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Article — Published Version

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Suggested Citation: Lemken, Dominic; Zühlsdorf, Anke; Spiller, Achim (2021) : Improving Consumers' Understanding and Use of Carbon Footprint Labels on Food: Proposal for a Climate Score Label, EuroChoices, ISSN 1746-692X, Wiley, Hoboken, NJ, Vol. 20, Iss. 2, pp. 23-29,
<https://doi.org/10.1111/1746-692X.12321>

This Version is available at:

<https://hdl.handle.net/10419/284761>

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Improving Consumers' Understanding and Use of Carbon Footprint Labels on Food: Proposal for a Climate Score Label

Améliorer la compréhension et l'utilisation par les consommateurs des étiquettes d'empreinte carbone sur les denrées alimentaires : proposition pour une étiquette de score climatique

Verbesserung des Verständnisses und der Nutzung von CO₂-Fußabdruck-Label auf Lebensmitteln durch Verbraucherinnen und Verbraucher: Vorschlag für ein Klima-Label

Dominic Lemken, Anke Zühlsdorf and Achim Spiller

Consolidation of CO₂ footprint labels

Recognition of the role of consumers in CO₂-equivalent (CO₂-e) emissions is rising in importance in the EU's political agenda. The EU 'Farm-to-Fork' strategy published in May 2020 includes a proposal for a 'Sustainable Food Labelling Framework' by 2024. This framework foresees a role for clear labelling and accessible sustainability information for agri-food products.

Several multi-national agri-food firms, such as Nestlé-Germany, Unilever, Barilla, Arla, and other major food manufacturers are already moving to use some form of carbon footprint or CO₂-equivalent (CO₂-e) label on their products. The growing number of climate labels in the food market shows how it is increasingly attractive to advertise positive CO₂-footprints. For now, these efforts remain limited to a few firms, and it is not clear that all products in their portfolio are being labelled. Importantly, the type of CO₂ information labelled can differ substantially between firms and products. Carbon footprints are displayed in the form of: (1) 'relative reduction labels' compared to product processes at some point in the past, relative to a selection of market competitors, or the reductions apply only to a specific product attribute, such as packaging¹; (2) 'best in class labels' with similar

reference products; (3) 'climate neutrality labels' that intend to offset production emissions via compensation schemes; (4) 'absolute CO₂-e value labels' that simply state the measurements from lifecycle-assessments (LCA); and (5) 'categorical labels' that intend to assist consumers with the interpretation of LCA-measurements (Table 1). The informative value of these different label concepts is difficult for consumers to compare and could be misleading. Consumers face more than 200 food choices each day (Wansink and Sobal, 2007). The co-existence of different label concepts in the market will increase the cognitive burden on consumers. Such information overloads lead to consumer indifference and loss of confidence concerning food choices (Grunert and Wills, 2007; Verbeke, 2005).

Indeed, a consumer cannot verify emissions associated with a product. Thus, the government or a reputable third party should ensure the comprehensibility and credibility of climate labelling to build confidence. This means there may be a role for government-approved or 3rd party certified labelling schemes to avoid consumer confusion and skepticism. Ideally, we believe CO₂-e labels should be limited to a few government-approved labels. For some years, the scientific advisory boards of the BMEL

(German Ministry for Nutrition and Agriculture) have called for a condensation on a manageable number of labels that are clearly communicated (WBAE & WBW, 2016).

“ Le score climatique proposé peut contribuer aux objectifs climatiques de l'Union européenne. ”

To assist consumers with lowering the carbon footprint of their food choices, the information provided must be easily accessible, clearly presented, accurate, and should allow comparisons across food categories. We propose a simple, easy to understand, colour-coded Climate-score label, which provides the consumer with information on the relative impact of a given category of food on CO₂-e emissions as well as absolute values of these. Furthermore, our concept is straightforward and can make use of already available data on food emissions. We first explain the role of CO₂-e labels in a consumer policy mix and how such a label can contribute to the partial substitution of foods associated with clearly larger CO₂-e emissions. In our contribution, we focus on

Table 1: Consumer-focused carbon footprint labelling concepts

	What is labelled	Claim	Example	Demonstration of GHG across categories	Evaluation
Compensation label	Suppliers' purchase of compensation certificates equal to GHG emissions	'climate-neutral'	Atmosfair, Arla Foods, stop-climate-change	X	Supply of compensation schemes is limited; no communication of CO ₂ -e associated with product category; transition option for suppliers
Reduction label	Reduction of past GHG emissions by a certain percentage	'X % decrease in GHG emissions'	Arla Foods	X	Can incentivise product improvements; no communication of CO ₂ -e associated with a product category
Best-in-class label	Significantly lower GHG emissions than average of food category or market leader	'particularly climate-friendly'	Climatop, Carbon trust lower carbon	X	Can incentivise product improvements; no communication of CO ₂ -e associated with a product category
Absolute CO ₂ -e label	CO ₂ footprint, the absolute value of GHG emissions per kg	GHG in kg CO ₂ -e per kg of product	Oatly	√	Promotes dietary change; accurate, but demands high consumer involvement
Multi-level, categorical label	Normative rating of absolute GHG emissions through colour-coding	Green equals a low CO ₂ footprint	Nutri-Score	√	Promotes dietary change; simple; sensitive to scaling decisions; does not incentivise producers to demonstrate small improvements
Categorical label with absolute CO ₂ -e values	Colour coding in combination with the absolute value of GHG emissions	Absolute CO ₂ -e value with a normative colour coding	Eatarnity	√	Simple, accurate and can promote dietary change; incentivises producers to demonstrate small improvements

questions of consumer communication: We will discuss how to communicate LCA measurements to consumers, how to construct an easily interpreted label and how to limit the costs for producers that apply the label. Specifics of LCA accounting methods, trade issues or the question of the voluntary or mandatory nature of climate labelling are beyond the scope of this article. We suggest our Climate-score label provides an instrument to inform consumers about CO₂-e-emissions of the production of their food and limits the burden of data collection and calculations by firms thus making its use accessible to smaller manufacturers/producers/distributors.

A climate label as an instrument of nutrition policy

Consumers play a major role in mitigating climate change through their lifestyle choices and in

particular dietary choices which can contribute to lower CO₂-e emissions. Indeed, following a plant-rich diet produces roughly half the GHG emissions of an average 'business as usual' diet (Clark *et al.*, 2020). However, at present climate-friendly dietary choices are difficult for consumers because they lack information about the relative quantities of emissions of different foods (Camilleri *et al.*, 2019; Laureati *et al.*, 2013). Other environmental labels, such as the organic label, do not indicate a lower carbon footprint.

In many cases, labels are viewed simply as a way for producers to market their goods rather than a policy instrument for informing consumers. Research shows that people have limited knowledge about the CO₂-e emissions of foods and how these affect global warming. While many consumers have some idea that meat consumption is

positively and directly related to greenhouse gas (GHG) emissions, few know that cheese and dairy products have similar effects. In research by Shi *et al.* (2018) consumers were asked to estimate the climate footprint of selected food categories. Their answers indicated that consumers make significant errors and underestimate the relative impacts of foods. For instance, the relative impact of beef compared to lentils on CO₂-e emissions was estimated to be about 1.4 larger but in fact, it was 40 times larger indicating little knowledge of the actual data (Clune *et al.*, 2017). Although consumers' eating behaviour is rigid and only gradually changes, a partial substitution of such product categories is feasible on a dietary and on a meal level. Even gradual progress can help to mitigate the long-term issue of climate change. The provision of information supports consumers in making climate-conscious dietary decisions.

Addressing climate-friendly food choices will also require other policy instruments. Not all meat or cheese fans, even when informed on CO₂-e emissions, will revolutionise their eating habits (Kortelainen *et al.*, 2016). Due to budget constraints or even the simple difficulty of changing food preferences due to habit, taste or tradition (Camilleri *et al.*, 2019), label effects may be limited. However, labels can be especially useful for guiding decision-making when consumers are price-insensitive as well as committed to limiting CO₂-e emissions, leading to voluntary and appropriate changes.

Increasing information of emissions through labels can also promote social acceptance of more intrusive policy instruments. The increased awareness of the impact of food choices on climate change should be an opportunity to move forward in climate policy. Public relations and information campaigns via different forms of media will also be needed to influence food choices and promote CO₂-e labels. Increased uptake of CO₂-e labels will also incentivise manufacturers to consider product redesigns or reformulations concerning their CO₂-e emissions (Vermote *et al.*, 2020). Such indirect effects of a CO₂-e label could eventually outperform the direct effect on consumers' dietary behaviour.

Designing a consumer-focused carbon footprint food product label

The proposed climate-score label is a simple, five-level, front of package categorical label (A–E, dark green to dark red) which also provides the exact value of CO₂-e emissions per kilogramme of a particular food. These are colour-coded for rapid and easy communication of information. Other front-of-package labels such as the Nutri-Score, first introduced in France in 2017 (<https://www.sante.publiquefrance.fr/determinants-de-sante/nutrition-et-activite-physique/articles/nutri-score>), are similarly designed as categorical labels, which makes it possible for sustainability



Consumers face more than 200 food choices each day. © Gustavo Fring, Pexels.

labels to be placed equivalently. Unpackaged goods such as fruit and vegetables could be labelled on the shelf where electronic labels are increasingly being introduced.

Studies have shown that most people cannot easily interpret absolute CO₂-e values because they are too abstract

“ Das vorgeschlagene Klimalabel kann zu den Klimazielen der EU beitragen. ”

(Meyerding *et al.*, 2019); the unit of measure of emissions is generally not understood so most consumers have difficulty in using these numbers as a guide when shopping. Similar problems have been discussed for some time in the context of nutrition labelling when measuring calories and nutrients per unit of weight.

Reducing the number of labels and standardising their content concerning emission objectives could actually encourage consumers to look to labels for guidance. Colour-coded, categorical labels (e.g. food traffic lights, Nutri-Score or energy consumption labels) quickly convey the information needed by consumers in making their choices. The use of only a five-level colour scale may hide details of value to involved

consumers. Precise emissions values also give manufacturers the option to make small improvements visible within the label, even if a more climate-friendly label category is not immediately feasible. Combining both categorical and absolute CO₂-e information into one label can overcome the disadvantages of simple categorical or emissions quantity only labels (Table 1).

Label content. A significant label decision revolves around the reference unit of measurement, the so-called functional unit in lifecycle assessment. Most scholars argue for using the GHG per product weight (kilogramme). More recently, suggestions have also been made to weigh various necessary nutrients (Weighted Nutrient Density Score) and to relate GHGs to such an index. However, weight is a reference value known without measurement error for all products and is easily understood by consumers, so we advocate this straightforward measure. It is also used as a reference unit for the mandatory nutritional information, and would therefore allow comparisons. Equally important is the decision on which foods need to be labelled. We strongly suggest all foods be labelled: from packaged food to food in fast food restaurant chains and canteens. Comprehensive labelling enables transparency about the climate relevance of one's diet. As the complexity of the food increases so does the effort to calculate its emissions.

Constructing the Climate-score label.

To construct our label, we first estimate a target quantity of CO₂-e emissions per year/ person/per kg of food supply. At present, the EU food supply per person is approximately 800 kg per year per person (Table 2). Studies

show that a vegan consumption habit leads to approximately 1 tonne of CO₂-e emissions /per person / per year, while average consumption patterns generate twice that level of emissions (WBAE/WBW, 2016). A flexitarian eating style would lower

emission levels and may also achieve 1 tonne of CO₂-e emissions /per person / per year, if the production techniques for foods were further optimised (e.g. greenhouses heated with renewable energies).

Thus, dividing the achievable '1-tonne diet' (total emissions per person per year) by the 800 kg food supply yields an average value of 1.25 CO₂-e per kg food, which we designate our target value. We use this value to construct our 5 categories thus permitting us to compare the emission levels of different foods. Therefore, the category thresholds are informed by possible GHG savings in the food domain. A synthesis of the method of calculation and resulting categories are presented in Table 2. To summarise design decisions on the label content, the construction of the label, and how to communicate CO₂-e information to consumers, we graphically illustrate a climate score label for three food products (Table 3).

Measuring emissions: data sources.

Earlier attempts to establish a CO₂-e label failed because they were too ambitious (Liu *et al.*, 2016). The leading British supermarket chain Tesco had planned to measure the exact GHG emissions of all brands, but then decided this was too costly and time-consuming considering the sheer number of products and agricultural producers. Measuring the specific GHG balance of a single product could cost between 50,000 and 60,000 euros and with nearly 100,000 articles on major retailer shelves of which about 20 per cent are substituted every year, the financial burden would be enormous, especially if a single company does so voluntarily.

Our label simplifies the procedure and reduces its costs. We propose to make use of existing standardised GHG-emission data per product category to show the median values of milk, pasta, rice, etc. This approach reduces the burden of measurement by avoiding heterogeneity issues at the agricultural level. These values (Clune *et al.*, 2017) and the methodology necessary for the calculation are in principle already

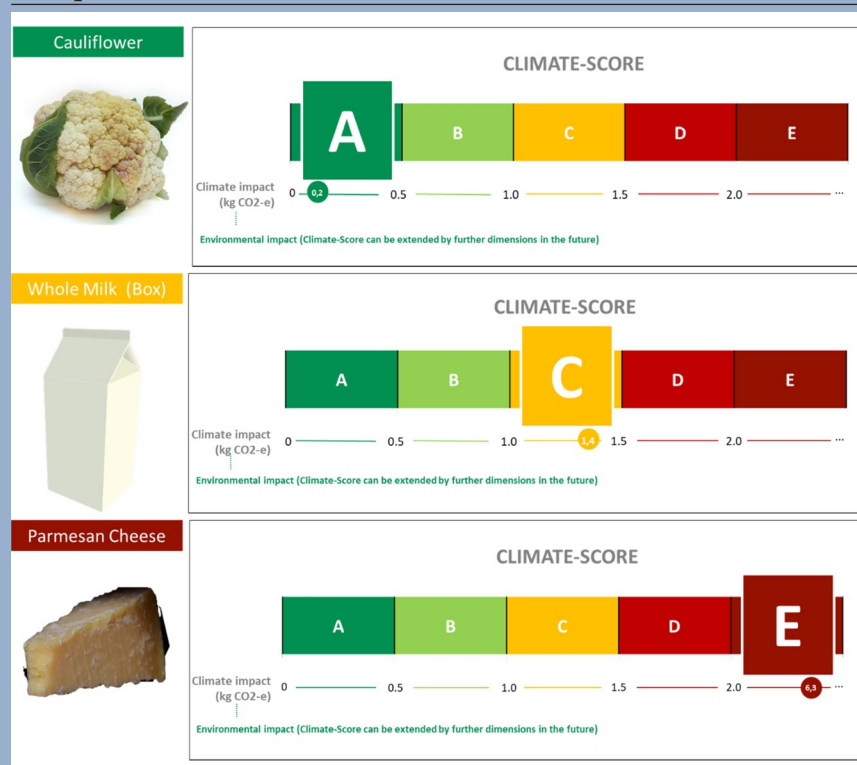
Table 2: Summary of a scaling method for a Climate-score label

- Target state of the carbon footprint for food: 1,000 kg CO₂-e per person / year
- EU's food supply for human consumption: approx. 800 kg per person / year¹
- Target state of carbon footprint per food weight: target value 1.25 (= 1,000 / 800) CO₂-e / kg food
- The average target value of 1.25 CO₂-e / kg of food products should be in the middle (yellow) of the scale to distinguish an above- and below-average climate footprint
- The limits would then be:

A	•0.01–0.5 CO ₂ -e / kg (dark green)
B	•0.51–1 CO ₂ -e/ kg (light green)
C	•1.01–1.5 CO ₂ -e / kg (yellow)
D	•1,51–2 CO ₂ -e / kg (light red)
E	•>2 CO ₂ -e / kg (dark red)

¹FAOSTAT - *New Food Balances for the EU*: 880 kg per person / year potentially available for human consumption, i.e. not considering household processing losses etc.

Table 3: Graphical proposal for a carbon footprint label on food, three examples



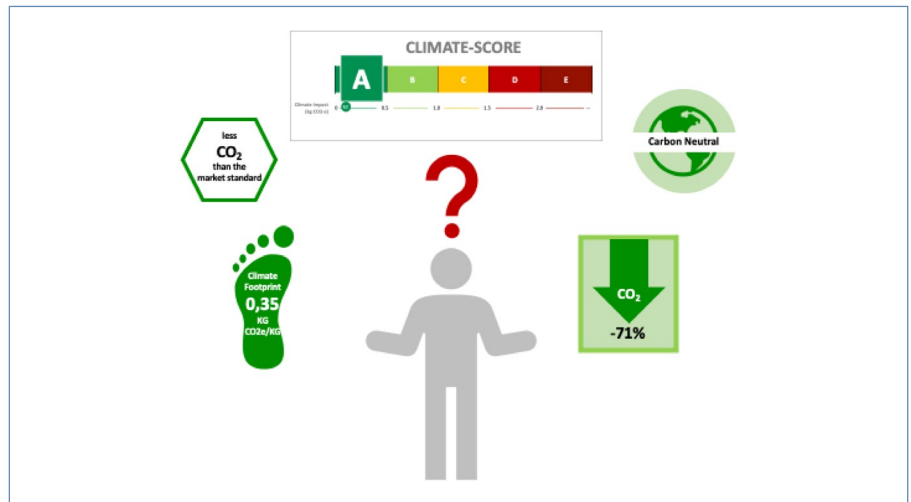
Source: Own illustration based on Feucht and Zander (2017). CO₂-e data based on Reinhardt *et al.* (2020), p. 8 f.

available for a large number of foods across Europe and any company can use these default values. New databases are also emerging so that the overall costs of acquiring data for the labelling are falling considerably. Recently the global food emissions database (EDGAR-FOOD) (Crippa *et al.*, 2021) was released and provides a detailed analysis of GHG emissions which can complement previous databases. The cost of labelling is particularly relevant as the quality of the label depends on updating data in line with evolving product characteristics. The database nevertheless requires a reliable number of cases and a wide spectrum of products to apply useful median values. Median values could provide an initial estimate for a wide range of foods and could be a legitimate basis for determining dietary choices. Later, committed manufacturers could specifically measure their GHG emissions and those of their agricultural suppliers and, if these significantly improve upon the median, they could then advertise the better values. Any company-specific values would also have to be certified so that they are reliable.

“ The proposed climate score can contribute to the EU’s climate goals. ”

Thus, a CO₂-e label based on median values for the agri-food products and the emissions from processing, packaging and logistics can be a low-cost instrument for processors. While larger brand manufacturers are already trying to achieve more transparency for their own environmental management system, small producers or craft businesses could be subject to average values to enable labelling. In addition, external service providers are increasingly lowering the price to procure carbon footprint data.

Certifying label information. Measuring CO₂ footprints can be controversial so that the possibility of mislabelling or fraud must be minimised. A 3rd



As more and more companies are already starting to label their products in different ways, consumer confusion is likely to rise if no uniform guidelines are established.

party certification process is therefore required. This could be undertaken by the government or private certification firms such as those used for certification of organic agriculture. At the very least, the state should retain oversight of the certification procedures. This applies not only to measurement and classification but also to the rules for calculating GHG emissions (Product Category Rules), e.g. how to allocate GHG emissions from bovine production to beef and milk products. The GHG value for a fresh pineapple that is transported by ship is 0.6 kg; for a pineapple transported by air, it is 15.1 kg (Reinhardt *et al.*, 2020). A predefined threshold should allow homogeneous products to be

grouped in separate product categories if GHG emissions are clearly different due to value chain features. This may also lead to different median values for homogeneous foods, based on geographic advantages. If GHG values become subject to debate, a binding standardisation of the procedure is required, as is already the case with accounting rules in business.²

Contribution to the EU’s climate goals

Given our discussion on the benefits of CO₂-e labels for consumer policy, we believe the proposed climate score can contribute to the EU’s climate goals. A



Even gradual changes in consumers’ eating behaviour can help to mitigate the long-term issue of climate change. © Jane D., Pexels.

formally agreed set of procedures certified by the state or trustworthy organisation is required to set up an operational labelling scheme based on reliable median values of CO₂-e. The label should be comparable between food product categories via a colour-coded scheme accompanied by actual product values of their CO₂-e for a given unit of weight. There is still a debate to be held on the mandatory vs. voluntary character of such a label. For instance, the Nutri-score is a voluntary one but companies are required to label all products of a brand line if they decide to label, to

avoid cherry-picking. It is time for a broad European debate on the type of climate footprint labels that can empower consumers. Nonetheless, it will probably take time for consumers to build trust in the information content of these labels and use them to guide their daily purchases. A policy mix, including labelling, will likely yield dietary changes which reflect greater attention to climate issues.

Notes

1 Arla advertised a 70 per cent reduction of CO₂-e on milk products. According to

a Forsa Institute survey on behalf of Food Watch, the majority of consumers did not understand that the CO₂-e reduction applies only to the packaging material and not to the milk product itself (<https://www.foodwatch.org/de/aktuelle-nachrichten/2021/umfrage-klimaschutz-zweckung-von-arla-ist-irrefuehrend/>).

2 The International Organization for Standardization has created the ISO standards 14040 and 14060 to provide a framework for quantifying, monitoring, reporting and validating carbon footprints in LCA.

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Summary

Improving Consumers' Understanding and Use of Carbon Footprint Labels on Food: Proposal for a Climate Score Label

 Today, the food sector is largely excluded from climate protection policies. Nevertheless, the food sector is responsible for about 20 per cent of greenhouse gases. Food policies could substantially contribute to the EU's ambitious climate goals. Currently, the debate on CO₂-e labelling is gaining momentum. Consumers know very little about the climate footprint associated with food choices. A climate label would strengthen consumer knowledge, may eventually influence food choices, could trigger reformulation efforts, raises awareness, and contribute to better informed discussions about climate policy. Based on a review of the current state of research and industry developments on designing CO₂ footprint labels, this article provides recommendations on how to develop a clearly understood and trustworthy label. We propose a government approved, multi-level, and categorical CO₂-e label, with colour coding and numeric CO₂ equivalents; primarily based initially on median values. The design of the label should allow for an adoption of other environmental dimensions in the future. It should be scaled to weight (CO₂-e per kg) and apply to food products and meals. In the proposed form, a CO₂-e label is a low-cost instrument. As more and more companies are already starting to label their products in different ways, consumer confusion is likely to rise if no uniform guidelines are established.

Améliorer la compréhension et l'utilisation par les consommateurs des étiquettes d'empreinte carbone sur les denrées alimentaires : proposition pour une étiquette de score climatique

 Aujourd'hui, le secteur alimentaire est largement exclu des politiques de protection du climat. Il est néanmoins responsable d'environ 20 pour cent des gaz à effet de serre. Les politiques alimentaires pourraient contribuer de manière substantielle aux objectifs climatiques ambitieux de l'Union européenne. Actuellement, le débat sur l'étiquetage des équivalents CO₂ (CO₂-e) prend de l'ampleur. Les consommateurs connaissent très peu l'empreinte climatique associée aux choix alimentaires. Un label climatique renforcerait les connaissances des consommateurs, pourrait à terme influencer les choix alimentaires, et pourrait déclencher des efforts de reformulation, sensibiliser et contribuer à des discussions mieux informées sur la politique climatique. A partir d'un examen de l'état actuel de la recherche et des évolutions de l'industrie sur la conception d'étiquettes d'empreinte CO₂, cet article fournit des recommandations sur la façon de développer une étiquette clairement comprise et digne de confiance. Nous proposons une étiquette CO₂-e approuvée par les pouvoirs publics, avec plusieurs niveaux et catégories, et un codage couleur et des équivalents CO₂ numériques. Il serait principalement fondé initialement sur des valeurs médianes. La conception du label devrait permettre l'adoption d'autres dimensions environnementales à l'avenir. Il doit être mis à l'échelle en fonction du poids (CO₂-e par kg) et s'appliquer aux produits alimentaires et aux repas. Dans la forme proposée, une étiquette CO₂-e est un instrument à faible coût. Comme de plus en plus d'entreprises commencent déjà à étiqueter leurs produits de différentes manières, la confusion des consommateurs risque de s'accroître si aucune directive uniforme n'est établie.

Verbesserung des Verständnisses und der Nutzung von CO₂-Fußabdruck-Label auf Lebensmitteln durch Verbraucherinnen und Verbraucher: Vorschlag für ein Klima-Label

 Der Lebensmittelsektor wird gegenwärtig von der Klimapolitik weitestgehend ausgenommen. Dennoch ist er für etwa 20 Prozent der Treibhausgase verantwortlich. Die Lebensmittelpolitik könnte einen wesentlichen Beitrag zu den ambitionierten Klimazielen der EU leisten. Derzeit gewinnt die Diskussion über ein CO₂-Label an Bedeutung. Verbraucherinnen und Verbraucher wissen häufig wenig über den CO₂-Fußabdruck, der mit der Wahl ihrer Lebensmittel verbunden ist. Ein Klimalabel würde nicht nur ihr Wissen über den CO₂-Fußabdruck verbessern, sondern möglicherweise auch ihre Wahl von Lebensmitteln beeinflussen. Das CO₂-Label könnte darüber hinaus Änderungen in der Lebensmittelzusammensetzung anstoßen, ein Bewusstsein schaffen und zu besser fundierten Diskussionen über die Klimapolitik beitragen. Dieser Artikel gibt auf der Basis eines Reviews zum aktuellen Stand der Forschung und der Entwicklungen in der Lebensmittelindustrie Empfehlungen für die Entwicklung eines leichtverständlichen und vertrauenswürdigen Labels. Wir schlagen ein staatlich zertifiziertes, mehrstufiges und in Kategorien eingeteiltes Klimalabel mit Farbkodierung und numerischen CO₂-Äquivalenten vor, das zunächst überwiegend auf mittleren Werten basieren soll. Die Ausgestaltung des Labels sollte darüber hinaus die Möglichkeit beinhalten, zukünftig auch andere Umweltdimensionen mit aufzunehmen. Es sollte sich auf das Gewicht (CO₂-Äquivalente pro kg) beziehen und für Lebensmittel und Mahlzeiten gelten. In der vorgeschlagenen Form ist das Klimalabel ein kostengünstiges Instrument. Bereits jetzt kennzeichnen immer mehr Unternehmen ihre Produkte auf unterschiedliche Art und Weise. Die Kennzeichnungsvielfalt trägt zu einer steigenden Verwirrung der Verbraucherinnen und Verbraucher bei, falls keine einheitliche Festlegung von Richtlinien erfolgen sollte.