption. However there has been a reduction of impacts in the housing sector (about -10% for all the impacts), which is mainly driven by a general reduction of energy use in the buildings especially for space heating, and to energy efficiency regulations introduced since 2010. The benefits of other policies affecting the other areas of consumption, e.g. **the progressive reduction of car emissions**, were instead **partly offset by the increased use of cars** (so called “**rebound effect**”), highlighting the **importance of putting in place policies not only targeting the efficiency of production but also aiming to enhance more responsible consumption patterns**.

Consumer Footprint: contribution of each area of consumption for an average EU citizen in 2010. Results are reported as single score



Consumer Footprint: environmental impacts of an average EU citizen in 2010 (2010=100%) and 2015, by consumption area. Results are reported for the 16 impact categories used in the Environmental Footprint method



### What are the life cycle stages driving the environmental impact of consumption?

The relevance of life cycle stages is very much dependent on the area of consumption analysed, hence on the representative products included.

**Primary production**, for example, is the **hotspot for** almost all the impacts generated by the area of consumption **food**. Indeed, food products have a short life compared to products belonging to other areas of consumption, and primary production has a considerable importance in the overall life cycle of a single product. On the contrary, **the majority of the impacts of mobility and housing are driven by the use phase**. Indeed, cars and dwellings have a longer life compared to food, and the impacts of their production should be distributed along their entire life cycles. The only exception, is observed for the impacts on mineral and metal resource use, where the extraction of raw materials is predominant for all the areas of consumption.

For **household goods and appliances**, the share of the impacts associated to various life cycle stages is more balanced.

### Is it possible to evaluate in a systemic manner solutions and eco-innovations, towards the SDGs?

The **Consumer Footprint** in a certain year could be considered a **baseline scenario against which different policy options could be tested**. Adopting LCA, trade-offs of ecoinnovation clearly emerge. The results from testing more than 50 scenarios on the different areas of consumption showed that, apart few cases, **only an integrated action combining several interventions may ensure reducing significantly the environmental impacts**.

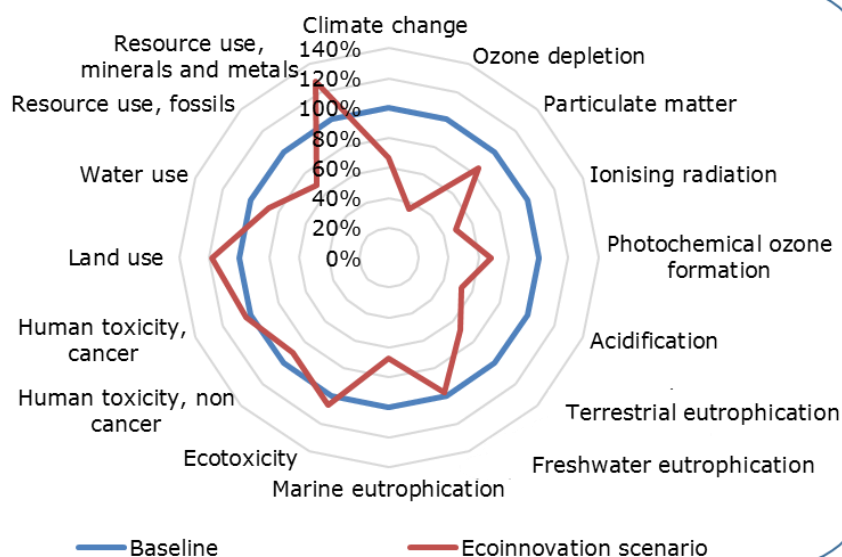




## Appliances

The Ecoinnovation scenario includes:

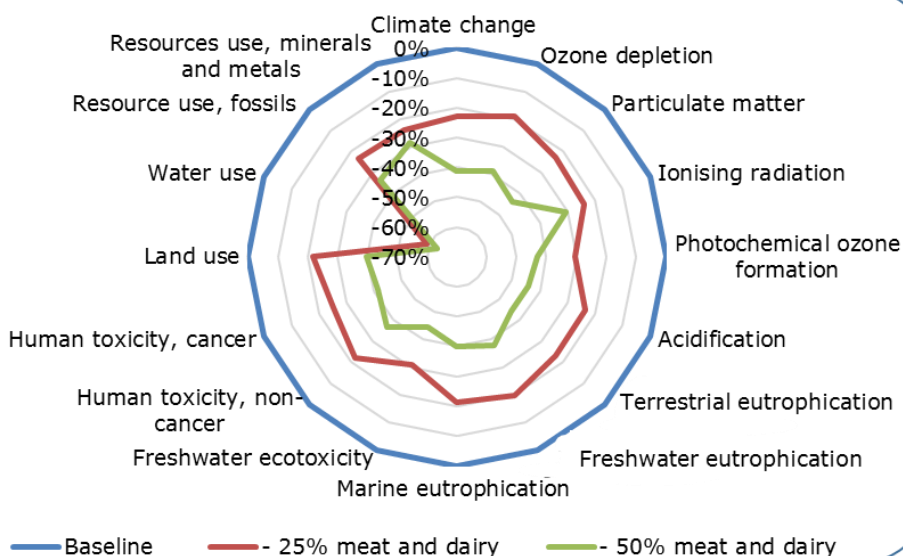
- Improved energy efficiency of appliances
- Use of less harmful refrigerants for air conditioning and reduction of their leakages
- Increase in the number of appliances (as in 2030)
- Improvements in the end of life (increased reuse, collection rate, and material recovery rate)



## Food

- 25% meat and dairy scenario: 25% of the consumption of meat, and dairy is replaced by cereal-based products

- 50% meat and dairy scenario: 50% of the consumption of meat, and dairy is replaced by cereal-based products



## To which extent the impacts of specific lifestyles may diverge from the ones of an average EU citizen?

The Consumer Footprint is referred to an average EU citizen. However, individual lifestyles may diverge importantly from the average, resulting in different types of impacts and of different intensity. The Consumer Footprint approach can be applied to consumption patterns and lifestyles different from the average one, to highlight environmental hotspots and possible areas for improvement.

The analysis of certain consumers' profiles highlighted that the **environmental benefits obtained through the adoption of virtuous behaviours in specific areas of consumption may be totally or partly offset by the impacts generated in areas of consumption**. For example, the benefits of climate change associated with a vegetarian diet may be offset by a use of private cars above the average. Hence, when assessing the impacts of consumption patterns it is key to adopt a comprehensive perspective, including all the areas of consumption.

## Which is the impact of Consumer Footprint on biodiversity?

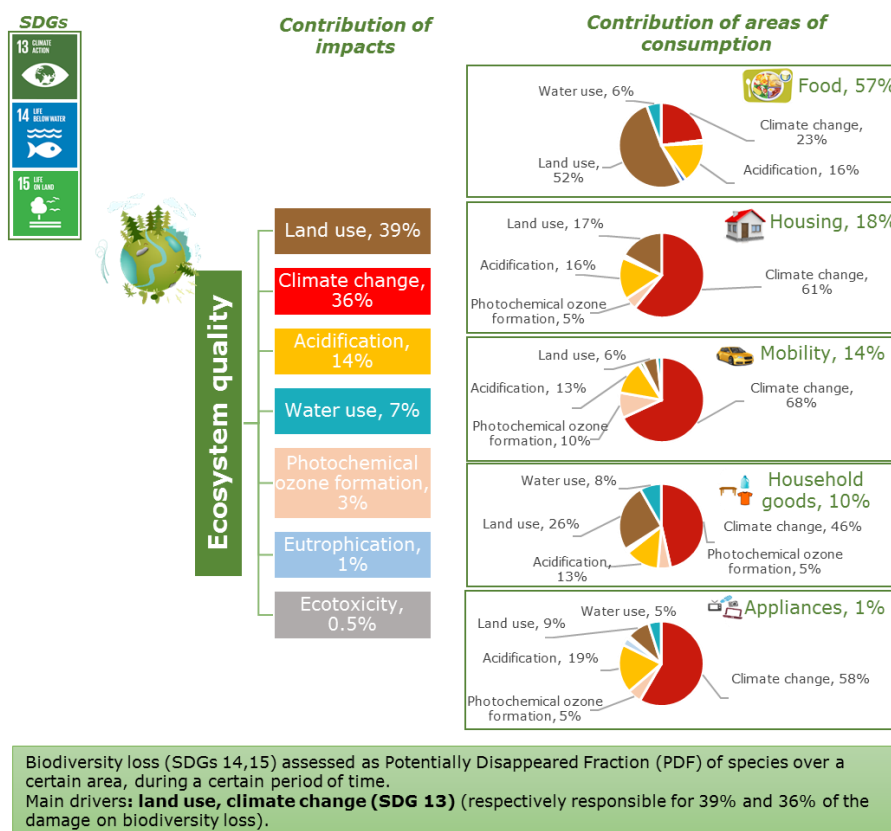
The 16 analysed LCA-based impact indicators assess potential impacts due to a number of environmental pressures. Estimating the impacts at the endpoint means modelling more broadly the effects of the environmental pressures, assessing the damage effects that may be generated on areas of protection, such as biodiversity loss and human health (here only the results for biodiversity loss are reported, see Sala et al., 2019 for further details).

By focusing the evaluation of the damage provoked by environmental pressures on a few areas of protection, the endpoint modelling may facilitate the interpretation of the Consumer Footprint results in light of the SDGs objectives, as well as reveal potential connections between them.

Indeed, the quality of aquatic and terrestrial ecosystems and the conservation of biodiversity are within the focus of SDGs 14 “Life below water” and 15 “Life on land“, whereas human health is at the core of SDG 3 “Good health and well-being”.

**Land use and climate change are responsible for the largest share of the damage on biodiversity loss caused by consumption in the EU.** These results are coherent with the findings already reported in the Millennium Ecosystem Assessment (MEA), which identifies climate change and land use among the main drivers of biodiversity loss. Food is the area of consumption that mostly affects biodiversity loss, especially due to the environmental impacts caused by primary production

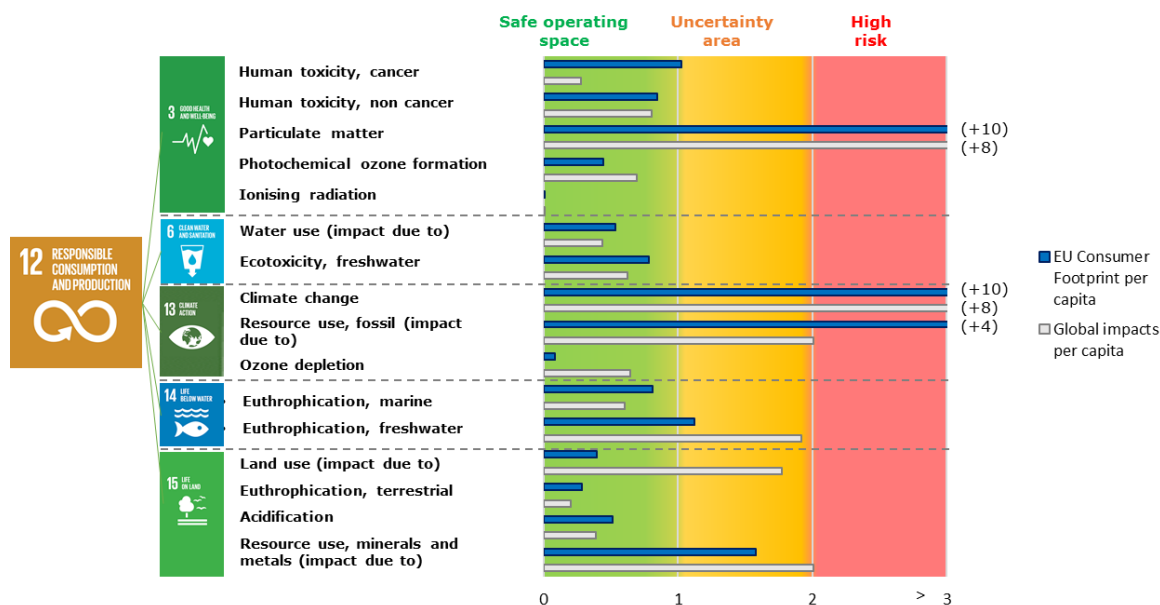
Damage on biodiversity loss generated by EU consumption in 2010



## Is EU consumption environmentally sustainable and within planetary boundaries?

To assess the sustainability of an average EU citizen, the Consumer Footprint has been compared with the planetary boundaries, namely the quantitative estimation of the Earth carrying capacity, defining the so-called “safe operating space for humanity”.

The environmental impacts of the consumption of an average EU citizen (**Consumer Footprint**) are **outside the safe operating space for humanity for several impact indicators**. Despite the differences in the robustness of the various impact categories, results conclude that for most categories the impacts are close to the threshold, when not over it.



## Conclusions and next steps

The LCA has revealed that the EU is a net importer of environmental impacts and that there is a limited decoupling of economic growth from the environmental impacts. Food, followed by housing and mobility are responsible for most impacts. The environmental impacts of the EU average consumption are outside the safe operating space for humanity for several impact indicators.

The European Commission **is working on further developing LCA-based methodologies for supporting policy making** in relation to the assessment of the environmental impacts of consumption.

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### Disclaimer

The views expressed in this Policy Brief are purely those of the authors and may not in any circumstances be regarded as stating an official position of the European Commission.

The study underpinning the calculation of the Consumer and Consumption Footprints started in 2016 and run in parallel to the Environmental Footprint (EF) pilot phase. Hence, the modelling approach adopted and the life cycle inventory data used are not fully compliant with EF rules and are only intended to illustrate the use of Life Cycle Assessment (LCA) to define the baseline of impacts due to consumption in the EU and to test ecoinnovation and policy options against that baseline.

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