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Sustainability labelling in the EU food sector: current status and coverage of sustainability aspects

Knowledge to support policymaking

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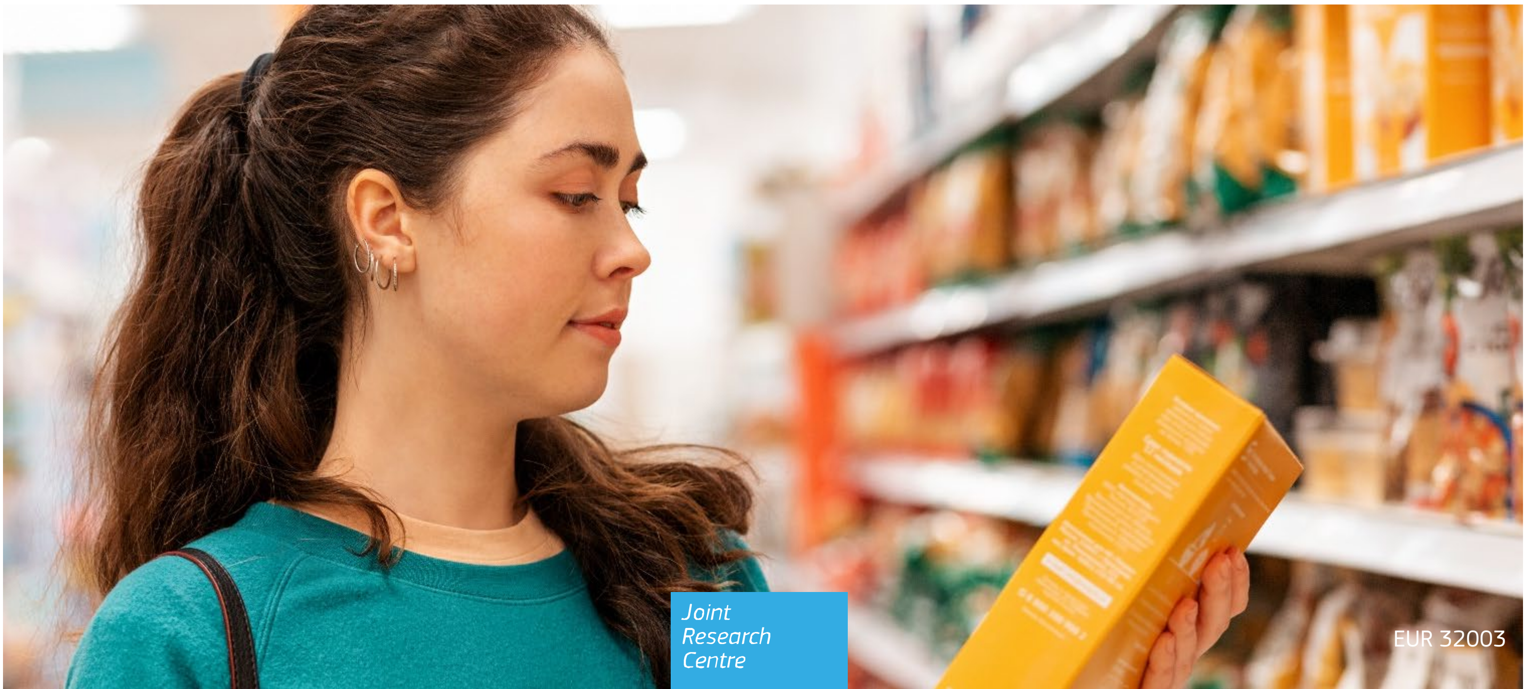

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Contents

Abstract

The creation of favourable food environments that make sustainable food choices easier to consumers is critical to the EU transition to a more sustainable food system. An important barrier to sustainable food choices relates to the absence of clear and trustful information that could help consumers make better informed decisions. Sustainability labelling can be an important policy instrument to reduce barriers towards sustainable food consumption by increasing consumers' information, understanding and awareness regarding the sustainability value of food products. The present report aims to provide a better understanding of the current status of sustainability labelling in food products in the EU and contribute with sound evidence to the development of policy in the area of sustainability and food information to consumers. It provides a mapping, characterisation and comprehensive overview of existing sustainability-related labels in the EU market including an analysis of the environmental and social aspects covered by a selection of sustainability labelling initiatives and its reliability. More than 200 sustainability-related labels have been identified indicating an increased interest by food business operators in sustainability labelling initiatives. The analysis shows an increased uptake of sustainability labels in the last years, although very heterogeneous among Member States and products groups, and with a limited number of labels dominating the market in terms of new labelled products. Actors in the food supply chain unevenly participate in the implementation of sustainability labels. Current labels are not addressing homogeneously environmental and social impacts, distributing almost equally between very good/good and fair/poor reliability levels. Furthermore, available literature on the effectiveness of environmental sustainability labelling in influencing environmental impacts is limited, with sporadic examples of positive effects on specific impacts, like deforestation.

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1 Introduction

The creation of favourable food environments that make sustainable food choices easier to consumers is critical to promote sustainable diets and achieve sustainable food systems. Addressing the quality of food environments is an important policy priority in the EU, as highlighted in the Farm to Fork Strategy which aims to support a transition towards sustainable food systems, and central to the EU Green Deal and a wider Commission' agenda to achieve the United Nations' Sustainable Development Goals (SDGs) (F2F Strategy; European Commission, 2020).

However, transforming food environments requires the modification of many physical, economic and socio-cultural factors that influence the complex contexts in which consumers make decisions. Recently, the Group of Chief Scientific Advisors has highlighted the importance of more systemic actions to address the whole food environment (European Commission, Directorate-General for Research and Innovation, Group of Chief Scientific Advisors, 2023). In their report, they recommend various areas for EU policy action to reduce barriers that prevent consumers of making more sustainable food choices.

An important barrier to sustainable food choices relates to the absence of clear and trustful information that could help consumers assess the sustainability impact of food products. Sustainability labelling[1] can be an important policy instrument to increase consumers' information, understanding and awareness regarding the sustainability value of food products (Cook et al., 2023). It can support the creation of a more transparent food environment, by facilitating informed food choices (European Commission Eurobarometer, 2020), as well as strengthening the resilience of the EU food system by encouraging the transition to sustainability. By promoting a more transparent food environment, sustainability labelling can also incentivize food business operators to provide more sustainable foods in the market (Stein & de Lima, 2022). Indeed, more reliable, consistent and coherent information exposed to consumers regarding the impact of food choices in the food system could trigger an increase in demand, which would lead in turn to increased production of sustainable food products. Furthermore, this change in production and consumption will deliver multiple benefits as in many cases the most environmentally sustainable options are also among the healthier and more nutritious (Poore and Nemecek, 2018).

However, the wide range of labels affixed on products, together with the widespread malpractice of greenwashing, can result in mistrust and confusion (UNEP, 2017). The upcoming "Green claims" initiative aims to address this issue, by means of a list of requirements for methodologies used to assess the environmental impacts, which aims to allow reliable, comparable and verifiable evaluations, avoiding greenwashing statements.

Within this context, the present report aims to provide a better understanding of the current status of sustainability labelling in food products in the EU. It dives deep into the identification and characterisation of existing sustainability-related food labels present in the EU market, providing analysis of current trends of EU labelled food products, analysing the life cycle stages and food supply chain operators involved in sustainability labelling of food products, assessing the environmental and social aspects covered by current sustainability labels in the EU and evaluating their reliability.

Our analysis also aims at contributing to sound evidence informed policymaking. As stated by the better regulation guidelines and associated toolbox (the main Commission regulatory framework; European Commission, 2021a), political decisions should indeed be informed by the best available evidence throughout the policy cycle. In this context, our findings are relevant in various respects. The analysis was completed in summer 2023 and includes an evaluation of sustainability labels launched in the market during the year 2021.

First, as the actual objectives of the analysis are related to a key policy question. Climate change and environmental degradation are an existential threat to Europe and the world; the Farm to Fork Strategy is at the heart of the European Green Deal[2] that strives to transform the EU into a modern,

[1] The meaning of sustainability labelling in the context of this report is reported in the section "Glossary and definitions" at the end of this report

[2] https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/european-green-deal_en.

resource-efficient and competitive economy. Second, the complexity of the policy issue at stake implies a number of methodological challenges. Integrated, systemic perspectives are needed that account for all sustainability dimensions (economic, environmental, social including health) across all stages in the food system, taking into account all relevant actors involved as well as different policy sectors. An appropriate methodological mix has to be designed, backed up by desk research and expert advice. Third, our analysis builds a comprehensive picture which is available to help defining the policy issues at stake, which remains one of the most key and challenging elements of evidence informed policymaking. Last but not least, the present exercise aims at contributing to the debate on the improvement of regulatory quality[3] by designing a pragmatic but sound methodology to address key policy questions, as well as by bridging the gap between different scientific communities which are involved in promoting evidence informed policymaking. This is of crucial importance for learning and further improvement of regulation quality.

[3] For a review see Listorti et al., 2019.

2 Goal and scope of the report

The present report aims to provide a better understanding of the current status of sustainability labelling in food products in the EU. The report aims to characterise and provide a comprehensive overview on existing sustainability-related labels in the market including an analysis of the environmental and social aspects covered by the identified sustainability labelling initiatives.

This study aims at answering the following research questions:

- What is the current status of sustainability labelling for food products in the EU?
- What are the social aspects covered by the current sustainability labels in the EU?
- What are the environmental impacts covered by current sustainability labels in the EU?
- Which life cycle stages and food supply chain operators are currently involved in environmental sustainability labelling of food products?
- What are the market trends in environmental sustainability labelling for food products in the EU?
- How reliable are sustainability labels of food products currently present on the market?
- What are the expected effects of sustainability labels on the environmental impacts of the food system according to scientific knowledge?

This report is organised as follows. Firstly, the methodologies used for addressing the abovementioned questions are presented (Chapter 3). Then the results of such exercises are shown, aiming at: providing an overview of the current existing food sustainability labels (Chapter 4); showing the social and environmental impacts encompassed by the existing food sustainability labels (Chapter 5 and 6, respectively); defining the life cycle stages and food supply operators more frequently addressed by environmental sustainability labelling (Chapter 7); defining the current trends of environmental sustainability labels in the EU food market (Chapter 8); assessing the reliability of the sustainability labels (Chapter 9), and, finally, analysing scientific evidence of the effectiveness of such labels in mitigating environmental impacts (Chapter 10). The limitations of the current exercises are reported in Chapter 11. Concluding remarks are drawn in Chapter 12.

3 Methodology

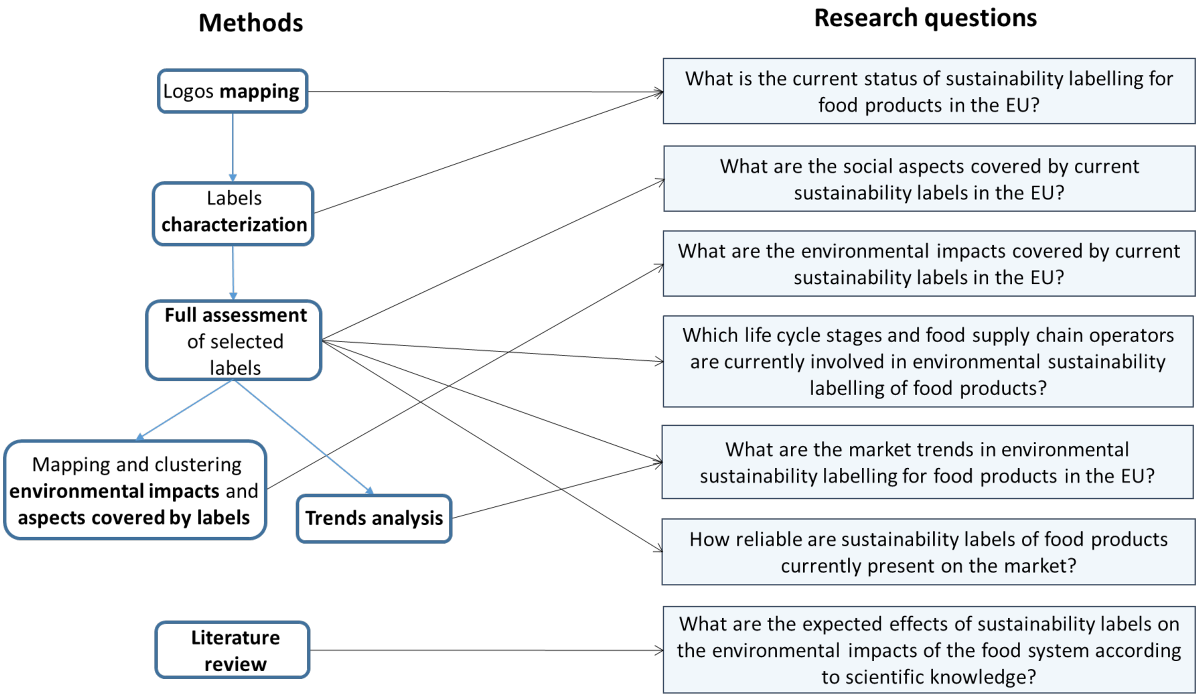
As shown in Figure 1, different methods have been adopted to address the research questions explored in the present report in chapters 4 to 10.

In particular, the analysis included the following:

- mapping of existing sustainability-related labels (logos) on food products (section 3.1), distinguishing three separated sets defined as those covering:
  - both environmental and social sustainability (animal welfare and nutrition being part of social sustainability);
  - environmental sustainability only;
  - social sustainability only, excluding those focused solely on nutrition.
- characterization of the labels as basis to compare them and their characteristics (section 3.2);
- assessment of a subset of sustainability-related labels aiming at evaluating the coverage of sustainability aspects, the methodological robustness, and the relation with the Environmental Footprint methods[4] (section 3.3) ;
- evaluation of sustainability labelling uptake trends in the European market (section 3.4);
- review of the literature on the effects on environmental impacts of sustainability-related labels and certifications (section 3.5).

A description of the different methods is provided on the following sections.

Figure 1. Workflow and linkages among methods used and research questions.



Source: JRC own elaboration.

3.1 Mapping of sustainability-related logos in food products

The Mintel's Global New Products Database (GNPD) was selected as the primary source of information available to search for existing sustainability-related logos in packaged foods in the EU market. Mintel is a global market research company and the GNPD monitors worldwide product innovation in consumer-packaged goods markets, screening hundreds of thousands of new foods and drinks

[4] Environmental Footprint methods have been indicated as basis for other efforts in providing environmental information of products to consumers, e.g. Green Claims (Circular Economy) or Chemical Strategy for Sustainability.

products by country, category, packaging, price. The database provides comprehensive product details including nutrition facts and product claims that relate to specific properties of the product and product packaging information. In addition to the many product claims available such as "Suitable for vegetarians", "Organic", "GMO free" or "Sugar free", the GNPD categorises a product claim as "Ethical & environmental" when any information (e.g. text, claims, logos) in the packaged food products related to environmental and social aspects. The "Ethical & environmental" category includes a list of specific claims (e.g. carbon neutral, ethical-environmentally friendly product, ethical –sustainable habitat/resources or ethical animal) which were used as an assumption for the analysis of sustainability claims in new food product launches and to filter the number of food products launched that were screened for the existence of any sustainability-related logos (see Annex 1 for further details).

The GNPD reports on the existence of logos (visual representations) in the packaging of each food product item which could possibly be related to sustainability claims. Thus, the mapping of all the logos displayed in the share of packaged foods launched with a sustainability claim attributed by Mintel was conducted to identify possible visual representations of food labelling schemes related to sustainability aspects covered in the production of the food products. Considering it was not possible to associate directly the presence of the logos with the sustainability claims attributes, the mapping of all existing logos was followed by an online verification on logo owners' websites for their sustainability relevance (environmental and/or social aspects). Logos that were confirmed to inform on sustainability aspects were then referred as sustainability-related labels and were considered for characterisation and assessment. More information on the mapping of the logos follows below.

To search for logos within the GNPD, the following criteria were used in the dataset to filter the number of food products: 1) all food and drinks, 2) products published in the GNPD between January and December 2021, 3) geographical scope limited to the EU market (all EU countries are available in Mintel GNPD except Cyprus, Malta and Luxembourg), 4) food products with Mintel product claims classification related to environmental and social positive impacts. Among the 36,335 eligible products meeting the selection criteria in the GNPD, logo names were searched in the "product description" field at product level. Only food products with information on existing "logos" in the food packaging were searched in the database. As the strict time schedule did not allow to search each individual product for new logos, a subtractive approach was applied, by iteratively focusing the search on products with no identified logos, as follows (see as well Figure 2):

Step 1: Searching for known logos

On a first step, a search for already known logos related to environmental and/or social sustainability was conducted. These included logos like the "EU organic", "Fairtrade", "Rainforest Alliance" or "FSC". For each logo, a new variable with the corresponding logo name was created in the database and the corresponding text string was searched on the entire products list. For all products that included the searched text string these were flagged with a "1" on the corresponding logo name variable column. This iterative approach allowed the calculation of number of products by logo and, consequently, the reduction of the number of products with no logo.

Step 2: Searching for unknown logos

Following step 1, the search for unknown logos focused on examining the "products description" information individually on those products that had still no identified logo flagged. For every new logo identified, a similar approach to the first step included the creation of a new logo name variable and the identification of all products with the corresponding text string. This iterative approach resulted in the reduction of the list of logos without no logos identified. The extraction of existing logos in the Mintel eligible list of products database was completed when there was no food product with at least one logo identified.

Figure 2. Extraction from a product description in the GNPD database. On the example below, four logos were identified.

Product Description	Claim Category	Natural	Free from	Ethical & environmental
HAS BEEN REPACKAGED WITH AN UPDATED DESIGN FEATURING A NEW CAP MADE FROM CANE SUGAR, A 100% RENEWABLE RESOURCE, WHICH IS SAID TO CONTRIBUTE TO A REDUCTION IN CO2. THIS ORGANIC, 100% PLANT-BASED AND UHT PRODUCT IS MADE WITH INGREDIENTS RESPECTFUL OF THE ENVIRONMENT, AND IS LOW IN SATURATED FATTY ACIDS. IT FEATURES A DELICIOUS ALMOND AND HAZELNUT FLAVOUR, AND CAN BE CONSUMED HOT OR COLD. IT RETAILS IN A 1L RECYCLABLE PACK FEATURING THE B CORPORATION CERTIFIED, AB CERTIFIED, EU GREEN LEAF AND FSC MIX LOGOS, AND A RECIPE SUGGESTION.	Natural, Ethical & environmental, Minus, Suitable for	Organic	0	Ethical - Environmentally Friendly Package, Ethical - Environmentally Friendly Product, Ethical - Human, Ethical - Recycling, Ethical - Sustainable (Habitat/Resources)

Source: JRC own elaboration.

Step 3: Other data sources

To complement the search of sustainability-related logos, other data sources were used including the online logos inventory Ecolabel index (https://www.ecolabelindex.com/), published papers and logos inventories from previously conducted studies[5].

Step 4: Confirmation of sustainability-related food logos

The final list of logos included many logos that were unknown and possibly unrelated to the scope of the search. In addition, the GNPD does not provide information regarding how food logos featured in food products actually relate to its product claim. Therefore, it was necessary to verify in trusted sources how each logo was related to sustainability. The mapped logos were verified for sustainability relevance (environmental and/or social aspects) by looking at available information on the logo owners' websites. The criteria for sustainability coverage were discussed and agreed between the researchers as follows:

— Environmental sustainability: logos standing for any environmental positive impact including sustainable farming practices, environmental and biodiversity protection, lower climate change impacts and logos helping consumers how to improve recycling;

— Social sustainability: logos standing for any social positive impact including fair trade, good working conditions, gender equality, fair income, social responsibility, better nutrition, animal welfare but also related to social related charity actions

Regarding the scope, sustainability logos issued by charity sustainability-related logos were included. However, organic, GMO-free and vegetarian related logos, logos not related to sustainability components (including taste, suitable for, geographical origin, quality, awards) and duplicates were excluded from the scope of the further characterisation of the logos. The decision reflects the perspectives of the authors on the need for integrating evidence in the context of potential future EU policy developments. For instance, organic and geographical origin was not included in the scope of the present analysis as specific EU legislation is already existing in these areas.

Those logos that were confirmed to inform on sustainability aspects related to how food products were produced are then henceforth referred to as 'sustainability-related (or sustainability) food labels (see the section "Glossary and definitions" for further details), which include signalling and graded labels. A search for additional information including label typology, implementation status, geographical and product scope, type of ownership and compliance (i.e. verification and auditing) was carried in the websites for all confirmed sustainability-related labels.

[5] e.g. https://www.qualenergia.it/wp-content/uploads/2023/01/Envclaims_inventory_2020_final_publi.pdf

3.2 General characterisation of sustainability-related labels

The general characterisation of sustainability-related labels consisted of data extraction from each of the logo owners' websites regarding an agreed list of aspects developed and proposed as part of an assessment framework for labelling schemes (Table 1, Leite et al. 2023) (logo image, web page, the number of products launched in the Mintel GNPD with the label scheme (when applicable), label typology, sustainability dimensions coverage, implementation status and date, geographical scope (regional, national, international), label scope/focus, ownership and verification/assessment.

Table 1. Criteria used for the general characterization of sustainability-related labels (logos). Source: Leite et al. (2023)

Criteria for the evaluation of the sustainability-related food labels	**Description of criterion**	**Possible answers**
Name	name of the logo	
Logo visualization	image	
Website	website link	
Number of products launched with the logo	Number of products appearing in Mintel's Global New Products Database (GNPD) within the period January-December 2021 in available EU countries	number
Label typology	Indicates the type of the label	Brand, Brand (charity), Brand, Claim, Graded/Scoring, Graded/Scoring (recycling), Signalling/Positive endorsement, Signalling/Positive endorsement (charity), Signalling/Positive endorsement (recycling)
Coverage of sustainability dimensions	Indicates which sustainability dimension(s) is(are) covered by the label	Environmental, Social, Social (including animal welfare/animal welfare only), Social (nutrition/nutrition only)
Implementation status	Defines if the label is already used in the market or under development	(Experimental/Pilot/Implemented)
Implementation year	Defines the implementation year, or the year of the pilot phase	Implementation year if available
Geographical scope	Defines the scale of the market where the label is used	Defines the scale of the market where the label is used (regional/national/European/international)
Geographical scope (specification)	Geographical scope (specification)	Defines the scale of the market where the label is used, specification if available (e.g. countries)
Label scope (focus)	Defines the object of the label	Company, Process/Product, Process/Product (ingredient only), Process/Product/Product (ingredient), Process/Product (including packaging), Process/Product (packaging only), Product (packaging only)
Products/product groups addressed by the labelling	Defines the coverage of the label in terms of products/product group	Limited to certain foods (specify)/All packaged foods/All foods)
Product coverage specification	Specification of the products covered by the label, if available	Food categories/Products
Ownership	Defines if the ownership of the label is a public body, a private body, a public-private partnership	Public, Private (brand owned), Private (multiple stakeholders), Private (no profit), Private (other)) or not applicable

Verification and auditing	Defines if the label entail a verification process. More specifically, if the auditing party is the labelling organization (first), a linked entity (second) or an independent entity (third party)	Self-assessment only, second party assessment, third party assessment (no certification), third party assessment (certification), third party assessment (certification under accreditation), not specified, not applicable)

Source: JRC own elaboration

3.3 Assessment of sustainability labels

The evaluation of sustainable food products labels followed a two-step approach: first, an ad-hoc assessment framework was defined; second, the mapped and characterized labels were short-listed, according to specific objectives and agreed criteria, to be then assessed against the criteria set within the framework.

3.3.1 Labels assessment framework

The objectives of the framework include:

— to evaluate the current coverage of sustainability aspects on existing labels;

— to assess the quality of available labels in the market focusing on specific criteria, reflecting the principles of trustworthiness, robustness and completeness;

— to identify potential aspects related to 'greenwashing' in the labels;

— to evaluate the relation to the Product Environmental Footprint (PEF)[6] whenever labels claim of PEF-compliance or refer to PEF.

The full assessment framework was built using a hierarchical approach (as shown in Figure 3) upon existing international recognised guidelines (FAO, 2003; Perrin, 2021; UNEP, 2017; World Business Council for Sustainable Development, 2021), existing social frameworks (Arnold et al., 2019; Platform of Sustainable Finance, 2022) milestone literature (Asioli et al., 2020; Engels et al., 2010; Stein & de Lima, 2022) and the environmental and social life cycle assessment methods (European Commission, 2021b and UNEP, 2020, respectively), particularly in relation to coverage of sustainability aspects. This was complemented by additional criteria resulting from the testing of the full assessment framework on existing labels.

[6] European Commission 2021, Commission Recommendation of 16.12.2021 on the use of the Environmental Footprint methods to measure and communicate the life cycle environmental performance of products and organisations, https://environment.ec.europa.eu/publications/recommendation-use-environmental-footprint-methods_en (accessed on the 11th July 2023).

Figure 3. Hierarchical approach of references used to build the full assessment framework for the sustainable labelling assessment of food products.

Source: JRC own elaboration. Note: Examples of milestone documents underpinning the full assessment framework are the United Nation (UN) guidelines for providing product sustainability information (UNEP, 2017), the International Guide to Fair Trade labels (Arnold et al., 2019) and the Social taxonomy (Platform of Sustainable Finance, 2022).

The framework includes three main parts, each dedicated to assessing specific aspects:

— general aspects: identified by 43 criteria, covering the label's scope, its governance, transparency, acceptance and clarity, reliability, the presence of supply chain mechanisms, the monitoring systems applied to the labels' schemes and information on the sustainability assessment;

— environmental aspects: assessed through 67 criteria, intending to provide information on the environmental dimension of the label, such as describing the label's goal and scope, the list of environmental pressures addressed by the labels and a detailed section analysing the methodology underpinning the environmental assessment;

— social aspects: assessed by 30 criteria, analysing the social goal and scope of labels and describing human wellbeing (criteria related to fair trade, discrimination, decent work and local community) and animal welfare aspects.

In the current report only a subset of the criteria included in the full assessment framework have been deeply analysed. These are related to the environmental and social aspects encompassed by the labels, the life cycle stages covered by the labels and the reliability of the labels. The latter criterion was compounded through a scoring range and the performance of the label according to different criteria assessing the trustworthiness, robustness and completeness of the label, following the principles and guiding questions of the reliability criteria of claims proposed within the UNEP guidelines (UNEP 2017).

The overall framework structure is available in Sanyé Mengual et al. (2023).

3.3.1.1 *Evaluation of the labels reliability*

As mentioned in the previous section, the reliability of labels was also evaluated. Reliability is considered one of the fundamental principles that must be accomplished when providing product sustainability information to consumers (UNEP 2017). As suggested by the United Nation Environmental Programme' guidelines on sustainability information provision (UNEP 2017), a claim or a label should be built on reliable basis, meaning that it should be accurate, robust, based on generally accepted scientific methodology and assure trustworthiness of information and data sources. Basing on these principles, we built up ad-hoc criteria useful to evaluate the degree of reliability of a label (Table 2). The principles of robustness and completeness were rated considering either the method underpinning the environmental quantitative assessments or considering if the label is based on recognized norms, certification, and standard in case of qualitative environmental evaluation and for social aspects.

The principle of trustworthiness was rated evaluating the monitoring systems adopted by the label's scheme, the transparency concerning the documentation and the limits and uncertainties of the label's scheme, and the acceptance intended as the range of stakeholders engaged in the development and communication of the label's scheme.

We associated a score ranging from 0 (not comply) to 3 (fully comply) to each of the possible answers obtained from the analysis of the labels. Labels obtaining an overall score higher than 12 points were associated to a very good level of reliability, overall scores ranging from 11 to 8 were associated to a good level of reliability, while overall scores ranging from 7 to 4 identified fair reliable labels; finally labels totalizing an overall score lower than 4 were assessed to be poorly reliable.

Table 2. Assessed criteria, potential answer and score, by principle and aspect, for evaluating the label reliability.

Principle	**Aspect**	**Criteria**	**Potential answer**	**Score**
Trustworthiness	Monitoring	Compliance (verification and auditing)	Self-assessment only	0
			second party assessment	0.5
			third party (no certification)	1
			third party (certification)	1.5
			third party (certification under accreditation)	2
			not specified/not applicable	0
		Surprise-audit	yes	1
			no	0
			not specified	0
	Transparency	Transparency: Access to documentation on methodology underpinning label	yes	2
			no	0
			incomplete	1
		Transparency: Limits of claim/uncertainties clearly stated	yes	1
			no	0
			not specified	0
	Acceptance	Acceptance: Collaboration (broad range of stakeholders included in claim development and communication)	0	0
			1	1
			2	2
			3	3
			not specified	0
Robustness and completeness	For environmental pressures			
	quantitative evaluations	Method underpinning the environmental assessment	LCA-based	2
			PEF-based	3
			LCA-based + other	2
			PEF-based + others	3
			non-LCA based but based on standards or regulation complaints	2
			non-LCA based and not based on standards or regulation compliant	1
			not specified	0
	qualitative evaluations or management based labels	Based on norms/certification/standard or other labels are using them	yes	3
			no	0
			not specified	0
	For social aspects			
	Based on norms/certification/standard		yes	3
			no	0
			not specified	0

Source: JRC own elaboration

3.3.2 Criteria considered for the selection of labels to undergo the full assessment

The mapped and characterized labels have been selected to undergo the full assessment considering the following general criteria:

- Typology: labels referring to positive endorsement and scoring labels were selected. Brand-owned labels or claims were excluded, as well as labels referring exclusively to charity or packaging aspects;
- Implementation status: only labels which are implemented, proposed or at a pilot phase were retained for the analysis. Labels under development were excluded;
- Coverage of sustainability dimensions: labels exclusively encompassing the environmental dimension, labels exclusively encompassing the social dimension and labels including both dimensions (i.e. environmental and social) have been selected. Note that among labels focusing on social aspects only, some were exclusively related to animal welfare. These, although not eligible to undergo to the full assessment, have been separately assessed against a specific list of criteria set to analyse the coverage of the supply chain (i.e. process along the supply chain covered by the labels, such as breeding, transportation, slaughtering, etc.) and specific aspects related to animal welfare (e.g. housing, feeding, health care). Results of these specific labels typology are reported in section 5.1.
- Scope: labels focusing on products and/or processes and company have been selected to undergo to the full assessment. Labels related exclusively to company aspects, charity aspects, and labels referring exclusively to the product's packaging composition and product's packaging dismantling options (e.g. possibility to recycle or to compost) were excluded from the analysis.

This selection brought to a short-list of 73 labels, which were analysed against the criteria set within the assessment framework, investigating the label owner's webpage and the label's on-line publicly consultable documents (e.g. label's standard description, label's policy and management, certification conditions, annual reports). The 73 short-listed labels are reported in Annex 2 and their detailed assessment is consultable in Sanyé Mengual et al. 2023.

3.3.3 Assessment of the social aspects of the main labels present in the EU market

The full assessment exercises provided results concerning social aspects related to fair trade, discrimination, decent work and local community. A qualitative assessment of the coverage of social aspects have been performed based on the information related to a specific subset of labels, which includes the labels dealing with the social sustainability dimension and presenting at least one product launched in the market in 2021, as reported by GNPD, resulting in a list of 43 labels (visible in Annex 2 and Sanyé Mengual et al. 2023).

3.3.4 Assessment of the environmental impacts of the main labels present in the EU market

The results provided by the labels' full assessment exercises have been used to make assumptions on the environmental impacts considered by labels, as described below.

Those labels covering environmental aspects (thus the ones characterised as "environmental" and "environmental and social" within the sustainability coverage dimension) and presenting at least one product launched in the market in the consultation year (i.e. 2021) were considered for to answer this specific research question, amounting to 57 labels (visible in Annex 2 and in Sanyé Mengual et al. 2023).

The task of defining which are the environmental impacts covered by labels is complex, since labels covers a wide range of actions and aspects of the whole food system, from the manufacturing of input products until the final consumption of meals at home. Furthermore, requirements for label compliance are varied, but in some cases, a quantitative environmental impact assessment is explicitly required by the labelling scheme (such as conducting a carbon footprint or a life cycle assessment - LCA), which facilitates the identification of the environmental impacts covered by the label. Example of LCA-based environmental impact categories are: climate change, ozone depletion, eutrophication, ecotoxicity, land use, etc.

In the majority of the cases, however, labelling schemes do not require a quantitative assessment of specific environmental impacts, rather they are management- or practice-based labels, implying that companies are required to observe principles, obligations and practical actions related to certain area of intervention (e.g. fertilisation, pest management, water management, habitat/land management and/or conservation, atmospheric pollution and air quality) to be able to obtain a certain label.

Such actions and practices requested by the labelling schemes obviously affect specific environmental impacts.

For this reason, firstly a comprehensive list of impacts across the various environmental dimensions has been defined, which represents the main environmental impacts caused by the food sector. Secondly, an attempt has been made to detail the relationship existing between environmental impacts (e.g., climate change) and the relevant activities along the food supply chain causing these impacts (e.g., energy consumption or fertilisation practices both emit greenhouse gases). Thirdly, actions and practices requested by the labelling schemes analysed have been then associated to the specific environmental impacts' list, according to the aforementioned relevant activities causing the impacts.

Table 3 shows the list of environmental impacts considered and the mapping and clustering among the environmental aspects and impacts categories, whereas a detailed description of the hotspots per each environmental impact is provided in Annex 3.

Table 3. Mapping of the environmental aspects and impacts found in labels with defined environmental impacts categories.

Environmental impact	**Relevant activities causing the impact**	**Environmental impacts categories and aspects assessed in the full assessment**	
		Environmental aspects (non-LCA based environmental impacts)	**LCA-based environmental impact category**
Climate change	Land use and land use changes (incl. deforestation), energy consumption along the supply chain (incl. fertiliser production), fertilisation, animal effluent management (incl. enteric fermentation emissions and effluents management), transportation (incl. fuels for machinery)	Climate change/carbon balance Energy use (fossil, renewable, energy efficiency) Fertilisation/fertilisers	Climate change
Ozone depletion	Transportation and refrigeration, fertilisation	Atmospheric pollution/air quality (e.g. PM, VOC, ozone depletion substances, nitrogen oxides) Fertilisation/fertilisers	Ozone depletion
Land use (incl. deforestation and soil health)	Farmland expansion, energy production and use along the supply chain, soil management practices (such as practices that increase soil fertility and quality and prevent soil degradation – e.g.,	Soil fertility/soil quality Soil degradation/soil conservation (e.g. erosion) Doil management	Land use

	increasing soil organic matter, implementing cover crops, crops rotation, no or minimum tillage)	Habitat/land management/use; land/habitat conversion	
Water use	Irrigation, processing	Water management/irrigation (e.g. water withdrawal, water use)	Water use
Eutrophication	Fertilisation (incl. synthetic and organic fertilisers), animal farming, aquaculture	Fertilisation/fertilisers Water management/irrigation (water quality)	Eutrophication
Ecotoxicity	Agrochemicals (pesticides and fertilisers)	Pest management/pesticides Reduction of toxic, persistent or bio-accumulating substances Fertilisation/fertilisers	Ecotoxicity
Particulate matter	Energy consumption along the supply chain (incl. machinery used in the fields), fertilisation, crop residues burning	Atmospheric pollution/air quality (e.g. PM, VOC, ozone depletion substances, nitrogen oxides, etc) Energy use (fossil, renewable, energy efficiency) Fertilisation/fertilisers	Particulate matter
Mineral and metals resource depletion	Agrochemicals, packaging	Fertilisation/fertilisers Packaging materials Resources use	Resource use
Biodiversity loss	Land use changes, farming management (concerning biodiversity at farm level: species and genetic diversity of cultivated crops and animal breed, GMO; concerning biodiversity at higher levels: ecosystem preservation or improvement, wildlife protection, protection of flora and fauna), pesticides, fisheries management	Biodiversity (ecosystem, species and genetic diversity) Wildlife protection/protection of flora and fauna Habitat/land management/use; land/habitat conversion GMO/no GMO	n.a.
Waste generation	Packaging	Waste management/reduction/reuse Packaging materials (only when dealing with packaging reduction or packaging material reuse and recycling)	n.a.

Food waste generation	Food consumption (incl. households, retail and food services), processing	Requirements on food waste	n.a.
Biotic resources (overexploitation)	Fisheries and aquaculture, livestock feedstock	Requirements on sustainable fishing and fish-stocks regulation/preservation	n.a.

Source: JRC own elaboration

3.3.5 Assessment of the life cycle stages of the main labels present in the EU market

During the full assessment, the life cycle stages addressed by the labels were identified and an analysis of how sustainability labels cover the supply chain of food products have been performed. The life cycle stages considered are the following:

- provision of input, concerning the raw material acquisition (e.g., seeds, fertilisers, pesticides, feed, feed additives);
- primary production, entailing all the farming activities (i.e., crops cultivation, animal breeding, aquaculture, fisheries);
- transformation and processing, including all the activities of food processing, manufacturing and transformation);
- packaging;
- trade, distribution and retail (e.g., transportation, wholesale, export and import, retail);
- waste management (incorporating the end of life of the products and of their packaging).

The coverage of life cycle stages can provide an idea of which actors in the food supply chain participate in the application or compliance to specific production standards.

3.4 Trends of sustainability labels

An analysis of the trends in the uptake of sustainability labelling was done to gather information on the evolution of the market. We focused on data extracted from Mintel GNPD for a subset of 57 labels, specifically the ones covering environmental aspects (thus the ones characterised as "environmental" and "environmental and social" within the sustainability coverage dimension) and presenting at least one product launched in the market in the consultation year (i.e. 2021) (visible in Annex 2 and in Sanyé Mengual et al. 2023). The trends were extrapolated for three years (2010, 2015, 2021) to capture: label uptake levels over time, food categories, market (MSs where products are launched) and the most prevalent labels.

The label uptake level in the market was defined, in the present analysis, as the share of new products launched in the EU market bearing a sustainability label within a specific time frame. The labelling uptake for a specific label was calculated as the percentage of new products with that label over all the new products launched over one year (as the equation below).

$$Uptake\ level\ (\%) = \frac{number\ of\ new\ labelled\ products}{number\ of\ new\ products}$$

3.5 Literature review on the effects of sustainability food labelling on environmental impacts of the food system

The analysis of the Mintel GNPD was complemented with a literature review on sustainable labelling for food products, including three main sources.

First, a narrative review of scientific and grey literature investigating the effect on environmental impacts related to the application of the sustainability labels, and related changes in management of the production and trade of food products. Labels providing information exclusively about packaging materials, or informing consumers on recycling, were excluded as considered out of scope. The search engines Google Scholar and Scopus were used to retrieve literature sources and by using specific queries linking certification and labelling to the environmental impacts enumerated in Section 3.3.4. The specific queries included “environmental impact AND certification”, “sustainable label AND environmental impact”, each environmental impact AND “sustainable labelling OR certification”. In addition, the most prevalent sustainability labels, as shown in Section 8.4, were also used as key words to retrieve relevant literature. Results of the queries were screened to find pertinent sources. Inclusion criteria for further assessment included studies assessing environmental impacts related to the certification and labelling of food products. Articles on consumer willingness to pay for sustainable products or other consumer side aspects of labelling were not included for further assessment. Both scientific and grey literature in English were considered for the review.

A second source to enrich the analysis included a review of impact reports from the label owners. These reports contain information on trends from the production and supply chain side. The selection of the label owners was also based on the results presented in Section 8.4: these were prioritized because of availability of publicly disclosed information. The review led to the collection of quantitative information on: number of stakeholders involved (farmers, fishers, producer organizations), tons of products certified per country, sales volume.

In addition, information about market trends and forecasting of markets of sustainability labelling was also researched through web searches. In this case, however, no useful data was retrieved, except for generic statements[7].

[7] Such as “The top markets for Fairtrade bananas in 2020 were the UK, Germany, France, Switzerland, and the Netherlands.” (Fairtrade International, 2021)

4 What is the current status of sustainability labelling in food products in the EU?

4.1 Uptake of sustainability labelling in food product launches

Analysis of the uptake of sustainability labelling in food products was conducted using data from food product launches in the EU market as described in sections 3.1. While the Mintel GNPD was the primary and most suitable source of data analyse sustainability information displayed in packaged food products, there are limitations on the usage of the GNPD data. First, by looking at new product launches, the actual share of sustainability claims/labels in the market is likely to be overestimated, as this amplifies efforts by food business operators towards innovation, including on sustainability aspects. Another relevant limitation is that only packaged food products are included in the database (e.g. excluding raw fruits and vegetables). More information on the usage and limitations of Mintel data is further detailed in Chapter 11.

The data on the uptake of sustainability-related information in food products (e.g. text, logos, claims) relates to food products displaying a relevant sustainability claim as attributed by Mintel in the GNPD dataset. Data on sustainability claims was available for 2022 and thus used in the present report.

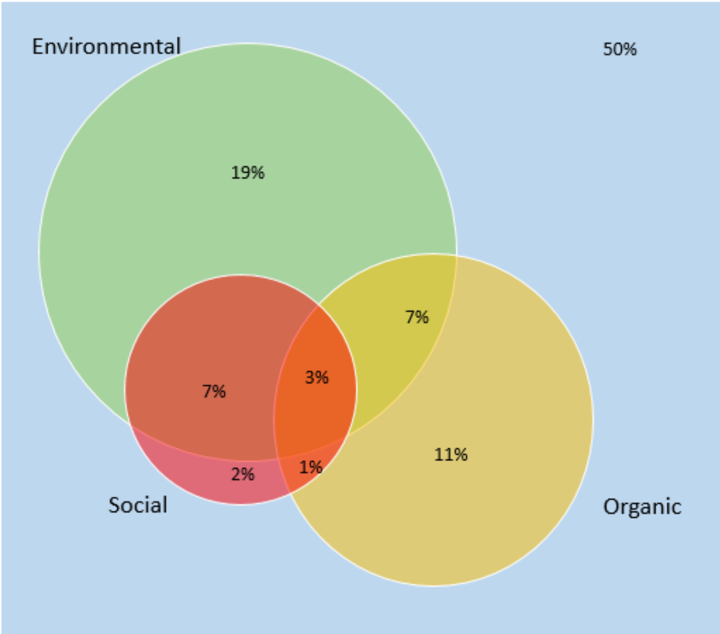
The analysis of the uptake of sustainability-related labels was conducted through the angle of number of products with the respective sustainability claim (i.e., displaying a mapped logo with sustainability relevance), as registered in the GNDP for the year of 2021 as explained in section 3.1.

4.1.1 Sustainability claims

Analyses indicate that the current share of new food products launched with any sustainability-related claims is 39% (50% if organic claims are included). More than one in three products carried a sustainability label related to the environmental domain (36%), just over one in five an organic label (22%) and social related claims are less frequent (13%). Domain specific claims are more frequent in relation to the environment (19% of labels just referring to the environment and in addition 11% to organic production) than in the social domain (just 2%). In addition, labels covering two domains are more frequent than those covering environment, organic and social (just 3%). With regards to combinations of domains we see that 7% of the product launches carry a label related to the environmental and social dimensions of sustainability, an additional 7% combine organic and an additional claim related to the environment and the least frequent combination is that of organic and social (just 1%). In Figure 5, analysis of the trends from 2011 indicate a constant increase on the uptake of sustainability claims among new product launches with a slight plateau in the last few years.

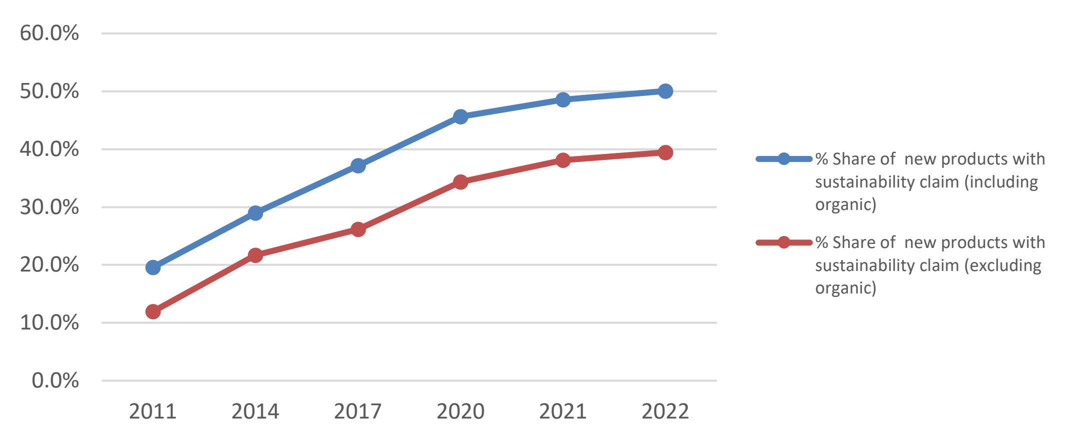
For the mapping and characterisation of sustainability labels, organic-related labels are not the focus of the present analysis, as dedicated legislation is already existing in this area (see section 3.1).

Figure 4. Share of different types of sustainability claims in new launches of packaged food products for 2022. N=24 countries (Source: Mintel GNPD)



Source: JRC own elaboration.

Figure 5. Uptake of sustainability claims in product launches in the EU between 2011 and 2022, n=24 countries (Source: Mintel GNPD)

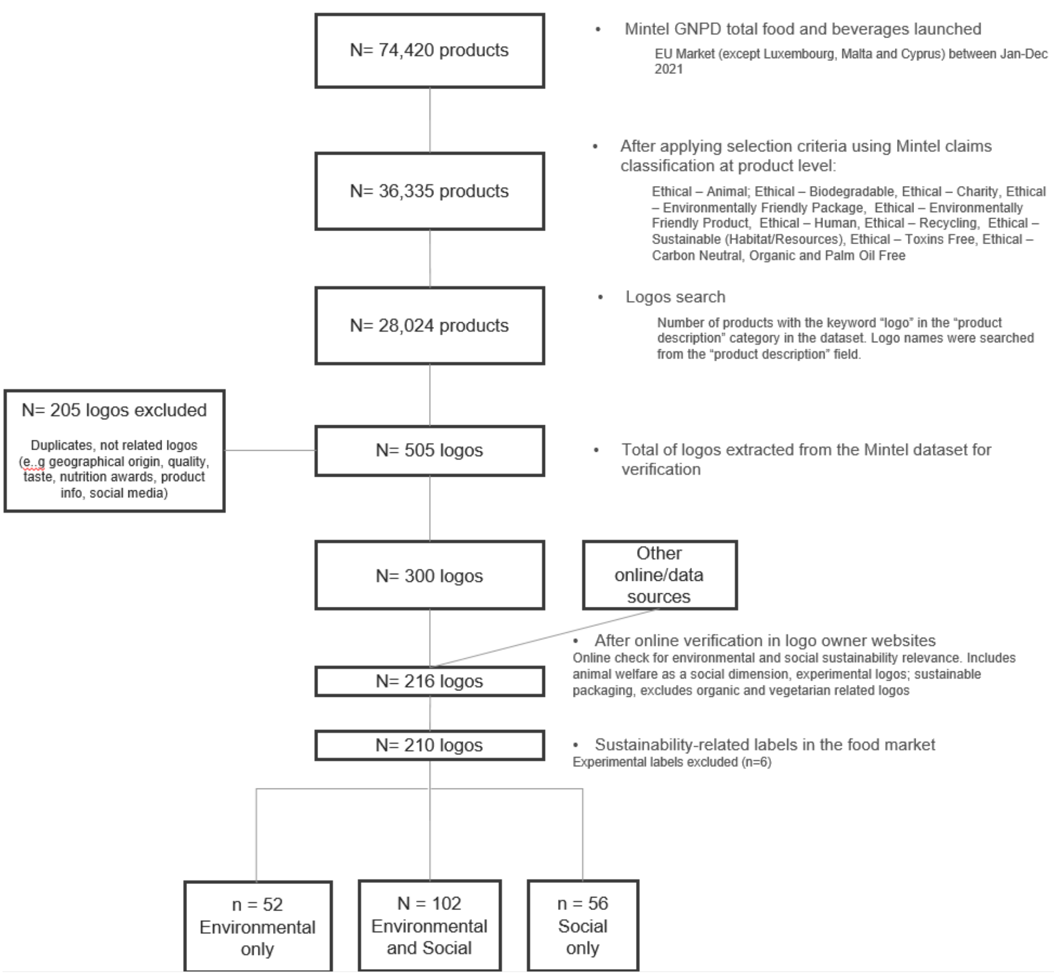


Source: JRC own elaboration.

4.1.2 Sustainability-related labels

The mapping and characterisation of the sustainability-related labels in food products resulted in the compilation of two datasets which are publically available in the JRC Data Catalogue (Leite et al. 2023, Sanyé Mengual et al. 2023). A total of 36,335 food products in the GNPD were screened for the presence of sustainability-related logos (Figure 6). Following the application of the exclusion criteria and verification in logo owners' websites, there were a total of 210 logos present in the EU market confirmed to have sustainability relevance. These are referred to as sustainability-related labels in our results.

Figure 6. Mapping of sustainability-related logos flowchart

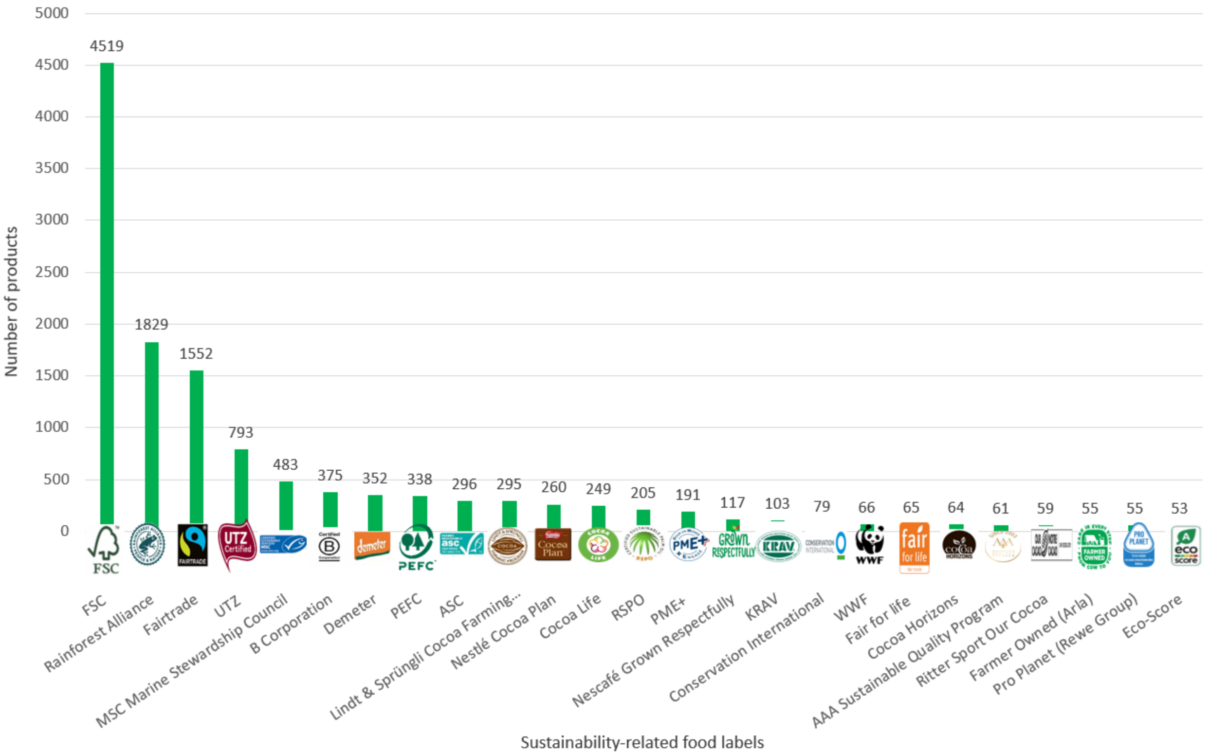


Source: JRC own elaboration.

The uptake of sustainability-related labels in product launches was 14,720, which accounts for 20% of the total product launches (n=74,420). However, when we analysed the uptake of labels that cover production of ingredients or the overall food product, thus excluding packaging and recycling only or charity related labels only, the ratio was reduced to 12% (n=8,835). These results should however be interpreted with caution, as many products are likely to display more than one sustainability-related label and it is possible that the actual number of food products concerned is thus lower.

Figure 7 lists the top 25 most frequently displayed sustainability-related labels covering both environmental and social sustainability. The distribution of the labels uptake is clearly skewed to a few labelling schemes. For instance, the top 5 labelling schemes that covered both environmental and social sustainability aspects accounted for 81% (n=9,176; total=11,351) of the uptake in the category. In particular, the Forest Stewardship Council (FSC) label, which covers food packaging only, was the most displayed in food product launches (n=4,519) contributing to 40% of the uptakes among those covering both environmental and social sustainability, 32% of the total sustainability labelling uptakes and 6% of the total new product launches (4,519 products of the total 74,420 products launched). This was followed by the Rainforest Alliance (n=1,829, 2.4%), Fairtrade (n=1,552, 2%) and UTZ (n=793, 1.1%).

Figure 7. Number of products launched in the EU in 2021 with the top-25 sustainability-related food labels covering both environmental and social aspects. (Total launches=74,420)

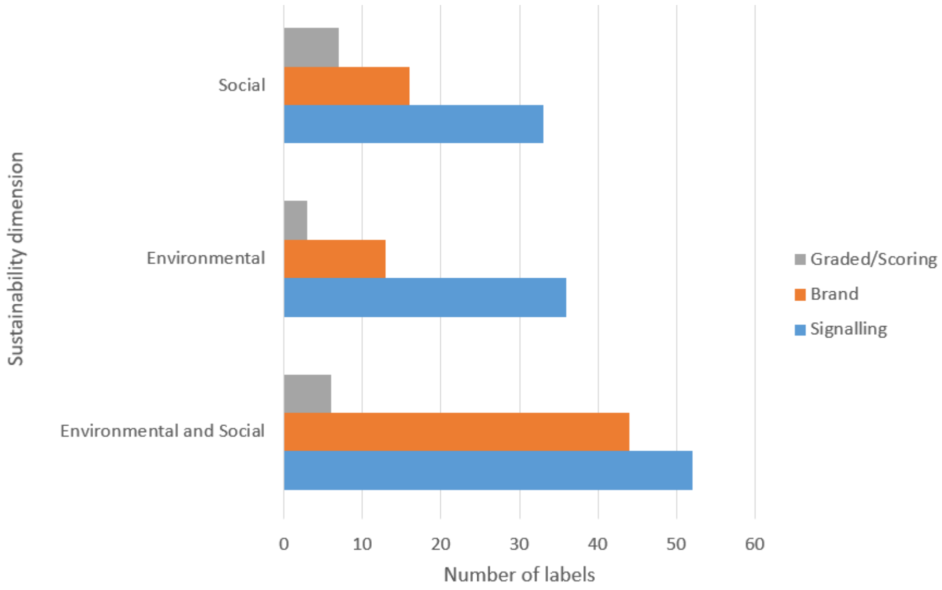


Source: JRC own elaboration.

4.2 Characterisation of sustainability-related labels

Among the total of 210 sustainability-related labels identified in the food market, there were, 102 labels covering both environmental and social aspects, 52 labels covering only environmental sustainability and 56 labels covering only social sustainability (Figure 8). All mapped labels have been characterised for general aspects. When we examined the type of labels (), 58% were related to a positive endorsement (e.g., certification) (n=121), 35% related to own brand initiatives (e.g., a brand sustainability program implemented for sustainable production of used ingredients or a selection of sustainably sourced food products by a retailer) (n=73). Graded labels represented only 3% (n=16) of the total.

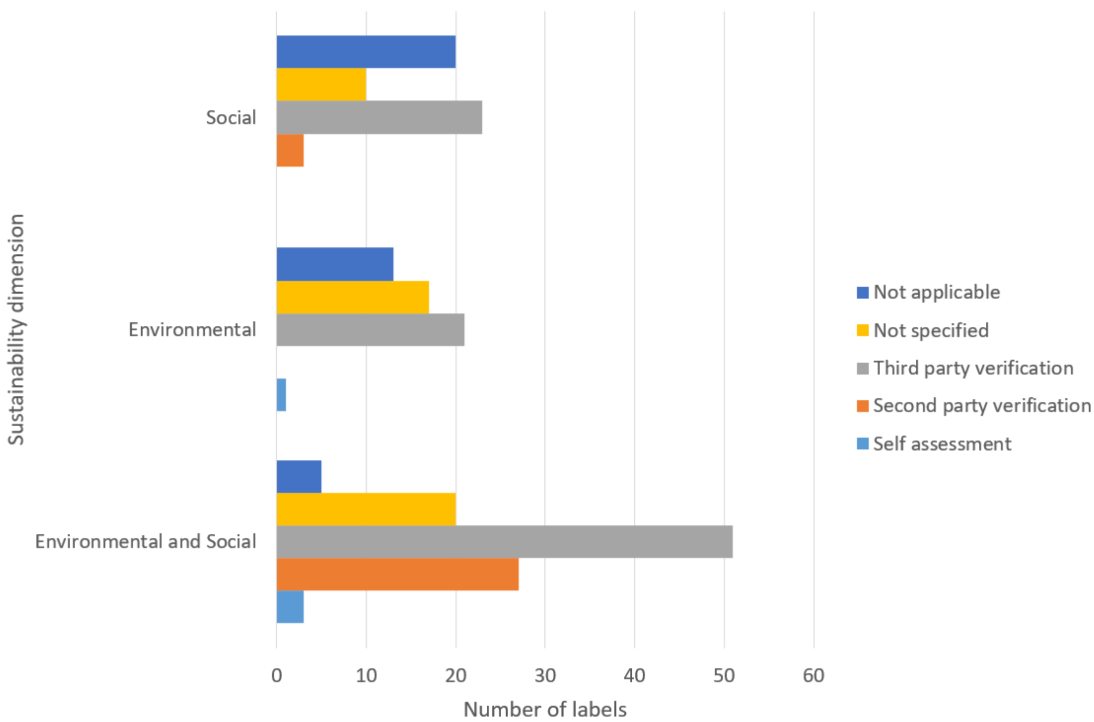
Figure 8. Characterization of labels: Type of label (n=210), by sustainability dimension covered.



Source: JRC own elaboration.

When labels were checked for level of verification, 45% (n= 95) were based on a third party assessment (either through a certification process or not), 30 labels (14%) were based on a second party assessment (e.g. a brand that verifies the suppliers (e.g., farmers) processes behind the production of sourced ingredients), and only 4 labels (2%) were related to a self-assessment (e.g., commitment by local producer, selection of products at retail level, sustainability program implemented by a cooperative or group of farmers) (Figure 9). However, more than 50% of labels covering environmental and social aspects were verified by a third party. The verification process could not be identified for 47 labels (22%). Labels related to support sustainability programs, charity actions, information for consumers on recycling were considered as 'not applicable' (n=34, 16%).

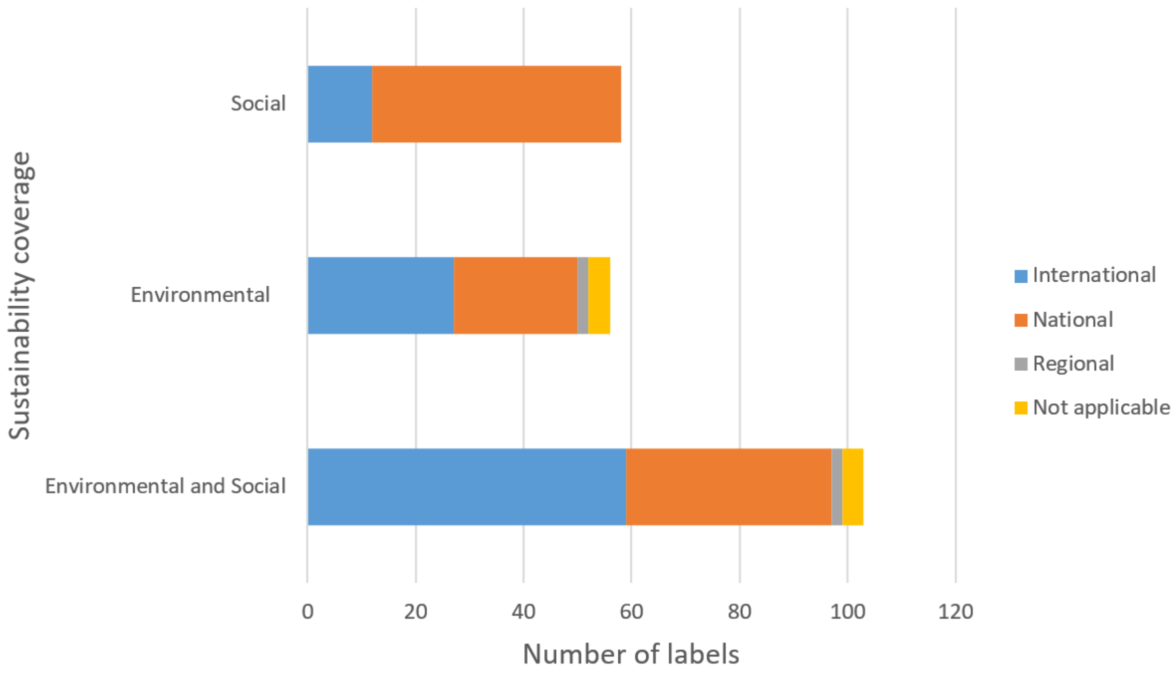
Figure 9. Characterization of labels: Type of verification/assessment of labels (n=210), by covered sustainability dimension



Source: JRC own elaboration.

The geographical scope of the mapped labels, i.e. whether the label is used at regional, national or international (EU and globally) level of the market, is provided in Figure 10. The considered labels were to a similar extent either displayed in food products only in one country or in several EU countries, while a use solely at a regional level was rare. Social only labels were predominately used at national level, whilst labels combining environmental and social aspects were more often found to be used in several countries, in an international food environment.

Figure 10. Characterization of labels: Geographical scope of labels (n=210), by covered sustainability dimension.

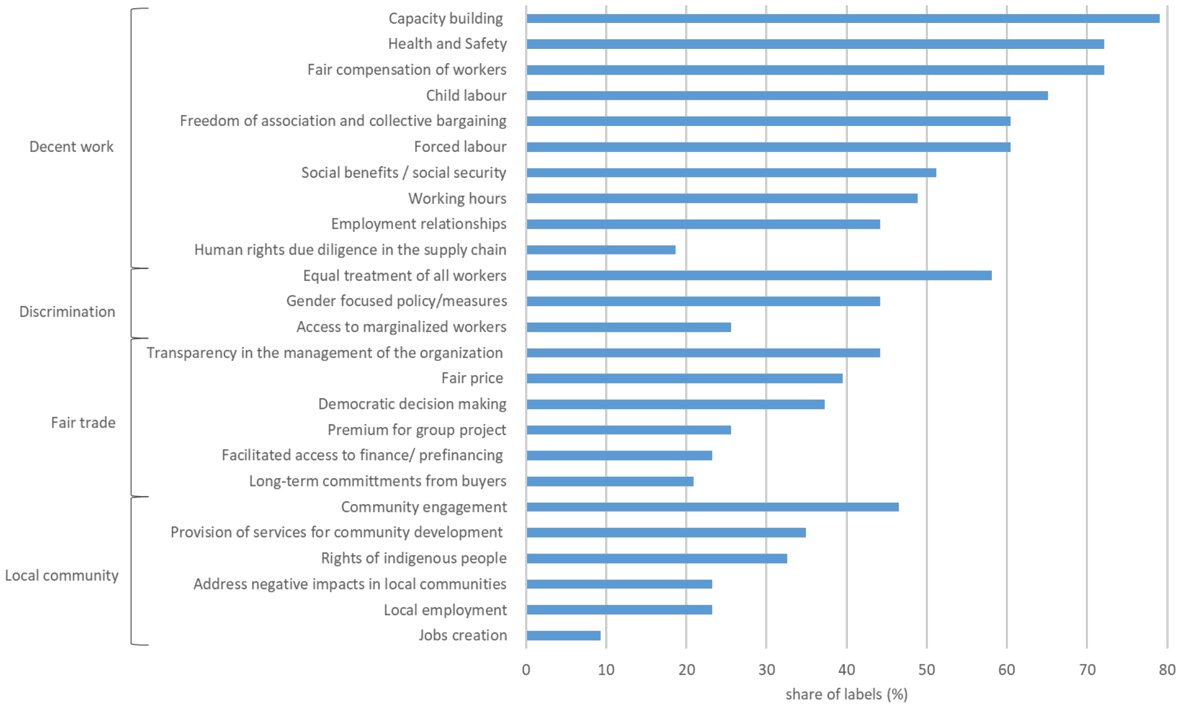


Source: JRC own elaboration.

5 What are the social aspects covered by the current sustainability labels in the EU?

Among the assessed labels covering social sustainability aspects (n=43), there is a great heterogeneity in the coverage of social aspects (Figure 11). Social aspects related to decent work (e.g. capacity building, fair compensations, health and safety, child labour, forced labour, freedom of association and collective bargaining) are the aspects more frequently covered by labels. Social aspects dealing with discrimination (e.g. equal treatment of all workers, gender focused policy) are covered too, although to a lesser extent. Contrarily, aspects related to fair trade production (e.g. transparency in the management of the producers organization, fair prices paid to farmers, democratic decision making), and in support to local communities (e.g. community engagements, provision of services for community development and rights of indigenous people) are less covered.

Figure 11. Share of the assessed labels (%) addressing the social aspects covered in the full assessment of sustainability labels.



Source: JRC own elaboration. Note: Total number of labels are those dealing with the sustainability social dimension and presenting at least one product launched in the market in 2021 according to the GNPD (n=43).

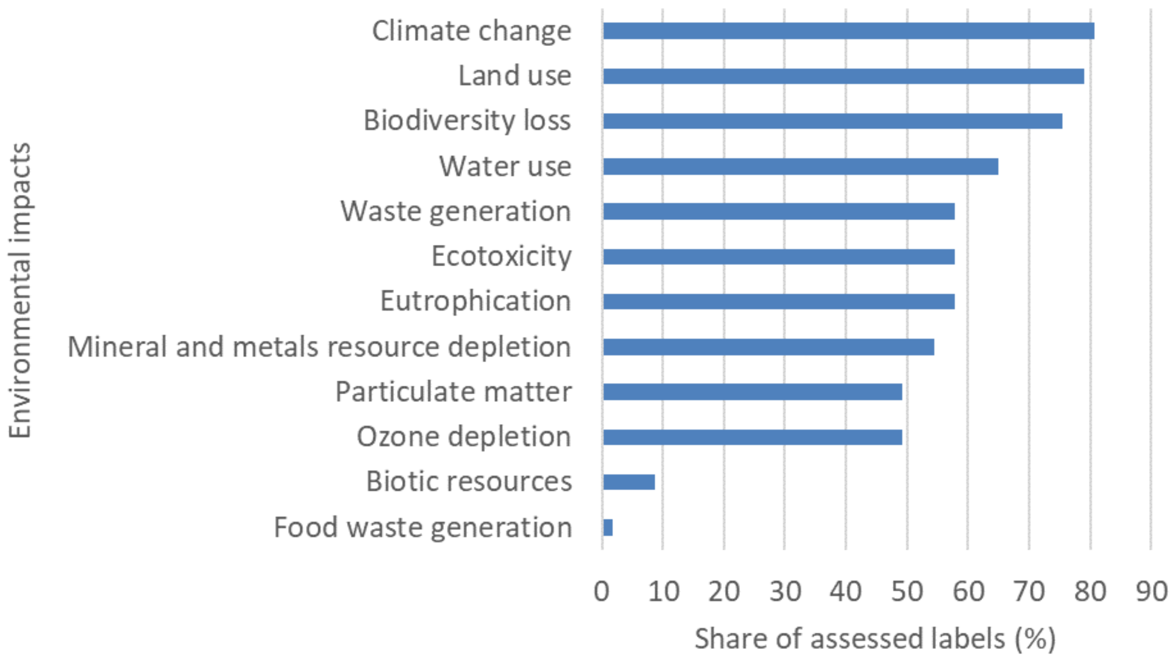
5.1 Overview of animal welfare labels

Among the labels focusing on social aspects only, some were exclusively related to animal welfare. Although these were not in the scope of the full assessment, they were scanned to provide an overview on the aspects they encompass (see section 3.3.2). Animal welfare labels present in the market were obtained considering two different sources: the characterised labels with an exclusive focus on animal welfare, without other sustainability aspects included, and the labels analysed in a recent study on animal welfare labelling by the European Commission (European Commission, Directorate-General for Health and Food Safety, 2022). From this list, the labels focusing on organic agriculture or on meat quality schemes were not considered in the analysis. A list of 31 animal welfare labels (reported in table A4.1 in Annex 4) have been assessed. 11 of them are developed by specific brands having an own animal welfare program and logo. 6 labels provide a scoring/rating system which allow to signal various levels of compliance against specific animal welfare standards or guidelines. The remaining 14 labels are of endorsement type, meaning that they allow to use the label if specific criteria and requirements are met. 10 labels are owned by private brands, 7 by no profit organizations (mainly NGOs) and only one is owned by a public body, while the others are developed by partnerships of various actors. Most of the labels (15) develop their own standards; only in one case a third-party standard is followed, while in the remaining labels this information was not found/available.

6 What are the environmental impacts covered by current sustainability labels in the EU?

To gain an overview of the environmental impacts covered by sustainability labelling, the process and practices associated with obtaining the label were mapped to a list of relevant environmental impacts (Section 3.3.4 and Annex 3 include detailed information on the mapping). This exercise was an approximation based on the sustainability requirements stated by the labels' standards. As explained in the methodology (Section 3.3.4), the results of the mapping between labels and impacts refer to the labels covering the environmental sustainability dimension and presenting at least one launched product according to the GNPD (57 labels). As shown by Figure 12, the coverage of the environmental impacts encompassed by the considered labels is rather uneven.

Figure 12. Share of the assessed labels (n= 57) addressing the environmental impacts considered

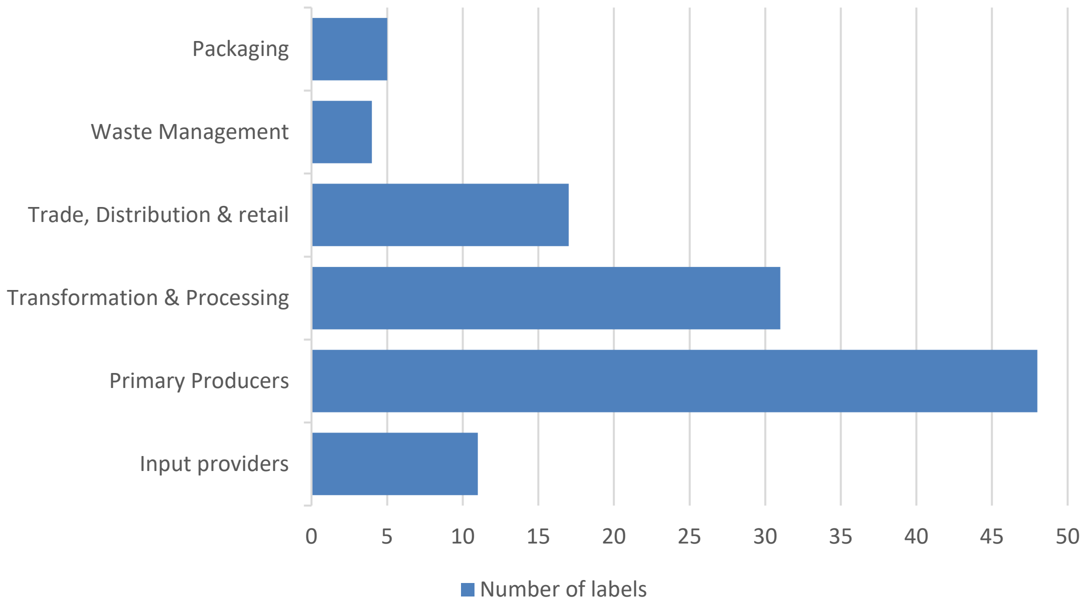


Source: JRC own elaboration. Note: Total number of labels are those dealing with the sustainability environmental dimension and presenting at least one product launched in the market in 2021 according to the GNPD (n=57). See Section 3.3.4 and Annex1 for a detailed mapping between the environmental impacts reported in this figure and the list of environmental aspects (non-LCA-related) and environmental impact categories (resulting from LCA use in labels) addressed in the full assessment of sustainability labels.

7 Which life cycle stages and food supply chain operators are currently involved in environmental sustainability labelling of food products?

The analysis of the life cycle stages involved in the environmental sustainability labelling shows that not all the actors of the food supply chain participate equally in the implementation of sustainability labels. Figure 13 shows the actors of the food chain life cycle stages as considered by the labels assessed. Primary producers are the ones most commonly involved in the application of the sustainability requirements to obtain the label, while other actors of the supply chain are less represented. On the one hand, this might steer a transition towards sustainability practices more concentrated in primary production, compared to other stages of the life cycle. On the other hand, the burden in applying sustainability requirements is disproportionally given to primary producers, and to a lesser extent to actors operating in processing and trade. This result is aligned to the fact that primary production are the hotspot of the total environmental impact for most of the food product groups (Deconinck & Toyama, 2022); however it also opens to the proposition of engaging the whole food supply chain in sustainable practices to ensure a greater consideration of environmental burdens.

Figure 13. Number of labels involving life cycle stages in the achievement of the labels requirements



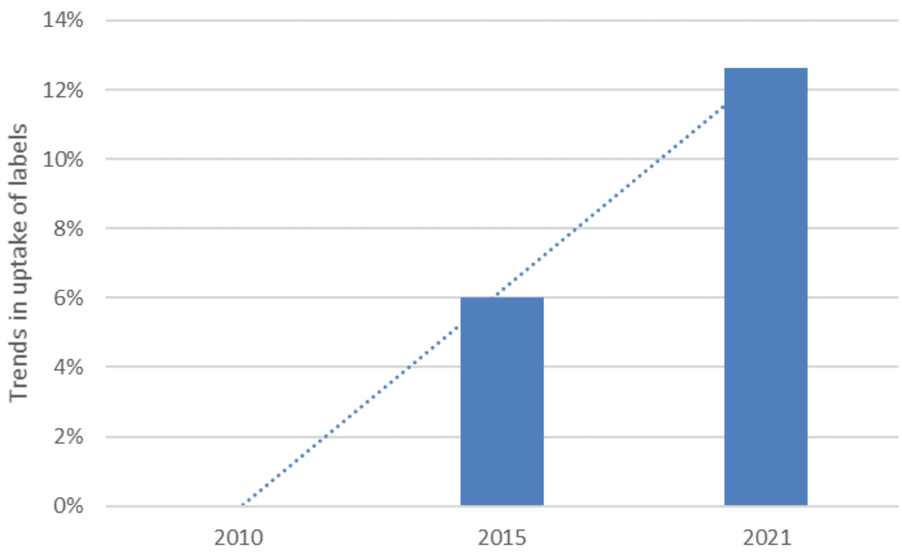
Source: JRC own elaboration. Note: Total number of labels are those dealing with the environmental dimension and presenting at least one product launched in the market in 2021 according to the GNPD (n=57).

8 What are the market trends in environmental sustainability labelling for food products in the EU?

8.1 Trends in sustainability labelling uptake

The analysis of the trends of the uptake (that is, the share of sustainability labelled new food products) of environmental sustainability labels, which has been conducted for the subset of 57 labels covering the environmental dimension (as described in section 3.4), provides indications on the current situation in the EU market regarding the application of voluntary sustainability standards from the food supply chain. The results illustrate a clear trend through the three years considered in the analysis: the share of labelled products from the new market launches steadily increased (Figure 14). This represents an expected outcome from the analysis, as sustainability standards and labelling schemes have increased in recent years (Dietz et al., 2022). Data extracted from the Mintel GNPD highlighted the increase in share of new products carrying one of the 57 analysed label both for the different product categories and the different national markets[8].

Figure 14. Evolution of the uptake increase of sustainability labelling. The columns show the share of sustainability labelled new products compared to 2010, which is the reference year.



Source: JRC own elaboration, based on Mintel GNPD data. Note: We consider only labels dealing with the sustainability environmental dimension and presenting at least one product launched in the market in 2021 according to the GNPD (n=57).

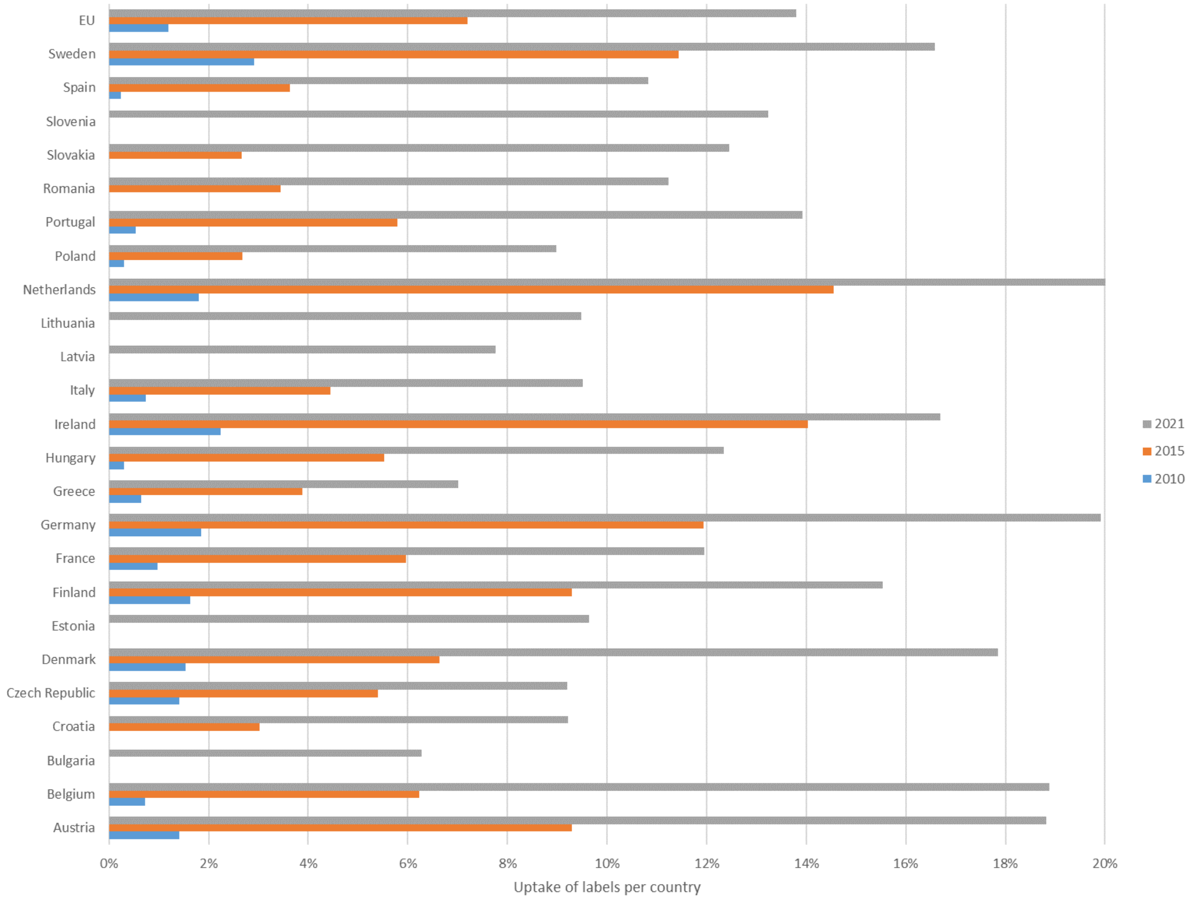
8.2 Trends of sustainability labels among Member States

While more advanced markets (NL, DE, BE, AT, IE, DK, SE) show a consistent increase in sustainably labelled products for the three years considered in the analysis (2010, 2015 and 2021), with the share of labelled products reaching 20% of new launches in 2021, other emerging markets (HR, CZ, HU, IT, FR, EL) show a more contained development of the share of labelled products (Figure 15). This

[8] A general disclaimer needs to be made regarding FSC and PEFC, which are sustainability labels tackling deforestation and good practices in the timber and paper sector. FSC uptake especially concerns almost 45% of all sustainably labelled new products launched on the market. This disproportionate uptake could lead to an overestimation of the sustainably labelled products on the market, considering also that FSC labels are often paired with another sustainable label signalling the production of the food ingredients. FSC and PEFC however are included in the label assessment and cover some environmental impacts (especially waste generation, deforestation and land use) which are part of this analysis.

difference could also be attributed to some inconsistencies in the Mintel GNPD, as new markets could have been added at a later stage (i.e., for Baltic countries). While certain MSs have shown steadily increasing trends through the years (NL, SE, DK, DE), others have shown a more conservative growth. Overall, however, the growth trend of sustainability labelling over time is confirmed for all MSs.

Figure 15. Evolution of the uptake of sustainability labelling for new products launched in the market for the assessed period (2010, 2015, 2021), by Member State

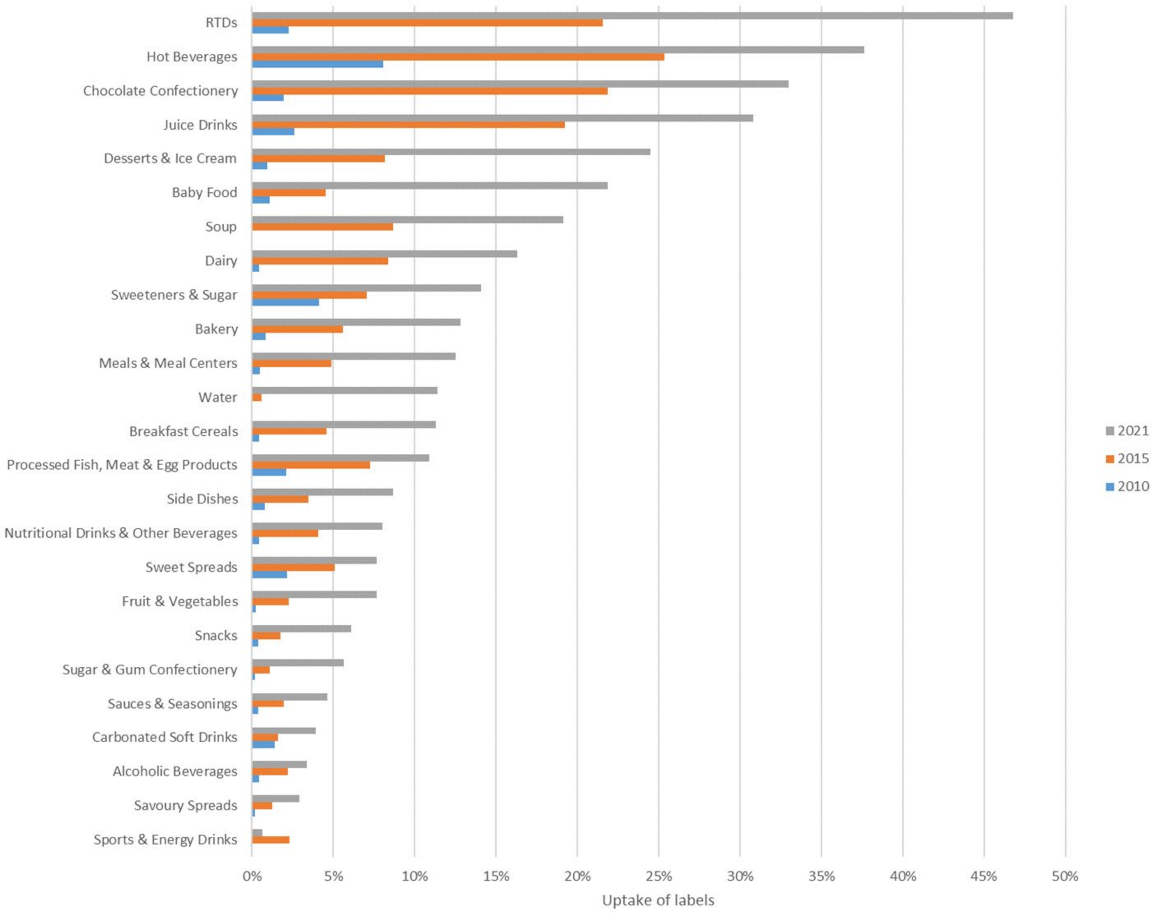


Source: JRC own elaboration. Note: We consider only labels dealing with the sustainability environmental dimension and presenting at least one product launched in the market in 2021 according to the GNPD (n=57).

8.3 Trends of sustainability labels among food product categories

Sustainable product labels are present mostly within few product categories (Figure 16), such as Hot beverages (coffee, tea), Ready to Drink products (which are coffee and tea products) and Chocolate Confectionary. Sustainably labelled cereal based products, pre-prepared meals, snacks and spreads are less present in the market. It should be recalled that the GNDP database only includes packaged products. Thus, the extracted percentage figures of the uptake of food products which are usually sold without packaging (e.g. fish products, fresh vegetables and fruits) should not be intended as representative of the whole market of such food products.

Figure 16. Evolution of uptake of labelling in new products for the assessed period (2010, 2015, 2021), by food categories



Source: JRC own elaboration. Note: We consider only labels dealing with the sustainability environmental dimension and presenting at least one product launched in the market in 2021 according to the GNPD (n=57).

8.4 Trends of sustainability labels covering the environmental sustainability dimension

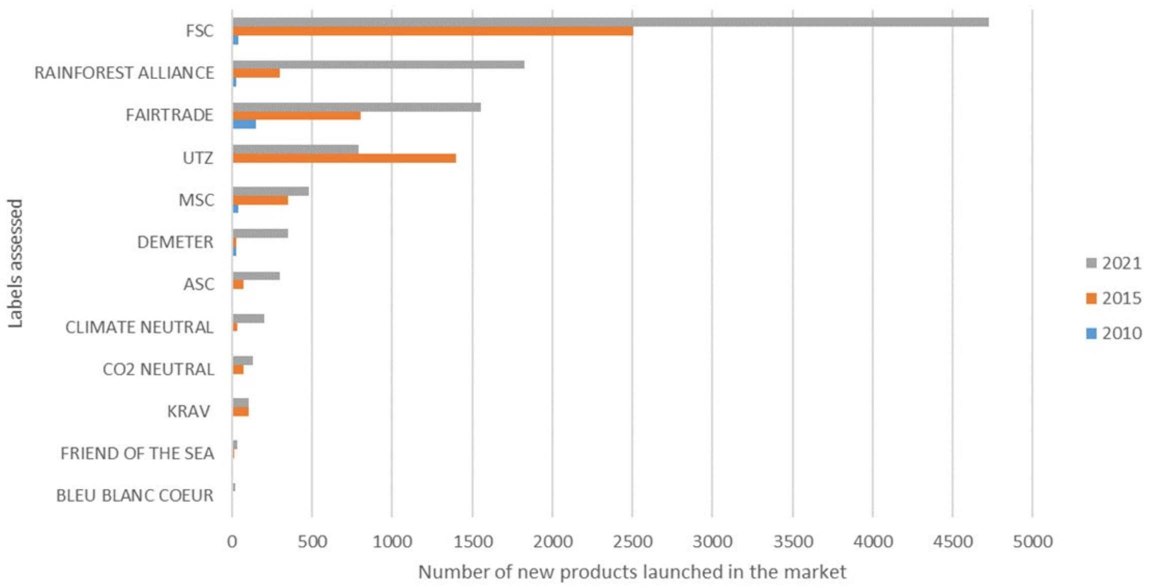
The analysis of the different environmental sustainability labels showed varying trends through the three years considered. In 2010, only 11 of the assessed environmental sustainability labels were present in the market. The year 2021 shows the highest share of labels on the market, being also the reference year for the assessment exercise (Section 3.3). For most of the labels considered in the assessment exercise, no new products could be found for the years 2010 and 2015.

Few sustainability labelling are obvious leaders in the market by being present for all three years and consistently having the majority of new products launched. These resulted to be, in order of number of products launched in the market (Figure 17): Forest Stewardship Council (FSC), Rainforest Alliance, Fairtrade, UTZ[9], Marine Stewardship Council (MSC), Demeter, Programme for the Endorsement of Forest Certification (PEFC), Aquaculture Stewardship Council (ASC), Roundtable on Sustainable Palm Oil (RSPO), Climate Neutral, CO2 neutral, and KRAV. The number of sustainably labelled products increased across the three time points considered, alongside the number of different labelling

9 Although UTZ merged with Rainforest Alliance since 2018, it is considered individually in the analysis, because a significant number of products still using the UTZ logo were launched in the market in 2021.

schemes applied. The graphs below show the trends in the labelling schemes that are market leaders since a decade. These findings are consistent with Meier et al. (2021) and OECD (2016).

Figure 17. Evolution of the number of new products launched in the market for the most prevalent labels (2010, 2015, 2021)



Source: JRC own elaboration. Note: We consider only labels dealing with the sustainability environmental dimension and presenting at least one product launched in the market in 2021 according to the GNPD (n=57).

In addition, the review of impact reports from label owners confirmed the general trends in uptake increase from the market. The impact reports were examined for: Fairtrade, Demeter, MSC, Rainforest Alliance and RSPO. All of these labels show increasing trends in production area (hectares and volume), number of stakeholders involved and live volumes of products on the market. However, these reports only relay information regarding the labels own activities and do not compare it to the general markets trends of unlabelled products.

9 How reliable are sustainability labels of food products currently present on the market?

The assessment of the reliability of labels is key to ensure that citizens can trust the sustainability information on the products for decision-making. This has been highlighted recently in EU policy through, e.g., the Proposal for a Directive on Green Claims[10] or the proposal for a Directive on empowering consumers in the green transition[11]. The use of robust methodologies and trustworthiness of the labels (transparency, monitoring and stakeholders acceptance) were assessed to provide a reliability score to the labels. The analysis of the reliability criterion concluded that the assessed labels would be almost equally divided between a very good – good group, and a poor-fair group (Table 4).

Table 4. Reliability evaluation of the assessed labels (n=73) presented according to the sustainability dimension covered.

Sustainability dimension covered	**Reliability**			
	Poor	**Fair**	**Good**	**Very good**
Environmental	7%	12%	3%	0%
Environmental, Social	4%	8%	7%	10%
Environmental, Social (animal welfare only)	1%	3%	7%	1%
Environmental, Social (including animal welfare)	1%	8%	11%	8%
Environmental, Social (including animal welfare and nutrition)	0%	3%	0%	0%
Social	1%	1%	0%	0%
Social (including animal welfare)	0%	0%	3%	0%
Total	15%	36%	30%	19%

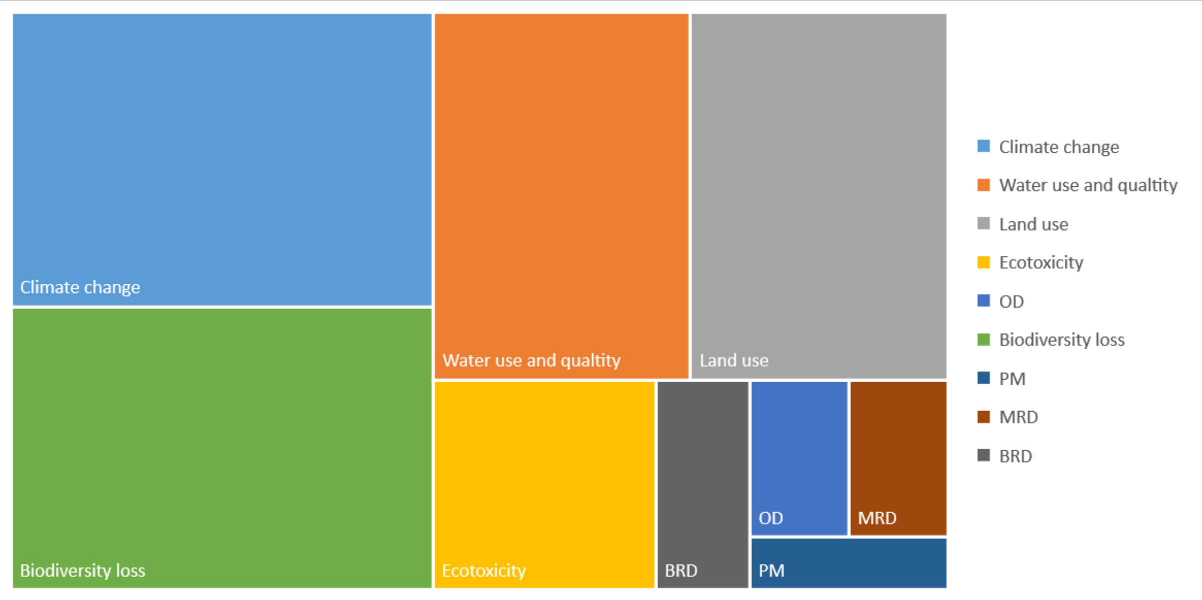
Source: JRC own elaboration

[10] https://environment.ec.europa.eu/publications/proposal-directive-green-claims_en
[11] https://ec.europa.eu/commission/presscorner/detail/en/ip_22_2098

10 What are the expected effects of sustainability labels on the environmental impacts of the food system according to scientific knowledge?

The literature review collected 75 different sources, both from scientific and grey literature, exploring the potential effects of sustainability labelling of food on the associated environmental impacts (Figure 18). A large part of the studies covered multiple environmental impacts (e.g. biodiversity and ecosystem services, land use and soil health), while the rest covered mostly biodiversity loss and deforestation and, to a lesser extent, depletion of biotic resources. Other environmental impacts such as ecotoxicity, eutrophication, particulate matter formation and waste/food waste generation were seldom extrapolated. A more detailed overview of the results is provided later in the section. The impacts extrapolated for this analysis were mapped according to the logic shown in Table 2; therefore it should be noted that the impact categories mapped in this section do not equate to the variables explored by the single literature sources but are an approximation to facilitate the analysis.

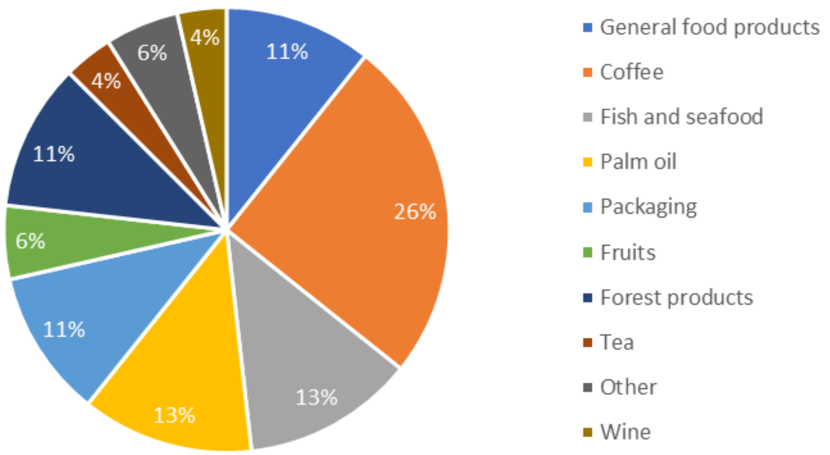
Figure 18. Frequency of environmental impacts (%) investigated by the reviewed scientific literature



Source: JRC own elaboration. Note: PM: Particulate Matter; MRD: Mineral and Metal Resource Depletion; BRD: Biotic Resource Depletion; OD: Ozone Depletion; WG: Waste Generation.

Scientific literature focussed mostly on a handful of products, highlighting the same conclusion drawn from the analysis of the GNPD, whereby the current sustainability labelling landscape is not comprehensively considering the whole food system's product coverage. A breakdown of the food products is provided below in Figure 19.

Figure 19. Frequency of food products (%) covered by the reviewed scientific literature



Source: JRC own elaboration. Note: the category "General food products" refers to those studies who considered multiple foods in the same study (i.e. more than three) and were not extrapolated singularly, the category "other" refers to products such as animal feed.

The literature review had the specific objective of collecting any quantifiable and robust evidence that the labelling schemes currently present on the market lead to any environmental benefit. We observed a lack of quantitative substantiation of effects on environmental impacts, as also confirmed by a recent meta-analysis by Traldi (2021), which asserts that assessments of voluntary sustainability labelling and standards are split quite equally between positive (51%) and neutral (49%) outcomes. The meta-analysis, by focusing on effects only at primary production level, also confirms the conclusion that life cycle stages are not uniformly included in sustainability labelling initiatives.

The literature review focused also on the individual environmental impacts. Beside a limited number of evidence on the positive effects of certain certifications on biodiversity conservation and protection in coffee plantations (Gather & Wollni, 2022; Rueda & Lambin, 2013) and in productive forests (Di Girolami & Arts, 2018), and on halting deforestation (Burivalova et al., 2017; Miteva et al., 2015), several authors underline the need to further investigate the effectiveness of labelling in contrasting environmental issues. Scientists call for increasing the studies, including long-term monitoring (DeFries et al., 2017; Haggar et al., 2015), broadening the scope of the impacts considered (Arton et al., 2020), and including impacts that are seldom investigated (e.g., biotic resources, waste and food waste generation).

Some sources are available on sustainable labelling for food products such as coffee (Bose et al., 2016; Mas & Dietsch, 2004; Pico-Mendoza et al., 2020) and palm oil (Morgans et al., 2018; Schmidt & De Rosa, 2020), and fish (Arton et al., 2020). The environmental impacts covered by these studies are varied: addressing conservation and biodiversity (especially for coffee under Rainforest Alliance certification), GHG emissions and pollution. Some literature is available also on the labelling of sustainable fish and seafood (MSC, ASC) for which fish stock reproduction is assessed. Some impacts, such as biodiversity loss, land use (especially deforestation), and biotic resource depletion are more investigated by the research community, while particulate matter, eutrophication, ecotoxicity are less present. In certain cases it was possible to connect the hotspots in the supply chain analyzed by the sources with the environmental impacts.

The review conducted confirms the research gaps on the actual effects of sustainable labelling on the environment, as denounced by OECD (Deconinck, K. & M. Hobeika, 2022). Available literature focuses mainly on comparisons between organic vs conventional farming systems (e.g., Boschiero et al. 2023) and on specific case studies of the implementation of labelling schemes. There is a lack of quantified evidence for the global impact of labelling schemes on the environment, assessing if the implementation of production and management changes in a specific supply chain leads to improvements (Deconinck, K. & M. Hobeika, 2022). Moreover, the results of the review focused greatly on the labels and certification of specific food products (coffee, palm oil, cocoa, fish, cane sugar, timber and wood products) which are produced outside of Europe.

The following sections present the results of a targeted literature review according to main environmental impacts which have been identified as relevant for the food system.

10.1 Climate change

Climate change emerges as one of the environmental impacts mainly addressed by the reviewed literature (38% of studies considered this impact category). The studies considered climate change from many lenses and not only the associated environmental impacts (e.g., GHG emissions). When comparing LCAs for conventional and RSPO certified palm oil, Schmidt & De Rosa (2020) found that the latter emits 35% less GHG emissions, mostly thanks to higher yields, less cultivation on peat soils and more efficient waste flows treatment. In two LCA studies of wine production, biodynamic management showed decreased GHG emissions when compared with organic (Masotti et al., 2022) and conventional (Villanueva-Rey et al., 2014). In terms of carbon stock, higher values have been found in sustainably certified coffee farms in Nicaragua (Haggar et al., 2017). In a review of certified forests, Di Girolami & Arts (2018) found generally positive outcomes of certification in terms of ecosystem services including carbon stock, but highlighting how generalization of these results should be cautious, as the ecosystems and biomes analysed are very different and impact assessment methodologies not always comparable. Literature was found also on the effect on climate change linked to other drivers of environmental degradation, such as dietary patterns (Willett et al., 2019). To conclude, the assessment of climate change impacts (and related aspects) collected through this review showed that certification could be useful in reducing GHG emissions of food production or increasing the carbon stock in forests, however generalization and comparison across studies is not possible due to differences in methodologies.

10.2 Biodiversity loss

Biodiversity conservation and protection is generally found to be favoured by sustainable certification schemes. Positive effects on biodiversity aspects have been observed on Rainforest Alliance (RA) certified coffee cultivations. Specifically, the RA-certified production counted a greater tree diversity (Haggar et al., 2015), a higher number of farmers who planted trees outside the coffee plots (Rueda and Lambin 2013), and who applied biodiversity-related practices more frequently compared to non-certified farmers (Gather & Wollni, 2022). Benefits of RA-coffee certification on species conservation have been found by Hardt et al. (2015), demonstrating that certified coffee farms have more native vegetation cover than non-certified farms for the entire decade under investigation. An opposite result emerged from one study on bananas (Bellamy et al., 2016), affirming that RA-certified farms had less insect diversity compared to non-certified farms and little difference between RA and non-certified farms was found with regards bird community composition. Authors underline that both RA-certified and non-certified banana plantations showed less insect diversity than organic farms.

A study addressing the effectiveness of the RSPO certification on delivering sustainability objectives (Morgans et al., 2018) reports no difference on the presence of orangutang (number of animals per hectare) among certified and non-certified concessions, showing a similar decline rate of the primate in both concessions typology. Forest managed under FSC and PEFC show lower impacts on flora and fauna (Di Girolami & Arts, 2018) than non-certified forests. In addition, Moore et al. (2012) found that certifications (FSC and PEFC) prevent deforestation and biodiversity loss, trough actions on old growth/high conservation reserves (in 56% of responses), prevention of exotic invasive species (41%), threatened species protection (36%) and biological diversity planning (35%).

Haggar et al. (2015) underline the need for longer-term monitoring and higher number of studies, possibly harmonising assessment methodologies, to determine whether certification can be an incentive to conserve or expand biodiverse systems, within the cultivation field and in zones around the cultivation areas.

10.3 Land use, soil health and deforestation

Sustainable labels seem to produce positive effects in contrasting soil erosion, as reported by (Willemen et al., 2019) for Rainforest Alliance certified tea, which presented a reduced sediment transportation with respect to uncertified fields, and by Pico-Mendoza et al. (2020), were UTZ/Rainforest Alliance certified coffee farms had the greatest number of conservation activities and erosion control measures compared to those of non-certified farms. Moreover, sustainable standards usually prompt farmers to pay more attention to the soil conditions than non-certified farmers, by performing soil analysis (Rueda & Lambin, 2013).

Cultivating palm oil following the RSPO certification standard demonstrated a lower nature occupation of about 20% with respect to uncertified fields (Schmidt & De Rosa, 2020). Contrasting results are published concerning certified biodynamic viticulture (Masotti et al., 2022; Villanueva-Rey et al., 2014).

It should be noted that impacts on land use, when assessed using the life cycle assessment methodology, as done in the aforementioned studies, are strictly linked to productivity. Indeed, when the impacts are expressed per unit of product (e.g. 1kg of a certain crop), the higher the productivity, the lower the impacts on land use, since less surface is required to produce the same amount of products. The effects of certifications on the soil carbon content of forest and agricultural products vary across studies. FSC and PEFC certified forests show higher carbon storage, coarse woody debris volumes and dead wood (Di Girolami & Arts, 2018) with respect to the non-certified forests. Soil organic matter, which is composed mainly of carbon, has been found to be almost double in biodynamic certified viticulture sites with respect to the uncertified ones in one LCA case study (Villanueva-Rey et al., 2014). However, the carbon stocks in the aboveground biomass of coffee plants were higher in the non-certified coffee plantations with respect to UTZ/Rainforest Alliance certified coffee (Pico-Mendoza et al., 2020).

Sustainability standards and certifications are widely used to promote adequate forest management and to halt deforestation. The FSC is widely known, and its trademark is used to certify millions of products and items of packaging (including for the food market). For example, the number of FSC-labelled packages delivered by Tetra Pak has grown exponentially in the past years: from 1.5 billion in 2009 to 500 billion packages in 2019.

Certification of wood products has substantial environmental benefits, typically achieved at a cost of reduced short-term financial profit, and accompanied by some improvement to the welfare of neighbouring communities (Burivalova et al., 2017). From a meta-analysis, it was found that deforestation rates are reduced in certified areas and, when accompanied by reduced impact logging practices, certification is also associated with less deleterious impacts on biodiversity (Burivalova et al., 2017). Similar findings have been pointed out for Indonesia (Miteva et al., 2015). However, more recent findings are questioning the effectiveness of certification for halting deforestation, as studies for Congo (Tritsch et al., 2020) and for Mexico (Blackman et al., 2018) have found. The risk of greenwashing in this sector is quite high and a few episodes have been signalled by NGOs (Conniff, 2018).

10.4 Water use and quality

Although the impact of certifications on the activities that contribute the improvement or maintenance of water quality and use is seldom considered in the literature (Pico-Mendoza et al., 2020), some studies show the positive effects on water quality due to sustainable certification. Rueda & Lambin (2013) found that 90% of the certified producers carry out some sort of wastewater management with respect to 30% in the case of non-certified farms. Haggar et al. (2015)

demonstrated that organic and UTZ/Rainforest Alliance certificates help farmers in reducing the volume of water used for coffee processing and in the managing of wastewater from processing coffee and domestic sources. Another study investigating the production of Rainforest Alliance coffee in Costa Rica (de Jesús-Crespo et al., 2016) provided evidence of how the implementation of specific agricultural management practices, such as increasing tree coverage, lead to reductions in non-point source pollution in streams. By contrast, a recent study on coffee (Pico-Mendoza et al., 2020) warns that all the coffee farms evaluated in their study, independently by the certification used (i.e. UTZ/Rainforest Alliance and organic), reported few activities to secure water quality, underling the need to push producers to improve the management of wastewater.

10.5 Waste generation and food waste

The contribution of sustainable certification standards to waste generation is seldom investigated. Beside positive results presented in a study of Brazilian small-scale coffee growers (Rueda & Lambin, 2013), showing that the number of certified households collecting trash from the field and carrying out recycling activities are significantly higher than the numbers of uncertified households, robust evidence is missing. However, this aspect is gaining of importance and several labels address this issue within their standards. For example, Rainforest Alliance, UTZ, Fairtrade, ASC, FSC and PEFC require a proper waste management plan, in order to reduce the amount of materials unnecessarily thrown away and to ensure a proper disposal of hazardous wastes.

RSPO calls for actions aiming at recycling bio-wastes, converting them into value-added products or nutrients (e.g. through animal feeding programmes).

Demeter supports a circular use of non-environmental-harmful bio-materials, avoiding bio-waste generation (e.g. on-site composting of crop residues, daily recycling of spent mushroom compost), and promotes actions to reducing contaminated waste back to the environment.

Demeter and KRAV include in their standards also indication on the packaging. They promote resource-efficient packaging solutions (e.g. minimising the amount of packaging material used, preferring reusable or at least recyclable materials) and provide a list of prohibited packaging material.

The assessment of existing sustainability labels in the EU market revealed that 45% of these labels include a criterion regarding waste generation, i.e. focused on reducing waste by following the waste hierarchy or proper management of waste for these companies aiming at obtaining the label. These include food waste and waste (without distinction) occurring along the food supply chain as requirements to adopt the label follow a "better resources management avoiding waste" approach. While focusing on packaging, 24% of the full assessment was included under the packaging category. They guarantee certain sustainability requirements regarding the raw material to produce the packaging. The following tags, packaging and waste generation, have an overlap as 12 labels out of 17 under waste management were also under the packaging criterion. Other packaging labels, i.e. helping consumers to sort the waste by informing the packaging material, were excluded from the full assessment as they did not cover a holistic sustainability approach as described in the previous paragraphs.

Beyond the scope of the full sustainable labelling assessment, some examples of voluntary certifications were found to deal with a hotspot identified in food waste generation at the consumer level, which is the lack of food date marking understanding. This case aims to warn about the challenge of label understanding and how trade-offs should be carefully studied.

A study carried out by the European Commission (European Commission, 2018a), estimates that up to 10% of the 88 million tonnes of food waste generated annually in the EU are linked to date marking. The lack of data marking understanding by consumers was also found as a food waste driver in a study conducted by WRAP. Taking into account these figures, as part of the Circular Economy Action Plan, the Commission has sought to examine ways to improve the use of date marking by actors in the food chain and its understanding by consumers, with the support of the EU

Platform on Food Losses and Food Waste and its sub-group on date marking[12]. The Strategy foresees the revision of EU rules on date marking in order to prevent food waste linked to misunderstanding and/or misuse of these dates.

Some parallel actions aiming at reducing food waste from data marking by helping consumers and companies are:

- The EFSA Guidance on date marking and related food information published in 2020 which establishes a risk based approach to be employed by Food business operators to apply appropriate date marking following specific criteria. The guidance also includes recommendations on training activities and support for FBOs to develop appropriate food safety objectives. The aim of this document is to support food businesses in the process of establishing date markings that are actually based in risk assessment and not on the principle of avoiding liability (which is laid out in Reg. 178/2002).
- Initiatives launched by NGOs or companies: there is the Campaign lead by "Too good to go" focused to improve the understanding of "best before" and "use by" by a campaign pledge to reach food brands19. They invite companies adhering to this campaign to follow 4 steps, which include the adoption of a label to help consumers in understanding the food safety of a product. Other initiatives have been launched in Greece, with the "No food waste" promoted by Borume or "Refood" label in Denmark.

It should be noted that the effectiveness of these interventions has not been evaluated yet.

10.6 Overfishing

The EU marine living resources sector relies on wild fish and shellfish populations. This sector has increased the turnover since 2009 (European Commission, 2022). According to the EU blue economy 2022 report (European Commission, 2022), the situation of wild populations depends on the geographical area. In the North-east Atlantic Ocean and Baltic Sea, 28% of assessed fish and shellfish stocks are within safe biological limits, meaning that the number of stocks within safe biological limits has experienced a 3.5-fold increase, from 8 in 2003 to 28 in 2020. In contrast, 87% of the assessed stocks were overfished in the Mediterranean and Black Seas. According to the data disclosed by the Marine Stewardship Council (MSC) in its impact reports, about 58% of the catch reported in the North Sea is certified according to MSC standards, while only 0.17% of catch in the Mediterranean is certified and no certified catch data is available for the Black Sea (Marine Stewardship Council, 2021). However, the environmental impacts assessed by the MSC cover only stock status, fishing pressure, ecosystem health and habitats (Arton et al., 2020). Scientific research seems to converge on the need to broaden the scope of the impacts considered by sustainable fishery certification to account for more environmental dimensions, especially as recent studies have highlighted the high energy consumption and large use of fossil fuels by fishing vessels (Arton et al., 2020). Recent literature also points to correlations between energy intensity and overfishing, further stressing the need for further research and updates in eco-label standards (Vázquez-Rowe et al., 2012). Participation of other stakeholders of the fishery sector is also recommended, as life cycle approaches are not employed by MSC standards or other leading fishery eco-labels. Variability within the fishery sector entails a great complexity of standardizing evaluating practices as technological factors (vessel types and fishing fleet), distances of fishing areas, and the "skipper effect" (i.e. how variability in efficiency and environmental impact of a fishery can be related to the abilities of a vessel captain) affect the performance of different fisheries. In order to standardize, MSC favours mostly large scale fisheries, making it difficult for small-scale fleets to gain the recognition through sustainable labelling (Autzen & Hegland, 2021).

[12] EU Platform on Food Losses and Food Waste - https://food.ec.europa.eu/safety/food-waste/eu-actions-against-food-waste/eu-platform-food-losses-and-food-waste_en

10.7 Other environmental impacts

As mentioned previously, the coverage of environmental impacts by scientific literature is uneven and the following impacts were assessed by a lower number of documents: ecotoxicity, particulate matter, mineral and metal resource depletion. Effects of certification programs on ecotoxicity is indirectly addressed by the retrieved studies, which usually investigate the use of pesticides in certified and non-certified productions or evaluates the chemical safety action adopted by the standards. In Furumo et al. (2020) and Vermeulen et al. (2016), certified producers significantly decrease the use of pesticides and herbicides compared to non-certified production, Particulate matter did not seem to be addressed specifically by any source, however specific agricultural practices associated with particulate matter production such as burning in fields is excluded in certain labelling schemes and reported by Di Girolami & Arts (2018) when examining FSC labelling. Mineral and metal resource depletion can be linked with synthetic inputs used in agricultural production (e.g. fertilisers, pesticides, herbicides, fungicides, antibiotics, growth enhancers). Petrokofsky & Jennings (2018) found that studies generally evaluate the production practice adopted (i.e., whether certified producers decrease the use of synthetic inputs compared with non-certified ones), rather focusing on the final impacts. However, mixed evidences on input use are found within the literature (Petrokofsky & Jennings, 2018), with the exception of certified organic farming, which prohibit the use of synthetic inputs. Schimdt & De Rosa (2020) is one of the very few studies that apply Life Cycle Assessment to compare the impacts of a crop certified with a sustainable certification scheme vs a non-certified crop, thus have provide some indication on most of the environmental impacts.

11 Limitations

The present report aims to provide a better understanding of the current status of sustainability labelling in food products in the EU. The report aims to characterise and provide a comprehensive overview on existing sustainability-related labels in the market including an analysis of the environmental and social aspects covered by the identified sustainability labelling initiatives.

The analysis is extremely challenging as it needs to address different dimensions of sustainability, for various actors of the food system. The complexity of the present analysis required to combine different approaches and data sources with the aim of providing a comprehensive assessment from the current presence of sustainability labels in the market to available knowledge on the potential effect on environmental and social impacts. The assumptions made and limitations encountered are transparently presented, and should be carefully taken into account for the interpretation of the results.

11.1 Limitations in the use of the Mintel GNPD database

Some main limitations emerge in the use of Mintel GNPD for deriving the uptake shares and trends.

First, a new product in the database can be a new product launched but also any change in the packaging or reformulation of existing products, which could possibly lead to double counting of products that were already available in the market. However, as the number of products launched each year amounts to tens of thousands of products, this double counting is probably not severe. In addition, GNPD is supposed to mirror food product innovation, thus new food products are more likely to reflect initiatives on sustainability information compared to the actual food products in the EU market. However, GNPD does not provide total market shares of specific products. This may have resulted in an overestimation of the share of sustainability-related labels displayed in food products as these are more likely to be captured in GNPD as a niche in product innovation. Another limitation of the analysis concerns products that display more than one sustainability label covering different sustainability aspects, an issue that was noticed especially in the case of packaging related labels. Also, the GNPD includes new launches of finished products found in conventional retailers, while fresh products are not addressed. In addition, the data collection methods used by GNPD are likely to have evolved over time to capture more products and more markets, likely leading to underestimation of the uptake levels especially for the initial year of the uptake analysis (i.e., 2010). Such methodology refinements can have an impact in the precision level of actual trends definition. Finally, in the GNPD is not possible to distinguish EU produced from imported products.

An extensive review of grey and scientific literature was conducted to support the analysis and provide the necessary nuance to the interpretation of the results derived from the GNPD.

11.2 Limitations on the assessment of environmental and social impacts and aspects

Information on the environmental and social aspects covered by the current labels of the food EU market, as well as on life cycle stages, have been extrapolated investigating the label owner's webpage and the label's on-line publicly available documents (e.g. label's standard description, label's policy and management, certification conditions, annual reports). It is possible that, in certain cases, the publicly available information provided by the labelling standards is not complete. Thus, the analysis performed on determining the environmental impacts encompassed by the standard relies only on partial information. Furthermore, for certain labels, information is provided in a language other than English. In those cases, translation of documents or websites was carried out with on-line translator services (e.g. Google translator), which might have led to misinterpretations.

11.3 Limitations on the literature review

The literature review we conducted analysed a significant number of studies investigating a wide range of impacts and labels. However, it has a mainly narrative character: the results obtained only aim at providing a first qualitative overview of which environmental impacts are often analysed and if there is a general agreement on the effectiveness that such labels have in mitigating certain environmental impacts, rather than quantitative estimations of the effects such labelling schemes have on environmental impacts.

12 Conclusions

This technical report aims to characterise and provide a comprehensive overview on existing sustainability-related labels in the EU food market including an analysis of the environmental and social aspects covered by the identified sustainability labelling initiatives.

The results underline the high proliferation, heterogeneity and incoherencies of the sustainability labelling in the EU food market. Our research unearths how the abundance of different labels, with heterogeneous and non-systematic coverage of environmental impacts, is not addressing horizontally environmental aspects nor employing a systematic life cycle approach. We found a similar picture for labels encompassing the social sustainability dimension. Furthermore, the analysis shows how food supply chain actors are not equally involved in the sustainability efforts required by the label's standards, thus generating trade-offs among food products and environmental and social issues.

In addition, as shown by the analysis of trends over time, labels are unevenly implemented and distributed across EU Member States, with few sustainability labels leaders in the market, meaning that few labels cover a big share of labelled products. Moreover, labels are applied to few food product categories (such as: cocoa, oil palm, coffee, soybeans, sugarcane and fisheries), most of them produced in countries outside the EU.

Our literature review also aimed to complement and better understand the potential environmental impacts of sustainability labelling in food products. However, the main findings highlight the lack of quantitative scientific evidence on the environmental impacts of the labelling schemes. The establishment of causality between the implementation of production and management changes in a specific food supply chain and the environmental benefits is therefore not feasible. Besides sporadic evidence on the positive effects of certain certifications on biodiversity conservation and protection, and on halting deforestation, it was not possible to draw conclusions concerning most of the considered environmental impacts. The outcomes of the literature review, in agreement with previous studies, underline the need to further investigate the effectiveness of labelling in contrasting environmental issues. Knowledge and research gaps subsist in this field, especially on long-term monitoring and on broadening the scope of the impacts considered (e.g., biotic resources, waste and food waste generation).

Since the use of sustainability labels is set to spread further, as shown by current increasing trends of newly launched labelled products, policy measures to be implemented at European level would be pivotal to guide the consumer demand across the sustainability label plethora, enhancing a sustainable consumption and consequently pushing for a sustainable production, aiming to decrease potential impacts of the EU food system.

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List of abbreviations

ASC	Aquaculture Stewardship Council
CFCs	Chlorofluorocarbons
EEA	European Environment Agency
EC	European Commission
EFSA	European Food Safety Authority
FAO	Food and Agriculture Organization
FBO	Food Business Operator
FSC	Forest Stewardship Council
F2F	Farm to Fork
GHG	Greenhouse gas
GMO	Genetically modified organism
GNPD	Global New Products Database by Mintel
HBFCs	Hydrobromofluorocarbons
HCFCs	Hydrochlorofluorocarbons
JRC	Joint Research Centre
LCA	Life Cycle Assessment
LULUC	Land use and land use changes
MSC	Marine Stewardship Council
NGO	Non-Governmental Organization
N_2O	Nitrous oxide
OECD	Organisation for Economic Co-operation and Development
PEF	Product Environmental Footprint
PEFC	Programme for the Endorsement of Forest Certification
PM_{10}	Coarse particulate matter
$PM_{2.5}$	Fine particulate matter
RSPO	Roundtable on Sustainable Palm Oil
SDGs	Sustainable Development Goals
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
WWAP	World Water Assessment Programme

EU Member States

MS	Member State
EU	European Union
AT	Austria
BE	Belgium
CZ	Czechia
DE	Germany
DK	Denmark
EL	Greece
FR	France
IE	Ireland
IT	Italy
HR	Croatia
HU	Hungary
NL	Netherlands
SE	Sweden

Glossary and definitions: the meaning of sustainability labelling in the context of this report

In the present report, the following concepts and definitions regarding sustainability label are used:

Claim – A sustainability claim is defined as a message used to set apart and promote a product, process, business or service with reference to one or more of the three pillars of sustainability: social, economic and/or environmental (ISAEL, 2015). Examples of claims include logos and text claims.

Logo – Logo is meant as a symbol or other small design adopted by an organization, or a company, used as a special identifying sign (e.g. the European Union organic logo gives a coherent visual identity to organic products produced in the EU)[13].

Label – A food label is defined as "any tag, brand, mark, pictorial or other descriptive matter, written, printed, stencilled, marked, embossed or impressed on, or attached to the packaging or container of food" (Regulation (EU) No 1169/2011 of the European Parliament and of the Council of 25 October 2011 on the provision of food information to consumers, amending Regulations (EC) No 1924/2006 and (EC) No 1925/2006 of the European Parliament and of the Council, and repealing Commission Directive 87/250/EEC, Council Directive 90/496/EEC, Commission Directive 1999/10/EC, Directive 2000/13/EC of the European Parliament and of the Council, Commission Directives 2002/67/EC and 2008/5/EC and Commission Regulation (EC) No 608/2004). A label is thus an item providing consumers a variety of information about the product itself. This information, which includes notices such as ingredients, quality and nutritional value, can accompany the food or be displayed near the food to promote its sale. Labels may be of different typology, such as signalling positive labels or scoring/graded labels.

Sustainability food label – A sustainability food label is defined as a label providing information to consumers about the sustainability performance of food products, the latter intended as any information that relates to any of the sustainability dimensions underpinning the product (including any environmental and social aspects, as well as aspects of charity, animal welfare, packaging or end of life). Sustainability food labels may be of different typology, such as signalling positive labels or scoring/graded labels.

In this report the wording sustainability food label, sustainability-related food labels, sustainability label and sustainability labelling are interchangeably used.

Standard/Scheme – A sustainability labelling standard (or simply standard) and sustainability labelling scheme (or simply scheme) are used to identify "documented agreements containing technical specifications or other precise criteria to be used consistently as rules, guidelines or definitions, to ensure that materials, products, processes and services are fit for their purposes", as defined by FAO (2003).

In this report, the aforementioned terminologies are always intended to be related to the food sector and to food products and reflect the agreement between the researchers to support the approach used in the present work.

[13] Definition adapted from the EU organic farming logo description (https://agriculture.ec.europa.eu/farming/organic-farming/organic-logo_en) and the Oxford Dictionary (https://www.oxfordlearnersdictionaries.com/definition/english/logo?q=logo)

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Annexes

Annex 1. List of Mintel GNPD product claims related to ethical and environmental aspects

The list of Mintel GNPD product claims related to ethical and environmental aspects was used as an assumption to analyse the share of sustainability claims in the present report. In the absence of a legal definition for sustainability-related claim in food products, the current results reflect the agreements between the authors for the purpose of the analysis. The list of product claims was used as an inclusion criteria to define the share of food products screened for the presence of logos.

Figure A1.1. Mintel GNPD product claims related to ethical and environmental aspects and used as criteria to define sustainability claims

Carbon Neutral	" for products that have been manufactured without producing carbon emissions or where the manufacturer has offset all of the carbon emissions used in the production of the product. Also, if the packaging itself is described as being carbon neutral, then this claim should be selected. "
Ethical Biodegradable	"Selected for products whose materials are chemically broken down by the environment"
Ethical – Environmentally Friendly Package	"For products that claim that the packaging for its product is friendly to the environment"
Ethical – Environmentally Friendly Product	"For products that claim that the actual product is friendly to the environment. references to being environmentally friendly/ethical such as earth-friendly, eco-friendly, taking care of the planet, safe for the environment, minimal impact on the environment, no negative impact to the environment, ethically-sourced or responsibly sourced; climate-neutral; reference to climate change/global warming; carbon positive; short distribution channels; for ISO certifications in the 14000 group; upcycle; reducing CO2 emissions; low carbon footprint; agroecological farming; or for all mentions of ethically sourced without further explanation"
Ethical – Human	For products that support or adhere to certain moral or social ideals that regard the treatment of people.
Ethical – Recycling	This includes all products or packaging that can be recycled, or are made from recycled materials.
Ethical – Sustainable (Habitat/Resources)	Sustainable items are those providing environmental, social and economic benefits while protecting public health, welfare, and the environment over their full commercial cycle, from the extraction of raw materials to final disposition, if the product is claimed to preserve, protect, sustain or encourage wildlife, species, ecosystems, biodiversity, flora and fauna; if it mentions respect or support to different habitats or habitat preservation
Organic	Used when the product is claimed to be organic or features any reference to organic, and for the terms organically grown, Biodynamic and Demeter. Some logos include Bioland, EKO, KRAV, Naturland etc
Ethical - Charity	For products that claim to support any charitable organisation to benefit the environment, people or animals – through raising awareness or financial donation. Key charities include: breast cancer, cancer research, projects around the world, 1% for the planet, cleaner water, etc.
Ethical - Animal	For products that support or adhere to certain moral or social ideals that regard the treatment of animals. Common terms include but are not limited to: not tested on animals, against animal testing, free-range, BUAV approved, pasture fed/raised, humanely treated animals, cage-free, FAD-free, animal/dolphin/sow/bee/orangutan/panda/elephant friendly
Ethical – Toxins Free	To be flagged if reference is made to the product or packaging containing fewer environmentally harmful, polluting or toxic ingredients, or for the keywords: CFCs, DDT, pesticides, herbicides, water-based, non-polluting ingredients, ozone-friendly, dioxin, phosphate, chlorine, ammonium, phosphorus, and toxic ingredients (unless they are associated with skin or personal health). It is also to be selected for packaging when watery ink/vegetable ink/soy ink, unbleached packaging is used, water-based products, when the packaging is ozone friendly, lead-free wick (lead free), non-polluting ingredients, printed with colours free from mineral oils, and should also be selected for products free from mineral/artificial/chemical fertilisers
Palm Oil Free	This claim should be selected for products that state they are free from palm, palm oil, palm fat, or any palm-derived ingredient. Should not be flagged for products that only state to be made with ethically sourced, sustainable, RSPO certified palm oil, or any other certified palm oil.

Source: Adapted from Mintel GNPD

Annex 2. List of selected labels analysed in the full assessment

The shortlist of fully assessed sustainability labels comply with the following criteria:

- Label typology: labels referring to positive endorsement and scoring labels were selected. Brand-owned labels or claims were excluded, as well as labels referring exclusively to charity or packaging aspects;
- Implementation status: only labels which are implemented, proposed or at a pilot phase were retained for the analysis. Labels under development were excluded;
- Sustainability dimension coverage: labels exclusively encompassing the environmental dimension, labels exclusively encompassing the social dimension and labels including both dimensions (i.e. environmental and social) have been selected.
- Label scope: labels focusing on products and/or processes and company have been selected to undergo to the full assessment. Labels related exclusively to company aspects, charity aspects, and labels referring exclusively to the product's packaging composition and product's packaging dismantling options (e.g. possibility to recycle or to compost) were excluded from the analysis;

This selection brought to a short-list of 73 labels, which are listed in Table A2.1. The majority (65) were positive endorsement labels and only 8 were scoring labels. The label scope was mostly focused on process/products (36%) and process/product/product (ingredient only) (35%). The majority of the labels may be applied to all food (about 53%) and are management based (76%). Most of the labels (72%) encompasses both environmental and social dimensions. When labels were checked for the level of compliance, these resulted to be mostly certified by a third party under accreditation (45%). The ownership of these labels was mostly private whereas public labels resulted to be a minority (about 7%).

Table A2.1. List and characterization of fully assessed sustainability labels, alphabetically ordered. (Source: Sanyé Mengual et al. 2023)

Name	Label typology	Label scope (focus)	Geographical scope	Products/product groups addressed by the labelling	Product coverage (specification)	Label basis	Coverage of sustainability dimensions	Verification and auditing	Ownership
A+ New Zealand Sustainable Aquaculture	Signalling/Positive endorsement	Process/Product (ingredient only)	International	Limited to certain foods	Fish and Seafood from Aquaculture	Management based	Environmental, Social (including animal welfare)	Third party (certification under accreditation)	Private (other)
Agri Confiance	Signalling/Positive endorsement	Process/Product	National	All foods	Dairy, Fruit, Vegetables, Field Crops, Poultry, Palmipedes, Fish Farming, Wine	Management based	Environmental, Social (including animal welfare)	Third party (certification under accreditation)	Private (multiple stakeholders)
Agriqualita	Signalling/Positive endorsement	Process/Product/Product (ingredient)	Regional	All foods	Vegetables, Crops	Management based	Environmental	Third party (certification)	Public
Alaska Responsible Fisheries Management	Signalling/Positive endorsement	Process/Product (ingredient only)	International	Limited to certain foods	Fish, Seafood	Management based	Environmental, Social (including animal welfare)	Third party (certification under accreditation)	Private (no profit)
ASC (Aquaculture Stewardship Council)	Signalling/Positive endorsement	Process/Product/Product (ingredient only)	International	Limited to certain foods	Fish and Seafood from Aquaculture	Management based	Environmental, Social (including animal welfare)	Third party (certification under accreditation)	Private (multiple stakeholders/No profit)
Bee Friendly	Signalling/Positive endorsement	Process/Product	European	Limited to certain foods	Fruits and Vegetables, Dairy	Management based	Environmental	Third party (certification)	Private (multiple

									stakeholders)
Beelong Eco-Score	Graded/Scoring	Process/Product/Product (ingredient only)	National	All foods	All Foods	Environmental assessment based	Environmental, Social (animal welfare only)	Not specified	Private (other)
Best Aquaculture Practices Certified	Signalling/Positive endorsement	Process/Product (ingredient only)	International	Limited to certain foods	Aquaculture Products	Management based	Environmental, Social (including animal welfare)	Third party (certification under accreditation)	Private (multiple stakeholders/No profit)
Bilan Carbone	Signalling/Positive endorsement	Company/Process/Product	National	All foods	All Foods	Environmental assessment based	Environmental	Not specified	Private (other)
Bio Equitable en France	Signalling/Positive endorsement	Process/Product	National	All foods	Fruits, Legumes, Cerals, Spices and Medical Plants, Dairy Products, Meat (Cows, Goats, Pork, Birds), Eggs	Management based	Environmental, Social (including animal welfare)	Third party (No certification)	Private (multiple stakeholders)
Biopartenaire	Signalling/Positive endorsement	Process/Product/Product (ingredient only)	National	All foods	All Foods	Management based	Social (including animal welfare)	Third party (No certification)	Private (multiple stakeholders/No profit)
Bird Friendly Coffee (Smithsonian)	Signalling/Positive endorsement	Process/Product	International	Limited to certain foods	Coffee	Management based	Environmental	Third party (certification)	Private (other)
Bleu Blanc Coeur (Blue White Heart	Signalling/Positive endorsement	Process/Product	National	All foods	All Foods	Combination	Environmental, Social (including	Third party (No certification)	Private (other)

							animal welfare and nutrition)		
Bonsucro Certified Sustainable Sugar Cane	Signalling/Positive endorsement	Process/Product (ingredient only)	International	Limited to certain foods	Sugar Cane	Management based	Environmental, Social	Third party (certification under accreditation)	Private (multiple stakeholders/No profit)
Carbon Trust	Signalling/Positive endorsement	Company/Process/Product	International	All foods	All Foods	Environmental assessment based	Environmental	Third party (certification)	Private (other)
Certifié Agri-Éthique France Commerce Équitable (Agri-Ethic France Certified Fair-Trade)	Signalling/Positive endorsement	Process/Product	National	All foods	Cereals, Legumes, Fruits, Vegetables, Dairy, Meat, Eggs, Honey	Management based	Environmental, Social (including animal welfare)	Third party (certification)	Private (other)
Chocolatiers Engagés	Signalling/Positive endorsement	Process/Product (ingredient only)	European	Limited to certain foods	Cocoa	Management based	Environmental, Social	Not specified	Private (multiple stakeholders)
Climate Neutral	Signalling/Positive endorsement	Company/Process/Product	International	All foods	All Foods	Environmental assessment based	Environmental	Third party (certification)	Private (multiple stakeholders/No profit)
CO2 Neutral	Signalling/Positive endorsement	Company/Process/Product	International	All foods	All Foods	Environmental assessment based	Environmental	Third party (certification under accreditation)	Private (other)

Control Union Fair Choice	Signalling/Positive endorsement	Process/Product	International	All foods	Agricultural Products	Management based	Environmental, Social	Third party (certification)	Private (other)
Cradle to cradle	Signalling/Positive endorsement	Process/Product (packaging only)	International	All packaged foods	Plastic	Management based	Environmental, Social (including animal welfare)	Third party (certification under accreditation)	Private (multiple stakeholders/No profit)
CRC	Signalling/Positive endorsement	Process/Product/Product (ingredient only)	National	Limited to certain foods	Bread, Cereals	Management based	Environmental, Social	Third party (certification)	Private (multiple stakeholders)
Demeter	Signalling/Positive endorsement	Process/Product/Product (ingredient only)	International	All foods	Wine, Dairy, Meat, Eggs, Fruit, Vegetables, Processed Foods With Certified Ingredients	Management based	Environmental, Social (including animal welfare)	Third party (certification under accreditation)	Private (multiple stakeholders/No profit)
Direct Trade	Signalling/Positive endorsement	Process/Product	International	All foods	All Foods	Management based	Social	Not specified	Private (multiple stakeholders/No profit)
Eaternity Score	Graded/Scoring	Process/Product	National	All foods	All Foods	Environmental and social assessment based	Environmental, Social (animal welfare only)	Not specified	Private (other)
Eco Impact	Graded/Scoring	Process/Product	National	All foods	All Foods	Environmental assessment based	Environmental	Not specified	Private (No profit)
Eco-Score	Graded/Scoring	Process/Product	National	All foods	All Foods	Environmental and social	Environmental, Social	Not specified	Private (multiple

						assessment based			stakeholder s)
Enviroscore	Graded/Scoring	Process/Prod uct	Not applicable	All foods	All Foods	Environmental assessment based	Environmental	Not specified	Private (other)
Fair for life	Signalling/Positi ve endorsement	Process/Prod uct/Product (ingredient only)	International	All foods	Crops, Wild Plants, Livestock, Beekeeping, Aquaculture, Sea Salt,	Management based	Environmental, Social (including animal welfare)	Third party (certification)	Private (other)
Fair'n Green	Signalling/Positi ve endorsement	Process/Prod uct	International	Limited to certain foods	Wine	Combination	Environmental, Social	Third party (certification)	Private (multiple stakeholder s)
Fairtrade	Signalling/Positi ve endorsement	Process/Prod uct/Product (ingredient only)	International	Limited to certain foods	Bananas, Cocoa, Coffee, Composites, Fruit Juices, Herbs, Spices, Honey, Nuts, Oils, QuiNoa, Rice, Sugar, Tea, Vegetables, Wine	Management based	Environmental, Social	Third party (certification under accreditation)	Private (multiple stakeholder s/No profit)
FairWild	Signalling/Positi ve endorsement	Process/Prod uct/Product (ingredient only)	International	Limited to certain foods	Wild Medicinal and Aromatic Plants, Tea Plants, Plant Parts and Plant Products, Fungi and Lichenes Collected from Natural Habitats	Management based	Environmental, Social	Third party (certification under accreditation)	Private (No profit)
FirstClimate Naturstrom Basis	Signalling/Positi ve endorsement	Company/Pr ocess/Produ ct	International	All foods	All Foods	Environmental assessment based	Environmental	Third party (certification)	Private (other)

(Natural Energy Base)									
Food Alliance	Signalling/Positive endorsement	Process/Product/Product (ingredient only)	International	All foods	Fruits, Vegetables, Grains, Livestock, Eggs, Dairy, Shellfish, Mushrooms, Grains, Legumes, Horticultural Products, and Prepared Food Products	Management based	Environmental, Social (including animal welfare)	Third party (certification)	Private (No profit)
Friend of the Earth	Signalling/Positive endorsement	Process/Product	International	All foods	Agricultural Products	Management based	Environmental, Social (including animal welfare)	Third party (certification under accreditation)	Private (other)
Friend of the Sea	Signalling/Positive endorsement	Process/Product (ingredient only)	International	Limited to certain foods	Fish,Seafood, Algae and Seeweeds, Aquaculture Products	Management based	Environmental, Social (including animal welfare)	Third party (certification under accreditation)	Private (multiple stakeholders/No profit)
FSC (Forest Stewardship Council)	Signalling/Positive endorsement	Process/Product (packaging only)	International	All packaged foods	Wood, Paper Packaging	Management based	Environmental, Social	Third party (certification under accreditation)	Private (multiple stakeholders/No profit)
Gepa Fair	Signalling/Positive endorsement	Company/Process/Product	National	All foods	All Foods	Management based	Environmental, Social	Not specified	Private (other)

GGN (Global Gap Agricultural Practice)	Signalling/Positive endorsement	Process/Product/Product (ingredient only)	International	Limited to certain foods	Fruit, Vegetables,	Management based	Environmental, Social (including animal welfare)	Third party (certification under accreditation)	Private (multiple stakeholders)
Haute Valeur Environnementale (High Environmental Value)	Signalling/Positive endorsement	Process/Product/Product (ingredient only)	National (France)	All foods	Farmed Seafood	management based	Environmental	third party (certification)	Public
Haute Valeur Environnementale (High Environmental Value)	Signalling/Positive endorsement	Process/Product/Product (ingredient)	National	All foods	Agricultural Products	Management based	Environmental	Third party (certification)	Public
Iceland Responsible Fisheries	Signalling/Positive endorsement	Process/Product/Product (ingredient only)	International	Limited to certain foods	Fish	Management based	Environmental, Social (animal welfare only)	Third party (certification under accreditation)	Private (multiple stakeholders/No profit)
Imprim'Vert	Signalling/Positive endorsement	Process/Product (packaging only)	International	All packaged foods	Printing Communication	Management based	Environmental	Third party (No certification)	Private (other)
KRAV	Signalling/Positive endorsement	Process/Product/Product (ingredient only)	European	All Foods	Crops, Animal-based Products	Management based	Environmental, Social (including animal welfare)	Third party (certification under accreditation)	Private (other)
La Note Globale	Graded/Scoring	Process/Product	National	All foods	All Foods	Combination	Environmental, Social (including	Third party (certification)	private (multiple

							animal welfare and nutrition)		stakeholders)
LEAF Linking Environment and Farming	Signalling/Positive endorsement	Process/Product/Product (ingredient only)	International	All foods	Agricultural Products	Management based	Environmental, Social (including animal welfare)	Third party (certification under accreditation)	Private (other)
LifeGate Carbon Neutral	Signalling/Positive endorsement	Process/Product	National	All foods	All Foods	Environmental assessment based	Environmental	Not specified	Private (other)
M-Check (Migros, retail)	Graded/Scoring	Process/Product	National	Limited to certain foods	Animal-based Products	Environmental and social assessment based	Environmental, Social (animal welfare only)	Not specified	Private (brand owned)
MSC Marine Stewardship Council	Signalling/Positive endorsement	Process/Product/Product (ingredient only)	International	Limited to certain foods	Fish, Seafood	Management based	Environmental, Social (including animal welfare)	Third party (certification under accreditation)	Private (multiple stakeholders/No profit)
Nature & Progrès (Nature and Progress)	Signalling/Positive endorsement	Process/Product	National	All foods	Agricultural Products	Management based	Environmental, Social (including animal welfare)	Not specified	Private (multiple stakeholders)
Naturland Fair	Signalling/Positive endorsement	Process/Product/Product (ingredient)	International	All foods	All Foods	Management based	Social (including animal welfare)	Third party (certification under accreditation)	Private (other)
Nordic Ecolabel	Signalling/Positive endorsement	Process/Product	European	All packaged foods	Glass	Management based	Environmental	Third party (certification)	Private (other)

		(packaging only)							
On the Way to PlanetProof	Signalling/Positive endorsement	Process/Product	European	All foods	Potatoes, Vegetables, Fruit, Dairy, Eggs, Flowers, Flower Bulbs, Trees and Plants, and Prepared and Processed Products.	Combination	Environmental, Social (animal welfare only)	Third party (certification under accreditation)	Private (No profit)
Operaequa	Signalling/Positive endorsement	Process/Product (ingredient only)	International	All foods	Agricultural Products	Combination	Environmental, Social	Third party (certification)	Private (other)
Origin Ireland Q Mark (Bord Bia)	Signalling/Positive endorsement	Process/Product	National	Limited to certain foods	Bacon, Beef, Chicken, Duck, Eggs, Pork, Turkey, Vegetables	Management based	Environmental, Social (including animal welfare)	Third party (certification under accreditation)	Public
PEFC (Programme for the Endorsement of Forest Certification)	Signalling/Positive endorsement	Process/Product (packaging only)	International	All packaged foods	Wood, Paper Packaging	Management based	Environmental, Social	Third party (certification under accreditation)	Private (multiple stakeholders/No profit)
Planet-Score	Graded/Scoring	Process/Product	National	All foods	All Foods	Environmental and social assessment based	Environmental, Social (animal welfare only)	Not specified	Private (multiple stakeholders)
PLS Productos Lácteos Sostenibles	Signalling/Positive endorsement	Process/Product	National	Limited to certain foods	Dairy Products	Management based	Social	Third party (No certification)	Public

(Sustainable Dairy Products)									
Presidi Slow Food	Signalling/Positive endorsement	Process/Product/Product (ingredient only)	National	All foods	Agricultural Products	Management based	Environmental, Social (including animal welfare)	Self assessment	Private (multiple stakeholders)
Pro Weideland	Signalling/Positive endorsement	Process/Product (ingredient only)	National	Limited to certain foods	Dairy and Meat	Management based	Environmental, Social (animal welfare only)	Third party (certification)	Private (multiple stakeholders)
Producción Integrada Andalucia (Integrated Andalusian Production)	Signalling/Positive endorsement	Process/Product/Product (ingredient only)	Regional	All foods	Fruit, Vegetables, Nuts, Wine, Olive Oil, Cereals, Livestock	Management based	Environmental, Social (animal welfare only)	Third party (certification)	Public
Proterra	Signalling/Positive endorsement	Process/Product/Product (ingredient only)	International	All foods	Agricultural Products	Management based	Environmental, Social	Third party (certification under accreditation)	Private (multiple stakeholders/No profit)
Rainforest Alliance	Signalling/Positive endorsement	Process/Product/Product (ingredient only)	International	Limited to certain foods	Cocoa, Coconut,	Management based	Environmental, Social	Third party (certification under accreditation)	Private (multiple stakeholders/No profit)
RTRS Certified (Round Table on	Signalling/Positive endorsement	Process/Product (ingredient only)	International	Limited to certain foods	Coffee, Fruits, Herbal, Spices, Nuts, Tea, Vegetables	management based	Environmental, Social	third party (certification under accreditation)	Private (multiple stakeholders/no profit)

Responsible Soy)									
RSPO	Signalling/Positive endorsement	Process/Product (ingredient only)	International	Limited to certain foods	Palm Oil	Combination	Environmental, Social	Third party (certification under accreditation)	Private (multiple stakeholders/No profit)
RTRS Certified (Round Table on Responsible Soy)	Signalling/Positive endorsement	Process/Product (ingredient only)	International	Limited to certain foods	Soya	Management based	Environmental, Social	Third party (certification under accreditation)	Private (multiple stakeholders/No profit)
SIP Certified	Signalling/Positive endorsement	Process/Product/Product (ingredient only)	International	Limited to certain foods	Grapes, Wine	Management based	Environmental, Social	Third party (certification)	Private (other)
SQNPI Qualità Sostenibile	Signalling/Positive endorsement	Process/Product/Product (ingredient)	National	Limited to certain foods	Crops, Vegetables	Management based	Environmental	Third party (certification)	Public
Sustainable Rice Platform, SRP Verified	Signalling/Positive endorsement	Process/Product (ingredient only)	International	Limited to certain foods	Rice	Management based	Environmental, Social	Third party (certification under accreditation)	Private (multiple stakeholders/No profit)
Sustainable Winegrowing New Zealand	Signalling/Positive endorsement	Process/Product	International	Limited to certain foods	Wine	Not specified	Environmental, Social	Third party (certification)	Private (multiple stakeholders)

Sustainably Grown certified	Signalling/Positive endorsement	Process/Product/Product (ingredient only)	International	Limited to certain foods	Vegetables, Crops	Management based	Environmental, Social	Third party (certification under accreditation)	Private (other)
UTZ	Signalling/Positive endorsement	Process/Product/Product (ingredient only)	International	Limited to certain foods	Bananas, Cocoa, Coffee, Composites, Fruit Juices, Herbs, Spices, Honey, Nuts, Oils, QuiNoa, Rice, Sugar, Tea, Vegetables, Wine	Management based	Environmental, Social	Third party (certification under accreditation)	Private (multiple stakeholders/No profit)
Vergers Écoresponsables (Eco-Responsible Orchards)	Signalling/Positive endorsement	Process/Product	National	Limited to certain foods	Apples, Pears, Peaches, Nectarines and Apricots	Management based	Environmental	Third party (No certification)	Private (multiple stakeholders)

Source: JRC own elaboration

Annex 3. Mapping between environmental impacts and related activities of the food systems, by impact category

This annex details the scientific knowledge underpinning the mapping between the environmental impacts and the related relevant activities along the food supply chain (presented in Section 3.3.4), by environmental impact. Current policy initiatives targeting these impacts (e.g., initiatives related to energy and climate, to circular economy or to organic production) have been identified and described in Sanyé Mengual et al. (2024a, 2024b).

Climate change: The current food system (production, transport, processing, packaging, storage, retail, consumption, waste management) is responsible for 30% of greenhouse gas (GHG) emissions in Europe (Crippa et al., 2021).

Farm stages dominate the GHG emissions, representing 61% of the whole food sector's GHG emissions (Poore & Nemecek, 2018). Land use and land use changes (LULUC) associated with agricultural production represent the main GHG emissions source. In 2018 these were estimated to account for 4 Gt CO_2eq year (FAO, 2020), or about 32% of the total food-system emissions (Crippa et al., 2021). Deforestation and land degradation are the main drivers of LULUC climate change through emission of GHGs and reduced rates of carbon uptake (FAO, 2020; Olsson et al., 2019).

The food system has become more and more energy intensive. GHG emissions derived from the production and use of energy and fuels required along the whole supply chain represent the second cause of GHG emission in industrialised as well as in developing countries (Crippa et al., 2021). A significant share of energy is required at farm level, especially for fertilisers manufacturing, use of machinery and irrigation. Food packaging, retail and supermarkets are also energy intensive processes within the food supply chain (European Environment Agency, 2019; Notarnicola et al., 2017), as well as food processing industry and households, which represent 30% and 20% of total food systems' energy emissions, respectively (UNEP, 2022). Food transportation has been estimated to account between 5% and 11% of the total emissions from energy in the global food systems (Poore & Nemecek, 2018; Tubiello et al., 2022). However, when the relevant international and domestic transport distances and commodity masses used by the global food sector are accounted for, transportation account for almost the 20% of the total food-system carbon footprint (Li et al., 2022).

Another important climate change driver is represented by non-CO_2 GHG emissions sources. Although since 1990 non-CO_2 GHG emissions from agriculture have declined, agriculture remains the largest contributor to total EU non-CO_2 GHG emissions (European Environment Agency, 2019). Agricultural non-CO_2 emissions are constituted mainly by methane (CH_4) and nitrous oxide (N_2O). Enteric fermentation of ruminant livestock is the major source of methane emissions, which make up the largest share (38 %) of all GHG emissions in the sector. Nitrous oxide generating from the use of fertilisers (both synthetic and organic) represented 25 per cent of total agricultural emissions in 2019 (FAO, 2020).

Although methane emissions from enteric fermentations and nitrogen emissions from fertilizers have decreased in Europe in the last decades, global emissions continued to grow after 2010 (FAO, 2020; UNEP, 2022).

The food sector contributes to climate change, but it is also vulnerable to climate change. Changes in CO_2 concentration, temperature and precipitation patterns as well as weather and climate extremes are already influencing crop yields and livestock productivity in Europe (European Environment Agency, 2019). Climate change may favour the productivity of certain crops, being longer growing seasons and more suitable crop conditions in certain world areas. However, the number of extreme climate events is expected to increase, accelerating land degradation, altering water availability and quality (Bezner Kerr et al., 2022), inducing land use changes and biodiversity loss (European Environment Agency, 2019), with consequent negative impacts on food quality and production stability (Ebi & Loladze, 2019; Rama et al., 2022). Climate change affects oceans, marine and freshwater systems as well. Ocean warming has decreased sustainable yields of some wild fish populations and has already affected farmed aquatic species (Rama et al., 2022).

Nevertheless, the agricultural sector may contribute mitigating climate change, through the removal of CO_2 from the atmosphere by implementing adaptation strategies that increase carbon sequestration and storage, such as cover crops, crops diversification and rotation, minimum or no tillage, increased irrigation efficiency, organic and precision farming, improved grassland and pastures (European Environment Agency, 2019).

Ozone depletion: As widely recognised in the literature, the main compounds causing significant ozone depletion are represented by refrigerants, including chlorofluorocarbons (CFCs), carbon tetrachloride, methyl chloroform, halons, hydrochlorofluorocarbons (HCFCs), hydrobromofluorocarbons (HBFCs) (European Environment Agency, 2016), which are strictly regulated by international[14] and European[15] measures. Another important compound is methyl bromide. Although banned in European countries as agricultural pesticides, it is still used throughout the developing world, especially as a fumigant to control pests in soils, structures and commodities (European Environment Agency, 2016).

Other anthropogenic factors affecting the ozone layer are constituted by certain GHG emissions, such as methane and nitrous oxide (Ravishankara et al., 2009). Nitrous oxide (N_2O) is nowadays considered as the dominant ozone-depleting substance (Portmann et al., 2012; Ravishankara et al., 2009). In agriculture, this gas results from nitrogen surplus on farm, especially deriving from application of nitrogen-fertilisers (Meier et al., 2015; Tuomisto et al., 2012). Therefore, interventions in decreasing the use of fertilisers and ameliorating fertilisation practices by increasing their efficiency may favour a reduction of N_2O emissions, and thus a reduction of ozone depletion at primary production stage of the food supply chain.

Land use: The food system is recognised to be one of the major drivers of land use and land use changes worldwide (Poore & Nemecek, 2018; Willett et al., 2019). Almost half of all habitable land is used for agriculture (Ritchie & Roser, 2022) which is among the dominant sectors driving land degradation due to land use changes and unsustainable land management practices (Olsson et al., 2019). Indeed, farmland expansion, driven by the necessity of higher production, have caused land use changes, converting different ecosystems areas to agricultural land. Over the period 2011-2015, almost 30% of the deforestation (e.i. long-term permanent conversion of forest to non-forest land uses) occurring at global scale was attributed to commodity production (including palm oil, soybean and cattle grazing), and shifting agriculture was estimated to cause 24% of global forest disturbance (Curtis et al., 2018). Livestock production is an important driver of deforestation due to the rapid expansion of pastures but also to the increasing demand for high-quality protein feeds, such as soybean. It has been estimated that, in South America, livestock is responsible for more than 85% of deforestation (71% for grazing and 14% for animal feed)(Bonnet et al., 2020).

Unsustainable farming practices may provoke land degradation, including soil erosion, compaction, salinisation and soil organic carbon and nutrient losses (Olsson et al., 2019; van der Werf et al., 2020), deteriorating in such way the overall soil quality and fertility. Contrarily, sustainable practices may reverse land degradation (Olsson et al., 2019). Indeed, preferring organic fertilisers, green manure, intercropping, no or reduced tillage, agroforestry, livestock integration and other sustainable practices often applied under organic and agroecological agriculture, it has been demonstrated to favour soil fertility and quality (Gomiero et al., 2011; Wezel et al., 2014). These practices moreover may also increase the carbon stock of soils, acting as soil carbon storage, influencing positively GHG emissions at farm level (European Environment Agency, 2019; Olsson et al., 2019; Wezel et al., 2014).

[14] The first international agreement aimed at protecting the ozone layer was the Vienna Convention (1985). The Montreal Protocol of 1987 (and subsequent Amendments and Adjustments) aims to eliminate the production and use of ozone-depleting substances worldwide (EEA, 2022).

[15] EU measures and policies to protect the ozone layer include the Regulation (EC) No 1005/2009 on substances that deplete the ozone layer lays down rules on the production, use, trade, recovery, recycling, reclamation and destruction of ODS and sets out requirements and measures for products and equipment containing these substances. On 5 April 2022, the European Commission put forward a legislative proposal to replace it (European parliament 2022, https//www.europarl.europa.eu/thinktank/en/document/EPRS_BRI(2022)738195)

Nonetheless, under large-scale implementation of organic or agroecological food production, the land requirement for agriculture would increase, due to the lower yields obtainable from organic systems in comparison with conventional systems (Röös et al., 2022). However, it has been demonstrated that if combined with a reduction in food waste and shifts to plant-based diets (allowing a reduction in farmed animals and feed crop production), organic agriculture could contribute to feeding more than 9 billion people in 2050 (Benton et al., 2021).

Water use: Food systems are nowadays incredibly resource intensive, also concerning water use (Poore & Nemecek, 2018). It has been estimated that almost 70% of global freshwater is withdrawn for irrigation and livestock production (Foley et al., 2011; WWAP, 2019). Irrigation is performed only on 20% of the global arable land, producing 40% of the global food production. More efficient irrigation practices and wastewater treatments are key to increasing the resilience of food systems (Mohtar & Fares, 2022). The remaining production relies on water-fed, which faces growing water risk due to climate change and water use competitions. Indeed, in many regions, agriculture is increasingly subject to extreme weather events (such as droughts, floods, storms, and sea-level rise), which translates into significant yields decline (Gruère et al., 2020). Furthermore, these risks are exacerbated by the growing competition for water from energy, industry or domestic use in urban areas (Gruère et al., 2020).

Almost all animal-based products have a higher water footprint than plant-based products (Watts et al., 2016), since livestock systems use water for feedstock cultivation, but also for drinking and animal servicing, stable washing and cooling, as well as for the maintenance and operation of slaughterhouses and processing plants (Steinfeld et al., 2006a).

Food processing is estimated to consume 20% of all extracted fresh water (FAO, 2012).

Eutrophication: Eutrophication is defined as the excessive plant and algal growth in waterbodies due to the increased availability of one or more limiting growth factors needed for photosynthesis (Schindler, 2006), such as sunlight, carbon dioxide, and nutrient fertilizers. Food systems, besides being a major responsible for water consumption, also concur in polluting aquatic ecosystems through both point-source discharges and non-point loadings of limiting nutrients, especially nitrogen and phosphorus compounds and organic matter (Mateo-Sagasta et al., 2017; Ringler et al., 2022).

Primary production is the main responsible of eutrophication along the entire food supply chain (Notarnicola et al., 2017).

In crops cultivation, eutrophication generally occurs when fertilizers are applied at a greater rate than they are fixed by soil particles or exported from soil profiles (Mateo-Sagasta et al., 2017). A recent systematic review of life cycle assessment (LCA) studies comparing organic and conventional cropping systems by (Boschiero et al., 2023) reveals that organic crop systems present lower eutrophication impacts, irrespectively by lower yields.

Livestock husbandry also plays a key role in generating eutrophication. Although organic fertilisers (i.e. manure) have positive impacts on soil fertility and soil biodiversity, a high concentration of livestock in a given zone risks to eliminate these positive impacts by generating an excess of nutrients and thus leading to water pollution (Bonnet et al., 2020). In extensive livestock production systems, usually a diffuse water pollution takes place, due to natural manure or slurry fertilisation of pastures and grazing areas. In intensive systems the associated production of wastes tends to go beyond the buffering capacity of surrounding ecosystems, thereby polluting surface waters and groundwater (Mateo-Sagasta et al., 2017).

Fish excreta and uneaten feeds from fed aquaculture diminish water quality and concur to eutrophication, even though this is much lower than the agriculture-related contribution (Mateo-Sagasta et al., 2017).

Ecotoxicity: Worldwide, pesticide use increased from 1.5 to 2.6 kg active ingredient per ha of cropland from 1990 to 2015 (van der Werf et al., 2020). If agrochemicals undoubtedly permitted an intensification of production and increased yields, to the other side they are recognized as a major cause of environmental burdens and impacts, such as ecotoxicity (UNEP, 2016).

It is demonstrated that generally organic production presents a lower ecotoxicity impact compared to conventional crop systems (Boschiero et al., 2023), although relying on copper-based agrochemicals.

Beside crop production, also animal farming and aquaculture are responsible for ecotoxicity impacts, with emissions of nutrients, hormones, antibiotics and heavy metals to the environment (Du & Liu, 2012; UNEP, 2016; Watts et al., 2016).

In 2020, with food representing around 45% of the environmental impacts of EU consumption, the EU food system alone transgresses several planetary boundaries, including freshwater ecotoxicity (5 times) (Sala et al., 2023).

Resources minerals and metals: Food systems heavily rely on metals and minerals. Primary production uses minerals and metals as source of fertilisers and pesticides (UNEP, 2016). Conventional systems use significant amount of phosphorous (P) and potassium (K) which represent fundamental fertilisers for crop production Organic cultivation, which is one of the most restrictive standards in terms of pesticides and fertilisers use, although forbidding synthetic fertilisers and pesticides, allows sulphur and copper and sulphur-based compounds, which are extensively used, especially as pesticides (Tamm et al., 2022).

Packaging is another step of the food supply chain that consumes metals (Notarnicola et al., 2017), such as aluminium, iron, tin and bauxite. For instance, about 17% of aluminium in Europe is used in packaging (UNEP, 2016). The metals used in building the infrastructures and machineries used during food processing, transport, storage and waste treatment should also be considered, however they are of minor extent (UNEP, 2016).

Particulate matter: In 2020, the EU food system alone transgresses several planetary boundaries, including particulate matter (6 times) (Sala et al., 2023). Food systems contribute to particulate matter (PM) formation in several ways. Road transportation and energy consumption required along the whole food supply chain represent the principal source of coarse (PM_{10}) and fine ($PM_{2.5}$) particulate matter (European Environment Agency, 2021).

Other emissions of PM_{10} arise from farm-level operations, such as soil tillage and crop harvesting, and from burning crop residues and, to a lesser extent, grasslands (European Environment Agency, 2021). Primary $PM_{2.5}$ caused by the agricultural sector largely derives from dust from tillage, livestock dust, field burning, and fuel combustion in agricultural equipment use (Domingo et al., 2021).

Biodiversity loss: The most important drivers of biodiversity loss are: habitat changes, climate change, pollution, invasive alien species and overexploitation (Crenna et al., 2019; Millennium Ecosystem Assessment, 2005; Steinfeld et al., 2006b).

The global food system plays a key role in decreasing biodiversity (Benton et al., 2021), as it contributes directly or indirectly to all these drivers, at the local and global scale.

Land use changes caused by the conversion of natural land to agricultural land result in habitat changes and destruction (Benton et al., 2021). Crop and animal farming has been behind much of these changes (Steinfeld et al., 2006b), due to deforestation caused by the rapid expansion of pastures but also to the increasing demand for high-quality protein feeds, such as soybean or the cultivation of certain plant commodities (e.g. oil palm).

Agriculture contributes to climate change and causes the release of nutrients and pollutants, as described above. Pesticides are indeed recognized as a major driver of biodiversity loss in both terrestrial and aquatic ecosystems (van der Werf et al., 2020). The food sector also directly affects biodiversity through invasive alien species and overexploitation, for example through overgrazing of pasture plants (Steinfeld et al., 2006b) or overfishing of natural stocks.

However, certain sustainable farming practices, often applied in agroecological and organic systems, such as diversification of crops species and animal breeds, use of old cultivars, ecological structures (e.g. hedgerows, herbaceous strips, woodlot preservation) may promote biodiversity conservation (Gomiero et al., 2011; Jeanneret et al., 2021; van der Werf et al., 2020). Nevertheless, some authors argue that, due to the lower yield of such systems, a large-scale conversion to sustainable agriculture would require converting more natural habitats for agricultural production, negatively affecting biodiversity conservation (Clark & Tilman, 2017). Major improvements on biodiversity may be reached only when a conjunction of actions is implemented, including sustainable farming techniques, drastic dietary changes, food loss and food waste reduction, expansion and increase of protected areas in key biodiversity areas, minimising agricultural expansion into species rich areas and increasing international trade from high yielding nations with low biodiversity to low yielding nations with high biodiversity (Röös et al., 2022; Willett et al., 2019).

Waste generation: Waste generation is increasing in the EU with an increase in total waste generation of 5.0% between 2010 and 2018 (114 million tonnes) (European Environment Agency, 2022). Agriculture, forestry and fishing accounted in 2016 for around 20% of the total share of waste Eurostat, 2023). Although not the major cause of waste production, the food system produces large volumes of wastes, generated from the production, preparation, packaging and consumption of food.

The packaging sector seems to contribute significantly to waste generation. Over the 2009–2020 period, the generation of all types of packaging waste material increased of about 20% (Eurostat, 2022) . Paper and cardboard were the main packaging waste material in the EU (32.7 million tonnes in 2020) followed by plastic and glass (15.5 million tonnes for plastic and 15.1 million tonnes for glass waste materials in 2020) (Eurostat, 2022).

Food and beverage packaging accounts for almost two-thirds of total packaging waste by volume and approximately 50% of total packaging sales by weight (Marsh & Bugusu, 2007), and it is estimated to represent two- thirds of total European packaging in terms of market share value (European Commission, Directorate-General for Environment, 2020). Materials that have traditionally been used in food packaging include glass, metals (e.g., aluminium, tinplate, and tin-free steel), paper and paperboards, and plastics (Marsh & Bugusu, 2007).

The packaging sector is the biggest user of plastics (around 40%) and plastic packaging is responsible for around 60% of post-consumer plastic waste in the EU, most of which is only used once and then discarded (European Commission, 2018b). While plastics production is growing, the recycling of plastics is still low. Less than a fifth of plastic packaging waste is recycled globally and a lot ends up in the environment, is incinerated or landfilled (Heinrich Böll Foundation, 2019). In the EU 28+2, only 41,9% of the 16,7 tonnes of plastic packaging waste was recycled (Eurostat, 2022).

It has been estimated that in 2018, in the European Union 28+2 countries, the agricultural sector used approximately 1 million tonnes of plastics for packaging purposes (FAO, 2021). This figure may be underestimated, since data were not available for usage in storage, processing, and distribution.

Food waste generation: Estimates for the EU indicate that around 88 million tonnes of food are being wasted yearly across the food supply chain, roughly corresponding to 9% of the total food produced in the EU (De Laurentiis et al., 2021). Food waste occurs along the whole food supply chain, from food production to consumption. However, the consumption stage is identified as the major contributor to the total amount of food waste generated along the food supply chain (De Laurentiis et al., 2021; Stenmarck et al., 2016). Households, retail and food services are estimated to produce altogether 931 million tonnes of food waste per year at a global level (UNEP, 2021), being households the larger food waste producers (79 kg/year), followed by food services (26 kg/year) and retail activities (13 kg/year).

Household food waste can occur throughout the household management stages, including purchasing, storing, preparing, and consuming (Vittuari et al., 2022).

Food processing and manufacturing are responsible for a lower share of food waste, especially concerning fruits, vegetables, cereals, meat and dairy products (De Laurentiis et al., 2021).

Causes of food losses and waste differ based on supply chain stage and geographical setting. Among the drivers, Canali et al. (2014) highlighted 271 drivers of food waste generation per food supply chain segment and context category; while the study of Vittuari et al. (2022) provides a literature review of food waste prevention drivers and levers at consumer level.

Waste in primary production can depend on technological inadequacies in harvesting and post-harvest management, caused by lack of appropriate infrastructure and equipment. Inefficiencies can affect operations throughout the supply chain: suboptimal management during food processing and cold chain logistics can aggravate waste production. Other managerial shortcomings, such as imprecise matching between supply and demand/forecasting, together with poor control over inventory and corporate policies on product aesthetics are indicated as leading causes of wholesale and retail waste. Faulty communication and lack of cooperation between supply chain actors can exacerbate operation failures (Canali et al., 2014; FAO, 2019).

Biotic resource (overexploitation): Since biotic resources are limited, it has been widely recognized that a transition to a sustainable exploitation of such resources is necessary (Lampert, 2019), exploiting them at a rate that permits their natural reproduction or regeneration capability.

Overfishing is still widespread across the pan-European region. Globally, the share of overfished fish stocks (meaning that fishes are catch at a rate faster than the natural fish reproduction rate to sustain population levels) has more than doubled since the 1980s (Ritchie & Roser, 2022) leading to unsustainable biotic resource depletion. In 2017, one third (34%) of the of global fish stocks was overfished (Ritchie & Roser, 2022). According to the EU blue economy 2022 (European Commision, 2022), the situation of wild populations depends on the geographical area. In the North-east Atlantic Ocean and Baltic Sea, 28% of assessed fish and shellfish stocks are within safe biological limits, meaning that the number of stocks within safe biological limits has experienced a 3.5-fold increase, from 8 in 2003 to 28 in 2020. In contrast, 87% of the assessed stocks were overfished in the Mediterranean and Black Seas.

Livestock and aquaculture play an important role in the overall pressure on demand for fish (Ritchie & Roser, 2022; Steinfeld et al., 2006b), being the 16% of world fishery production used for fishmeal and fish oil for feeds in 2017 (Naylor et al., 2021). Approximately 17% of the fishmeal produced in the world is manufactured from trimmings from food fish processing, having an indirect impact on fish stocks. However, the remaining 83% come from direct marine capture fisheries (Steinfeld et al., 2006b).

Annex 4. Assessment of animal welfare labels

Labels focusing on animal welfare and undergoing the assessment are reported in Table A6.1. The collected information includes:

- General aspects:
    - Name
    - Label typology:
    - Geographical scope
    - Geographical scope specification
    - Product coverage (specification)
    - Standard setter
    - Compliance (verification and auditing)
    - Unannounced visits
    - Ownership
- Phases of the supply chain covered by the label, which might include:
    - Breeding or aquaculture (B/A)
    - Transport (T)
    - Slaughtering or fishing (S/F)
- Requirements concerning:
    - Housing
    - Health
    - Feed

Table A4.1. Assessment of animal welfare labels. Blank cells indicate that information was not found, not specified or not available in the consulted websites and documentation; n.a.: not applicable.

General aspects									Phases of the supply chain covered by the label			Requirements concerning		
Name	Label typology	Geographical scope	Geographical scope specification	Product coverage (specification)	Standard setter	Compliance (verification and auditing)	Unannounced visits	Ownership	B/A	T[16]	S/F	Housing[17]	Health[18]	Feed[19]
AMA-Gütesiegel	Signalling/positive endorsement	National	Austria	Poultry, beef, dairy, pork, ovine meat, goat	External	third party (certification under accreditation)		Public-private	●	○	●	no	yes	yes
Animal Welfare Certified (Global Animal Partnership)	Signalling/positive endorsement	International	US	Animal-based products	Self-setting	third party (certification under accreditation)		Private (no profit) NGO	●	●	●	yes	yes	yes
Bedre Dyrevelfaerd (Better Animal Welfare)	Mix (Signalling/positive endorsement/ scoring)	National	Denmark	Animal-based products	Self-setting	third party (no certification)	Yes	Public	●	●	●	yes	yes	yes
Best Farmer – Cuidamos do Bem-Estar Animal	Brand	National	Portugal	Poultry, pork, beef, fish				Private (brand owned)	●	●	●			
Bienestar Animal Certificado Welfair	Signalling/positive endorsement	National	Spain	Animal-based products	Mixed	third party (certification)		Public-private	●	n.d.	●	yes	yes	yes
Compromiso Bienestar Animal PAWS	Signalling/positive endorsement	National	Spain	Bovine meat	Mixed	third party (certification under accreditation		Public-private	●	n.d.	●	no	yes	no

[16] E.g., e.g. maximum length of transport
[17] E.g. minimum space, access to outdoor, max. density
[18] E.g. pain relief for castration and/or other practices; avoided use of growth hormones, antibiotics
[19] E.g. access to pasture, natural/organic feed, water, minimum age for weaning, etc.

General aspects									Phases of the supply chain covered by the label			Requirements concerning		
Name	Label typology	Geographical scope	Geographical scope specification	Product coverage (specification)	Standard setter	Compliance (verification and auditing)	Unannounced visits	Ownership	B/A	T[16]	S/F	Housing[17]	Health[18]	Feed[19]
Etiquette bien-être animal	Mix (Signalling/positive endorsement/ scoring)	National	France	Poultry, pork	Self-setting	third party (no certification)	Yes	Private (no profit)	●	●	●	yes	yes	no
Good Farming Star	Brand	National	Netherland	Pork	Self-setting			Private (brand owned)	●	●	●	yes	yes	no
Haltungsform	Mix (Signalling/positive endorsement/ scoring)	National	Germany	Animal-based products	Self-setting			Private (other)	●	○	○	yes	yes	yes
HFAC - Certified Humane	Signalling/positive endorsement	International	US	Animal-based products	Self-setting	third party (certification under accreditation)	yes	Private (no profit)	●	●	●	yes	yes	yes
Beter Leven (Better Life)	Mix (Signalling/positive endorsement/ scoring)	National	Netherland	Meat, eggs, dairy	Self-setting	third party (certification under accreditation)	Yes	Private (no profit)	●	●	●	yes	yes	yes
Mehr Tierwohl	Signalling/positive endorsement	National	Germany	Poultry, pork	Self-setting	third party (certification)	Yes	Private (multiple stakeholders)	●	○	●	yes	yes	yes
Method-of-Production labelling (Welfare Windows)	Brand	National	UK	Poultry, eggs, pork, duck, turkey	Self-setting	third party (no certification)		Private (brand owned)	●	○	○	yes	yes	no
Pro-Weideland - Deutsche Weidecharta	Signalling/positive endorsement	National	Germany	Dairy	Self-setting	third party (no certification)		Private (no profit)	●	○	○	yes	yes	yes
Terra Suisse (affiliated with IP-SUISSE)	Brand	National	Switzerland	Pork, beef, veil, lamb meat					n.d.	n.d.	n.d.			

General aspects									Phases of the supply chain covered by the label			Requirements concerning		
Name	Label typology	Geographical scope	Geographical scope specification	Product coverage (specification)	Standard setter	Compliance (verification and auditing)	Unannounced visits	Ownership	B/A	T[16]	S/F	Housing[17]	Health[18]	Feed[19]
Tierschutzlabel: Für Mehr Tierschutz	Signalling/positive endorsement	National	Germany	Pork, poultry, beef, dairy cattle	Self-setting	third party (certification)	Yes	Private (no profit)	●	●	●	yes	yes	yes
Bel Engagement Pâturage	Brand	National	France	Dairy				Private (brand owned)	n.d.	n.d.	n.d.			
Dolphin Safe	Signalling/positive endorsement	International	US	Tuna				Private (other)	n.a.	n.a.	●	n.a.	n.a.	n.a.
Filiera Benessere Animale	Brand	Regional (subnational)	Italy (Lombardy)	Milk		third party (certification under accreditation)		Private (brand owned/ multiple stakeholders)	n.d.	n.d.	n.d.			
KAT (Kontrollierte Freilandhaltung; Kontrollierte Alternative Tierhaltung)	Signalling/positive endorsement	National	Germany	Poultry, eggs		third party (certification under accreditation)	Yes	Private (other)	●	n.d.	n.d.	yes		
Kontrolliertes Tierwohl	Brand	National	Austria	Dairy cattle		third party (no certification)		Private (brand owned)	n.d.	n.d.	n.d.			
Naturafarm	Brand	National	Switzerland	Beef, pork, veal, poultry		third party (no certification)		Private (brand owned)	n.d.	n.d.	n.d.			
Neuland	Brand	National	Germany	Pork, beef, poultry		third party (no certification)		Private (brand owned)	●	○	○	yes	yes	yes
No Monkey Business	Brand	International	UK	Coconut based products		second party		Private (brand owned)	n.d.	n.d.	n.d.			
NZMP Grass Fed	Signalling/positive endorsement	International	New Zealand, international	Beef, diary cattle		third party (certification under accreditation)		Private (multiple stakeholders)	●	○	○	yes	no	yes
Red Tractor	Signalling/positive endorsement	International	UK	Dairy, goat dairy, pork, beef, lamb,	Self-setting	third party (certification under accreditation)	Yes	Private (multiple stakeholders/no profit)	●	●	○	yes	yes	yes

General aspects									Phases of the supply chain covered by the label			Requirements concerning		
Name	Label typology	Geographical scope	Geographical scope specification	Product coverage (specification)	Standard setter	Compliance (verification and auditing)	Unannounced visits	Ownership	B/A	T[16]	S/F	Housing[17]	Health[18]	Feed[19]
				poultry, turkey, ducks										
RSPCA Assured	Signalling/positive endorsement	International	UK	Beef, dairy cattle, poultry, ducks, pork, eggs, turkeys, sheep, salmon, trouts	Self-setting	self audit	Yes	Private (no profit)	●	●	●	yes	yes	yes
Tierschutz Kontrolliert	Graded/Scoring	National	Austria	Dairy cattle, beef, pork, ducks, eggs, poultry, turkeys		third party (certification)	Yes	Private (other)	●	●	●			
Gesellschaft !Zukunft Tierwohl!	Graded/Scoring	National	Austria	Beef, dairy cattle, pork, poultry, sheep, goats		third party (certification)		Private (other)	●	○	○	yes	yes	no
Weidemelk	Signalling/positive endorsement	International	Netherlands	Dairy		third party (certification under accreditation)		Private (other)	●	n.d.	n.d.			yes
Zeta Animal Welfare	Brand	National	Spain	Pork				Private (brand owned)	●	○	○	yes	yes	yes

Source: JRC own elaboration

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