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Sant'Anna
School of Advanced Studies – Pisa

Istituto di Management
Scuola Superiore Sant'Anna

Piazza Martiri della Libertà, 24 - 56127 Pisa
tel. 050 88.39.83-82 - fax 050 883.936
idm@sssup.it

Socio-economic and environmental analysis of the effects of Regulation 2023/1115/EU on the European leather sector

Authors:

Prof. Fabio Iraldo

Prof. Tiberio Daddi

Prof. Monia Niero

Prof. Alessandro Nuvolari

Prof. Daniele Moschella

Dr. Angelo Cuzzola

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idm@sssup.it

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Executive Summary

This study examines the possible effects that the listing of leather in the scope of Regulation 2023/1115/EU for deforestation-free supply chains (EUDR) can generate on the leather trade and industry and whether this is likely to bring about environmental benefits.

The EUDR is the Green Deal initiative to curb EU-driven deforestation for reducing its impact on climate change. It identifies a number of commodities and their derived products as drivers of deforestation and sets mandatory due diligence requirements for operators that imply full traceability of those goods back to the plot of land where they originated. Leather is listed next to meat as the derived products from the commodity "cattle".

Although the European Commission's impact assessment of the EUDR on the commodities to be included in the scope, examined the impact on cattle, it never addressed the impact on leather. This study aims to contribute to the review process of the scope of the EUDR.

The study is structured in three parts: The first part consists of a critical **analysis of the technical-scientific literature** inherent to the connections between the leather sector and deforestation. In addition to this desk activity, a series of **interviews** were carried out with public and private stakeholders for completing the picture regarding. The second part of the project focuses on **socio-economic impacts** while the third part of this study concerns the **analysis of environmental impacts**. Several scenarios were developed to estimate the socio-economic effects and the environmental consequences. These were based on different hypotheses regarding likely trade deviation and product substitution.

The research provided following findings:

None of the studies scrutinised denies the connection between cattle raising and deforestation. Indeed, the review of scientific literature confirms the link between livestock and deforestation. However, with regard to the connection between leather and deforestation, **no authors have found a direct link**. If there are some authors affirming that there is an indirect link between the two (embedded deforestation) it is because of its economic value in terms of exports – or, in general, the value of the leather industry – and the related profit that slaughterhouses make by selling hides. But no author has provided data or performed quantitative analysis to support the hypothesis of a link, and some authors even state that the problem of deforestation is extended to leather only by 'proxy'. In fact, the majority declares that it is difficult to draw a conclusion on this matter from the evidence

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available up to now. On one point there seems to be convergence though, as most studies agree that **reductions of the leather market generate an increase in the number of raw hides sent to landfill disposal**. The majority of documents and authors support the classification of hides as by-products of cattle.

Similar results were obtained through the interviews. The large majority of the interviewees support the position that there is a connection between cattle raising and deforestation in some parts of the world such as the Brazilian Amazon. They also agree that **the primary output of cattle raising is meat**, with dairy products also mentioned as a significant output. Raw hides are predominantly viewed as by-products of the slaughter process, with some stakeholders referring them as waste products due to their low value compared to meat, and others as co-products due to the high value of the finished leather products. A combination of factors, including market demand, hide quality, and economic considerations, influences the final destination of raw hides, whether it be in leather production or, in some cases, landfills. Interviewees understand that the potential for tanneries to influence environmental practices within the cattle raising and slaughterhouse industries depends upon a multitude of factors, including economic incentives, the structure of the industry, and the capacity for collaborative and integrated approaches to supply chain management.

The majority of interviewees support the position that **there is not a relationship between leather and deforestation**. Among those who believe the contrary, the majority argues that this relationship is indirect.

The interviews also revealed that only a limited number of larger companies with a vertically integrated production system would be able to trace the entire supply chain up to the animals' birth farm(s), while most tanneries would be able to trace back goods to the slaughterhouse. The main barriers to the implementation of a leather traceability system up to the birth farm of cattle are the by-product/waste nature of cattle hides and skins, the complexity and fragmented nature of the supply chain and the costs involved in setting up such systems. The majority of interviewees predict the **shift of the leather market away from Europe to countries where traceability is not required**. They anticipate a negative impact on the European leather sector and increased costs as potential socio-economic impacts resulting from the eventual implementation of traceability systems.

The entry into application of Regulation 2023/1115/EU risks creating a **supply shock in the cattle hide market**. The loss of extra-EU supplies incapable to comply with the EUDR traceability requirements will impact market prices materializing for EU operators in increased competition and

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additional costs for their cattle-leather raw materials. Conversely, with the loss of the EU market for their exports, these extra-EU raw materials suppliers are likely to results in an excess of supply on the open market and a drop in raw material prices on the global market, widening the price differential for leather products between leather products made with traceable leather in the EU and those imported into the EU without traceability. The main quantitative output of this socio-economic section was, thus, the analysis of the effects of such a price increase on the demanded quantities in the client sectors by examining the demand elasticity to prices.

According to the proposed methodology, a scenario analysis sees a **collapse in demand for leather between 9.3% and 15.5% in the face of a price increase of inputs between 6% and 10%**, in line also with what was documented by interviews with experts.

A 15% decline in demand is likely to have **substantial implications for wealth creation and adversely impact businesses and employment within the leather industry**. Notably, to find a comparable demand shock in international markets, one must reference the downturn experienced by Italy and Spain during the 2012 debt crisis, which saw demand shocks of 18% and 26%, respectively. In that instance, the shock was transient, as it was widespread across sectors and countries thus not resulting in a relative loss of competitiveness.

In contrast, the demand shock induced by the EUDR, coupled with a significant loss in competitiveness relative to extra EU players, is expected to have long-lasting effects. The persistent nature of such a downturn suggests that the industry may face long-term challenges in maintaining its workforce and supporting local communities dependent on leather production. Further research is needed to quantify the specific impacts on employment and to identify the most effective strategies for addressing the social consequences of the demand shock.

The qualitative analysis delves into the potential economic and social ramifications, focusing on the availability and pricing of bovine hides and leather, which are central to the European leather industry. The analysis warns of a **potential shortage of raw materials for EU tanneries** starting in 2025. In 2023, the EU imported substantial quantities of bovine raw hides, wet blue hides, and crust hides, primarily from extra-EU countries. These imports, which are at high risk of non-compliance with EUDR requirements, may lead to a projected **35% decrease in European leather production**. This reduction could cause the **closure of vulnerable companies**, resulting in **job losses** in an industry that currently comprises 1,500 companies and 35,000 employees, with an annual turnover of €7 billion.

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The last part of this study evaluates the changes in environmental impact derived from the implementation in the leather sector of Regulation 2023/1115/EU. The study compares a baseline scenario, reflecting current trade and practices, with two alternative scenarios predicting market responses to the EUDR, including trade deviation, product substitution and raw hides/skins destruction.

The **baseline scenario considers current patterns of raw hides and skins imports from the USA and Brazil which are processed in European tanneries** using a mix of tanning technologies. The first **alternative scenario (A) considers a shift of leather processing to China**, while the **second scenario (B) redistributes processing between the USA and China and includes increased production of polyurethane leather-like materials (PU LLM) in Europe**.

Results indicate that **both alternative scenarios increase environmental impacts compared to the baseline**. Scenario A shows a 40% higher overall environmental footprint, and Scenario B shows a 36% increase. The most significant impacts are seen in acidification, climate change, particulate matter, resource use of fossils, and resource use of minerals and metals. Hotspot analysis reveals that **tanning processes, especially those conducted in China, and the production of PU LLM are the primary contributors to increased impacts**.

The study adopts two methodological choices for making results comparable. On the one hand, the upstream livestock sector is ignored in the LCA calculation, as part one of the study had revealed that the demand for leather did not drive livestock production or slaughter, and because in the LCA of PU LLM oil-based products benefit from system boundaries that do not include the environmental impacts of forming the raw material before extraction. This puts animal-based materials and oil-based materials on a same footing with regard to system boundaries. On the other hand, the reference flow for leather and PU LLM have been adjusted to reflect the relative durability of materials, as genuine leather typically has a longer lifespan than PU LLM.

The findings of this study reveal that:

- leather has a physical link to cattle, but its **by-product/waste nature disqualifies leather as a driver of deforestation**;
- the socio-economic consequences of the implementation of the EUDR by its scheduled application date are likely to materialize as a persistent **loss of competitiveness in international markets** which will drive a significant decrease in the demand from the client

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sector. This is expected to result in a **substantial adverse impact on the EU leather industry** in terms of wealth creation, business density and jobs;

- while the EUDR aims to mitigate deforestation risks, the inclusion of leather in its scope will not generate the expected environmental benefits and may inadvertently **increase other environmental burdens by shifting production geographically and increasing reliance on synthetic alternatives**.

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1. Introduction and structure of the report

Although the leather sector widely agrees on the importance of combating deforestation and forest degradation that contribute in various ways to the global climate crisis, the leather world has developed a series of observations relating to the possible effects of Regulation 2023/1115/EU.

The following study originated precisely in the wake of these concerns, which have been appropriately analysed from a technical-scientific point of view, in order to give an overall and holistic evaluation of the effects of Regulation 2023/1115/EU. The activities conducted by the Scuola Superiore Sant'Anna for the realization of this project applied to the leather sector can be distinguished into three macro steps. It is important to underline how the analysis focused exclusively on raw bovine hides, as required by the regulation itself.

The first phase consisted of a critical analysis of the technical-scientific literature inherent to the connections between the leather sector in all its various phases (from the cradle to the grave) and deforestation. In addition to this desk activity, a series of interviews were carried out regarding the possible and actual interconnections between the various phases of the leather cycle and forest degradation. These interviews involved key actors, forming a heterogeneous and impartial audience of interviewees in order to guarantee robustness to the underlying methodology of the specific activity, but more generally of the entire project. This section was coordinated by the Institute of Management and, in particular, by Prof. Tiberio Daddi and Prof. Fabio Iraldo.

The second part of the project focused on the socio-economic impacts. The application of Regulation 2023/1115/EU could have significant impacts on the European and non-European economy connected to the world of leather. Considering the absence of an economic impact study on the topic, the project aimed to understand the evolution of the market under different scenarios that could arise with the application of the due diligence systems envisaged by the Regulation. The economic impacts were evaluated with reference to the current values and the historical values of leather in order to understand and estimate the trend of the global market. This analysis applied quantitative methods focusing the attention on the leather value chain (e.g. farmers, slaughterhouses, etc.). This task was coordinated by the Institute of Economics and in particular by Prof. Alessandro Nuvolari, Prof. Daniele Moschella and Dr. Angelo Cuzzola.

The third activity included in the project concerned the analysis of the environmental impacts. In fact, in close connection with the various scenarios that could occur within the second phase, it is necessary to estimate and quantify the environmental consequences of the application of the Regulation. Any

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changes on the global leather market could also have repercussions in terms of environmental impact. It is therefore important to see how a change in production flows affects the entire natural ecosystem. Any eventual benefits in terms of reduced forest degradation would be completely eliminated by the negative effects on other impact categories. Activity 3 related to the analysis of socio-economic impacts is closely linked to activity 2. In fact, alternative scenarios that were developed to estimate the socio-economic effects were also used to study the environmental consequences. Therefore, the study considered how the new legislation can influence leather production and processing practices, which in turn will generate variations at a logistical-production level on a global scale with evident environmental consequences. In this case the analysis was supported by the main tool for calculating impacts, namely the Life Cycle Assessment methodology. This section was coordinated by the Institute of Management and, in particular, by Prof. Monia Niero.

2. The Regulation 2023/1115/EU

The nineth of June 2023, the *Regulation (EU) 2023/1115 of the European Parliament and the Council of 31 May 2023 on the making available on the Union market and the export from the Union of certain commodities and products associated with deforestation and forest degradation and repealing Regulation (EU) No 995/2010* was published in the Official Journal of the European Union. As reported in *Article 1.1*:

This Regulation lays down rules regarding the placing and making available on the Union market as well as the export from the Union of **relevant products**, as listed in *Annex I*, that contain, have been fed with or have been made using relevant commodities, namely cattle, cocoa, coffee, oil palm, rubber, soya and wood, with a view to:

a. minimising the Union's contribution to deforestation and forest degradation worldwide, and thereby contributing to a reduction in global deforestation;

b. reducing the Union's contribution to greenhouse gas emissions and global biodiversity loss.

Relevant commodities and products, in particular (*Article 3.1*), shall not be placed or made available on the market or exported, unless all the following **conditions** are fulfilled:

a. they are deforestation-free;

b. they have been produced in accordance with the relevant legislation of the country of production;

c. they are covered by a due diligence statement.

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Deforestation-free means that the relevant products contain, have been fed with or have been made using, relevant commodities that were produced on land that has not been subject to deforestation after 31 December, 2020 or, in the case of relevant products that contain or have been made using wood, that the wood has been harvested from the forest without inducing forest degradation after 31 December, 2020 (*Article 2.13*).

The relevant legislation of the country of productions (*Article 2.40*) refers to the laws applicable in the country of production concerning the legal status of the area of production in terms of:

a. land use rights;

b. environmental protection;

c. forest-related rules, including forest management and biodiversity conservation, where directly related to wood harvesting;

d. third parties' rights;

e. labour rights;

f. human rights protected under international law;

g. the principle of free, prior and informed consent (FPIC), including as set out in the UN Declaration on the Rights of Indigenous Peoples;

h. tax, anti-corruption, trade and customs regulations.

The due diligence statement (*Article 8*) – to be updated at least once a year and kept recorded for five years – regards all relevant products supplied by each particular supplier and it shall include:

a. the collection of information, data and documents needed to fulfil the requirements set out in *Article 9* (including geolocation of all plots of land where the relevant commodities that the relevant product contains, or has been made using, were produced, as well as the date or time range of production);

b. risk assessment measures as referred to in *Article 10*;

c. risk mitigation measures as referred to in *Article 11*.

Operators and traders, in particular, shall not place relevant products on the market or export them without prior submission of a due diligence statement (*Article 4*.2 and 5.*1*) and they are considered responsible for the compliance of the relevant product with the *Article 3* (*Article 4*.2 and 5.*1*). They also shall communicate to operators and to traders further down the supply chain of the relevant

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products they placed on the market or exported all information necessary to demonstrate that due diligence was exercised and that no or only a negligible risk was found, including the reference numbers of the due diligence statements associated to those products (*Article 4*.2 and 5.*1*). **Operators further down the supply chain**, i.e., those who transform a product listed in Annex I (which has already been subjected to due diligence) into another product listed in Annex I, can thus refer to due diligence performed earlier in the supply chain by including the relevant reference number when submitting their due diligence statement in the Information System; yet they retain legal responsibility in the event of a breach of the Regulation (*FAQ32*). Also, operators that are SMEs (**SME operators**) shall not be required to exercise due diligence for relevant products contained in or made from relevant products that have already been subject to due diligence: in such cases, SME operators shall provide the competent authorities with the reference number of the due diligence statement upon request, while for parts of relevant products that have not been subject to due diligence SME operators shall exercise due diligence *(Article 4.8)*. However, traders that are SMEs (**SME traders**) shall collect and keep (for at least 5 years) information relating to the relevant products they intend to make available on the market, including the name, registered trade name or registered trade mark, the postal address, the email address and, if available, a web address of the operators or the traders who have supplied the relevant products to them, and of the operators or the traders to whom they have supplied the relevant products, as well as the reference numbers of the due diligence statements associated to those products (*Article 5.3*).

The Regulation also establishes a **three-tier system for the assessment of countries or parts thereof**, suggesting the following categories (*Article 29*):

a. high risk, which refers to countries (or parts thereof) for which the assessment resulted in the identification of a high risk of producing in such countries (or in parts thereof) relevant commodities for which the relevant products do not comply with Article 3;

b. low risk, which refers to countries (or parts thereof) for which the assessment concluded that there is sufficient assurance that instances of producing in such countries (or in parts thereof) relevant commodities for which the relevant products do not comply with Article 3;

c. standard risk, which refers to countries or parts thereof which do not fall in either the category "high risk" or the category "low risk".

The classification of countries, or parts thereof – that will be published no later than 30 December 2024 – will be based primarily on the following **assessment criteria**:

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a. rate of deforestation and forest degradation;

b. rate of expansion of agriculture land for relevant commodities;

c. production trends of relevant commodities and of relevant products.

In addition, it will take into account:

a. information regarding the effective covering of emissions and removals from agriculture, forestry and land use in the nationally determined contribution to the UNFCCC;

b. agreements and other instruments between the country concerned and the Union and/or its Member States that address deforestation and forest degradation and facilitate compliance of relevant commodities and relevant products with Article 3 and their effective implementation;

c. national or subnational laws, enforcement measures to tackle deforestation and forest degradation, and to avoid and penalise activities leading to deforestation and forest degradation, as well as penalties to deprive of the benefits accruing from deforestation or forest degradation;

d. transparent availability of relevant data and the existence, compliance with, or effective enforcement of laws protecting human rights, the rights of indigenous peoples, local communities and other customary tenure rights holders;

e. sanctions imposed by the UN Security Council or the Council of the European Union on imports or exports of the relevant commodities and relevant products.

The Regulation, however, **does not apply** to relevant commodities and products produced before twenty days following that of its publication in the Official Journal of the European Union (*Article 38.1*) – except for the timber and timber products as defined in Article 2, point (a), of Regulation (EU) No 995/2010 that were produced before 29 June 2023 and placed on the market from 31 December 2027 shall comply with Article 3 of this Regulation (*Article 37.3*). Moreover, operators sourcing commodities entirely from areas classified as low risk will be subject to **simplified due diligence obligations**, meaning that they will not be required to assess and mitigate risks (Articles 10 and 11) unless the operator obtains or is made aware of any relevant information that would point to a risk that the relevant products do not comply with this Regulation (*Article 13*).

More generally, the Regulation is intended to cover commodities the Union consumption of which is the most **relevant in terms of driving global deforestation and forest degradation** and for which

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a **Union policy intervention could bring the highest benefits per unit value of trade** (*Point 38 of the Regulation*).

According to the extensive **review of relevant scientific literature**, namely of primary sources estimating the impact of Union consumption on global deforestation and linking that environmental footprint to specific commodities, carried out as a part of the **study supporting the impact assessment** for this Regulation and cross-checked by means of **extensive consultation** with stakeholders, **eight relevant commodities** (cattle, cocoa, coffee, oil palm, rubber, soya and wood) have been included in the scope of the Regulation, each of which presents different, related relevant products, considering that wood was directly included in the scope as it was already covered by Regulation (EU) No 995/2010 (*Point 38 of the Regulation*).

The progressive scope has been chosen to successive updates, reflecting the dynamism of the consumption and trade markets, while allowing to address issues such as the risk of leakage or rebound, to accommodate changes in consumption patterns in the EU and to address future new knowledge or technological developments in relation to deforestation and forest degradation. Thus, commodities and their derived products are covered in the legislative instrument, based on (i) their high contribution to deforestation and forest degradation and (ii) the share of EU imports (intra and extra EU imports) on total imports. However, regular updates to the scope are carried out by the Commission or the legislator with the possibility to add or remove commodities and derived products from the scope (*Final Report*).

The progressive scope will also allow the **review of the Regulation** to eventually include other wooded lands, other natural ecosystems – including other land with high carbon stocks and with a high biodiversity value such as grasslands, peatlands and wetlands – and/or other further commodities and related products. To do this, the Commission shall present an impact assessment accompanied, if appropriate, by a legislative proposal no later than 30 June 2024 (for wooded lands) or 30 June 2025 (for natural ecosystems, commodities, and related products). Also, by 30 June 2028 and at least every five years thereafter, the Commission shall carry out a general review of this Regulation, and shall present a report to the European Parliament and the Council accompanied, if appropriate, by a legislative proposal (*Article 34*).

2.1 Methodology used for the Development of the Regulation

The study ***EU policy on forest products and deforestation***, undertaken under the broader contract *Economic analysis of environmental policies and analytical support in the context of Better*

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idm@sssup.it

Regulation (Framework Contract No. ENV/F1/FRA/2019/0001), examines the potential impacts of policy options and measures contained therein addressing additional demand-side regulatory and non-regulatory measures in order to increase supply chain transparency and minimise the risk of deforestation and forest degradation associated with products placed on the EU market.

The initiative is intended to follow the European Commission's ***Better Regulation Guidelines***, which provides relevant "better regulation" principles, objectives, tools and procedures over the whole policy cycle – from the policy design and preparation, through adoption, implementation and application – to allow political decisions to be prepared in an open and transparent manner, informed by the best available evidence, including via the comprehensive involvement of stakeholders (*Better Regulation Guidelines*). The key instruments suggested in the guidelines are (i) forward planning and political validation, (ii) stakeholder consultation, (iii) evaluation and fitness checks, (iv) impact assessment, (v) quality control, and (vi) compliance support and implementation. However, the **general approach to the analysis** applied in the study can be summarised in three key activities:

a. collection of data through an extensive **literature review**;

b. complementing and validating the information through **consultation activities**, namely feedback to the Inception Impact Assessment (IIA), Online Public Consultation (OPC), and targeted stakeholder consultation;

c. analysis and comparison of the **policy options**.

An extensive **literature review** was carried out to identify a number of **commodities** where the policy intervention is justified in terms of efficiency. The consequent first list of commodities – including beef, wood, palm oil, soya, coffee, cocoa, rubber, and maize – was then brought to the attention of stakeholders through the **Commission Expert Group/Multi-Stakeholder Platform** on Protecting and Restoring the World's Forests, and subjected to an **efficiency analysis** that compared the hectares of deforestation linked to EU consumption for each of those commodities with the average value of EU imports. At the end of the analysis, six commodities were selected for the scope of the legislative instrument: palm oil, soy, wood, beef (cattle), cocoa, and coffee – though rubber is present in the list of commodities included in Annex 1 of the Regulation. Finally, to identify **relevant derived products**, the **main trading forms** for each commodity, as they appear in trade databases, were used – except for wood, where the EUTR scope was used. In doing this, the *Impact Assessment* advice to postpone the detailed listing of derived products to a **specific impact assessment** and subsequent implementing legislation.

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The Inception Impact Assessment was opened for public feedback from the 5 February 2020 to 4 March 2020, collecting a total of 99 responses from 23 countries through the online portal. A general assessment of the responses is that the Commission seeking to minimise the EU's contribution to deforestation and forest degradation worldwide and promote the consumption of products from deforestation-free supply chains in the EU is very welcome (*Impact Assessment, Part 2*).

For the Online Public Consultation – from 3 September 2020 to 10 December 2020 – two questionnaires were developed, one general and one more specific with questions directed at more expert stakeholders (*Synopsis Report*). One questionnaire is still available on the website of the #Together4Forests campaign – carried out by a group of NGOs, including ClientEarth, Conservation International, Environmental Investigation Agency, Greenpeace and WWF[1] – while the other one was published for a limited period of time on the *Have Your Say* online portal of the European Commission, addressing forward-looking options about demand-side measures, which should ultimately contribute to addressing deforestation and forest degradation associated with products placed on the EU market (Impact Assessment, Part 2).

Targeted consultations were carried out to complement and validate the information gathered from the literature review. Two stakeholder meetings focusing on the Impact Assessment were used to update participants on progress and request their inputs on the legislative work, covering topics such as definition of deforestation-free, products and commodities to be covered, and possible measures. During the interviews, selected stakeholders were asked to review the inputs provided and to submit additional literature and data, when relevant (*Impact Assessment, Part 2*).

Among the 17 proposals, a total of **5 regulatory and non-regulatory policy options**, elaborated based on the feedback provided by stakeholders to the Inception Impact Assessment as well as the literature (*Final Report*), were assessed through the study. **The baseline** (Baseline scenario – do nothing extra) provides a critical reference point against which to assess changes and impacts of the formulated policy options, serving as the counterfactual for examining how the situation is expected to change with the policy options considered. The baseline selected in the study reflects the deforestation and forest degradation impacts of EU consumption in the context of these existing measures and settings, with the aim to illustrate the impact of EU consumption on deforestation and forest degradation and CO_2 emissions. To quantify the baseline, data about the production of key selected commodities, the volumes that are placed on the EU market and key impacts associated with

[1] https://together4forests.eu/news-resources/answers

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their consumption within the EU were included. The evolution of imports to 2030 was estimated based on projected annual growth rates found in literature, where possible, or otherwise based on historical trends. For impacts on global deforestation and CO_2 emissions, average intensity factors (i.e., deforestation and emission ratios) were derived from literature and applied to import volumes (historical and projected), while impacts on deforestation and emissions is assumed to remain the same until 2030 (*Impact Assessment, Part 1*).

The first option (**Option 1**) involves the implementation of an improved due diligence system based on deforestation-free definition. **Option 2** suggests benchmarking and country carding systems (with DD). The third option (**Option 3**) reflects a mandatory public certification (with DD), while the fourth one (**Option 4**) a mandatory labelling (with DD). Finally, **Option 5** stands for deforestation-free requirement supported by a benchmarking and country card systems. Though, in terms of policy options, during the Online Public Consultation support was stronger for a deforestation-free requirement or standard, after the identification of impacts, **the most viable option** appeared to be a combination of Option 1 and Option 2: a benchmarking system and a list of contravening operators combined with a tiered improved mandatory due diligence system, relying on a deforestation-free definition (*Impact Assessment*). This resulted by the Impact Assessment conducted by the European Commission in relation to environmental, economic, and social impacts, coherence with other EU policy objectives, and leakage problems.

2.2 Limitations of the Approach

Triangulation of primary (consultation) and secondary (literature) data was carried out in **order to validate the research**, through the use of a variety of methods to collect data, with different types of samples and different methods of data collection, with the aim to cross-validate data as well as capture different dimensions on a same topic. However, the method used a **simplified approach** to build the quantitative baseline and, consequently, to calculate the impact on deforestation and emissions, including **proxies and assumptions when data was not available**. The baseline reflects an analysis that uses different databases to obtain import data, used as a proxy for consumptions. This, other than increasing the risk of double counting some imports, means that it is not certain that the commodity groups fully align. Moreover, the method to calculate the intensity factors differed slightly depending on the dataset used. The commodities and country-specific intensity factors then multiplied by the volume of imports at country and commodity levels may not fully reflect the reality of impacts, since the volumes of imports itself may not be accurate and, in cases where intensity factors are missing but products are placed on the EU market, regional averages are used to fill in gaps. In addition,

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Piazza Martiri della Libertà, 24 - 56127 Pisa
tel. 050 88.39.83-82 - fax 050 883.936
idm@sssup.it

certain commodities were excluded from the assessment of impacts due to a lack of conversion factors for bulk commodities that differed significantly in weight from their weight as raw materials. Thus, the **impact assessment resulted to be difficult to determine for certain commodities**, due both to their multiple supply chains and specifics and to the challenges in collating and comparing data relative to these commodities.

By defining the commodities and products falling under the scope of the several measures and policy options is a key element of the impact assessment (*Final Report*), the approach of the study presents important limitations from the beginning, considering **the state of scientific research** – i.e., there is no scientific study that assesses all commodities potentially causing deforestation in a comprehensive manner and there is a lack of data on several commodities and their contribution to deforestation – and **the number and diversity of derived products** containing the considered commodities (*Final Report*), that ended up with a selection of relevant derived products by considering the main trading forms for each commodity, as they appear in trade databases *(Impact Assessment Part 1*). The statistics used by some of the reviewed reports are old, and the numbers have substantially changed. Some papers start from a preliminary list of commodities, which makes them uncomprehensive, others focus only on tropical deforestation, and a majority disregards forest degradation, which is much more difficult to measure (*Impact Assessment*). Also, the selection of the final seven commodities does not accurately reflect the efficiency analysis conducted in the study, for at least two reasons. First, the **efficiency analysis** suggested that including maize and rubber in the scope would require a very large effort and significant financial and administrative burden, with limited return in terms of curbing deforestation driven by EU consumption – since they account for the smallest fraction of embodied deforestation among the commodities analysed, while their trade volumes are very large (around EUR 2.8 billion per year for maize and 17.6 billion for rubber) – and, at the end, rubber was included in the scope, while maize not. Also mining, that – together with agriculture, infrastructure development, urban expansion, and logging – is consider among the main drivers of deforestation (*Final Report*), is not taken into consideration in the impact assessment, though it was investigated during the public consultation. Second, the **cost-benefit analysis** – based on the work of Pendrill, Persson, and Kastner (2020) and then elaborated for the scope of the study – is based on HS codes that correspond to "beef", but then "cattle" was preferred to enlarge the progressive scope options. Also, the majority of data used to calculate the intensity factors came from Pendrill et al. (2020) and FAOSTAT but, in some cases, it is not certain that the commodity groups fully align, and Pendrill et al. (2020) data focuses only on tropical countries, so that GFW data was

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Scuola Superiore Sant'Anna

Piazza Martiri della Libertà, 24 - 56127 Pisa
tel. 050 88.39.83-82 - fax 050 883.936
idm@sssup.it

used though it provides data on forest loss and CO_2 emissions associated with a number of drivers (*Final Report*). The reliability of impacts is also affected by the **volume of imports**, since some countries placing commodities/products on the EU market may not be countries producing those same commodities/products, so the factors applied to the volumes may not be accurate (*Final Report*).

On the scope, during stakeholder meetings a point was made that, if derived products were to be included too, HS codes could be useful in the early stages of processing a specific commodity but may not be appropriate further down the supply chain, and some preferred using thresholds to ascertain how much of a commodity is contained within a product (*Impact Assessment Part 2*). Even interviewees, who mostly agreed that bulk commodities and derived products that contained them should be under scope, raised **concerns on how this could be done in practice**, suggesting **focusing only at commodity level** if not possible to cover all products, even though it seems to be more practical than trying to select some only (*Synopsis Report*). Indeed, among the **three scenarios** presented to stakeholders – targeted scope (i.e., only the selected commodities are covered in the legislative instrument, based on the criteria enumerated above), progressive scope (i.e., selected commodities and certain derived products are included in a list that undergoes regular reviews), and expanded scope (all commodities and their derived products are covered in the legislative instrument) of commodities – the overwhelming majority of NGOs and some industry associations called for including all products derived from the selected commodities from the outset (*Impact Assessment, Part 1*). Despite this, the impact assessment considers the scenario of "**progressive scope**" the most suitable, clarifying that an analysis of derived products based on potential costs and benefits, similar to the analysis of commodities, would be needed and that simply including all potential products in the scope without a clear map of which products these would be against the Better Regulation principles. Thus, the progressive scope for both commodities and derived products is intended to favour flexibility and adaptability to changes in consumption in the EU, global deforestation patterns, as well as to new knowledge or technological developments. However, the **selection of derived products** to be specified in the scope – with the exception of wood, where the EUTR scope would be used – is based on the identification of the main trading forms for each commodity (as they appear in trade databases), without specific impact assessments being conducted. For example, according to the *Impact Assessment*, leather "should be properly studied in the impact assessment foreseen to extend the product scope downstream", considering also that the **cost-benefit analysis** is based on HS codes that originally corresponded to "beef, but "cattle" has been preferred because it would allow for the progressive scope to be enlarged to derived products such as leather. In addition, deforestation

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Piazza Martiri della Libertà, 24 - 56127 Pisa
tel. 050 88.39.83-82 - fax 050 883.936
idm@sssup.it

or degradation embedded in EU consumption may be reduced or eliminated, but at the same time unsustainable production activities would either be transferred to **other commodities not in scope** of the regulation or by switching to less discerning markets, potentially reducing the overall impact of the EU intervention (*Impact Assessment*).

More generally, referring to **stakeholder consultation**, results show that of the 1,194,761 responses obtained during the open public consultation, 1,193,611 responses have been identified as submitted through the campaign (*Summary Report*). Thus, though these responses are supposed to be analysed separately from the non-campaign responses, the **results are not statistically representative** due to the inherent fact of self-selection, since the active stakeholders are those which are more likely to have contributed (*Synopsis Report*). Also, the questionnaire **lacks of clarity** – which is one of the five minimum standards applied to public consultations expressed in the *Better Regulation Guidelines* – in assessing the problem of deforestation and forest degradation, considering grouped commodities – like animal-based food and non-food products – and exploring certain commodities first alone and then with other commodities – as in the case of mining products and oil and gas, which are investigated together when asking "To what extent do you consider each of the economic sectors to contribute to deforestation and forest degradation via the goods and services that they provide (on the EU market)?" and separately when asking "To what extent do you consider the following commodity groups to contribute to deforestation and forest degradation worldwide, due to their consumption within the EU market?" (*Synopsis Report*). The **risk of bias** in the way questions are drafted and various options are presented is considered one of the main limitations of questionnaires (*Better Regulation Toolbox*). Questions and their answer options should be relevant, non-biased, short, and simple, while consultation documents should be explicit, clear, and understandable, including for non-experts (*Better Regulation Toolbox*). Animal-based food and non-food and mining/oil and gas were seen, among others, as the biggest contributors to deforestation and forest degradation via the goods and services that they provide (on the EU market) (*Synopsis Report*), and the *Better Regulation Toolbox* suggests to **isolate those drivers that play a major role** in determining a problem and differentiate those that could be targeted by the initiative from those falling outside of the scope because they are targeted by other initiatives or are outside the remit of EU competence. **Relevant interactions** among drivers should also be identified (*Better Regulation Toolbox*, pp. 90). Indeed, the more complex the problem being addressed and the more pervasive its implications for society, the economy and the environment, the greater the need for an in-depth analysis (*Better Regulation Toolbox*). All impact assessments should be **proportionate**, which means that a separate and lighter

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Piazza Martiri della Libertà, 24 - 56127 Pisa
tel. 050 88.39.83-82 - fax 050 883.936
idm@sssup.it

impact assessment category does not exist. The greater the likely impact, the more thorough the assessment should be and the greater the efforts to collect data and quantify impacts (*Better Regulation Toolbox*).

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Piazza Martiri della Libertà, 24 - 56127 Pisa
tel. 050 88.39.83-82 - fax 050 883.936
idm@sssup.it

3. Task 1: Analysis of the connections between the leather sector and the phenomenon of deforestation

Analysing the connections between the leather industry and deforestation is a complex process that requires careful research, critical evaluation and a commitment to address environmental problems effectively. The aim of the analysis was to detect and establish whether there are, and if so, to what extent, relationships, causes and effects between the leather sector and deforestation.

To achieve this objective, a two-pronged approach was followed. On one hand, a literature review was conducted, that provided in-depth data and analysis on the connections between the leather sector and deforestation. On the other hand, a series of interviews were conducted with experts of the tanning industry, leather production, environmental conservation and other key players. Experts provided valuable insights into the dynamics and interconnections between these sectors.

The results of the literature review were used to create the interview protocol fostering the interconnectedness between these two methodologies.

Specifically, Task 1 addressed the three following key research questions:

1. Is there a **connection** between **cattle raising** and **deforestation**?
2. If yes, what are the **outputs of cattle raising**? Are raw hides the primary aim of cattle raising or are they by-products?
3. Is there a direct connection between the **leather** sector (bovine raw hides demand) and the deforestation phenomenon?

3.1 Desk research

The present document details the results of the desk research, also detailing implications for subsequent research activities (e.g., socio-economic and environmental analyses) to be conducted within the frame of the study of the effects of Regulation 2023/1115/EU on the leather sector. The desk research aimed at delineating the interconnectedness between the leather sector and the phenomenon of deforestation, by establishing a robust knowledge base for subsequent empirical research activities.

Recognizing the importance of the objectives of the evaluation, the desk research lays the foundation to **improve the knowledge on the topics addressed by this study**. This approach is aimed at efficiently advancing knowledge while minimizing redundancy and overlapping with prior research efforts, thus ensuring innovativeness and comprehensiveness of the evaluation results.

In this perspective, the desk research aimed at **delineating the state-of-the-art of the empirical evidence** on the relationship between the leather sector and the phenomenon of deforestation.

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Piazza Martiri della Libertà, 24 - 56127 Pisa
tel. 050 88.39.83-82 - fax 050 883.936
idm@sssup.it

To ensure a comprehensive assessment of existant literature, the desk research gathered publications and studies from both the **scientific** and **"grey" literature**[2].

The bibliographic research was conducted separately for scientific and "grey" publications, in order to enhance the reliability and replicability of the literature review. The following paragraphs briefly detail the key methodological steps followed in the selection of relevant publications.

3.1.1 Bibliographic search on scientific publications.

The first step consisted in retrieving scientific publications on the leather sector and deforestation pertinent to the key research questions. To this aim, the bibliographic research followed the key steps of a systematic literature review (Tranfield et al., 2003): first, locating studies based on selected keywords and inclusion criteria; second, screening and selecting studies based on a set of exclusion criteria.

However, no criteria related to the year, subject area or source type were applied in order to preserve the comprehensiveness of sourced publications. In the use of keywords, we did not limit our analysis to the classic keywords such as "leather" and "deforestation", but we also include "meat", "cattle", "raw hides", "livestock" and "byproduct", testing the different combinations. Keywords were used to perform search queries on two bibliographic databases, ISI Web of Science and Scopus.

Scopus and ISI Web of Science are both bibliographic databases that are widely used in academic and scientific research to retrieve citation data and track the impact of scholarly publications. They are a trusted, source-neutral abstract and citation databases curated by independent subject matter experts who are recognized leaders in their fields. They include comprehensive scholarly literature, data and analytical tools, i.e., 94M+ records, 29,200+ active serial titles, 330,000+ books,

Table 1 summarizes the results for each combination of keywords adopted.

Keywords	Nr. of results
"Livestock OR Cattle OR Breeding" AND "Deforestation"	1011
"Leather OR Raw Hides" AND "Biodiversity"	59
"Leather OR Raw Hides" AND "Deforestation"	11
"Livestock OR Cattle OR Breeding" AND "Leather"	145
"Meat" AND "Byproduct"	790
"Meat" AND "Leather OR Raw Hides"	401
"Slaughterhouse" AND "Deforestation"	21

[2] For grey literature we mean materials and research produced by organizations outside of the traditional commercial or academic publishing.

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tel. 050 88.39.83-82 - fax 050 883.936
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Keywords	Nr. of results
"Slaughterhouse" AND "Leather OR Raw Hides"	69
TOTAL	**2,507**

Table 1 – Studies emerged from the first step of the bibliographic literature review.

First, we removed the duplicates found in the two databases and in the seven combinations of keywords adopted. We then analysed the titles, abstracts and keywords of the selected studies (TITLE-ABS-KEY), excluding those that were not coherent with our research questions.

Table 2 summarizes the results for each combination of keywords adopted after the first screening made per "TITLE-ABS-KEY"

Keywords	Nr. of results
"Livestock OR Cattle OR Breeding" AND "Deforestation"	49
"Leather OR Raw Hides" AND "Biodiversity"	2
"Leather OR Raw Hides" AND "Deforestation"	5
"Livestock OR Cattle OR Breeding" AND "Leather"	6
"Meat" AND "Byproduct"	15
"Meat" AND "Leather OR Raw Hides"	10
"Slaughterhouse" AND "Deforestation"	3
"Slaughterhouse" AND "Leather OR Raw Hides"	6
TOTAL	**95**

Table 2 – Studies emerged from the first screening made per "TITLE-ABS-KEY" of the bibliographic literature review.

After this first selection, we performed a full-text screening based on a content analysis. We included papers that investigated interconnectedness, nexuses and linkages between deforestation and leather, either on an abstract or micro-meso-macro (firms, industrial clusters, countries) level of focus. Furthermore, we included papers that explored the connection between the meat industry and the leather industry. Similarly, we excluded all the papers regarding specific technology or process innovation that is disconnected from a concrete analysis of the relationships between cattle, deforestation and leather, or that explained the leather industry without considering its connections with deforestation, livestock or beef.

The application of these criteria, in addition to removing duplicate papers, significantly reduced the number of articles for the analysis. No additional papers were added through cross-referencing.

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tel. 050 88.39.83-82 - fax 050 883.936
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Table 3 summarizes the results for each combination of keywords adopted after the second screening made per "FULL-TEXT".

Keywords	Nr. of results
"Livestock OR Cattle OR Breeding" AND "Deforestation"	25
"Leather OR Raw Hides" AND "Biodiversity"	1
"Leather OR Raw Hides" AND "Deforestation"	3
"Livestock OR Cattle OR Breeding" AND "Leather"	3
"Meat" AND "Byproduct"	4
"Meat" AND "Leather OR Raw Hides"	4
"Slaughterhouse" AND "Deforestation"	2
"Slaughterhouse" AND "Leather OR Raw Hides"	6
TOTAL	**48**

Table 3 – Studies emerged from the second screening made per "FULL-TEXT" of the bibliographic literature review.

Following this selection, the articles were analysed and classified according to key thematic categories (i.e., themes explored in the study), also in light of the research questions that guided the literature review. This process led to identify three distinct macro thematic categories. In case themes were recurrent across selected studies, but not yet consolidated as a distinct research inquiry in the field (i.e., limited number of studies), such themes were codified as sub-categories to a specific macro-category. In several cases, studies were assigned to multiple categories based on their contribution to diverse research inquires (e.g., deforestation, cattle raising, slaughterhouse, etc.). Thematic categories and sub-categories are briefly discussed as follows:

a. Cattle and Deforestation: this category collects together all the studies that investigate the link between cattle raising and deforestation. Satellite imagery and GIS analysis, field surveys and observations, economic, political and legal analyses, interviews and stakeholder engagement, environmental impact assessment, etc. Combining these approaches allowed to perform a comprehensive investigation of the intricate relationship between cattle raising and deforestation, and to provide a holistic view of the issue.

b. **Primary product, co-product and by-product of slaughterhouses, the relation between meat and raw hides**: this category focuses on the debate on the role of leather in the meat industry. Slaughterhouses produce different outputs, and it may be controversial to identify which one is the

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tel. 050 88.39.83-82 - fax 050 883.936
idm@sssup.it

primary and which are co-products or by-products. Researchers gained a comprehensive understanding of the relative significance of meat and leather production in the context of cattle raising by adopting different methodologies such as economic analysis, supply chain analysis, industry surveys and interviews, consumers' preferences and trends, environmental impact assessments, policy and trade regulations, etc.

c. Leather and Deforestation: this last category centres its attention on those studies that specifically investigate the relationship between leather and deforestation. Again, scholars have adopted different approaches to tackle this controversial debate.

The findings of the studies of each thematic category are discussed in greater detail in section "3.2 Results of the desk research" of the present document.

3.1.2 Bibliographic search on "grey" publications

To minimise the risk of omitting relevant sources a review of the grey literature was conducted developing and applying a three-steps method.

The first step was to define the most suitable sources to identify information and data on the topics of raw hide and deforestation. Specifically, we identified four main types of sources:

Sources
Customised Google search engines
Government websites
Organisations, foundations leather sector websites
Non-governmental organisations websites

Table 4 - Sources used to conduct the grey literature review

The second step was to scrutinize these sources, using a set of keywords which corresponded to the three research questions identified in section 3.1.1. "Bibliographic search on peer-reviewed publications". The main types of documentation that were collected are theses or dissertations, conference or workshop proceedings, white papers, reports from government, non-governmental organisations, associations and foundations, in addition to interviews (videos) or conference speeches.

Keywords
"Livestock OR Cattle OR Breeding" AND "Biodiversity"

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tel. 050 88.39.83-82 - fax 050 883.936
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Keywords
"Livestock OR Cattle OR Breeding" AND "Deforestation"
"Raw Hides" AND "Byproduct OR Waste"
"Raw Hides" AND "Biodiversity"
"Raw Hides" AND "Deforestation"
"Livestock OR Cattle OR Breeding" AND "Raw Hides"
"Slaughterhouse" AND "Raw Hides"

Table 5 - Keywords used to conduct the grey literature review

As a third step, to select a first group of documents, we screened the identified elements based on the analysis of abstracts or, when not available, indices. Consequently, we examined the full text of the publications, considering the following aspects: authorship and year, accuracy, subject, impartiality and coherence. This allowed us to end up with a final group of 71 documents and 25 websites.

Table 6 shows the final set of documents. For each keyword, the amount of documentation (theses or dissertations, conference or workshop proceedings, white papers, reports from government, non-governmental organisations, associations and foundations), websites and videos, was identified. In many cases, the same material was identified for several keywords but, in order to avoid repetition, the materials were distributed according to the key research word they contributed mostly.

Type of documents analysed	**N°**
EU Technical Documentation	8
Reports	58
Websistes	25
Videos	5

Table 6 - Final set of documents organised analysed in the grey literature review

After the selection of the final set of documents, we analysed the materials at our disposal according to the 3 key thematic categories, which summarise the results of the three research questions used in conducting the research. Please refer to section 3.1.1. "Bibliographic search on scientific publications" for a detailed presentation of the 3 thematic categories.

a. Cattle and Deforestation.

b. Slaughterhouse and Meat & By-product and Leather.

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tel. 050 88.39.83-82 - fax 050 883.936
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c. Leather and Deforestation.

The results of the grey literature review were organised on the basis of the 3 thematic categories and are presented in detail in section 3.2.2. "Findings of 'grey' literature" of this document.

3.2 Results of the desk research

In this section, the findings of both selected peer-reviewed and "grey" publications are discussed in detail, based on the thematic categories identified in the bibliographic research.

3.2.1 Cattle and Deforestation

a) Findings of academic publications

Most studies recognised a direct connection between cattle raising and deforestation, even in protected areas (West et al., 2022). Klingler et al. (2018) highlighted the importance of **developing new systems for monitoring cattle supply chains** in remote areas of the Amazon since the current agreement are ineffective. However, while discussing this aspect, the authors indicated that the latter agreements include high-profile commitments by major meatpacking companies operating across the Amazon basin to stop purchasing cattle from properties linked to illegal deforestation or other social or environmental standards. Thus, they indirectly suggest that **meat production, and not the raw hides production, is the main output of cattle raising activities**. Even Gibbs et al. (2016) confirmed that, after the agreements, slaughterhouses avoid purchasing from properties with deforestation, which was not the case prior to the agreements, recognising **important changes in the beef supply chain**. Santos and Costa (2018), instead, suggested that it is not possible neither to identify slaughterhouses as a leverage point to reduce deforestation nor their influence on cattle-ranching intensification. The authors concluded that slaughterhouses should not be considered a reliable strategy to achieve sustainable beef production, identifying **meat as the main output of the industry**.

Brandão Jr. et al. (2023) demonstrated that assessing slaughterhouse deforestation risk for the entire supply chain can be achieved by mapping only the direct suppliers. While recognising the remarkable potential that meatpacking companies hold to influence deforestation, the authors claimed that even **the leather sector through traceability data can estimate cattle supply chains and assess the associated risk of deforestation**. Nevertheless, as confirmed by Ruviaro et al. (2014), **beef certification is a prerequisite for meat produced in the Brazilian Amazon Region** for maintaining and expanding a sustainable share of the international markets without the burden of presumptive deforestation. Even Zu Ermgassen et al. (2020) studied the traceability of the beef supply chain, but

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tel. 050 88.39.83-82 - fax 050 883.936
idm@sssup.it

exclusively focused on **meat production, since it is recognized as the most relevant output of the livestock industry** both in terms of quantities exported and in terms of linkages with deforestation.

Contrarily, Levy et al. (2023) studied the G4 Agreement signed in 2009 by the four largest cattle meatpacking companies and suggested that deforestation in the Brazilian Amazon could be halved by scaling up the implementation of zero-deforestation cattle commitments. Despite the conflicting results, they all highlighted that **policymakers contacted meat producers to sign deforestation agreement and not leather producers**. On the agreements, Pereira et al. (2020) reported that they are a consequence of a Greenpeace report that linked clearing in the Brazilian Amazon to international supply chains for leather, tallow, and beef. However, by studying the regional expansion of the beef industry in Brazil from the coast to the Amazon, from 1966 to 2017, Vale et al. (2022) clearly stated that the **meat industry is the main driver** of all the actors of its supply chain, from farm to foreign buyers, passing through slaughterhouses.

Cederberg et al. (2011) included carbon emissions from deforestation in the carbon footprint of Brazilian beef and argued that **increased beef production for export has been the key driver of the pasture expansion and deforestation**. Moreover, Dávalos et al. (2014) stated that **demand for beef promotes forest loss** by making cattle ranching profitable. Thus, according to the authors, perennial **demand for beef promotes cattle ranching and ultimately causes deforestation.** Sandoval et al. (2023) performed an economic analysis of silvo-pastoral systems for cattle production. Although unrelated to our research, this study **considered only the income from the sale of meat as a source of revenue** of the analysed companies. Similarly to Sandoval et al. (2023), Pedrosa et al. (2021), investigating financial transition and costs of sustainable agricultural intensification practices on a beef cattle and crop farm in the Brazilian Amazon, centre the attention on the most dynamic and complex **for meat production**. Casagranda et al. (2023) highlight that **most Brazilian beef exports are live animals or raw meat**. However, when suggesting strategies to reduce the environmental impact of beef cattle industry, the authors claimed that **all stakeholders in the beef and leather value chains should collaborate** since without a joint support, deforestation caused by cattle farming is unlikely to decline.

Even Pendrill et al. (2019) indicated **cattle meat as a driver of deforestation**, while **leather is never mentioned** within their studies on agricultural and forestry trade that drives large share of tropical deforestation emissions.

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tel. 050 88.39.83-82 - fax 050 883.936
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Karstensen et al. (2013) suggested that **deforestation in Brazil cannot be considered in isolation from the global supply chain**. The average export of beef products was 15% (ranging from 12% in 1998 to 19% in 2008). The largest share of exported emissions from Brazilian beef production in 1990 were embodied in trade to the USA and the UK, while Russia has recently increased its share from very low levels to becoming the world's largest importer of emissions embodied in Brazilian beef in 2010 (from 0.1% of production in 2000, to 2.8% in 2010), with 15% of total exported beef. While consumption by most regions has been very stable over the last two decades, the Asian and European markets have seen large changes. Our study indicates that the Asian market now has a larger share of beef emissions than the European market. However, the authors did not provide a specific definition of "beef products". Thus, it is not clear if it includes only meat or also leather. Even Hoelle et al. (2017) suggested that the **global livestock industry is expected to continue increasing due to high meat consumption** among affluent consumers in developed nations, and "new" consumers in emerging countries, consequentially affecting deforestation.

Milán and González (2023) stated that the Paraguayan Chaco has experienced, in the last few decades, some of the highest rates of deforestation in the world. In parallel, this region has registered an increase in the number of cattle heads of 60% in the last decade. The authors recognized **the significant increase in demand for meat worldwide as the main driver of deforestation**. Even Eri et al. (2020), while studying livestock sustainable management, stated that "*intensifying meat production per hectare, both would significantly reduce the carbon footprint of livestock operations and their GHG emissions per kg of meat produced*". The authors, even though only indirectly, clearly identified **meat, and not raw hides, as the main output of livestock**.

Scholars strongly debate on the role of cattle raising intensification on deforestation. Garcia et al. (2017), while recognising extensive livestock production as a major deforestation driver in the Brazilian Amazon, suggested that the sustainable intensification of pasture areas has the potential to prevent further deforestation in the Amazon while generating social and environmental benefits. De Oliveira Silva et al. (2021) claimed that land sparing through sustainable intensification of predominant livestock pastures may be acting as a significant buffer **between meat demand and livestock production** and consequent land use change and deforestation. Well-intentioned beef boycotts potentially weaken the incentive to invest in pasture restoration and may lead to a counterfactual of extensive land use, and increased greenhouse gas emissions. Contrarily, Müller-Hansen et al. (2019), through a comprehensive analysis of the model with statistical methods, found that it produces highly non-linear transient outcomes in dependence on key parameters like the rate

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tel. 050 88.39.83-82 - fax 050 883.936
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of social interaction and elasticity of the cattle price, showed, that under many environmental and economic conditions, **cattle intensification does not reduce deforestation rates and sometimes even has a detrimental effect on deforestation**. Even Cohn et al. (2014) claimed that cattle ranching intensification in Brazil can reduce global greenhouse gas emissions by sparing land from deforestation. To perform the analysis, the authors considered six livestock products such as four types of meat, eggs, and milk. Even in this case, only indirectly, **leather was not considered as a main livestock product**. Moreover, Blumetto et al. (2023), while claiming the need to reconciling the design of livestock production system and the preservation of ecosystem, indicated meat and milk as the only forces that contribute to the intensification and development of livestock and farming system.

b) Findings of "grey" literature

According to the FAO's 2022 Report, *FRA 2020 Remote Sensing Survey*, which **pictured forests management between 2000 and 2018,** in these years, 173 Mha of forest was deforested globally but, simultaneously forest area expanded by 80 Mha, leading to a net loss of forest area of 93 Mha for the entire period. Through this data it is possible to understand that the phenomenon of deforestation, even if restrained, is still a challenge.

First of all, it should be pointed out that, according to the Report *Deforestation made in Italy*, by Pettenella and Masiero (2020), **the concept of deforestation is not necessarily linked to that of illegality.** In fact, in many countries, the conversion of forest land for agricultural activities can still be legally authorised.

Due to the still very high relevance of this topic, the phenomenon of deforestation has been addressed in multiple studies and the authors explore the main factors (drivers) and actors responsible for this phenomenon.

Among these, numerous studies confirm a close correlation between cattle raising and deforestation, which outlines how, depending on the geographical region considered, the former differently impacts the latter. According to the FAO, **agricultural expansion between 2000 and 2018 drove almost 90% of global deforestation**. Factors considered in agricultural expansion include cropland expansion (including oil palm plantations) converting forests to cropland, which accounted for almost 50% of global deforestation, but also **livestock grazing converting forests to pasture, which accounted for 38.5% of deforestation globally.**

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Piazza Martiri della Libertà, 24 - 56127 Pisa
tel. 050 88.39.83-82 - fax 050 883.936
idm@sssup.it

Regionally, expansion of cattle raising drove deforestation mainly in South America. Specifically, **livestock grazing was the predominant direct cause of 70% of forest loss in South America, 52% in Oceania and 44% in North and Central America,** and this is **closely linked to the continued expansion of cattle ranching in forested areas** (FAO, 2022). Similar conclusions are presented by De Koning P.C. (2020), that identify cattle raising as the main driver of tropical deforestation in some South American countries such as Argentina, Brazil, Uruguay and Paraguay, with the most affected regions being the Amazon, Gran Chaco and Cerrado.

Furthermore, **evidence of the link between livestock production and land-use change can be provided by georeferenced mapping.** Mammadova A., in her contribution to the study edited by Pettenella and Masiero (2020), presents the results of some data from Mapbiomas (2018) that suggest how the net loss of forest area in the Brazilian legal Amazon over the period 1985-2017 coincides quantitatively with the expansion of grassland that occurred in the analysed area over the period considered. In the same vein, the cited study by De Koning, Imazon (2017), confirms that deforestation in the Amazon and Gran Chaco affected mainly the cattle supply areas around slaughterhouses. De Koning specifically mentions one **slaughterhouse cattle supply area in the Brazilian Amazon that is equivalent to 88% of the area affected by deforestation that occurred between 2010-2015,** and assumes that 90% of all future deforestation will take place in the slaughterhouse cattle supply areas. **All this confirms the direct link between livestock farming and deforestation.**

In the report *The Root of the Problem: What's Driving Tropical Deforestation Today?*, Boucher et al. (2011) describe the evolution of the deforestation process caused by cattle raising. In the past, cattle pasture mostly expanded into the savannas or grasslands of southern Brazil, with low deforestation rates; however,the spread of cattle grazing northward drove large-scale deforestation. Factors favouring this development include (i) the extensive nature and (ii) low productivity of tropical grazing beef production. Other causes include the fact that, on the whole, the cattle industry requires low capital and labour investment, combined with the availability of large tracts of land at low cost that can be obtained by clearing forests. Furthermore, it is soybean production that has often shifted livestock production in areas such as forests where native vegetation is still present (MacFarquhar et al., 2019).

Cattle raising is usually identified as the main direct driver of deforestation. However, in some cases, it has been the principal mean used to achieve other aims than livestock farming. For instance, Sartorato (2017) points out that in several Brazilian cases, the expansion of cattle ranches

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Piazza Martiri della Libertà, 24 - 56127 Pisa
tel. 050 88.39.83-82 - fax 050 883.936
idm@sssup.it

has developed to secure ownership of deforested land, often legally with the support of development policies in the region that provided incentives and reliefs, in order to make a profit from the speculation opportunities associated with improving deforested land with low economic value.

A different viewpoint is shared by Real Leather (Rewin Episode One, 2022), which, supported by several sources, **recognises the role played by livestock raising** in transforming marginal land (i.e. land not suitable for cultivation) into agricultural land. Assuming that animals are no longer raised, feeding on the poor-quality, unfit-for-human-consumption grass that they turn into lean protein, the opportunity to utilise this otherwise unproductive and unfit land for food would be lost. The consequence would be an increased pressure on productive land. Furthermore, the socio-economic role that the livestock sector plays, providing economic support to many families, should not be forgotten. Similar positions are shared by Mike Redwood of the International Leather Maker (2021).

Last but not least, an understanding of the drivers of deforestation is also crucial given that **deforestation is identified as a major source of carbon emissions**. Pettenella and Masiero recalls studies supporting this analysis (Vermeulen et al., 2012; Gibbs et al., 2018) that show that on average about 15% of global greenhouse gas (GHG) emissions come directly from deforestation, and about 8% in particular from tropical deforestation. Hakansson E. et al, authors of the Report *Under their skin: leather's impact on the planet* (2022) identify further environmental impacts from the destruction of primary forests including devastation and loss of biodiversity. Although the most serious threat is posed by agriculture, deforestation, and the associated devastating habitat destruction for livestock production, **is identified as a threat and a major factor in the extinction of vertebrates. Moreover, the loss of plant biodiversity is also a consequence.** Aiama et al. (2016) in their report *Biodiversity Risks and Opportunities in the Apparel Sector* point out how the livestock sector represents the largest sectoral source of water pollution, and identifies animal waste, antibiotics and hormones used, and sediments from eroded pastures, citing FAO (2006).

In contrast, the Sustainable Leather Foundation (2021) draws attention to the positive impact that could be realised by implementing appropriate land management and the control of dominant species. Aiama et al. (2016) underlined that animals used for leather and wool are not considered invasive species and do not pose a threat to native biodiversity.

Section key findings:

- No studies have been found that deny the connection between cattle raising and deforestation and other negative environmental impacts.

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Piazza Martiri della Libertà, 24 - 56127 Pisa
tel. 050 88.39.83-82 - fax 050 883.936
idm@sssup.it

- Authors recognised that meat production and not raw hides production is the main driver of cattle raising.
- At the same time, it has also been highlighted the socio-economic added value that can be attributed to cattle breeding.

3.2.2 Slaughterhouse, Meat production, by-products and Leather

a) Findings from academic publications

Animal attributes are exploited by humans for non-food uses. Although leather have long been valued particularly as raw materials for clothing, it is still unclear if it is a co-product or a by-products of meat production, that is the main product.

According to the U.S. Environmental Protection Agency, a "co-product" can be defined as a product produced together with another product. Contrarily, a "by-product" can be defined as an incidental, unintended but inevitable secondary product or results made in the manufacture or synthesis of something else.

According to Scanes (2018), **bovines' hides and skins are considered either as a valuable by-product or coproduct in animal production** and account for 30-75% of the by-product drop value for cattle. According to Patel et al. (2022), the animal hide is the skin of an animal and represents a significant portion (cattle, 5.1-8.5%). The authors said that **hides and skins are one of the most valuable solid wastes of the meat processing industry** and were previously used abundantly by the leather industry. According to Patel et al. (2022), change in consumer behaviour has resulted in a shrinkage of the leather industry in North America, specifically, and also more generally worldwide. Consequently, the demand for animal hides has decreased drastically. This has caused major animal hides processing companies in North America to cease their operations, directly affecting 95% of small and medium-sized abattoirs and creating a crisis in the province of Ontario (Canada). These meat abattoirs have been left with **no other option but to landfill these hides**. As the animal hides fall in the category of perishable products, if not treated and due to declining demands in Ontario, **most of the hides from abattoirs end up in landfills and result in costing to livestock farmers**.

This study highlights how strongly raw hides management is connected with the leather sector. Without the demand of this sector, other industrial sectors are not yet able to completely satisfy the offer of raw hides generating thus the creation of a waste.

Limeneh et al. (2022) said that **only a small percentage of by-products** generated by the meat processing industry (approximately 150 million tons per year) **are nowadays exploited for the**

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tel. 050 88.39.83-82 - fax 050 883.936
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production of high added value products, whereas the main management method is direct disposal to landfills. In particular, **fashion products** such as seats, lyres, and jewellery **are produced from the trimming waste of the meat processing industry**. Toldrá et al. (2016) identified **raw hides as one of the several meat by-products** reporting their traditional use for leather-based articles like clothes, shoes, belts, handbags and purses.

This is also confirmed by McCabe et al. (2018), that investigated by-products in the Australian red meat processing industry, **classifying raw hides as a by-product**. Hides and skins can be categorized as a by-product for use as fur, leather or leather goods also for Prieto and García-López (2014). Moreover, Koloka and Coreki (2010), while recognising the leather industry in Botswana as a user of a by-product of the meat industry, **even though the consumption of meat has increased over the years, hides produced do not reflect such a scenario**. This indicates that **some hides do not reach the markets, contrarily to the meat**. In fact, according to Memedovic and Mattila (2008) **only 22% of the raw hides generates from cattle livestock from most developing countries**, such as India, Brazil, Pakistan, South Africa and other African countries, **is collected**.

Another relevant aspect that influences the number of raw hides sent to landfill disposal is the organisation of the supply chain. Not structured supply chains are not able to align the demand and the offer of raw hides increasing thus the production of waste.

Jayathilakan et al. (2012) reported that **hides and skins are generally one of the most valuable by-products from animals**. Examples of finished products from the hides of cattle and pigs, and from sheep pelts, are leather shoes and bags, rawhide, athletic equipment, reformed sausage casing and cosmetic products, sausage skins, edible gelatine and glue. Hides and hooves from the animal provide an economic rout between the factory farming and the leather business, because the **farmers sell these by-products in order to minimize the waste and maximize the revenue and profits** (Dhakal et al., 2018). Mora et al. (2019) confirmed that **inedible slaughter by-products such as raw hides are being increasingly used as raw materials for the production of a large variety of products in a sustainable manner**, such as the leather industry.

The secondary role of leather is recognized by Najeb (2020) who claimed that the economic importance of livestock in Iraq is the main objective of animal husbandry, which is the provision of food items primarily, such as meat and milk, while **other products, such as wool, pine, feathers, and inedible leather, come in second class**. This is also confirmed, although only indirectly, by Canals et al. (2022) that use the Life Cycle Assessment in the procedure for the establishment of

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tel. 050 88.39.83-82 - fax 050 883.936
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environmental criteria in the Catalan ECO-label of leather. In fact, in the slaughterhouse, the allocation factor adopted for hides is 7.7% (meat: 90.6%; other by-products: 1.7%); i.e., **only 7.7% of the environmental burdens produced upstream of the skinning operation are allocated to hide**.

Even Said (2021) recognised that livestock products can be in the form of meat, milk and eggs as well as by-products such as raw hides. The authors indicated **animal raw hides as one of the by-products of livestock produced from a livestock slaughtering industry**. Since leathers are one of the livestock by products that have the highest economic value compared to the others, according to the author, the **potential of livestock leathers** as one of the strategic commodities of the livestock industry **needs to be maximally developed**. In fact, Holmann et al. (2008) assessed from an economic point of view the beef supply chain. The authors noted that rural slaughterhouses seem to be operating at a loss, since they do not make additional income from **the sale of by-products such as hides**, blood, and bones.

Lastly, Cooper et al. (2011) recognised **leather as a by-product of the meat industry**, in which the principal source of raw material for the leather industry is the cattle hide, which **represents approximately 5% to 15% of the market value of an animal**. According to the authors, in 2009, **there were 181,193,000 bovine animals and the production of bovine hides and skins amounted to 39.5 million of pieces**. Contrarily, Walker et al. (2013) classified both **meat and leather as primary and most valuable products**, while bones, blood, hooves and horns are considered co-products. However, **when cattle are purchased by a slaughterhouse, the price is determined by a formula** called the "carcass yield", that for Amazon cattle ranges from 51- 55%. The carcass consists of the meat and bones and **does not include a payment for leather** or other co-products. While analysing both the number of cattle slaughtered and the number of raw hides produced, the authors noted that in the 2009, **tanneries purchased almost 6 million of raw hides that could not be attributed to a cattle slaughter, reporting that around 25% of all slaughters were clandestine**. Unfortunately, Walker et al. (2013) do not report absolute data, but the source used was the same of Cooper et al. (2011). Thus, it is difficult to understand why the two articles arrived at so different conclusions.

b) Findings of "grey" literature

According to the US EPA (United States Environmental Protection Agency), a by-product is defined as an incidental product deriving from a manufacturing process or chemical reaction, and not the primary product or service being produced. A by-product can be useful and marketable, or it can have

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negative ecological consequences. It can be considered as material, other than the intended product, generated as a result of an industrial or manufacturing process.

The analysed grey literature mostly identifies raw hides (and, consequently, leather) as a by-product of animal production. Leather Naturally states that animals are not killed for leathers, but **that hides come from animals raised for the food industry** – this account for 99% of the world's leather –[3]. Furthermore, in the technical report by **World Wildlife Fund (WWF)** and the **Royal Society for the Protection of Birds (RSPB)** (2017) authors specify that "no cattle are raised specifically for their leather, i.e. it is a by-product of beef production" (p.62), thus supporting the position that sees **leather as a by-product**.

According to the **WWF (2022)**, **leather is entirely a by-product of the meat and dairy industries**. **Without them, in fact, there would be no leather industry**. To demonstrate this assumption, the study refers to **Mckendree et al. (2019),** who indicate that for a 1% increase in cattle price, there is only a 0,1-0,2% increase in the supply produced. Being **leather a very small portion of the overall value of cattle**, this means that it has little to no influence on cattle supply. Furthermore, in early 2021, the Leather and Hide Council of America (LHCA) commissioned a study to **Brester** and **Swanser**, two agricultural economists, to address claims that cattle are raised because of their hides. In their study on U.S. cattle production, they carried out a quantitative analysis to determine if the value of cattle hides was linked to fed cattle production quantities, finding **no evidence of a direct effect of cattle hide prices on cattle production and evidence of only a small indirect effect**. According to their results, a **10% increase in hide prices is expected to cause a 0,36% increase in cattle production**. Because this small increase in cattle production would necessitate an increase in breeding cattle numbers, the total indirect effect of a 10% increase in Brazilian hide prices would be an increase of 283,800 head of cattle (breeding cows plus calves). This represents about a 0.12% increase in Brazilian cattle inventories. This evidence supports the notion of hides – and leather – as by-products, and not as drivers, of cattle raising, being cattle produced for the purpose of providing beef and meat.

Similar suggestions come from **RealLeather** (Rewind Episodes, 2022), where the authors state that **hides are by-products of the meat and dairy industries**. This is because the **value**, when sold, is typically **2-5% of a US cow**. It is so low that 10-20% are thrown away each year – because disposal is cheaper than processing. So, the act of **using leather cuts waste and is a step toward sustainability**. According to the LHCA, in 2021, 5.5 million US cowhides have been landfilled or

[3] https://www.leathernaturally.org/news-events/news/are-animals-killed-for-leather/

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tel. 050 88.39.83-82 - fax 050 883.936
idm@sssup.it

burned, with 10-20% of all the hides wasted. That's why cattle are farmed for beef and milk, not leather. An estimated 150 million hides are wasted each year, the Council stated. This generates more than 7 billion tonnes of CO_2 emissions. Hides weigh on average 25 kilos, and a 25 kilo hide generates around 250 kilos of $CO_{2\text{-eq}}$ if left to go to waste (ReFED). Thus, when hides, by-products of beef and dairy industries, are used to make leather, the disposal emissions are avoided.

Lastly, Harris Ranch Beef Division agrees that the **primary reason to raise livestock is meat consumption**.

Aligned with this view, it is relevant to consider the **relationship between beef** and **leather demand**. In fact, the global worth of **beef demand is considerably outpacing leather demand** (WWF, 2022). Although demand for meat and communication about its negative effects have been affected in some parts of the world, across the globe as a whole, **meat consumption continues to grow**. According to the Food and Agriculture Organization (FAO) of the United Nations (UN), the average global per capita consumption of meat has gone from 36.4 kg per year, at the end of the 20th century, to 41.3 kg in 2015. **The FAO (2018) predicts an increase to 45.3 kg in 2030**. Even if poultry will account for a large slice of this growth, the study reveals that the consumption of meat from cattle will increase, reaching 10.6 kilos of beef per person per year. Thus, livestock farmers will continue to send cattle to slaughter, generating hides for tanneries. **Livestock are raised for food purpose** and this makes **hides a by-product of the food industry**. Furthermore, nothing suggests that in the future we will stop raising livestock for food, given that it represents an important source of protein and an important social and economic driver, as well as it makes a positive contribution to the practice of regenerative agriculture, considered part of the solution to climate change (FAO, 2018). Globally, around 1.3 billion people are employed in the various livestock value chains. To support this perspective, while there is **evidence of an increasing meat demand** (FAO, 2018), the **demand of leather has collapsed over the past years** (Quality Meat Scotland, 2019). Nowadays, the demand of raw hides is decreasing due to, among others factors, increased competition, changes in trends such as alternative synthetic products, or a falling global demand for cars (QMS) or, again, perception of the environmental impacts of the tanning process. Similar conclusions are drawn by **Brester and Swanser (2021)** who analysed the relationship between hides and cattle farming using data over 25 years and found evidence that hides are a by-product and exert no direct influence on cattle numbers. Data showed that, despite hide prices falling by more than 50% over the last 25 years, cattle numbers are unchanged. Thus, current data show that **beef and leather demand do not have a direct relationship**.

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Ending the use of leather would not stop cattle production (LHCA, 2021). Quite the opposite, it would **cause significant environmental problems** (Brester and Swanser, 2021). Ascertained that the value of a raw hide is generally approximately 3-4% of the animal's value (Leather Naturally), it is logical that this cannot be the ultimate reason of cattle production. **Leather is one of the oldest forms of recycling and currently the best way to up-cycle hides and skins from the meat industry**. According to the data provided by the Leather and Hide Council of America, out of the 33 million cattle were processed in the US in 2020 for food, 28.2 million of hides were used to make leather. Thus, 14.5% of hides were wasted, creating 120.000 tonnes of avoidable GHGs. On a global level, leather saves around 7.3 million tonnes of hides from global landfill. Besides the relevance of waste prevention for related environmental problems, another current topic regards **the rise of synthetics**. Replacing natural leather with synthetics will not stop animals from being processed to make meat. On the contrary, it will divert nearly 7.5 million tonnes of unused cattle hide to landfill globally every year, generating 6.6 million tonnes of greenhouses gases every year. **Nevertheless, alternatives to leather industry are catching on, such as the use of hides for the booming collagen industry (Global Market Insights, 2023)**. In fact, collagen marked size exceeded USD 4 billion in 2022 and it is predicted to grow at 8% CAGR (Compounded Average Growth Rate) from 2023 to 2032. In relation to the meat-leather relationship here above described, according to the Sauer Report (2022), hide prices have dropped considerably after a peak around 2015 and have not recovered. This puts more pressure on producers as profits are lower from a lower value by-product, but it increases opportunities for the gelatine industry (WWF, 2022). However, it is worth noting that the large majority of gelatine or collagen producer buys raw hides, they do instead buy the limed splits from tanneries as raw material.

In contrast with the above identification of raw hides as a by-product of cattle ranching, few reports refer to leather as a **cattle product, as much as beef.** Greenpeace (2009) and Forest 500 (2023) state that **leather and beef are both cattle products** and Pettenella and Masiero (2020), in their study, affirm **that they treat hide as a complementary product of beef**. However, throughout their report, **they often refer to hides as a by-product of cattle ranching**. An additional reference to leather as a product instead of by-product comes from The Guardian (2023), which, on an article on collagen and its potential link with deforestation, states that, according to campaigners, non-meat products, such as leather and collagen, are the most valuable. In addition to that, Aiama et al. (2016), despite recognising that leather mainly comes from cattle reared for meat and milk production, stated that it cannot always be considered an "incidental product", as it can be the most profitable part of the animal and it can influence the livestock sector. However, no evidence is provided to support this conclusion.

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Even if these sources treat hides as cattle products, the references they make are purely descriptive. No data or quantitative analysis are provided to support this hypothesis.

Key findings:

- The majority of documents and authors support the classification of raw hides as by-products of cattle raising that has the primary objective of meat and dairy production.
- An increase of the price of raw hides virtually does not increase the volume of cattle raising.
- No robust quantitative data on raw hides production are available making difficult to understand the destination of raw hides in addition to the leather sector.
- Most studies agree that reductions of the leather market could generate an increase in the number of raw hides sent to landfill disposal i.e. increasing the environmental impacts.

3.2.3 Leather and Deforestation

a) Findings of academics' publications

Tropical and forest degradation remains one of the important sustainability challenges of our times. The concept of deforestation risk is highly relevant for current debates about policy and trade, and it is likely to increase in importance. Deforestation is a systemic risk that permeates through different economic sectors, including production, manufacturing, service and control sectors.

According to Mammadova et al. (2022), while the role of cattle raising in deforestation in Brazil is subject to increasing public scrutiny, **the leather commodity chain has remained in the shadows up until recently**. Moreover, raw hides production and trade are more complex compared to beef, and involve many national and international players, including intermediary sellers, tanneries and fashion houses among others. This, according to the authors, creates **traceability gaps and complicates the identification of deforestation risks along the supply chain**, especially for downstream market actors.

The authors said that leather supply chains have a complex structure and traceability gaps which make them susceptible to deforestation risk as well. They divided the supply chain of leather into farming, slaughtering, leather tanning/ processing, leather product manufacturing and retail segments to discuss its deforestation risk. As the supply chain structure follows the physical movement of materials, it covers only production, manufacturing and some parts of service sector (i.e., commodity trade and distribution). The **deforestation risk of leather is very visible in the production sector (farming)** as the tip of the iceberg and disperses further moving from production to service sector. In 2018, the Brazilian government **removed the protectionist 9% export duty** levied on exports of

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tel. 050 88.39.83-82 - fax 050 883.936
idm@sssup.it

raw hides and skins to Europe via Resolution no 65/2018, thus, **export of bovine raw hides and skins is estimated to increase generating more agricultural expansion**. Mammadova et al. (2022) claimed that there are **several manufacturing sectors still heavily depend on animal leather that create constant demand for raw materials, thus, there will be more cattle raising and consequentially more deforestation**. This statement affirms that the production of raw hides is a direct driver of deforestation, and it is in contrast with the findings described in the previous sections. Thus, it opens new research questions that need to be clarified in this study. A possible question directly linked with this statement is the following: is the raw hides market demand capable to trigger new cattle raising economic activities? In other terms: is the production and sale of raw hides sufficient to make a cattle raising company profitable? i.e. what is the percentage of turnover generated by the sales of raw hides for cattle raising and slaughterhouses companies compared to the turnover generated by meat product and other related activities?
These questions are key to investigate a possible link between the leather sector and deforestation. They will be further investigated in this report, especially in the chapter related to the results of the interviews.

With regard to farms and slaughterhouses, the authors reported **the risk of laundering animals from illegal farms to legal ones**. Even slaughterhouses create a significant risk of leakage as meat and leather produced in these slaughterhouses are transferred to supply chains of slaughterhouses who signed zero deforestation commitments. Specifically, with regard to slaughterhouses, the authors highlighted that **while beef supply chains are checked for legality, the same does not apply for animal hides**. The authors assessed that **only 10.8% of deforestation occurred within a 100 km radius from tanneries**. The lower percentage of deforestation associated with tannery locations can be explained with the fact that it is easier to carry animal hides after slaughter (compared to live cattle) and that the tanneries in the Brazilian Legal Amazon region are not located in direct proximity from where the cattle is raised/slaughtered. According to Mammadova et al. (2022) **without public traceability agreements, tanneries are at higher risk of receiving raw materials from bovines raised on deforested land**.

In conclusion, Mammadova et al. (2022) described how **deforestation risk, that is very visible in the production stage of a commodity,** can disperse when moving across different stages of the supply chains and across different economic sectors that are part of those supply chains. However, **the authors do not provide any specific evidence of a direct link between deforestation and leather**. Actually, they recognise that **the initial steps of the leather supply chain are the most**

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tel. 050 88.39.83-82 - fax 050 883.936
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responsible of deforestation. But, then, we are again at the second point of our analysis. What is the primary output of cattle raising and slaughterhouses?

Nevertheless, Mammadova et al. (2020a) investigated the deforestation risk of the leather trade between Brazil and Italy and recognised **bovine leather as a by-product of cattle**. Due to technical difficulties and the long travel distance, but mostly due to the protectionist policies of the Brazilian government, Italy does not import raw (salted) hides from Brazil. According to the authors, **deforestation risk can be considered more embedded in leather exports compared to beef since 80% of the produced beef is consumed locally in Brazil, while the export trends for bovine leather is the opposite**. However, the evidence that these authors identified to support this conclusion is not clear.

Mammadova et al. (2020b) performed an analysis extremely similar to ours, i.e., literature review and interviews. The authors interviewed **major government agencies, producer associations, roundtables, and the private sector in general**, and reported that these stakeholders believed that the **leather industry embraces the philosophy of circular economy**, as it turns the biological waste of the meat industry at the slaughterhouse into valuable items. Contrarily, interviewees from Greenpeace, the federal Brazilian agency IMAZON, international scientific journals and ecologists, public prosecutors, and the Brazilian Institute of the Environment and Renewable Natural Resources (IBAMA) supported a different view. However, as proved by this detailed literature review, international scientific journals do not achieve very robust statements; even Mammadova et al. (2020b) recognized that the **commodity of beef or meat is identified as the worst environmental problem** today and the **problem of deforestation is extended to the use of leather only by proxy, as a consequence** of the initial processes.

Nonetheless, these authors concluded that, exactly for this strong connection between the leather and the meat industry, none of them can be considered deforestation free. Thus, a strong **traceability system should be adopted to guarantee that leather, and thus, meat is obtained from legal cattle raising**.

While there are several studies that assessed the connection between deforestation risk and cattle raising, the direct relationship with bovine leather is still strongly understudied. In fact, the systematic literature review identified only three studies, all published by the same author, i.e., Mammadova. **It is still thus difficult to draw conclusions on this matter from the evidence available up to now**.

b) Findings of "grey" literature

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tel. 050 88.39.83-82 - fax 050 883.936
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Two main perspectives arise on the link between leather and deforestation from the analysis of grey literature. Before detailing these, it is crucial to underline that, even if various authors have identified potential connections between leather and deforestation, **none of them have provided evidence of a direct link**. Reports, videos, and papers underline and show the complexity of the supply chain of the leather industry and stress the attention on the responsibility that the industry has in contributing to the end of illegal cattle ranching and deforestation.

While the first perspective regards the **leather industry** and its role in causing **deforestation** because of the **economic interest** behind it, the second one refers to the **illegal cattle ranching,** and consequently, **deforestation,** partially caused by the leather industry. These two points of view are strictly interconnected, being the economic interest one of the main drivers of illegality.

Globally, the deforestation of the tropical forest (i.e., Amazon rainforest) is responsible for around 20% of global GHG emissions (Greenpeace, 2009). To tackle climate change and preserve biodiversity, deforestation must end. Although there is general consensus on the need to eliminate deforestation risk, the debate on its drivers is still ongoing. The authors of Slaughtering the Amazon (Greenpeace, 2009) clearly state that the **cattle sector in the Amazon is the single largest driven of global deforestation**, being responsible for about 80% of all deforestation in the Amazon region and for 14% of the world's annual deforestation. However, the report highlights how *cattle products* get around the world in different ways, thus associating the responsibility of deforestation to the final industries or brands of these cattle products. Because of the economic value (see section 3.2.1) that the international trade of leather generates, **leather and the leather industry are among these products**. The global leather value chain (from raw materials to consumer goods, such as shoes, bags, sofas…) has a total value of over US$ 300 billion a year and represents a job opportunity for 10 million people (UNIC, 2023). In conclusion, the report (Slaughtering the Amazon) entails that the **leather industry is responsible for deforestation**, as much as the cattle sector, **because of its economic interest.** In addition to that, the economic relevance of leather is also proven by the **profit that slaughterhouses make through the sales of hides**. According to a Bain & Co (2020), the sales of hides accounts for up to 26% of the profits of major meat companies in Brazil. This margin has changed since 2020, but according to data from the previous years, the analysis of income and profit margins for meat, leather and other products determined that meatpacking plants only operate at a profit because of the sales of leather and other co-products (meatpackers would operate at 3.2% loss with only beef sales as opposed to a profit of 4.2-13.8% when leather and other products are included, of which leather is the most valuable) (Scot Consultoria, 2024). Moreover, if referring to the Regulation, the study by NINT (2023), found that existing slaughterhouses operating with profit

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Piazza Martiri della Libertà, 24 - 56127 Pisa
tel. 050 88.39.83-82 - fax 050 883.936
idm@sssup.it

margins of 2% or less would cease to be viable businesses if they no longer supplied hides to the European market, thus suggesting that hides have a significant economic value for them.

In contrast to this perspective, that sees leather as a product of the cattle industry as much as meat, the **WWF (2021)** adopts a different view in the report *Deforestation Fronts: Drivers and Responses in a changing world*: aware of the fact that the causes, pace, and magnitude of deforestation and forest degradation have changed over time, the report **explores the direct and indirect drivers of deforestation**, and identifies **cattle ranching as a primary direct driver of deforestation**, **making no reference to raw hides and/or to the leather industry**. Population increase and growing domestic demand, increasing consumption levels and associated dairy shifts, and the persistence of informal, illegal economies in frontier areas are some of the indirect drivers identified in the report.

In the same way, another **WWF (2021)** report, *Stepping up? The Continuing impact of EU consumption on Nature Worldwide*, **does not include leather in the list** of commodities that contribute to at least 1% of the EU' total embedded deforestation impact.

However, in the report by **WWF Italia (2020)**, *Quanta Foresta avete mangiato, usato o indossato oggi? Deforestazione incorporata nei consumi*, the **leather industry is associated with a high risk of deforestation**. Yet, this statement is justified by the fact that companies that today deal with leather processing invest in sustainability fronts such as energy efficiency, water consumption, wastewater management, chemical materials used in the tanning process, with little or no mention to deforestation, i.e. hides, are considered "recovered waste" and **therefore the sector is relieved of any responsibility for the control of the origin of the hides and the risks of financing illegal tropical deforestation**.

Another perspective supports the connection **between the leather industry and illegal cattle raising**. According to the **Environmental Investigation Agency** (EIA, 2022), the Amazon rainforest in Brazil is being razed for cattle ranching, much of it illegally, with dire consequences for indigenous people and traditional communities, biodiversity and the global climate. Here, more than 80% of all deforested land in the Amazon has been converted to cattle pasture. **Leather products, they state, play an important role in this destruction, since 80% of leather produced by Brazil is exported and it significantly contributes to the profitability of the Brazilian cattle industry.** Moreover, the study analyze the movement of cattle within farms located in legal and illegal areas, found that **thousands of cattle from illegally deforested lands enter the supply chains of the Brazilian largest leather manufacturers.** Analyzing the link between illegal deforestation in Brazil and leather destined for international markets (automotive industry), they (EIA) found evidence that some slaughterhouses that work with leather producers **have signed commitments** to not source their

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Piazza Martiri della Libertà, 24 - 56127 Pisa
tel. 050 88.39.83-82 - fax 050 883.936
idm@sssup.it

supplies from deforested land, and they **are implementing a system to trace and audit the farms in their supply chain**. Although the **debate on traceability and supply chain transparency is growing**, the policy of leather companies often goes no further than those of the major meat companies in Brazil and does not exclude cattle raised on illegally deforested land in the indirect supply chains of slaughterhouses. Moreover, authors show how two biggest leather suppliers source hides from meat companies that regularly bought cattle directly from illegal farms inside a protected area and have made no public commitment to eliminate deforestation. A similar position can be found in Dummett et al. (2021) or Pettenella and Masiero (2020), where **discrepancies between the total production of hides and the number of slaughterhouses in Brazil, allow to estimate that the leather industry drives informal or illegal activities in the livestock/slaughterhouse.**

Besides the prevalent perspective of hides and leather as by-products of the meat industry, an emerging though is that **all companies** purchasing hides or leather anywhere along the value chain **play a role in driving more sustainable production** (**WWF, 2022**). Companies that purchase leather always have the potential to influence the beef industry, as the additional income made from hides increases its economic viability. It is evident, once again, that **traceability and supply chain transparency** is a crucial matter, often underlined by experts (Fripp et al., 2023). In relation to this, some papers (i.e. Pettenella and Masiero, 2020) recall the concept of ***embodied*** (or *embedded)* ***deforestation*** (see above section 3.2.1.c), that places emphasis on the risk of deforestation along the entire supply chain, including the consumption of final products, as well as on the interconnection between different supply chains and different production systems. A report from the European Union (EU) defines *embodied deforestation* as an externality arising from the production, marketing or consumption of a particular product, commercial/consumer good or service (Cuypers, 2013). The embodied deforestation debate focuses heavily on the link between deforestation and consumption of goods. The discussion on these issues creates the conditions for broadening the range of products whose production potentially entails risks for forests and could represent a driver of deforestation, going beyond a restricted group of five-six consumer goods that have long been object of attention. In fact, due to the complexity of global production systems, there are raw materials and products that present the **risk of coming from deforested areas without**, however, **being direct drivers of deforestation** and/or forest degradation. It is, therefore, crucial to distinguish between products with direct causal links to the risk of deforestation and products with indirect exposure to this risk along the supply chain, as this can influence the way in which responsibilities related to impacts on forest resources are measured and attributed. In their study, **Pettenella and Masiero (2020), explore leather as an indirect driver of deforestation.** They justify this choice because:

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Piazza Martiri della Libertà, 24 - 56127 Pisa
tel. 050 88.39.83-82 - fax 050 883.936
idm@sssup.it

- the sector and supply chains of leather and leather products have been marginally considered to-date;
- public discussion about transparency along the leather supply chain and the associated deforestation risk is mostly absent;
- leather supply chains are more complex than beef supply chains and involve many national and international players, including intermediaries, tanneries, fashion houses, etc. This creates gaps in traceability and complicates the identification of deforestation risk along the supply chain;
- leather is a product with intrinsically unbalanced power relations between the actors in the supply chain and with costs and benefits distributed unevenly along the supply chain itself.

Although the authors recognize that raw hides are very often considered as waste or by-products, they state that on average, Brazil exports approximately 80% of its national cowhide production to global markets (Walker et al., 2013). **According to them, it follows that the risk of deforestation can be integrated into the supply chain of leather of Brazilian origin and exported to international markets.** Results of their study show that even if, due to the complexity of supply chains, quantifying deforestation risk is very difficult in the case of leather and leather products. However, they **qualitatively** assessed and mapped the deforestation risk along the leather supply chain.

To conclude, what emerges from the grey literature on the link between leather and deforestation is that **there is no direct relationship** between these two. Although the leather industry may show a risk for deforestation within its supply chain (**indirect relationship**), because of illegality issues and its economic value, it is still difficult to draw the conclusion that leather is a driver of deforestation, especially due to the low economic relevance of raw hides production and sale in the frame of the cattle raising – slaughterhouses chain. In fact, up to now, no authors have provided data or quantitative analysis to support the hypothesis of a direct link.

Key findings:

- No authors have found a *direct* link between leather and deforestation.
- Some authors affirm there is an *indirect* link between the two (*embedded deforestation*) for its economic value in terms of exports – or, in general, the value of the leather industry – and the related profit that slaughterhouses make by selling hides.
- No publication demonstrates that the raw hides production alone can make the economic activities of cattle raising and slaughterhouses profitable.

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tel. 050 88.39.83-82 - fax 050 883.936
idm@sssup.it

- Other authors believe that the high demand of hides triggers illegal deforestation but without giving a convincing justification of this claim, especially under an economic perspective.
- No author has provided data or quantitative analysis to support the hypothesis of a link, and some authors even state that the problem of deforestation is extended to leather only by 'proxy'.

3.3 Interviews with key stakeholders

The literature analysis served as a basis for the development of the following part of this first research activity. Following the desk analysis, a series of interviews were conducted with the main stakeholders of the leather sector, that allowed us to collect useful information for our research. The following 28 stakeholders were interviewed:

- Two producers from the European leather sector
- Two producers from the non-European leather sector
- Two European slaughterhouses that regularly supply the leather market
- Two non-European slaughterhouses that regularly supply the leather market
- Two European farms, whose products are certainly destined for the leather market
- Two non-European farms, whose products are certainly destined for the leather market
- Three academic experts in the leather sector
- Two academic experts on the topic of deforestation
- Two academic experts on the topic of biodiversity
- Two European policymakers
- Two non-European policymakers
- Two non-European trade associations in the leather sector
- Three non-governmental associations expert on deforestation

An interview protocol was drafted, which is a structured document that provides detailed guidelines on how to conduct an interview. It is an essential component of the qualitative research process, particularly when aiming to collect data through semi-structured or open-ended interviews. An interview protocol helps standardize the interview process, ensuring that each participant is asked the same questions and treated consistently. However, it is important to note that the interviewer had the flexibility to adapt the interview based on the participant's responses and needs, while remaining within the limits established by the protocol. This allowed us to gain significant insights and to explore new emerging topics during the interviews.

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tel. 050 88.39.83-82 - fax 050 883.936
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As many interview protocols as the categories of stakeholders identified in the list above were drafted. All protocols were divided into categories that reflected the research questions and differed only in some questions. Table 7 shows the structure and contents of the interview protocol, including all the questions submitted, regardless of the category of stakeholders.

Question	Comments for the interviewer
INTRODUCTION	
Explain the objectives of the interview	Introduce the scope and objectives of the interview: • The interview is part of study that aims to analyse the effects of Regulation 2023/1115/EU on the leather sector. • The focus of the analysis will be on three macro topics: whether leather can be considered a driver of deforestation, to investigate the socio-economic effects of the implementation of the regulation on the European leather sector and more generally on global market flows, and to estimate, quantify and calculate the environmental impacts that will be generated based on the different environmental consequences
Explain the procedure of the interview	Briefly explain the interview protocol: • Open and semi-structured questions • Explain that the interview will be recorded only for note taking • The interview does not concern sensible data • Estimate the time required to complete the interview: 30-45 minutes
Professional background of the interviewee	• Ask about the professional background of interviewee: • Current position • How long have you been in your position? • Main duties and responsibilities • Previous positions in the organization • Who do you report to?

CATTLE RAISING AND DEFORESTATION
Do you believe that there is a direct connection between cattle raising and deforestation?
MEAT AND RAW HIDES
What is the main output of the cattle raising activity?
Do you consider raw hides as product or a by-product? Would you define raw hides as a substance or object, resulting from a production process, the primary aim of which is not the production of that item?

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Do you think that the indirect influence of the leather industry on cattle raising activities is relevant? Do you consider the leather industry as a sector that is recovering a possible waste (raw hides)?
Would the cattle raising business be economically sustainable if limited exclusively to the sale of raw hides?
Are you able to estimate the economic value of the raw hides compared to overall animal?
Do you believe that all the raw hides generated by the slaughterhouses are purchased by the leather industry?
Considering all the animals slaughtered, all the raw hides are sold or not? If there are some leftovers, what are their destinations? Other industries? Landfills?
Do you think that tanneries have the potential to influence the environmental responsibility and practices of cattle raising companies?
Are you aware of studies on the relationship between raw hides/leather and meat production?
If we consider LCA/PEF allocation, how the relationship between raw hides, leather and meat was managed?
RAW HIDES AND DEFORESTATION
Are you aware of the any studies that investigated the relationship between raw hides/leather production and deforestation/biodiversity?
Are you aware of the Regulation 2023/1115/EU on deforestation?
Do you believe that the majority of leather manufactures/tanning companies are aware of the origins of their raw hides?
Do you believe that there is a direct connection between raw hides, leather production and deforestation/biodiversity?
Do you know the concept of embedded deforestation? Do you believe there is an indirect link between raw hides and deforestation?
Are you aware of illegal cattle raising? Can you prove that all your raw hides are produced by legal cattle raising?
LEATHER AND TRACEABILITY
Are you aware of traceability systems for the leather sector?
Have you ever received pressures to monitor the traceability of your supply chain?
Do you believe that it will be possible to monitor the raw hides from cattle raising? What could be the main barriers?
What could be the socio-economics effects of the new traceability rules on the leather sector?
Do you believe that with a traceability system the raw hides cost will be higher? If yes, how much?

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tel. 050 88.39.83-82 - fax 050 883.936
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Table 7 – Interview protocol.

Each interview was conducted by two SSSA researchers and was recorded for notes taking. The anonymity of the interviewed was ensured for several reasons. Anonymity can create a safe environment for interviewees to express themselves more openly. Some individuals may be hesitant to share certain information if they fear it could be traced back to them. Anonymity allows for more candid responses, fostering a more accurate understanding of the interviewee's capabilities, experiences, and opinions. Interviewees may have personal or sensitive information that they are not comfortable sharing openly. Anonymity protects their privacy, allowing the interviewee to participate in the interview process without fear of negative consequences. Ensuring anonymity helps build trust between the interviewer and interviewee. Knowing that their identity is protected can make interviewees feel more comfortable and willing to share relevant information.

3.3.1 Interviews findings: cattle raising and deforestation

In line with the findings from the literature review, that identify a direct connection between cattle raising and deforestation, the large majority of the interviewees acknowledged the **connection between cattle raising and deforestation in some parts of the world**, especially in **South America**.

NGO representatives and academic biodiversity experts were the most supportive of this claim, considering cattle raising as the **main driver of deforestation in the Brazilian Amazon**. NGO#3 stated that "between 65 to 85% of cleared land in the Amazon is transformed into cattle pasture". In addition, Academic Biodiversity Expert #2 stated that this greatly impacts biodiversity through encroachment of cattle raising into indigenous and protected areas in the Amazon.

EU manufacturer #1 stated that "the phenomenon of deforestation is happening and will always happen for cattle raising aimed at both dairy and meat production in South America".

A few interviewees (7 out of 28 interviewees) preferred to focus their answers on their own countries, whose system they are most familiar with, stating that **in European countries, the USA and New Zealand there is no connection** at all between cattle raising and deforestation. In Europe, this may have happened 1,000 years ago or in New Zealand over a century ago, but not today (as stated by EU Farm #2, Extra-EU Slaughterhouse #1, Extra-EU Policymaker#1), whereas in the USA, most of the ecosystems where the cattle are raised is grassland, therefore no deforestation is needed, as reported by Extra-EU Farm #1. Nonetheless, these same interviewees stated that in other parts of the world, especially South America, the connection between cattle raising and deforestation may exist.

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tel. 050 88.39.83-82 - fax 050 883.936
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Some interviewees delved deeper into the topic and pointed out that **this connection is more complex than what most parties usually acknowledge**. According to their view, livestock production is not the only cause of deforestation: land grabbing and agriculture (for the production of corn and soy) are also key drivers of deforestation, specifically in South America. As explained by NGO#1, NGO#2, Academic Biodiversity Expert #1, and reiterated by Extra-EU Manufacturer #1 and EU Farm #2, **deforestation often starts with land grabbing and land speculation**: when the land is cleared, its value increases. After the land is cleared, it gets fenced and livestock pastures are put on it for two reasons: to demonstrate ownership of the land and to fertilize the soil and prepare it for the crops (i.e. when a piece of land is deforested, it cannot be cultivated immediately). After a few years, the land grabbers/farmers can claim ownership of the land and they usually switch to other commodities and **start planting corn or soy in these same lands**.

Therefore, as highlighted by Extra-EU Manufacturer #1, Extra-EU Manufacturer #2 and NGO#1, cattle raising is often **the first activity** that is carried out on a deforested land, **but usually not permanently**.

Academic Biodiversity Expert #1 even declared that "sometimes deforestation is promoted by some governments, as part of the system of the country to promote the expansion of production" (as in the cases of the Cerrado in Brazil and the Chaco region in Paraguay). According to some local regulations, if someone can prove that the land has been productive for a few years, they can claim title to that land. This provides an incentive for people to cut down forests and start some productive activity on the land. When the land has established a profitable business, then they can sell it for other purposes such as soy production. As stated by Academic Deforestation Expert #1, "those who are responsible in this process are the **landowners**, who are the "**hidden actors" behind the farmers**".

In summary, the general perspective sees cattle raising as connected to deforestation in some parts of the world, but according to some industry and academic experts, cattle raising is not always the root cause of deforestation, although it is surely part of the process.

Key findings:

- The large majority of the interviewees support the position that there is a connection between cattle raising and deforestation in some parts of the world such as the Brazilian Amazon.
- Some interviewees pointed out that the discussion is more complex than what most parties usually acknowledge, and that cattle raising is not the only cause of deforestation: it is surely

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Piazza Martiri della Libertà, 24 - 56127 Pisa
tel. 050 88.39.83-82 - fax 050 883.936
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part of the process, as it is often the first activity that is carried out on a deforested land, but land grabbing and agriculture are also key drivers of deforestation.

3.3.2 Interviews findings: meat and raw hides

Based on the comprehensive summary of interviews from various stakeholders of the leather sector, the relationship between raw hides/leather and meat production presents a multifaceted view of the economic and environmental dynamics within the industry. The interviews underscore the complexity of the value chain, highlighting the varied perceptions of raw hides as either a by-product, co-product, or waste product, and exploring the economic viability and environmental impacts associated with leather production.

The first topic investigated was related to the main output of the cattle raising activities. As consistently highlighted in the interviews, **meat has been identified as the main product generated by cattle raising activities**. This conclusion is supported by various stakeholders from the academic, manufacturing, slaughterhouse sectors and even NGOs, regardless of their geographic location or direct involvement in the leather industry. Meat production is the primary economic driver of cattle raising, with dairy products also mentioned as a significant output in some contexts.

Many interviewees consider **raw hides as a by-product of cattle raising**. This classification is largely based on the perception that the primary aim of cattle raising is the production of meat (and in some cases, dairy), making anything else, including hides, secondary. For example, stakeholders from slaughterhouses and farms describe raw hides as by-products or waste, indicating that their generation is not the primary aim of the production process but rather a secondary outcome.

However, the economic values of raw hides led some stakeholders (e.g., deforestation experts and some NGOs) to believe that raw hides should be considered as co-products. However, as reported by Academic Leather Expert #2, "*the ISO guidelines may define the hides as a co-product*". The Academic Leather Expert #2 explained that these guidelines identify two categories of co-products:

1) determining co-product – i.e., products that determine production (e.g., dairy);
2) dependent co-product – i.e., products that are produced as a result of the determining co-products (e.g. cattle manure). Dairy cattle manure is used for fertilizer, but nobody raises dairy cattle for the manure; they are raised for the dairy products; therefore, in this case, the manure is a dependent coproduct, and the dairy is a determining coproduct.

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tel. 050 88.39.83-82 - fax 050 883.936
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Therefore, according to some experts, raw hides can be defined either as a by-product or a dependent coproduct of cattle raising since these two concepts can often be considered as synonyms.

This interpretation is also confirmed by the profitability of slaughterhouses and cattle raising activities that would be hypothetically dedicated specifically to raw hides production. Academic Biodiversity Expert #2 claimed that "*the profit margin for both the ranchers and the slaughterhouses selling the products from the animals comes from the additional value of the hides*". Actually, almost all the other interviews agreed that the **cattle raising and slaughterhouse business would not be economically sustainable if limited exclusively to the sale of raw hides**. Raw hides, while contributing to the overall profitability of the cattle raising and slaughterhouse operations, represent only a small fraction of the total economic value of the animal with hides considered a by-product or waste product with very low value compared to meat. If slaughterhouses were to focus solely on the sale of raw hides without the meat market, they would incur **significant disposal costs** for the rest of the animal. Such a scenario would make the operations unprofitable, as the revenue from hides alone would not cover the costs of cattle raising and processing. Academic Leather Expert #1 said that "*the value of the skin is generally around 3-5% of the animal depending on the market where it might range from 1% to 10%"*. This is also confirmed by the EU Farmer #1, "*considering a veal factory, i.e., with higher value skin, on average the cost of the skin is 46 euros per animal out of a total of € 2,000 of the overall cost of the animal*". Extra-EU Manufacturer #1 reported that "*the economic value of raw hide compared to the total value of an animal slaughtered in Brazil today is less than 1%*". The same percentage was confirmed by the Extra-EU Manufacturer #2 and the Extra-EU Slaughterhouse #2, but for the US area.

Extra-EU Slaughterhouse #1 indicated that "*Raw hides are an absolute by-product with a very low value, which ranges between 5 and 25 NZ dollars as a raw hide (before any preparation with salt). This probably means 1% to 3% of the value of the animal*".

This non-homogeneous distribution is also valid in terms of mass and weight. According to Academic Leather Expert #1, "*per mass allocation, meat is 80% of the output, dairy products is 15% and leather is 5%*". More detailed information was provided by the EU Farmer #2 which indicated that "*a bull weights around 700 kg alive and around 400 kg as a carcass; of these, 300 kg is meat, while the hide would probably weight around 25 kg*".

Again, with regard to the economic relevance of raw hides in the frame of cattle raising – slaughterhouses value chain, we investigated whether tanneries, as customers of this chain, were able to influence the management decisions of cattle raising and slaughterhouses companies. Several

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tel. 050 88.39.83-82 - fax 050 883.936
idm@sssup.it

interviewees agreed that, due to the low economic relevance of raw hides in those companies, **cattle raising and slaughterhouses companies are not influenced by tanneries in their relevant management decisions**.

The EU Policymaker#1 provided a different perspective specifically focused on environmental impacts. Based on leather Product Environmental Footprint Category Rules (PEFCR)[4], 88% of the impacts of livestock farming go to dairy products, 12% to meat and co-products/by-products.7% of the meat entering the slaughterhouse is **raw hide to which 3% of the slaughterhouse and upstream impacts are allocated** according to a type of economic allocation. Allocation percentages for breeding and slaughter are given in the European EF Recommendation (2279/2021).

The interviews reveal a nuanced understanding of the destination of raw hides, highlighting that while a significant portion does find its way to the leather industry, there are instances where hides are not utilized fully, leading to alternative uses or disposal methods. **A considerable number of raw hides is indeed purchased by the leather industry, which serves as the primary destination for these materials**. This relationship underscores the interdependency between the slaughterhouse operations and the leather industry, with the latter significantly contributing to the utilization of by-products from cattle raising. Besides the leather industry, a portion of **raw hides**, even though as limed hides from tanneries, is also used by other industries, particularly in the **production of gelatin or collagen**. This indicates an extended value chain that encompasses various sectors beyond leather production, leveraging the raw materials for different commercial purposes. NGO#1 reported that "*15% of defected hides are going to gelatine production, especially when the leather market goes down*".

Despite the efforts to utilize raw hides fully, there are instances where **hides end up in landfills**, particularly when they are not deemed suitable for leather production or other industrial uses. This outcome is often related to market dynamics, the quality of hides, and the operational capacities of tanneries. Situations where the economic value of hides is too low to warrant transportation or processing costs might result in disposal rather than sale. This might happen more frequently in some part of the world, such as South-Est Asia, Africa, South-America.

The economic viability of utilizing raw hides is a critical concern for both slaughterhouses and the leather industry. The fluctuating demand for leather, coupled with environmental sustainability considerations, plays a significant role in determining how raw hides are managed. Slaughterhouses must balance between selling hides for profit, covering disposal costs if necessary, and adhering to environmental regulations that discourage waste.

[4] A ruleset describing how to calculate the environmental footprint of a specific product group.

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tel. 050 88.39.83-82 - fax 050 883.936
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The consensus varies among stakeholders when analysing the potential role of tanneries in influencing the environmental responsibility and practices of slaughterhouses and cattle raising companies, with some seeing potential for influence, while others are more skeptical about the extent of this potential.

Some interviewees, including Extra-EU Trade Association#2, acknowledge the potential for tanneries, through entities or certifications, to influence cattle raising practices on environmental topics. This potential is seen as part of a hopeful outlook where downstream companies can impact supply chain practices by demanding better environmental stewardship from their suppliers. However, this is tempered by the acknowledgment that such **influence is nascent and not yet evidenced by specific cases**.

Other perspectives offered in the interviews suggest skepticism regarding the ability of tanneries to significantly influence cattle raising and slaughterhouse operations due to economic and structural reasons. For example, the profit margins for slaughterhouses from hide sales are described as marginal, indicating that **the economic leverage tanneries might have is limited**. Furthermore, the value of hides is a small fraction of the total value of cattle, suggesting that incentives for environmental practices tied specifically to leather production might not be compelling enough to enact change at the level of cattle raising. The discussion also touches on the role of vertically integrated supply chains and large industry players, such as Extra-EU Manufacturer#1, which could potentially influence cattle raising practices due to their significant mobilization of raw hides and skins. This influence is thought to be more pronounced where there is a **close working relationship between slaughterhouses and tanneries**, allowing for the transmission of demands and standards up the supply chain. While acknowledging the challenges, some interviewees suggest that tanneries, especially those associated with large and influential corporations, could play a role in promoting environmentally responsible practices among cattle ranchers. This would require not only direct demands for sustainable practices but also possibly **sharing benefits with farmers** to make the supply chain more equitable and sustainable.

The overall sentiment suggests that while there are opportunities for positive influence, realizing these opportunities will require concerted efforts, innovative approaches, and perhaps a **re-evaluation of how value and costs are distributed throughout the supply chain**.

Key findings:

- The consensus across the interviews is that the primary output of cattle raising is meat, with dairy products also mentioned as a significant output.

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tel. 050 88.39.83-82 - fax 050 883.936
idm@sssup.it

- Raw hides are predominantly viewed as by-products of the slaughter process, with some stakeholders referring to them as waste products due to their low value compared to meat and other to co-product due to the high value of the finished leather products.
- A combination of factors, including market demand, hide quality, and economic considerations, influences the final destination of raw hides, whether it be in leather production, other industries, or in some cases, landfills.
- The only raw hides production would not make the cattle raising and slaughterhouses companies profitable, in other terms there is not a direct connection between the existence of these companies and raw hides production.
- Tanneries, as clients of cattle raising and slaughterhouses companies, have a very limited power to influence relevant management decisions of those companies.
- While there is recognition of the potential for tanneries to influence environmental practices within the cattle raising and slaughterhouse industries, this potential is seen as contingent upon various factors, including economic incentives, the structure of the industry, and the capacity for collaborative and integrated approaches to supply chain management.

3.3.3 Interviews findings: raw hides and deforestation

Given the lack of a clear positioning in literature, both academic and grey, on the relationship between raw hides and deforestation, this topic has been explored through interviews. The aim was not only to understand if a link between the two exists, but also how it can be classified, that is, basically, if this relationship can be considered *direct* or *indirect*.

As expected, among the 28 interviewees, some strongly support the opinion that leather (or raw hides) is not related to deforestation, while others believe that a link exists.

The majority of the participants belong to the **first group,** which represents people who declare that **there is not a relationship between raw hides and deforestation**. Different reasons were provided to lay the foundations for their statement; among them, the fact that (i) hides are a by-product of the cattle raising and that (ii) their economic value is minimal, are the two most supported arguments.

First of all, the interviewees said that a relationship between raw hides and deforestation does not exist – in other words, that raw hides are not a driver of deforestation – because of the **classification of hides as a by-product and not as a primary product** (see section 3.3.2). According to Academic Leather Expert #1, the logic is clear: being the meat the primary product, meat is the driver of deforestation, and not leather. Cattle are all raised for their meat, thus, "*leather production is not a*

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Piazza Martiri della Libertà, 24 - 56127 Pisa
tel. 050 88.39.83-82 - fax 050 883.936
idm@sssup.it

driver of deforestation" (Extra-EU Trade Association#2). The two interviewed Extra-EU Manufactures are also aligned with this view, confirming that hides are a by-product, and that deforestation is caused by raising cattle, soy, cotton or other commodities. However, "*no cattle are bred for their skin*" (Extra-EU Manufacturer #1). Being hides not the primary product, which does not drive or cause deforestation, some respondents also believe that "*to focus regulatory efforts on leather assuming that it can have an impact on cattle production it's a fallacy*" (Extra-EU Farm #1).

Second, some interviewees support the non-existence of a relationship between hides and deforestation because of the low **economic value** of hides on the total value of cattle. According to the Extra-EU Policymaker#2, what drives deforestation are the economic factors and, in this sense, the leather industry has no commercial leverage. Thus, in line with this perspective, a relationship between leather and deforestation does not exist. When referring to the PEFCR on leather and to the debate, based on LCA, on the amount of environmental impact of cattle raising to be attributed to leather, the interviewee states that "*there are arguments that since the engine of cattle raising is food production, nothing should be attributed to leather or any other by-product. This is a somewhat theoretical argument. If you actually want to influence deforestation, you have to look at the drivers and who holds the commercial power*". The economic view is supported also by other respondents, such as Extra-EU Manufacturer #2, who affirm that the hides' value is minimal and it is not able, under a logical point of view, to push somebody to "*go and buy land in the Amazon, cut down trees and put cattle there, just because of the hides*". Some participants also went beyond the 'simple' economic value of hide in comparison with the value of meat, arguing that "*in Brazil the hide value is less than 10$ per hide, so it would not be economically sustainable to deforest just for the hides. […] Moreover, because of the very low value of the hides, there is no possibility for the leather industry to influence change in cattle raising activities*" (Extra-EU Slaughterhouse #2). How could it be possible that "*a product which represents 1% of the value of the animal is going to have any meaningful impact in animal production practices*"? This is a question posed by Academic Leather Expert #2, that resumes one of the key aim of this report: **if the leather sector has no power to influence cattle raising practices it means that it cannot be considered as responsible of deforestation**. The low value of hides is not able to trigger the implementation of any kind of significant changes in the cattle industry, as it responds to the broader conversations about the environmental impact of meat production.

In addition to these two points of view, the interviewees cited some additional topics that support their belief that there is no relationship between raw hides and deforestation. Academic Leather

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Piazza Martiri della Libertà, 24 - 56127 Pisa
tel. 050 88.39.83-82 - fax 050 883.936
idm@sssup.it

Expert #3 referred to the leather industry **as an industry which not only buys something that, if not used, would be wasted, but also transforms it, increasing its value**. Moreover, according to Extra-EU Trade Association#2, "*there is an overabundance of hides and skins available*" and the **leather industry helps prevent hides from being landfilled**. Another point of view is the one supported by EU Manufacturer #1, who states that "*if we stop leather production today, and if we don't buy hides anymore, cattle slaughtering will nonetheless continue. Of course, we are using a by-product, but I don't think that stopping leather production would ever stop deforestation*". Moreover, in recent years, "*meat consumption has increased, but leather consumption has decreased*"; therefore, the meat industry, and not the leather industry, has the power to really influence deforestation (Extra-EU Trade Association#2).

A **second smaller group** of interviewees instead, affirmed that a relationship between raw hides and deforestation actually exists.

The **economic factor** is used by few participants to support this position. According to Academic Biodiversity Expert #2, the **leather sector directly contributes to deforestation because of the role of the profit margin of leather for the slaughterhouses**. This interviewee stated that leather allows slaughterhouses to be profitable. However, the interviewee also states that there is no evidence of this. This position is also embraced by EU Policymaker#2 who stated that "*approximately 1 billion worth of raw hides and skins are imported into the EU every year, in addition to the local production within the EU*" and that "[…] so, there is no doubt that there is a profit to be made from the leather for many companies", confirming that the EU regulation does not differentiates between the main drivers and the secondary drivers of deforestation. Thus, the determinant for being included in the scope of the regulation is the **economic relevance of the driver**. NGO#3 cited a couple of studies (Bain & Co, 2021; Scot Consultoria, 2024) – see section 3.2.3b – which support this view of economic profit for the slaughterhouses that come from hides and the leather industry.

The economic factor is relevant also from the **import/export perspective**. In fact, Academic Biodiversity Expert #2 asserted that slaughterhouses, when making business decisions, strongly consider profit from leather "*especially in terms of the amount exported in the EU market as that's where they make more money*". This economic facet was also shared by EU Policymaker#2, who confirmed that the choice of including hides in the EUDR was based on analyses and objective data which prove that hides and skins are relevant in terms of quantitative value, basically because of their value in terms of imports. However, this point may lead to some crucial considerations, such as the fact that, even if the EUDR indirectly refers to the concept of embedded deforestation, it is legitimate

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Piazza Martiri della Libertà, 24 - 56127 Pisa
tel. 050 88.39.83-82 - fax 050 883.936
idm@sssup.it

to suppose that the hides, in addition to meat, have been included in the scope of the regulation because of the significant amount of exported hides from Extra-European countries to European countries, that significantly outdistances the exports of meat. If only meat had been included, this would have had only a partial effect on Europe.

Another point of view is related to the **context**. The relationship between raw hides and deforestation is classified as **direct or indirect based on where it happens**. According to Academic Deforestation Expert #1, when animals reared in Europe, such as pigs, poultry and others, are fed with feed that comes from deforested land (i.e. Brazil), the relationship is indirect (in other terms, *embedded deforestation*). This last view is shared also by the NGO#1, who supported the existence of an indirect relationship because, even if cattle are raised in Europe and it does not directly impact deforestation, the soy used to feed it may come from other deforested lands, being the "*second main driver of deforestation*". On the contrary, when a forest is destroyed because of the need for cattle raising, and this activity generates hides which are, consequently, sold to the leather industry, this is an example of a direct relationship. According to the interviewee, "*unless proven otherwise, there is always a risk of deforestation*". The distinction between the European context and the Extra-European one is also supported by EU Slaughterhouse #2, who affirms that for European industries, the relationship with deforestation is direct in the case of raw hides supplied from, for example, South America,– "*there is evidence that deforestation is linked to cattle raising from which meat is derived as a primary product, but also leather*" –, while this connection vanishes in the case of hides coming from European slaughterhouses. Thus, if you are buying hides from countries such as Brazil, "*you cannot be sure that it is not deriving from deforested land*" (NGO#3).

Finally, an interesting point of view was provided by NGO#2 who supported the idea that there is a connection between leather and deforestation, but also invited to reflect on the **boarders of the definition of the drivers of deforestation**. This is why, for instance, "*deforestation can also be connected to smartphone companies because they are using animal collagen to glue some parts of the screens and phones*", or "*the concept of embedded deforestation could be extended, for example, also to the banks that finance farmers who raise cattle on deforested areas*". Thus, it is legitimate to wonder why some industries are subject to the regulation while others are not.

In addition to these two complementary views on the relationship between hides and deforestation, a **third one** is related to the **illegality of cattle raising**: according to the grey literature (see section 3.2.3b) illegal cattle raising is considered by some authors as a **driver of deforestation**, being driven by the demand of leather. First of all, it is important to specify that, in the past and in some regions,

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tel. 050 88.39.83-82 - fax 050 883.936
idm@sssup.it

deforestation was even "*promoted by government as part of the system of the country to promote the expansion of production*" (Academic Biodiversity Expert #1). Governments, in fact, were used to incentivize deforestation activities to create new pastures (Extra-EU Trade Association#2). Moreover, while a couple of interviewees affirmed that there is the possibility that the leather industry uses hides and skins from illegal cattle breeding activities in South America because this still a very widespread phenomenon (Academic Deforestation Expert #2, Extra-EU Farm #1), Extra-EU Manufacturer #1 believes that less and less illegally raised cattle is entering the supply chain, and Extra-EU Trade Association#2 argues that "*cattle raising itself is not illegal*". Furthermore, with reference to the link between illegality and leather, both Extra-EU Policymaker#2 and Extra-EU Trade Association#1 affirmed that there is no link between the leather industry and illegal cattle raising or illegal deforestation: being illegal cattle raising a crime in Brazil, "*the leather sector works exclusively with suppliers that comply with legislation*" (Extra-EU Trade Association#1).

Thus, according to the interviews, and in contrast with a limited part ofthe literature, **the leather industry cannot be considered a driver of illegal cattle raising**.

Last but not least, some intriguing thoughts have emerged from the interviews which are worth to be cited, even if they relate more to the **potential**, **positive** and **negative**, **effects caused by the Regulation**.

With regards to the first category (positive), NGO#1 affirmed that the EUDR will allow Europe to become a first mover and that, in the long-term, "it is going to force better practices and it is going to set examples for other countries". This opinion is supported by very few other respondents. The majority of them, in fact, argue that the EUDR, as it has been conceived, will bring lots of negative effects. Extra-EU Policymaker#2 believes that the EUDR will not be effective in achieving its goals, because the actors to work with should not be leather companies but local governments who can ensure that laws are enforced. Academic Leather Expert #2 argued that the EUDR will cause negative environmental effects (i.e., an increase in global warming) due to the severe impact in terms CO_2 emissions from hides that will become waste instead of being used for leather production. Other interviewees asserted that Europe will be impoverished by the effect of the Regulation, since it will increase prices for exporting to Europe, favoring of other markets such as China, Vietnam or India (EU Manufacturer #2; Extra-EU Slaughterhouse #2). Moreover, if other countries such as China, that import large volumes of hides from South America, do not apply a similar Regulation, the EUDR alone will not be effective in counteracting deforestation (Academic Biodiversity Expert #1). Lastly, while the EU cannot import hides that come from deforested areas, the Regulation does not forbid

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Piazza Martiri della Libertà, 24 - 56127 Pisa
tel. 050 88.39.83-82 - fax 050 883.936
idm@sssup.it

the final product from being imported (i.e., a pair of shoes). According to EU Manufacturer #1, "*the hides will still arrive in the EU, but in an indirect way. The final product will still end up in the EU, but the production, the money, is earned in China. This will totally destroy the European Leather sector*".

For all these reasons, according to the cited participants, **the regulation will not help stop deforestation**.

To **conclude,** what emerges from the interviews is that while for some of the participants there is no relationship between hides and deforestation, others believe the contrary. As expected, while leather trade associations, manufacturers, farm and academic leather experts bolster the first position (no relationship between the two), NGOs, policymakers and academic biodiversity and deforestation experts shore up the second one. Different reasons and explanations are provided for supporting the two points of views. Interestingly, among these, the economic factor is used by both groups for supporting their thesis. However, while only two of the interviewees argue that hides are economically relevant for the slaughterhouses, providing some evidence about it, the majority of them proved the contrary.

Moreover, almost all of the interviewees believe that **the current version of the EUDR will not be able to produce positive effects for the EU**. According to the majority of the interviewees, the leather sector alone is not able to counteract deforestation because "l*eather demand does not affect beef demand and there will always be beef production*" (NGO#1). Today, the leather industry is called to be part of the solution for avoiding deforestation, even if it "*does not want to have the responsibility for the deforestation as it does not want to be seen as part of the problem*" (NGO#2). Leather companies, choosing slaughterhouses that respect and guarantee sustainability standards, may help fight the deforestation phenomenon (EU Farm #1). Thus, even if they "*cannot solve the problem themselves, they can start implementing some solutions*" (NGO#1).

Key findings:

- The majority of interviewees support the position that there is no relationship between raw hides and deforestation.
- Among the few that believe the contrary, the majority argues that this relationship is indirect.
- The economic perspective is used by both groups for supporting their opinion.

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tel. 050 88.39.83-82 - fax 050 883.936
idm@sssup.it

- The high percentage of hides, in comparison to meat, exported in Europe appears to be one of the main reasons of the inclusion of raw hides in the Regulation.

3.3.4 Interviews' findings: leather and traceability

The final topic investigated through the interviews concerns the **transparency and traceability of the leather supply chain.** The main objective was to analyse the coverage of the leather supply chain achieved by existing traceability systems and the main barriers to obtaining full coverage, as well as the social pressures that influenced the development of these tools. The potential environmental and socio-economic impacts on the leather sector related to the possible implementation of the new traceability system foreseen by the European regulations were also explored.

Most of the 28 respondents foresee a market development at the expense of the European leather sector. Raw hides and skins will continue to be produced and sold to Europe, but with increased costs, or they will be sold to other countries without regulation on traceability of the supply chain, such as Asia.

The framework that emerged from the interviews presents **several traceability systems in operation and others in the planning stage**, many of which only intervene in the leather supply chain in a collateral way. These are initiatives implemented by different actors, such as federal governments, private companies or associations in the meat or leather sector, in some cases designed with the contribution of third sector entities and with purposes other than leather traceability, such as, for instance, the traceability of meat for health reasons. **Tanneries, both European and Extra-European, have implemented or are planning their own supply chain traceability systems. The manufacturing world is on the move, but only a limited number of larger companies with a vertically integrated production system manage to trace the entire supply chain up to the farm, while the majority of tanneries are able to trace the process back to the slaughterhouse.** As stated by Extra-EU Trade Association#2 "*Tanneries that have supply chains that go all the way back to the farm are a small number".* Furthermore, the level of coverage of the leather supply chain depends on the origin country of the raw hides. EU Farm#2 believes that in **Europe it is possible to cover the entire supply chain because** *"slaughterhouses in Europe have total traceability of their animals".* **In the context of Brazil, the situation is different, as the cattle chain is very complex** since bovines pass through 3 different farms before being slaughtered and ***"companies are just monitoring their direct suppliers that they interact with, without considering the behaviour of the farmers earlier in the supply chain"*** (Academic Biodiversity Expert #2). The fact that tanneries

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tel. 050 88.39.83-82 - fax 050 883.936
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mostly interact with the final supplier they buy from is confirmed by EU Manufacturer#1 *"We are mainly buying directly from the slaughterhouses. Thus, we are mainly buying raw hides and not semifinished hides, like wet blue or crust. (...) The majority of tanning companies is not aware about the origins of their leather. Because many of the tanning industry, mainly the Italian tanning industry, are buying semi-finished product, like crust or something like that".* Academic Leather Expert#2 shared a useful perspective distinguishing between **(i) trace-back** and **(ii) traceability systems**. **A trace-back system,** which is that of the United States, is for all food products and that means that if there's any problem in the product, (e.g. E-coli) then a Government body gets involved (such as the Food and Drug Administration or the US Department of Agriculture), and it will be able to trace back and to identify who sold the food to, from whom the ingredients were purchased, etc. so they can go all the way back. **Traceability** is the idea that you can get a piece of meat and attached to that product you can find information to identify all the places along the supply chain that are related to that product. The interviewee believes that in the case of hides and skins, the traceability system will only allow them to be traced back to the packer or slaughterhouse. Typically, the tanneries know from whom they purchased the hides, but may not know where the slaughterhouse is located, because **companies often aggregate hides from different places into one container and send it to the tannery as a unit.** The company may know more or less where a group of hides comes from, but not where each individual hide comes from. This is the position mostly shared by the interviewees.

Another aspect explored through the interviews was **the reason why the main players of the leather sector would trace their supply chains**. The prevalent position identified market pressures for more transparency as the main driver, coming from large customers such as big fashion brands, that consequently push the tanneries to ask slaughterhouses for more transparency. Only one interviewee cited the European deforestation regulation as the main lever (EU Manufacturer#1), while another interviewee highlighted the pressure from NGOs as a possible driver, mentioning the publication of the Green Peace Report (Extra-EU Manufacturer #1).

Respondents also commented on **the possibility of tracing the entire leather supply chain, up to cattle raising**, and identified the **main barriers to the full development of traceability in this chain.** The prevalent position is that **it will be very difficult to cover the whole supply chain, even by integrating the information with meat systems,** as linking each animal to a farm and each raw hide to each animal is quite difficult. **The complexity of the leather supply chain is a limitation to the implementation of a full-coverage traceability system. Firstly, complications arise concerning indirect suppliers:** many interviewees pointed out that animals not only pass from farm

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tel. 050 88.39.83-82 - fax 050 883.936
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to farm but also there is a risk that illegally raised cattle come into contact with legally raised cattle. **Secondly**, it is true that cattle have identification tags on their ears and when they go to the slaughterhouse the hide itself is identified with the tag. However, ear tags are present only in a limited number of countries and the ear tags are not put at the time of birth, but only later when they are destined to the EU market. The problem arises when the hides are collected by traders, who buy from different slaughterhouses. The different hides collected from the different slaughterhouses form a batch of hides that undergoes the preservation process, often in salt, and it is then difficult to trace/identify every hide individually after this process. **A major barrier to the implementation of a full-coverage traceability system is the need to create hide identification systems and specific databases, with investments in technological innovation.** Therefore, **in addition to the complexity of the supply chain, the majority of the respondents highlighted to the costs associated with the design and implementation of these systems and databases**. For example, Extra-EU Slaughterhouse #2 stated *"The cost of traceability and the complexity of the supply chain are too high and are the main barriers to the implementation of a traceability system"*. Extra-EU Farm #1 stated that *"Traceability to the slaughterhouse is possible, but tracing back to the farmers becomes very difficult if not almost impossible. Therefore, yes, the leather industry will benefit a lot from a system that tracks meat, but they still have to invest a lot of money in the technology to track hides and skins separately from slaughterhouses to tanneries".* Extra-EU Policymaker#2 identified among the main obstacles *"the availability of data and the issue of confidentiality. Traceability will have to be imposed by the government, which will also have to support access to data. Another obstacle is the financial support needed to create traceability. Without financial support from the EU, it will be difficult".* This position, which calls not only for economic support from the European Union but also for the **active involvement of local governments, is related to a confidentiality issue, because farmers are not obliged and cannot share information about their suppliers**. Extra-EU Manufacturer #2 also claims that *"Without government mandate, it is very difficult to achieve [traceability] because there are laws around confidentiality."* Finally, **the lack of involvement and communication with slaughterhouses and farms is identified by two of the interviewees as a barrier.** Farmers are in fact required to do extra work and, therefore, *"farmers need incentives to do this extra work, so that they see a value on traceability (i.e. we need to pay them for traceability), for example by giving them extra money, access to better lines of credit, etc."* (NGO#1).

The interviewees were involved in a reflection on the **potential socio-economic effects on the leather sector of the new traceability rules.** The most popular position identified **an increase in**

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tel. 050 88.39.83-82 - fax 050 883.936
idm@sssup.it

costs. As we have seen, the design and implementation of a full-coverage traceability system as required by the European regulation will increase costs and this is one of the main obstacles to its implementation. EU Manufacturer #2, who already has a supply chain traceability system in place, stated that this system has increased the cost of leather by at least €3 per square metre of raw hide. The implementation of this system will require the active involvement of breeders and slaughterhouses who will have to collect and provide information and data to the tanneries. The introduction of a **premium price to be paid to farmers and slaughterhouses for their efforts was considered**, although it was not supported by all respondents. Consumers or the fashion industry would have to bear these additional costs, but would they be willing to do so? The majority could not predict this. Extra-EU Slaughterhouse #1 stated that "*producers will have to bear the cost, it's part of their processing cost to have access to the market*". On the other hand, Extra-EU Policymaker#2 believes that the fashion industry is not willing to pay this extra amount for a poor quality material such as the Brazilian hides, especially if they are not forced to do so. This view links to **another position widely shared by most stakeholders, according to which there will be a shift in the leather market.** If selling raw hides and skins in Europe becomes too expensive and challenging, as it is expected to become, Brazil or other producing countries will look for other buyers and they will direct their products to countries that do not have traceability regulations on the supply chain, such as Asia. Academic Biodiversity Expert#2 stated *"There will be people who will be cut out of the market. To a large extent, the market will shift and the EU will end up receiving deforestation-free products, and producers who cannot meet these requirements will find other market segments for their products".* This market shift will have negative impacts on employment in the European leather sector. Extra-EU Trade Association#2 foresees ***"the potential bankruptcy of small tanneries and the survival of only the larger ones".*** The implementation of this regulation will be a problem not only for European tanneries but also for Norwegian and Swiss slaughterhouses that sell in Europe but are not responsible for deforestation, who will have to find new clients in other countries (EU Slaughterhouse #1). According to Extra-EU Slaughterhouse #2 this will only be a temporary change (3-6 years) in the market until a better traceability system is available for the entire supply chain. Only one interviewee believes that there will be no significant changes, only an increase in the bureaucratic compliance. EU Policymaker#2, reflecting on the possible socio-economic impacts of the new regulation, asserted that this is only a first step and that the regulation implementation will be under observation *"if any kind of trade disruption or potentially negative economic impact on European industry or any other problems are detected, the EU will try to take these considerations*

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tel. 050 88.39.83-82 - fax 050 883.936
idm@sssup.it

into account when reviewing the scope of the regulation (first review of the scope of the regulation by mid-2025)".

Another aspect analysed through the interviews was the **potential environmental impacts related to the implementation of the new regulation, especially in terms of its effectiveness in combating deforestation**. The most widely shared position among the academic and NGO interviewees is that **implementing a traceability system for the leather supply chain will contribute positively to combating deforestation**, **practitioners and technicians of the sector are highly critical on the positive contribution of this solution.** For example, Academic Deforestation Expert #2 stated that "*the traceability system that will be produced will help combat deforestation […] it will bring attention to the problem and provide more transparency. It will allow people to ask questions and understand where the impacts are."* Two interviewees expressed different opinions, recognising the implementation of this system only as a part of the solution. In particular, Academic Deforestation Expert #1 does not believe that investing in traceability systems can solve the larger problem of deforestation because it only focuses on the effort of individual supply chains, therefore *"wider landscape solutions are needed (…) there are ethical companies that work with farmers and share their profits so that everyone participates (jurisdictional or landscape approach)."* Finally, Extra-EU Manufacturer #2 affirmed that the percentage of raw hides sent to landfill will potentially increase.

Considering that some countries already have a system in place to trace the meat supply chain for food safety reasons, respondents were asked whether the information gathered from these systems could be sufficient to combat deforestation and, therefore, if it would be enough to implement food traceability systems. **The majority of respondents believe that information on meat hygiene and safety is an important source of knowledge and that leather traceability systems should link to these databases,** collaborating with the meat industry to avoid duplication of efforts. For example, there is a traceability system designed for slaughterhouses that uses safety information from the food industry to collect information on animal movements and trace the supply chain in several Brazilian Amazon states. The majority believes that leather traceability systems should be developed using information from existing meat traceability systems, but that specific systems should be designed for the identification and traceability of raw hides and skins, because "*if we only had one place where all the meat and leather comes from, obviously investing only in the traceability of the meat would make sense and this would automatically extend to the leather that comes from there. But the situation is different. There are many different countries producing meat and leather, many different farms, many different suppliers"* (Academic Deforestation Expert #1). Only few interviewees stated that the

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tel. 050 88.39.83-82 - fax 050 883.936
idm@sssup.it

traceability of the meat supply chain would be sufficient to avoid deforestation by meeting the relevant regulatory requirements because hides would have to meet the same requirements.

In conclusion, the leather sector is moving to design leather traceability systems, despite existing obstacles, such as the complexity of the supply chain and the costs necessary to implement these systems. Considering that the main impacts related to the eventual implementation of these traceability systems required by the new European regulation are market shift and increased costs for leather, economic support from the European Union, involvement of all actors of the leather industry and collaboration between different actors along the supply chains, such as the meat industry, is recommended by the majority of interviewees.

Key findings:

- The majority of interviewees believe that only a limited number of larger companies with a vertically integrated production system manage to trace the entire supply chain all the way up to the farm, while the majority of tanneries are able to trace it back to the slaughterhouse.
- The main barriers to the development of a full-coverage leather traceability system are the complexity and fragmented nature of the supply chain and the costs involved in setting up such systems.
- The majority of interviewees identify the shift of the leather market to countries where traceability is not required to the detriment of the European leather sector and the increased costs as potential socio-economic impacts resulting from the implementation of traceability systems.
- While academics and NGOs believe that the implementation of a leather traceability system would be a useful tool to fight deforestation, practitioners and technicians are extremely critical about it.

3.4 Task 1 Conclusions

The key findings of this report highlight several crucial aspects related to the socio-economic and environmental impacts of Regulation 2023/1115/EU on the leather sector. **A significant majority of interviewees do not believe that there is a direct relationship between raw hides and deforestation**. Those who perceive a connection argue that it is largely indirect. Economically, hides are often considered by-products of cattle raising, with meat production being the primary driver. The low economic significance of raw hides within the value chain of cattle raising and slaughterhouses is an important topic for understanding the connection between the leather industry and deforestation.

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Their economic value is relatively minor compared to the primary products of cattle, such as meat and dairy. In the context of cattle raising, the primary revenue streams are typically from meat (beef) and dairy products, which command higher market prices and consumer demand. Raw hides, on the other hand, only contribute to a small fraction to the overall financial returns of cattle operations. This lesser economic value affects how resources are allocated within the industry; for instance, investments in breeding, feeding, and care are primarily driven by the profitability of meat and dairy production rather than the potential sale of hides. Understanding the low economic relevance of raw hides in this value chain highlights why the industry focuses primarily on meat and possibly dairy, that shape many decisions from farm management to sustainability practices. In addition, according to the results of this task, the leather industry, as a customer of the value chain, has not the power to influence the management decisions of slaughterhouses and cattle raising companies.

For all these reasons, according to the authors of this research and based on the collected evidence, **the leather industry cannot be considered a driver of deforestation, since it cannot be considered a driver of cattle raising and slaughterhouses activities**.

Some findings highlight that the leather industry can be considered an *indirect* driver of deforestation. The term "indirect driver" refers to influences on systems or processes that are not direct causes, but rather contribute to the overall environment in which the direct causes operate. In the context of environmental studies or economics, indirect drivers could involve broader societal, economic, or political changes that influence more immediate, direct drivers of environmental degradation or economic development.

The leather industry is mentioned as an indirect driver because it contributes to the economic revenues of cattle raising and slaughterhouses, since raw hides are sold by these companies. However, as one of the interviewees argued, it is not fully correct to include in the Regulation only some sectors and exclude other similar indirect drivers. The interviewee reported the examples of smartphone companies, that use animal collagen to glue some parts of the screens and phones, or the example of the banks that "finance farmers who raise cattle on deforested areas".

The fact that a sector is an indirect driver of deforestation cannot be considered a justification to be included in such a relevant Regulation and, according to the authors of this study, it risks having a **negative economic impact** on the sector that is **far greater** than the **benefits** (unconfirmed and unclear) that will be achieved in terms of **deforestation reduction and prevention.**

Istituto di Management
Scuola Superiore Sant'Anna

Piazza Martiri della Libertà, 24 - 56127 Pisa
tel. 050 88.39.83-82 - fax 050 883.936
idm@sssup.it

The transparency and traceability of the leather supply chain emerged as a critical issue. While several traceability systems are in place or being developed, the complexity and fragmentation of the supply chain pose significant barriers to achieving full coverage. This complexity is particularly pronounced in countries like Brazil, where cattle pass through multiple farms before being slaughtered, complicating traceability efforts.

Most respondents foresee that the regulation may lead to unfavourable market developments for the European leather sector, including increased costs and shifts in trade towards countries without similar traceability regulations, such as Asian countries. This shift might undermine the effectiveness of the Regulation in combating deforestation, as hides might still enter the EU indirectly through finished products.

Despite differing views on the relationship between leather production and deforestation, there is a consensus that the leather industry must adopt more sustainable practices in addition to those already adopted. By selecting slaughterhouses that adhere to sustainability standards, leather companies could help mitigate deforestation.

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Scuola Superiore Sant'Anna

Piazza Martiri della Libertà, 24 - 56127 Pisa
tel. 050 88.39.83-82 - fax 050 883.936
idm@sssup.it

4. Task 2: Analysis of the socio-economic effects on the leather market resulting from the introduction of Regulation 2023/1115/EU

The introduction of **Regulation 2023/1115/EU** is expected to create a **supply shock** in the cattle hide market, materializing as **additional costs** for the **main input** for cattle hide and leather producers. These increased costs may be partially or fully passed through to the **average prices** for the **client sectors**. The main objective of this report is to analyse the effects of such a **price increase** on the demanded quantities in the client sectors by examining the **demand elasticity to prices**.

Studying price elasticities allows us to synthetically explain the composition of different effects in the dynamics of sectors. Looking at the various channels through which prices affect demand three considerations need to be highlighted.

1. The existence of **ready substitutes** for the production of the client sectors: The price elasticity of demand for a good is greater in absolute value if many close substitutes are available for it, making it easy for clients to switch to those substitutes when there is a price increase for that good. The availability of close substitutes such as **synthetic materials** or cattle **hides from suppliers not subject to the same shock** tends to make the demand for cattle hide more price elastic. If a good has no close substitutes, its demand is likely to be somewhat less price elastic.
2. Price changes affect quantity demanded if they change the **capacity of the client** sectors to buy the good as an input: Practically speaking, price changes can be transferred as a **supply shock for downstream sectors**, affecting their capacity to buy that particular input or any other substitute. This effect is stronger in the absence of equivalent substitutes.
3. The **timing of adjustment** of the demand to the price shock: The dynamics of the price adjustment might unravel with different paces as the horizon of interest changes. The reduction in quantity demanded by the next month is expected to be smaller than a reduction at a medium-term horizon for **persistent shocks**. On the other hand, it may happen that initial shocks that displace the production process are **reabsorbed** in the medium or long run.

In summary, the **price elasticity of demand** for cattle hides is influenced by several factors, including the availability of substitutes, the impact of price changes on client sectors' purchasing capacity, and the timing of demand adjustments. This report aims to address these questions for the cattle hide market using the model proposed in the following sections. The report is structured as follows. First, we introduce the basic concepts for the analysis of price elasticity of demand, present the references to the **econometric methodology** with a brief mention of the **identification strategy**, and finally,

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Scuola Superiore Sant'Anna

Piazza Martiri della Libertà, 24 - 56127 Pisa
tel. 050 88.39.83-82 - fax 050 883.936
idm@sssup.it

adapt the methodology to the problem under examination with reference to the **data** used for its implementation.

4.1 Price Elasticity of Demand: definition and classification

To approach the problem, we place ourselves in the classic context of a **market with a single good** following a demand function, or quantity demanded (Q), decreasing as the price (P) increases.

To **measure the variation in the quantity demanded** at the price of a good, we use the concept of price elasticity of demand. It is calculated as the percentage change in the quantity demanded divided by the percentage change in price:

$$\epsilon = (\Delta Q/\Delta P) \times (P/Q)$$

It should be noted, before proceeding, that the proposed definition of elasticity becomes less reliable for large price variations. This is because the elasticity of a good is **not necessarily constant along the demand curve** since the relative change in price can have an effect that may depend on the initial price. Furthermore, the percentage change depends on the directionality of the price increase, i.e., which of any two values is chosen as the starting value and which as the final value.

To overcome these limitations, in our work, we consider the case of **constant elasticity** and assume that the elasticity of demand for processed leather is constant in the range of prices at which the product is usually sold. Notice that in the estimation exercise proposed below, we will **relax the assumption on small price variations**, allowing for elasticity to vary across different **price buckets.** Within each price bucket, price variations (and the relative demand changes) can be reasonably considered small.

In the process of determining the optimal price for a product, its elasticity can be used both as a **qualitative metric**, which provides indicative information on how customers react to price variations, and as a **parameter** to be incorporated within elaborate models that propose **scenarios of variations in aggregate demand** and other consequences on macroeconomic variables.

Once the elasticity is estimated, given a defined price variation, it will be possible to calculate the increase or decrease in the demand, depending on whether the price decreases or increases, respectively. We recall here the standard definitions of the critical intervals for the elasticity values. The demand in the cattle hide market is therefore classified according to the following categories (of which the three central ones are of interest for the proposed analysis):

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Piazza Martiri della Libertà, 24 - 56127 Pisa
tel. 050 88.39.83-82 - fax 050 883.936
idm@sssup.it

For $\epsilon = 0$, the demand is said to be **perfectly inelastic**. In particular, price variations do not influence the quantity demanded, so increasing prices will always cause an increase in total revenue.

For $-1 < \epsilon < 0$, the demand is said to be **relatively inelastic**. In particular, the percentage variation in the quantity demanded is less than that of the price, so when the price increases, the total revenue increases.

For $\epsilon = -1$, the demand is said to be **unitary elastic**. In particular, the percentage variation in the quantity demanded is equal to that of the price, so changing the price will not affect the total revenue.

For $-\infty < \epsilon < -1$, the demand is said to be **relatively elastic.** In particular, the percentage variation in the quantity demanded is greater than that of the price, so when the price increases, the total revenue decreases, and vice versa.

For $\epsilon = -\infty$, the demand is said to be **perfectly elastic**. In particular, any price increase will cause the quantity demanded to drop to zero, so when the price increases, the total revenue drops to zero. This is the case for goods whose value is defined by some law or regulation.

4.2 The estimation of the elasticity

The formula presented above, although simple, does not allow reducing the problem of calculating elasticity to a simple question of identifying a price change and calculating the ratio between the change itself and the variation in average demand between the periods before and after this change. This is not possible in most cases where **historical data** are used for two reasons: i) the **presence of price endogeneity**; that is, the statistical dependence between prices and unobservable variables that also influence demand; ii) the demand for a particular good may depend on **demand shocks in other markets**. For this reason, estimating the elasticity of demand with respect to price falls within the scope of **causal inference problems**: that is, when one wants to estimate the causally identified effect that a phenomenon, price variation, has on a dependent variable, in our case, the quantity demanded for a product.

In absence of **quasi experiment** providing the proper setting for causal identification for a supply shock such as that under analysis, the approach proposed is an adaptation of the work by **Cooper (2003)**[5], which essentially specifies a **partial adjustment equation** to account for the difficulty and cost of adjusting demand in the short term.

[5] Cooper, John CB. "Price elasticity of demand for crude oil: estimates for 23 countries." *OPEC review* 27.1 (2003): 1-8.

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Piazza Martiri della Libertà, 24 - 56127 Pisa
tel. 050 88.39.83-82 - fax 050 883.936
idm@sssup.it

Considering the characteristics of the **European leather market**, where the two leading countries, Spain and Italy, contribute 76% of the entire market value with a significant projection on **intra and extra-European international markets**, we propose an adaptation of the method that exploits the configuration of export flows for the major European producers (see the details below).

$$\ln(D_{ij,t}) = \ln(\alpha) + \beta \ln(P_{ij,t}) + \gamma \ln(Y_{j,t}) + \delta \ln(D_{ij,t-1}) + \varepsilon_{i,t}$$

Where the symbols defining the equation represent:

$D_{ij,t}$ = **quantity** of prepared leather sold in period t from country i to country j;

$P_{ij,t}$ = **real average price** of prepared leather in period t for sales from country i to country j;

$Y_{j,t}$ = quantity sold and/or other **macroeconomic indicator referring to downstream markets**, i.e. buyers of leather goods (see below the applied definition for the indicator), in period t in the destination country j;

$\varepsilon_{i,t}$ = assumed **random error term;**

ln = natural logarithm function

α, β, γ, δ become the coefficients to be estimated and **β** can be interpreted as **short-term elasticity**, while **β/(1- δ)** can be interpreted as **long-term elasticity**.

For the definition of a macroeconomic indicator for the client sectors, let us consider the main downstream markets indexed by the letter k: manufacture of **leather clothes** (k=1), manufacture of **luggage, handbags and the like, saddlery and harness** (k=2), manufacture of **footwear** (k=3), manufacture of **other furniture** (k=4).

We then construct **relative weights $W_{kj,t}$** indicating the estimated share of the end-use k in country j at time t. We then take estimates of downstream market turnover at monthly frequency $Y_{kj,t}$ and construct the indicator for the country j using the weighted sum:

$$Y_{j,t} = \sum_k W_{kj,t} \cdot Y_{kj,t}$$

The following points should be considered:

Given the absence of the necessary data, the weights ($W_{kj,t}$) are not provided at a monthly frequency, but fixed and time-independent, meaning that **constant market shares** are assumed for the downstream markets in the destination country. The weights can be equal to zero for some of the downstream markets, even for all but one. In the latter case, the indicator for the destination country coincides with the indicator for that particular market for that particular country.

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Piazza Martiri della Libertà, 24 - 56127 Pisa
tel. 050 88.39.83-82 - fax 050 883.936
idm@sssup.it

4.3 Data Description

The proposed analysis employs **export data** to estimate the elasticity of demand for cattle hide in the European market. The decision to use export data stems from the fact that nearly 80% of the leather production in Europe is concentrated in two countries, Italy and Spain, which export approximately 70% of their output to **international markets**. Furthermore, in the context of European production, we anticipate that substitution by producers from other countries not affected by the cost shock will be a significant factor, with international trade flows reflecting these dynamics.

The datasets used in this study cover the period from January 2010 to November 2023 and are compiled at a monthly frequency. The data sources and their respective characteristics are as follows:

1. **EU export directed to the top 25 destinations.** This dataset comprises export flows, including value and supplementary unit, from which we derive the **average export price** per square meter. It captures the export trends for leather goods from the **top five EU tanning producers** (Italy, Germany, Spain, France, and Portugal) to their **25 main export destinations** worldwide. These 25 countries, ranked by the value of EU-27 exports of leather, are consistently present in the export flows of the five leading EU players, albeit with varying degrees of market relevance.

   Dataset details. Flow: export. Indicators: value in euros, supplementary quantity, average prices. Product codes include selected HSN codes (v. 2024) for bovine leather (any dimension, excluding sole leather): 41071111, 41071119, 41071190, 41071211, 41071219, 41071291, 41071299, 41071910, 41071990, 41079190, 41079210, 41079290, 41079910, 41079990.

2. **Eurostat production index 2010-2023.** This dataset contains the **Eurostat production indices** for the main European producers in the **client sectors** of leather clothing, leather goods, footwear, and upholstered furniture. The data is seasonally, and calendar adjusted, with 2010 as the base year (2010=100). The production index is a volume index that measures the evolution of value added at factor cost over time and is used to track the output fluctuations in the downstream sector.

   Dataset details. Time frequency: Monthly. Business trend indicator: Volume index of production. Statistical classification of economic activities in the European Community (NACE Rev. 2): manufacture of leather clothes, manufacture of luggage, handbags and the like, saddlery and harness, manufacture of footwear, manufacture of other furniture. Seasonal

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tel. 050 88.39.83-82 - fax 050 883.936
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adjustment: Seasonally and calendar adjusted data. Unit of measure: index with base year 2010=100.

3. **Eurostat export indicators 2010-2023**: To **complement the Eurostat production index** data, particularly for relevant European countries where it might be unavailable, we utilize export flows from all EU countries to the rest of the world for the four client sectors. This dataset provides the monthly value of exports in euros for each country and sector combination. This allows to assess the client sectors' performance in countries with potentially missing or incomplete production data.

   Dataset details. Flow: export. Indicators: value (in Euros). Goods under the HSN codes (v. 2024): 6401, 6402, 6403, 6404, 6405 (footwear and the like); 4202, 4203 (leatherware and the like); 940161, 940171 (leather furniture); 940120 (automotive).
4. **EU imports from the main extra-EU producers 2010-2023**: This dataset encompasses EU import flows, measured in value, from the main extra-EU partners (Brazil, China, India, Mexico, Pakistan, Turkey, and Vietnam) for selected client sectors (manufacture of leather clothes, manufacture of luggage, handbags and the like, saddlery and harness, manufacture of footwear, manufacture of other furniture). **Imports of EU** are used as a **mirror proxy for the production indices** for the client sectors in extra-EU countries.

   Dataset details. Flow: import. Indicators: value (in Euros). Goods under the HSN codes (v. 2024): 6401, 6402, 6403, 6404, 6405 (footwear and the like); 4202, 4203 (leatherware and the like); 940161, 940171 (leather furniture); 940120 (automotive).
5. **USA imports from the main extra-EU producers 2010-2023**: This dataset includes US import flows, measured in value, from the main international partners (Brazil, China, India, Mexico, Pakistan, Turkey, and Vietnam) for selected client sectors (manufacture of leather clothes, manufacture of luggage, handbags and the like, saddlery and harness, manufacture of footwear, manufacture of other furniture). **Imports of US**, combined with those of EU, are used as a **mirror proxy for the production indices** for the client sectors in extra-EU countries.

   Dataset details. Flow: import. Indicators: value (in US dollars). Goods under the HSN codes (v. 2024): 6401, 6402, 6403, 6404, 6405 (footwear and the like); 4202, 4203 (leatherware and the like); 940161, 940171 (leather furniture); 940120 (automotive).

These datasets, encompassing production, exports, and imports, provide a comprehensive perspective on the European cattle hide and leather market and its client sectors. They form the basis for analysing

Istituto di Management
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Piazza Martiri della Libertà, 24 - 56127 Pisa
tel. 050 88.39.83-82 - fax 050 883.936
idm@sssup.it

the elasticity of demand and the potential impact of substitution from international producers in response to the cost shock introduced by Regulation 2023/1115/EU.

4.4 Results

4.4.1 Point Elasticity for the Main EU Producers

According to the proposed methodology (see Figure 1 below), the **short-term elasticity** associated to the demand for leather goods is **estimated to be centred at -1.55**, within the range of (-1.48, -1.63)[6]. In the long term, no significant differences in the dynamics are identified, with a value that settles around -1.65 with the 95% confidence interval ranging from –1.51 to –1.79.

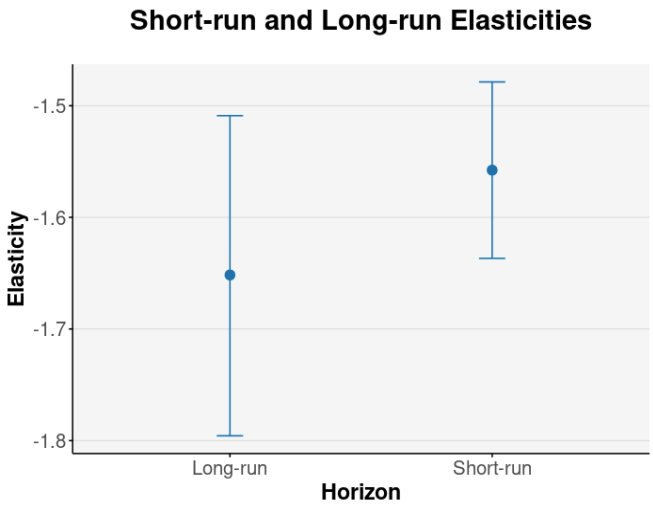

Figure 1 - Elasticity estimates obtained from the model benchmark specification.

4.4.2 Disaggregation by Main Countries

Attempting to identify the specificities of the main producing and exporting countries, within the limits given by the availability of data for a detailed analysis, the estimated elasticities show a certain **heterogeneity across countries**. The demand served by Spain suffers less from the price shock, while higher values are observed for Italy, but still below the aggregate value (driven by significant elasticities for Portugal, Germany, and France).

[6] Range is defined as the 95% confidence interval. For this analysis and the following variations short-run elasticities are presented with 95% theoretical confidence intervals, long-run elasticities are shown with bootstrapped 95% confidence intervals.

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tel. 050 88.39.83-82 - fax 050 883.936
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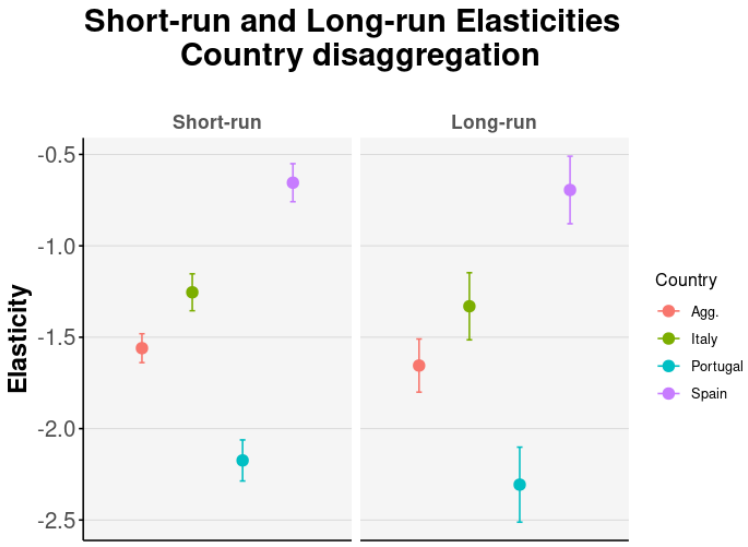

Figure 2 - Elasticity estimates obtained interacting the price-effect with producer-specific effects.[7]

4.4.3 Scenario Analysis of Demand-Price Trajectories

We propose here a variation on the benchmark model which allows for **non-linearities in the price elasticities**. In practical terms, elasticity of demand is not assumed constant within the range of price fluctuations and we the coefficient β to vary in nine **price-buckets**[8]. Using these estimates, we construct a **scenario analysis** to map the evolution of the demand as a consequence of an **incremental cumulated price increase**. The evolution considers possible variations in the elasticity for different price levels. Starting points for the scenario analysis are chosen from three **typical prices**: EU, Italy and Spain average price in 2023.

With minimal variability depending on the starting price, a scenario analysis sees a **collapse** in demand **between 9.3% and 15.5%** in the face of a price increase between 6% and 10%, as documented by interviews with experts.

[7] Aggregate estimates (red) are shown together with producer-specific elasticities for the three major producers.
[8] Price buckets are defined by the extremes (0,15,19,22,23,24,26,28,32,100). The model is linear within each bucket and the estimation is obtained interacting the price-effect with bucket-specific effects.

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Piazza Martiri della Libertà, 24 - 56127 Pisa
tel. 050 88.39.83-82 - fax 050 883.936
idm@sssup.it

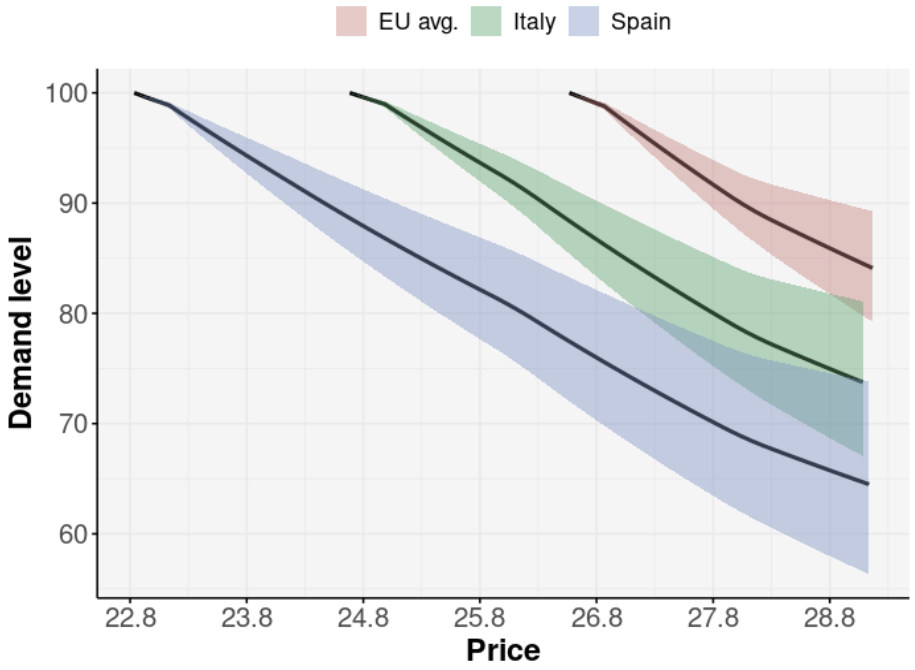

Figure 3 - Scenario analysis with non-linear demand elasticities for three typical prices and different cumulated price increase.

4.5 Qualitative analysis on the economic and social impact of the EUDR

The EUDR will bring about a paradigmatic change in the supply chain of cattle raw materials for European tanners. The impact on availability and prices is very difficult to predict, yet according to the discussions with trade operators in the international leather business during the first semester of 2024 (many of which have been also interviewed for the first part of the study), **many bovine hides/leather supply chains - both EU and extra-EU - might not be ready to comply with the EUDR requirements as of 30 December 2024**, when the Regulation enters into application.

Indeed, the operators upstream in these supply chains might not be capable, in the timeline provided by the EUDR, or willing to build up a traceability system that can geolocate all the establishments where cattle has been hosted since birth.

As a matter of fact, **if an animal tracking system is not already in place in the country concerned (usually for health and meat safety reasons), its setting up from scratch on the sole demand of the leather industry is highly unlikely, having regard the marginal value of hides compared to the entire animal**.

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Piazza Martiri della Libertà, 24 - 56127 Pisa
tel. 050 88.39.83-82 - fax 050 883.936
idm@sssup.it

The annex 1 in attachment presents the state of play of the structure of cattle products exports of EU supplying countries giving insight into the eventual leverage of EU imports of hides, skins and leather on supplying countries. The table highlights that:

- almost all countries supplying hides, skins and leather to the EU are marginal suppliers of meat to the EU (<10% of production). Since meat sales (and not hides sales) drive investments in the livestock sector and no other relevant market asks for traceability of cattle products, it is highly unlikely that hides, skins or leather exports to the EU, representing a tiny value of the entire animal, could lead to the setting up of a cattle traceability system as demanded by the EUDR;
- the countries which heavily depend on hides, skins and leather exports to the EU (> 50%) are relatively minor suppliers. They may have interest to implement a cattle traceability system, but without economies of scale, the costs per hide are likely to be disproportional to the benefit;
- the countries supplying the most important volumes of hides, skins and leather to the EU (see Brazil, United States, etc.), have other export markets not requiring traceability to which they can deviate their goods, erasing their interest to implement a cattle traceability system for EUDR compliance.

Making the necessary investments into a cattle traceability system only with the aim of tracing bovine hides is therefore very unlikely for countries supplying bovine hides, skins or leather to the EU but not meat (or very low quantities). Hides are just a byproduct of the meat industry and their value at the raw stage, when recovered after the slaughterhouse, is very low - from less than 1% to 5% maximum of the total meat value of the corresponding cattle.

Conversely, in **EU countries** where a cattle traceability system back to the birth of the animal is already in place for sanitary reasons, it would need to be complemented with the geolocation data required by the EUDR.

The setting up of a cattle traceability system needs **political will** from the public and private stakeholders, **appropriate technologies** for passing on to the by-products of animal traceability and geolocation data and **sufficient time** for sorting out technical and privacy issues and the testing of schemes. An EUDR transition period of 1-2 years might not be sufficient for most of the key EU hides, skins and leather suppliers.

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Piazza Martiri della Libertà, 24 - 56127 Pisa
tel. 050 88.39.83-82 - fax 050 883.936
idm@sssup.it

In the light of the above, **extra-EU countries** could be all far from qualifying for selling cattle hides and leather in the EU deforestation-free internal market, as almost all of their bovine supply chains do not have an EUDR compliant animal tracking system already in place.

In short, the availability of EUDR-compliant tanners' raw materials as of the end of 2024 will thus depend on the willingness of EU abattoirs to provide geolocation data for cattle hides, and on the capacity of extra-EU supply chains to securely track and trace the chain of custody of cattle since their birth.

Annex 1, further to its usefulness to understand the likely developments in extra-EU supply chains, can also be used to try to estimate the potential impact of the EUDR in the EU leather market.

According to the Eurostat data shown in the table, the EU import of bovine raw hides, wet blue hides and crust hides (all being raw materials for European tanneries) from extra-EU countries in 2023 was respectively 115.160 Tons, 245.989 Tons and 6.398 Tons. As mentioned above, these flows highly risk not to be compliant with EUDR requirements and consequently fail to enter the EU market from 2025 onward, thus creating a significant gap of raw materials for EU tanners.

According to the tanning producers and their discussion with the supply chain actors they estimate that the gap of raw material would determine a decrease of 58.5 million sqm in the European finished cattle leather production, that was estimated to be around 165.4 million sqm in total in 2023. This means that **the worst-case scenario of the potential impact of EUDR risks to be a loss of nearly 35% of the production of the European tanning/leather industry, the closure of the most vulnerable companies and the loss of a substantial number of jobs in the sector** (formed by nearly 1,500 companies and 35,000 employees, with a total annual turnover of 7 billion €).

The above analysis just considers the impact risk of the EUDR on the European tanning industry, but there would be moreover **negative consequences for all the industries supplying EU tanneries** (including chemicals and technology providers) **and for European production of leather manufactured products** (shoes, bags, garments, furniture, etc.). A part of these industries might not be able to source leather, whether they source it from European tanneries or from Extra EU tanneries.

4.6 Task 2 Conclusions

To sum up the results from the three empirical exercises, we highlight that short-term and long-term values are similar, and we expect that the shock is not absorbed in the long run given the **permanent**

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Piazza Martiri della Libertà, 24 - 56127 Pisa
tel. 050 88.39.83-82 - fax 050 883.936
idm@sssup.it

loss in competitiveness in international markets. Given a persistent decline in the demand, social impact on historical similar non-transitory shocks can be used to analyse the effect on employment.

A **decrease in demand of around 15%** is likely to have significant consequences for employment and other social aspects in the leather industry. It is important to note that a decrease of a similar magnitude in **international markets** was experienced by Italy and Spain only in 2012 during the debt crisis (demand shock of 18% and 26%, respectively).

The persistent nature of the shock suggests that the industry may **face long-term challenges in maintaining its workforce and supporting local communities** that depend on leather production. Further research is needed to quantify the specific effects on employment and to identify the most effective strategies for addressing the social consequences of the demand shock.

In conclusion, the proposed analysis provides important insights into the **potentially severe impacts** that the enactment of **Regulation 2023/1115/EU** may have on the European leather goods industry. By creating a supply shock that increases cattle hide costs for producers, the regulation is estimated to **reduce quantity demanded for leather products by 9-15% in the short run** based on a relatively elastic demand elasticity of around -1.55. Notably, this contraction in demand appears likely to persist long-term rather than be a temporary shock, with the long-run elasticity estimated at -1.65. There is some regional variation, as Spain's leather demand seems somewhat less elastic to price changes compared to Italy's. However, an overall demand drops of 9-15% which is unlikely to be reabsorbed by producers could be disruptive for local economies heavily reliant on leather production and exports, mirroring the major downturn seen during the European debt crisis a decade ago.

While utilizing detailed trade data allows capturing dynamics across countries and sectors, the elasticity estimates could be biased if international substitution patterns differ substantially from historical norms after this regulatory shock. Additionally, estimating a constant elasticity may oversimplify if demand responses are highly non-linear to levels which could not be captured by the price bucket exercise. The demand contraction scenarios also do not account for potential firm pricing power that could mitigate upstream cost pass-through. Despite these caveats, the stark results underscore the need for further analysis quantifying potential job losses and identifying policies to support affected workers and communities as this supply shock ripples through the industry.

The qualitative analysis delves into the potential economic and social ramifications, focusing on the availability and pricing of bovine hides and leather, which are central to the European leather industry. Key challenges arise from the EUDR's stringent traceability requirements, which demand geolocation

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Scuola Superiore Sant'Anna

Piazza Martiri della Libertà, 24 - 56127 Pisa
tel. 050 88.39.83-82 - fax 050 883.936
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data for cattle from birth. Many extra-EU and even some EU supply chains may **struggle to comply with these regulations due to the lack of existing animal tracking systems**. The leather industry, as a marginal component of the overall cattle value chain, is unlikely to drive the creation of such systems in countries where they are not already in place. Consequently, hides, often a byproduct of the meat industry, may **not justify the cost of implementing traceability systems** solely for EUDR compliance.

Countries heavily dependent on exports of hides, skins, and leather to the EU may attempt to meet the requirements, but th**e costs associated with setting up traceability systems could outweigh the benefits, especially for smaller suppliers.** Larger suppliers like Brazil and the United States may choose to **divert their exports to non-EU markets** that do not require traceability, further reducing the availability of EUDR-compliant raw materials.

The EUDR's effects extend beyond the tanning industry, **potentially disrupting supply chains for chemicals, technology providers, and manufacturers of leather goods** (shoes, bags, garments, furniture). These industries may struggle to source leather, whether from European or extra-EU tanneries.

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Scuola Superiore Sant'Anna

Piazza Martiri della Libertà, 24 - 56127 Pisa
tel. 050 88.39.83-82 - fax 050 883.936
idm@sssup.it

5. Task 3: Analysis of the environmental effects on the leather sector resulting from the introduction of Regulation 2023/1115/EU

Carrying out a Life Cycle Assessment (LCA) analysis of the environmental effects on the leather sector resulting from the introduction of Regulation 2023/1115/EU is crucial in order to provide a comprehensive assessment of environmental impacts across the entire lifecycle of leather products, from raw material extraction through production, use, and disposal. This comprehensive approach ensures that all stages are considered, helping to identify any shifts in environmental burdens that the new regulation might cause.

For policymakers, LCA provides critical data that can inform the development and adjustment of environmental regulations. It ensures that regulations are based on a thorough understanding of environmental impacts, helping to craft policies that effectively address the most pressing environmental issues in the leather sector.

When it comes to environmental effects, there are several aspects to consider, both in terms of the different ways in which a product or service can affect the environment, i.e. the steps it goes through to perform the function responsible of those impacts, and in terms of the different types and forms of environmental impacts that can be caused.

The LCA methodology can help us answer this complex issue, providing a scientific identification and measurement of the potential environmental impacts of products and services.

The following paragraph provides a brief description of the LCA methodology, the illustration of the study conducted to analyse the environmental effects on the leather sector resulting from the introduction of Regulation 2023/1115/EU, and the assessment and interpretation of the results.

5.1 Life Cycle Assessment methodology

Life Cycle Assessment (LCA) is an analytical and systematic methodology used to evaluate the potential environmental impact of a product or service throughout its life cycle. In fact, this operational procedure is based on the concept of Life Cycle Thinking (LCT) or Life Cycle Approach: a way of observing and assessing, in this case, the environmental impacts generated in all the stages through which a product or service reaches its function (design, procurement and supply chain, production, packaging, inbound and outbound logistics, use or consumption and end of life).

In addition, this LCA approach considers a wide range of impact indicators that can be used to assess the environmental impact of the processes under study, both on natural systems and on specific global

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Scuola Superiore Sant'Anna

Piazza Martiri della Libertà, 24 - 56127 Pisa
tel. 050 88.39.83-82 - fax 050 883.936
idm@sssup.it

and regional environmental issues (e.g. greenhouse effect, water footprint, non-renewable resources, etc.).

The results of an LCA analysis are returned in the form of environmental impact values, organised according to different categories (e.g. climate change, ozone depletion, eutrophication, acidification, water use, etc.), associated with each stage of product development and the entire life cycle.

At the international level, this methodology is regulated by the ISO 14040 series of standards, which define the steps through which the assessment work should be structured.

The LCA framework operates with four separate phases (Hauschild et al., 2018):

1. Definition of the goal and scope
2. Life Cycle Inventory (LCI) analysis
3. Life Cycle Impact Assessment (LCIA)
4. Life cycle interpretation

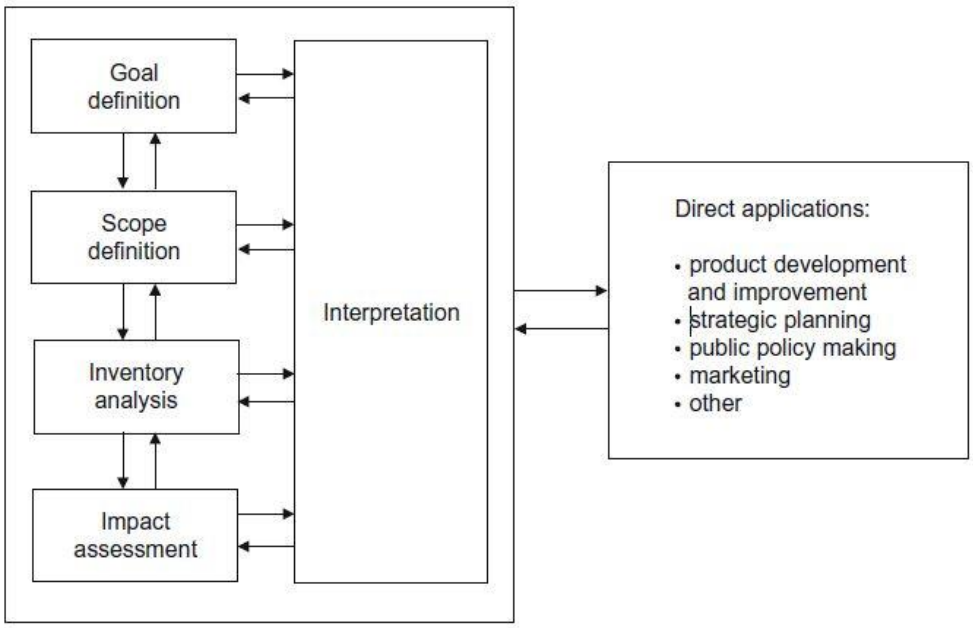

Figure 4 - Framework of the LCA modified from the ISO 14040 standard.

At European level, the strategic importance of its adoption as a scientific tool for the identification of environmental impacts is expressed in the Green Paper on Integrated Product Policy COM (2001) 68 and COM (2003) 302, in the European regulations EMAS (Reg. 1221/2009), in Ecolabel (Reg. 61/2010) and in the recent proposal on Green Claims Directive COM (2023) 166.

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Scuola Superiore Sant'Anna

Piazza Martiri della Libertà, 24 - 56127 Pisa
tel. 050 88.39.83-82 - fax 050 883.936
idm@sssup.it

5.2 Goal of the study

5.2.1 Intended application

The implementation of the Regulation 2023/1115/EU will have an impact on the leather market by causing a geographical shift in production, as leather finished articles are not covered by the proposal, and imports of leather articles from non-EU competitors, based on hides and skins at risk of deforestation, will continue without any due diligence obligation. In parallel, there may be an increase in the production of leather substitutes, but the contribution in terms of environmental impact is still uncertain and vague.

The present LCA study is intended to shed light on the environmental consequences of the implementation of the Regulation by comparing the business-as-usual scenario, hereafter referred to as baseline scenario with two alternative scenarios, representing plausible responses of the market to the introduction of the Regulation.

5.2.2 Baseline and alternative scenarios

The baseline scenario is based on primary data on raw hides and skins EU volumes of import in 2023 from USA and Brazil. The entire quantity of products reaching the European market is transformed by European tanneries into finished leather. The tanning process considers a mix of different technologies, such as chrome, vegetable and free of chrome tanning, representing the average European scenario, as described in Product Environmental Footprint Category Rules (PEFCR) for leather (Rosa-Giglio et al., 2018), with reference to the Representative Product 2 (RP2): Leather for upper footwear and leather goods (e.g. bags, belts, wallets, …).

The first alternative scenario, hereafter referred to as "A scenario", considers that the same volume of raw hides and skins leaving US and Brazilian slaughterhouses are sold and processed in China and then finished leather is sold and distributed in Europe.

The second alternative scenario, hereafter referred to as "B scenario", considers that the same volume of raw hides and skins leaving US and Brazilian slaughterhouses follows different streams:

- US raw hides and skins are sold to inhouse tanneries (15%), to Chinese tanneries (65%) and the remaining 20% goes to end of life in US treatment plants, of which 15% is supposed to be biowaste incineration and 5% open dump landfilling.

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tel. 050 88.39.83-82 - fax 050 883.936
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- Brazilian raw hides and skins are sold to Chinese tanneries (80%) and the remaining 20% goes to end of life domestic treatment plants, of which 5% is supposed to be biowaste incineration and 15% open dump landfilling.
- In addition, an extra production of an equivalent amount of polyurethane leather-like material (PU LLM) is produced in Europe to fulfil the domestic demand of leather.

5.2.3 Main limitations

Considering the purpose of this study and in order to respect the principles of transparency and consistency, this paragraph highlights some limitations of the study, that nonetheless do not hinder the quality of the results or the reliance of the scientific approach adopted.

System boundaries are "cradle to tannery/end of life treatment plant gate" including all the environmentally relevant processes. Considering raw hides and skins as a waste product resulting from farming activities, all livestock-stage processes are excluded from the system boundaries and the slaughterhouse is considered the "cradle" of the product life cycle. Moreover, the upstream part is excluded because hides would be produced any way in all the scenarios considered. The upstream effect would therefore be common and equal to all of them. The downstream phase of tanned raw hides and skins and the related impacts, considering further manufacturing into finished consumer products, distribution to customers, use phase and end-of-life treatment of used products have not been included in the system boundaries. For this reason, transportation of finished leather to the following production stages and all the subsequent distribution processes are also out of the scope of this document. The limit is that, especially in the context of B scenario, the durability is not taken into account and does not have any influence on the life cycle impact assessment of leather and its alternative product made of PU LLM.

This study does not analyse the actual availability of alternative materials to bovine leather, of which only PU is taken into consideration, and the willingness of consumers to choose leather products made of those alternatives.

Some processes are modelled using proxy data, more details can be found in Data collection procedures, documentation of unit process data and modelling assumptions chapter.

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5.3 Scope of the study

5.3.1 Function, functional unit and reference flow

The unit of analysis is 1 kg of bovine raw hides and skins leaving US and Brazilian slaughterhouses and considering tanneries activities and end of life treatment alternatives as the use and the end-of-life stages of the product life cycle, respectively.

5.3.2 System boundaries and system boundaries diagram

Within this study, the lifecycle of bovine raw hides and skins starts with the slaughterhouse process, so within the upstream phase the elements considered are slaughterhouse consumptions and emissions and the activities related to hides and skins preservation.

At the slaughterhouse animals are professionally slaughtered and flayed (separating the hides or skins from the carcases).

At the preservation site, immediately after the animal has been slaughtered, the flayed skin is subjected to preservation processes to avoid putrefaction. Preservation, salting or drying, is carried out in the slaughterhouse or by specialized companies. The hide or skin can also be stored for up to 10-12 days by cooling (+2 ºC).

The core phase includes different activities depending on the scenario, so the elements considered are:

- Supply transportation of raw hides and skins to tanneries, both domestic (USA) and foreign (Europe and China) ones;
- Tanneries consumptions and emissions;
- Raw hides and skins incineration;
- Raw hides and skins landfilling in open dump.

At the tannery, hides and skins are chemically and physically treated to make them imputrescible. The tanning process is very complex and consists of a range of chemical and mechanical operations. All chemical operations, up to the finishing, are typically carried out in a rotating tannery drum, containing the hides or skins and the required water and chemicals.

Downstream processes of tanned leather such as further manufacturing into finished consumer products, distribution to customers, use phase and end-of-life treatment of used products are excluded.

The product system is schematically illustrated in Figure 5.

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Transportations are omitted for clarity, however transportations between each phase are included in the system boundaries, in particular:

- Transportation from slaughtering to preservation;
- Transportation from preservation to tannery;
- Transportation from slaughtering to end of life treatment plants.

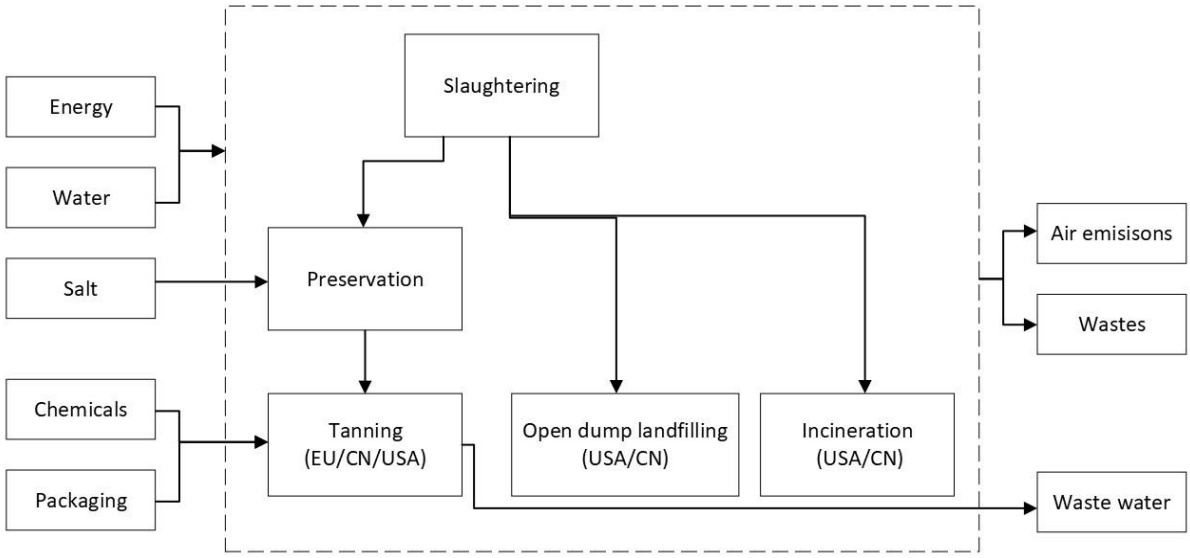

Figure 5 - *System boundaries.*

5.3.3 Treatment of multi-functionality

Multi-functionality occurs in different stages in the life cycle of finished leather.

At the slaughterhouse stage: multi-functionality has been treated in accordance with what has been established by the A1 Report "Baseline Approaches for the Cross-Cutting Issues of the Cattle Related Product Environmental Footprint Pilots in the Context of the Pilot Phase 2013-2016" prepared by Directorate-General Environment (DG ENV) in the context of the Environmental Footprint Pilot phase, defining the environmental impacts allocation factors used in the present study (see Table 8)

At the tannery stage: the impact of the tanning process to the different co-products has been allocated according to the distribution of the hide substance among the co-products. The average values considered are shown in Table 8.

Slaughterhouse	Fresh meat and edible offal	92.9%
	Food grade bones	1.0%
	Food grade fat	1.8%

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	Cat. 3 slaughter by-products	0.8%
	Hides and skins	3.5%
	Cat 1/2 material and waste	0.0%
Tanning	Finished leather	63%
	Leather co-products	37%

Table 8 – Bovine slaughtering and tanning allocation factors.

5.3.4 Impact assessment method

The impact assessment method used is the Environmental Footprint 3.1, adapted to better correspond with the substances used in the SimaPro data libraries. It is the method adopted in the Environmental Footprint (EF) transition phase of the European Commission and includes 16 impact categories and the normalization and weighting factors published in July 2022.

Data collection procedures, documentation of unit process data and modelling assumptions:

Raw hides and skins activity data on 2023 production in USA and Brazil slaughterhouses are primary data collected by COTANCE.

Bovine slaughtering process has been modelled based on Life Cycle Inventory (LCI) data available in the chapter "Description of the slaughtering and tanning process" by Puig et al. (2007). The process has been made country specific using national electricity mix and water sources.

Hide/skin preservation process has been modelled using UNIC Environmental Department data collected from one Italian supplier in 2013. Hide/skin preservation process has been made country specific using national electricity mix and water sources.

Transport has been modelled calculating the supply distances from countries of origin of raw hides and skins to finished leather producing countries using:

- Google Maps (https://maps.google.com/) for road distances;
- Sea Rates (http://www.searates.com/) for sea distances.

For what it concerns supply by ship, main ports of interested countries have been assumed to be port of origin and destination for supply transportations. 1000 km have been assumed as distance by truck to cover:

- transportation of raw hides and skins from producer to port of origin of the shipment:

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- transportation of raw hides and skins from destination port to leather producer.

No primary information was available on vehicles (type and technology, fuel and loading) used for raw hides and skins supply to the tanneries. For these reasons, the following Ecoinvent market inventories have been used:

- Ship: "Transport, freight, sea, transoceanic ship {GLO}| market";
- Truck: "Transport, freight, lorry 16-32 metric ton, EURO3 {GLO}| market". It has been assumed that EURO 3 reflects the average market technologies in the involved countries.

The distance between slaughterhouses and waste treatment facilities has been assumed to be 100 km and the Ecoinvent market dataset used is: "Municipal waste collection service by 21 metric ton lorry {GLO}| market".

Tanning process has been modelled using primary data on tanning process technologies available for Italy, covering 66% of European leather production and 51% of European leather consumption. The LCI data used in the present study are based on two studies conducted by UNIC in 2014 aiming at assessing the environmental footprint of the average m2 of leather produced in Italy, in tanneries operating in Campania, Tuscany and Veneto regions districts. The Italian datasets (UNIC, 2014) is the more complete datasets available for modelling tanning processes. For example, it includes more than 70 different classes of chemicals, whereas commonly only the consumption of a few chemicals is reported in published studies.

As stated in the Leather PEF screening report in the context of the EU Product Environmental Footprint Category Rules (PEFCR) Pilots, different considerations apply to Italian datasets as a good proxy of tanning processes performed in European and extra-European countries.

In particular, with reference to non-European modelling, one of these considerations is that, although it is not possible to perform a comprehensive study of the current state of the tanning industry in extra-EU tanneries, in some documents taken as reference for the tanning technologies in Pakistan and India (i.e. "Tannery of the Year Asia 2013: Finalist" reports for Pakistan and "Tannery of the Year Asia 2009: Finalist" reports for India) there is a strong evidence that it is possible to draw comparisons between the commitment to technological innovation and environmental best practice of the best tanneries in these countries and their counterparts in Italy and other parts of Europe. An important part of the evidence for this is the predominance of Italian technology (between 60% and 70%). Moreover, tanning machinery that rival companies are producing in cheaper locations, including Brazil and China, is based on Italian technology.

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tel. 050 88.39.83-82 - fax 050 883.936
idm@sssup.it

For these reasons, Italian datasets have been used as a basis for modelling European and extra-European tanning processes after the following adaptations:

- Country specific well water is used for each country;
- Country specific electricity mix is used for each country;
- Country specific raw material suppliers are selected for each country;
- When available, country specific natural gas and diesel are used for each country.

Extra-European tanning processes modelled in the PEF Screening study refer to India and Pakistan. In the context of the present study, assuming China as the major extra-European player for the tanning activities, it has been modelled as an average of Pakistan and India models.

The conversion factor of raw hides and skins into finished leather used is 7,41 kg/m^2 (Rosa-Giglio et al., 2018)

Incineration treatment has been modelled considering the absence of energy recovery and assimilating raw hides and skins to hazardous waste. The Ecoinvent dataset used is: "Hazardous waste, for incineration {RoW}| treatment of hazardous waste, hazardous waste incineration | Cut-off, U".

Landfilling of raw hides and skins has been modelled considering a non-conventional facility. The Ecoinvent dataset used is: "Biowaste {RoW}| treatment of biowaste, open dump | Cut-off, U".

Polyurethane leather-like material (PU LLM) production has been modelled based on LCI data available in Ferreira da Silva (2023), that elaborates primary data of the study by Xia et al. (2007) and direct measurements of the average surface mass (kg/m2) of some samples of PU LLM of different thickness and finishings.

5.4 Life cycle impact assessment (LCIA) results

5.4.1 LCIA methodological approach

An impact assessment has been performed for all default impact categories of EF 3.1 method and using the LCA software SimaPro 9.5. The results obtained are characterised impact scores. The characterisation consists in the quantification of the relationship between inventory data and impact categories, using appropriate characterisation factors and resulting in the calculation of indicators for each impact category.

The characterised impacts have been normalised and weighted to identify and analyse the most relevant results. The normalization is the stage of LCIA in which the impacts calculated are compared

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tel. 050 88.39.83-82 - fax 050 883.936
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to the impacts from other human activities, e.g. different products in a comparative assessment and/or background impacts (per person) in a reference year. The weighting provides comparison across the impact categories by using weighting factors that for each impact category give a quantitative expression of how severe an impact is compared to the other impact categories (Hauschild et al. (2018)).

Quantitative weighting allows aggregation of all the weighted impact scores into one overall environmental impact score for the product system, that may be useful when the results of the LCA are used in decision supported together with other condensed information like the economic costs of the alternatives (Hauschild et al. (2018)).

The most relevant impact categories have been identified as the first five impact categories that contribute the most to the overall environmental impact of the assessed scenarios.

The most relevant results of the comparative life cycle assessment of the three scenarios are described in the Baseline and alternative scenarios chapters presented below.

The results are referred to the FU of the present study, defined as 1 kg of bovine raw hides and skins leaving US and Brazilian slaughterhouses and following different streams according to the scenarios.

5.4.2 Baseline and Scenario A comparison

The most relevant characterized results are presented in Table 9, and the comparison of the two scenarios in terms of percentage values are shown in Figure 6.

Impact category	Unit	Baseline	Scenario A
Acidification	mol H+ eq	1.27E-02	2.33E-02
Climate change	kg CO_2 eq	1.90	2.65
Particulate matter	disease inc.	1.05E-07	1.50E-07
Resource use, fossils	MJ	27.06	35.66
Resource use, minerals and metals	kg Sb eq	2.03E-05	2.48E-05

Table 9 – Baseline vs Scenario A, most relevant environmental impact results.

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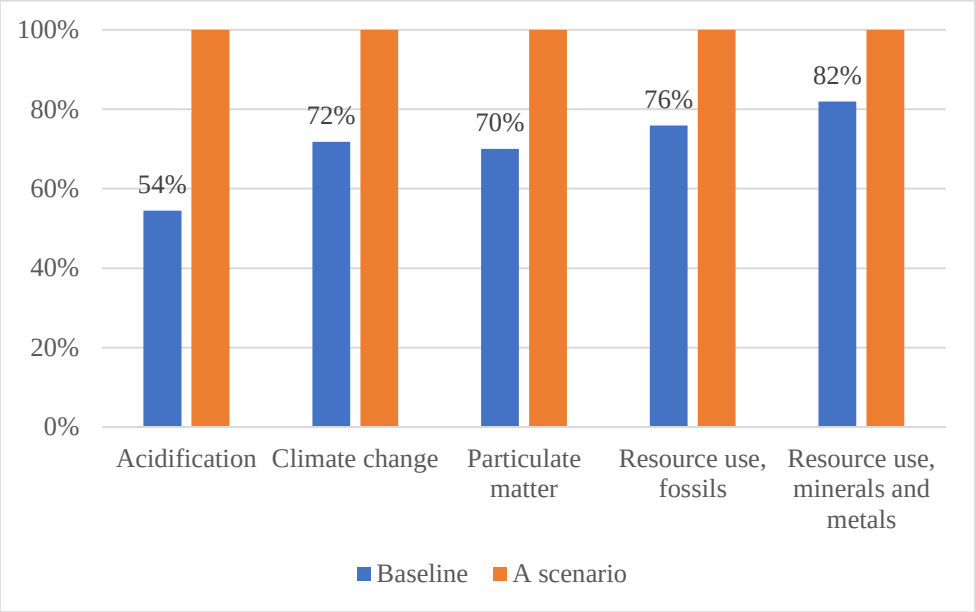

Figure 6 - Baseline vs Scenario A – LCIA characterized results in %.

The weighted single scores resulting from the sum of all 16 environmental impact weighted scores of the two scenarios are:

- Baseline scenario: 204 µPt
- A scenario: 286 µPt

5.4.3 Baseline and Scenario B

The most relevant characterized results are presented in Table 10 and the comparison of the two scenarios in terms of percentage values are shown in Figure 7.

Impact category	Unit	Baseline	Scenario B
Acidification	mol H+ eq	1.27E-02	1.63E-02
Climate change	kg CO_2 eq	1.90	2.84
Particulate matter	disease inc.	1.05E-07	1.31E-07
Resource use. fossils	MJ	27.06	37.84
Resource use. minerals and metals	kg Sb eq	2.03E-05	2.34E-05

Table 10 – Baseline vs Scenario B. most relevant environmental impact results.

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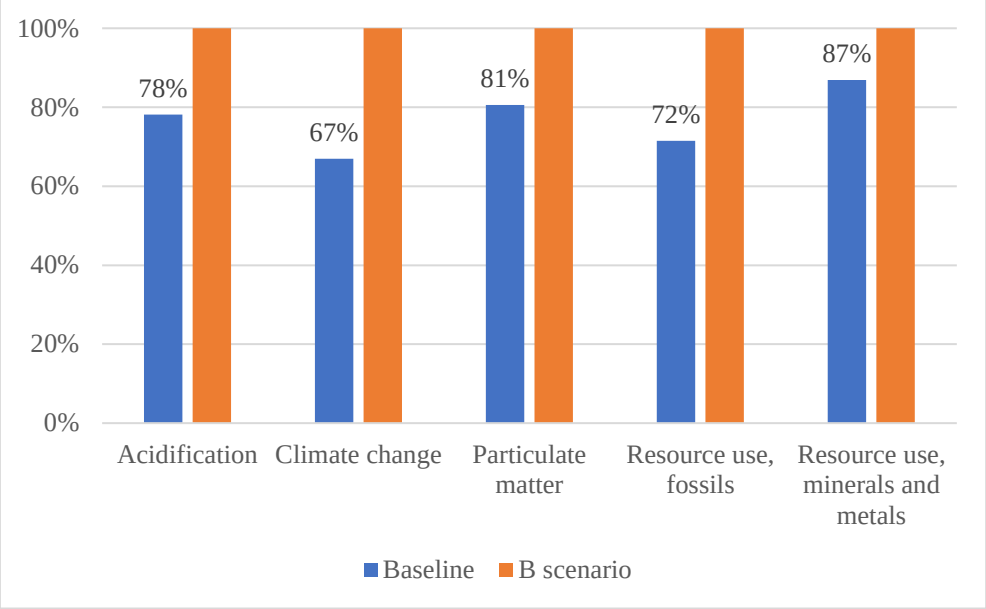

Figure 7 - Baseline vs Scenario B – LCIA characterized results in %.

The weighted single scores resulting from the sum of all 16 environmental impact weighted scores of the two scenarios are:

- Baseline scenario: 204 µPt
- B scenario: 278 µPt

5.4.4 Baseline, Scenario A and Scenario B comparison

The comparison of the three scenarios is presented in the following Table 11 and Figure 8.

Impact category	Unit	Baseline	Scenario A	Scenario B
Acidification	mol H+ eq	1.27E-02	2.33E-02	1.63E-02
Climate change	kg CO_2 eq	1.90	2.65	2.84
Particulate matter	disease inc.	1.05E-07	1.50E-07	1.31E-07
Resource use. fossils	MJ	27.06	35.66	37.84
Resource use. Minerals and metals	kg Sb eq	2.03E-05	2.48E-05	2.34E-05

Table 11 – Baseline vs. Scenario A vs. Scenario B. most relevant environmental impact results.

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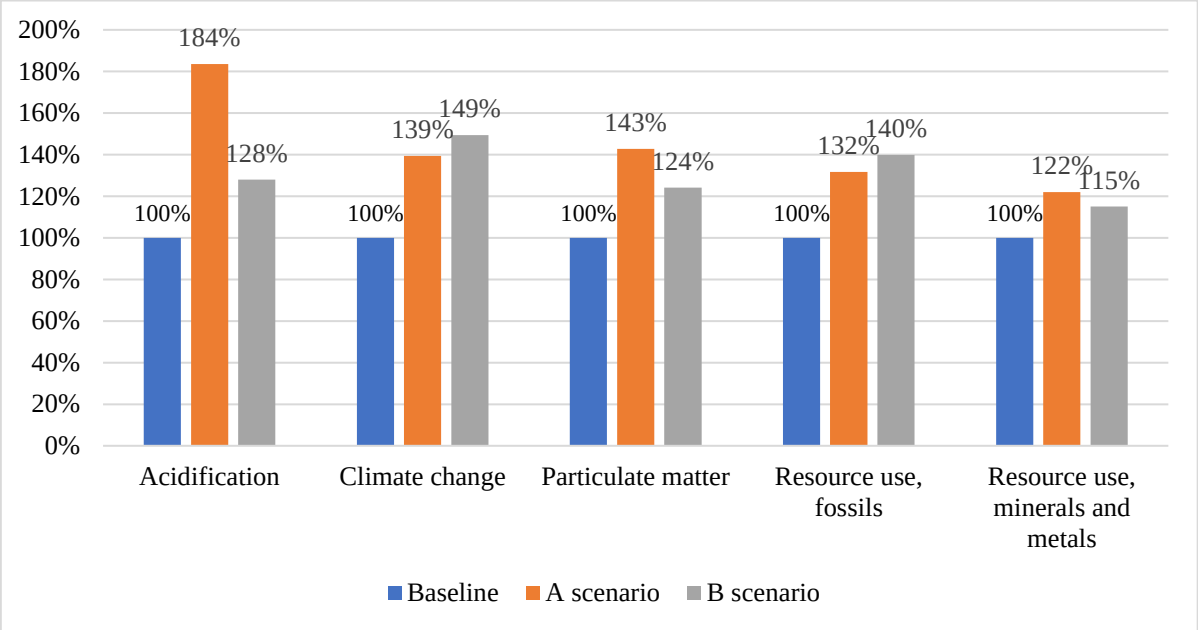

Figure 8 - Baseline vs. Scenario A vs. Scenario B – LCIA characterized results in %.

5.5 Interpretation

In order to identify where the majority of the effects are to be found, it is important to better investigate the results. The following paragraph illustrates the environmental hotspot analysis.

5.5.1 Environmental hotspot analysis

The aim of the environmental hotspot analysis is to highlight the life cycle (LC) stages and processes responsible of the major impacts in most relevant impact categories.

Each scenario has been analysed and the results are presented in the following tables and figures.

Impact category	Unit	Total	Preservation	Slaughtering	Tanning	Transport
Acidification	mol H+ eq	1.27E-02	8.31E-04	5.40E-05	**9.91E-03**	**1.92E-03**
Climate change	kg CO_2 eq	1.90	0.11	0.01	**1.66**	0.12
Particulate matter	disease inc.	1.05E-07	8.49E-09	8.49E-10	**8.50E-08**	**1.09E-08**
Resource use. fossils	MJ	27.06	1.41	0.16	**23.69**	1.80
Resource use. minerals and metals	kg Sb eq	2.03E-05	1.43E-06	1.84E-08	**1.87E-05**	1.21E-07

Table 12 – Baseline scenario hotspot analysis. most relevant LC stages.

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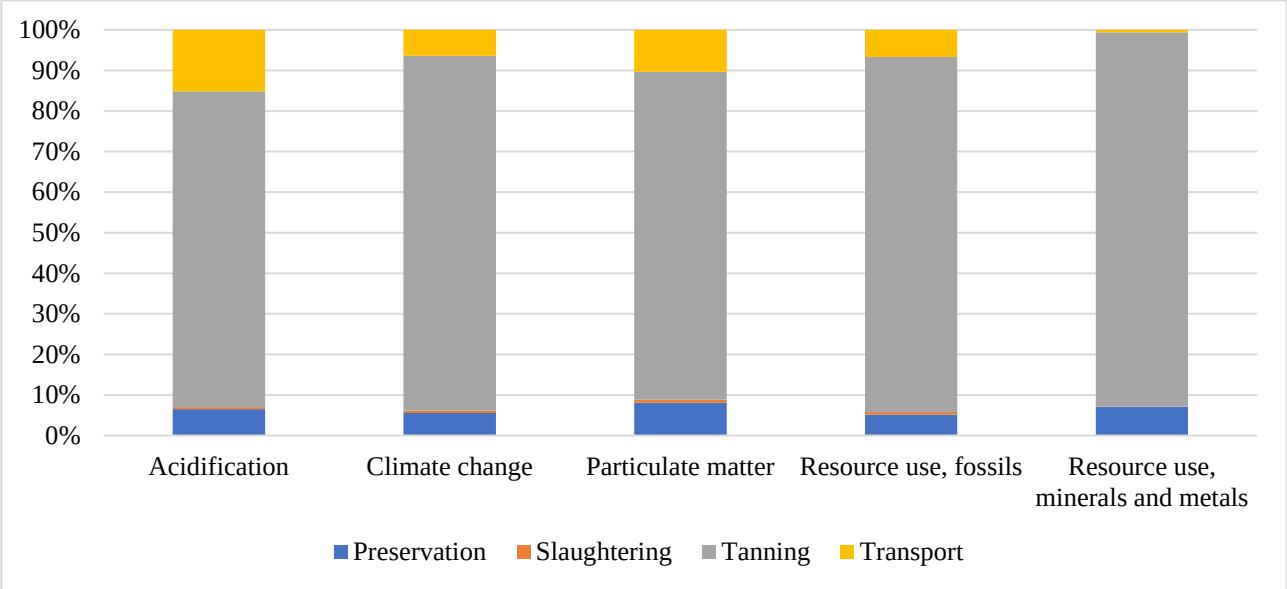

Figure 9 - Baseline scenario hotspot analysis, most relevant LC stages.

In the baseline scenario, in all most relevant impact categories, the tanning process is the most relevant activity, causing impacts ranging from 78% in Acidification to 92% in Resource use, minerals and metals categories. Transport is the second most relevant process, with 10% of impacts in Particulate matter and 15% in Acidification categories.

Impact category	Unit	Total	Preservation	Slaughtering	Tanning	Transport
Acidification	mol H+ eq	2.33E-02	8.31E-04	5.40E-05	**1.20E-02**	**1.04E-02**
Climate change	kg CO_2 eq	2.65	0.11	0.01	**1.96**	**0.57**
Particulate matter	disease inc.	1.50E-07	8.49E-09	8.49E-10	**9.73E-08**	**4.36E-08**
Resource use, fossils	MJ	35.66	1.41	0.16	**25.64**	**8.45**
Resource use, minerals and metals	kg Sb eq	2.48E-05	1.43E-06	1.84E-08	**2.28E-05**	4.89E-07

Table 13 – Scenario A hotspot analysis. most relevant LC stages.

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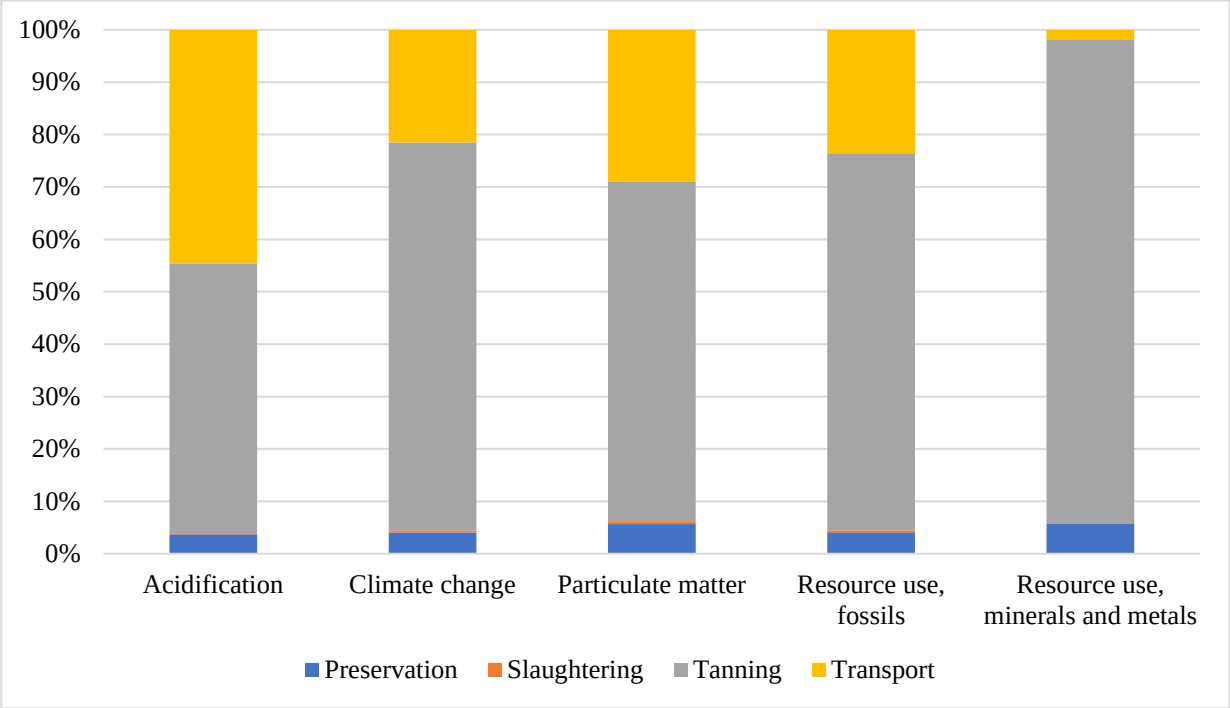

Figure 10 – Scenario A hotspot analysis, most relevant LC stages.

In Scenario A, the most relevant processes are the same as in the baseline, but show different contributions to the most relevant impact categories, apart from Resource use, minerals and metals. The tanning impact ranges from 52% in Acidification to 92% in Resource use, minerals and metals. Transport contribution to the impact categories is higher in this second scenario, ranging from 22% in Climate change to 45% in Acidification.

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Impact category	Unit	Total	Slaughtering	Preservation	Tanning USA	Tanning CN	Transport	EOL (composting and landfill)	PU LLM extra EU production
Acidification	mol H+ eq	1.63E-02	4.32E-05	6.64E-04	1.45E-03	**7.83E-03**	**3.12E-03**	5.22E-04	**2.63E-03**
Climate change	kg CO_2 eq	2.84	0.01	0.08	0.26	**1.27**	0.19	**0.40**	**0.61**
Particulate matter	disease inc.	1.31E-07	6.79E-10	6.79E-09	1.33E-08	**6.33E-08**	**1.66E-08**	5.53E-09	**2.44E-08**
Resource use, fossils	MJ	37.84	0.13	1.12	**3.64**	**16.67**	2.81	1.75	**11.72**
Resource use, minerals and metals	kg Sb eq	2.34E-05	1.47E-08	1.14E-06	**3.01E-06**	**1.49E-05**	1.60E-07	4.81E-07	**3.71E-06**

Table 14 – Scenario B hotspot analysis. most relevant LC stages.

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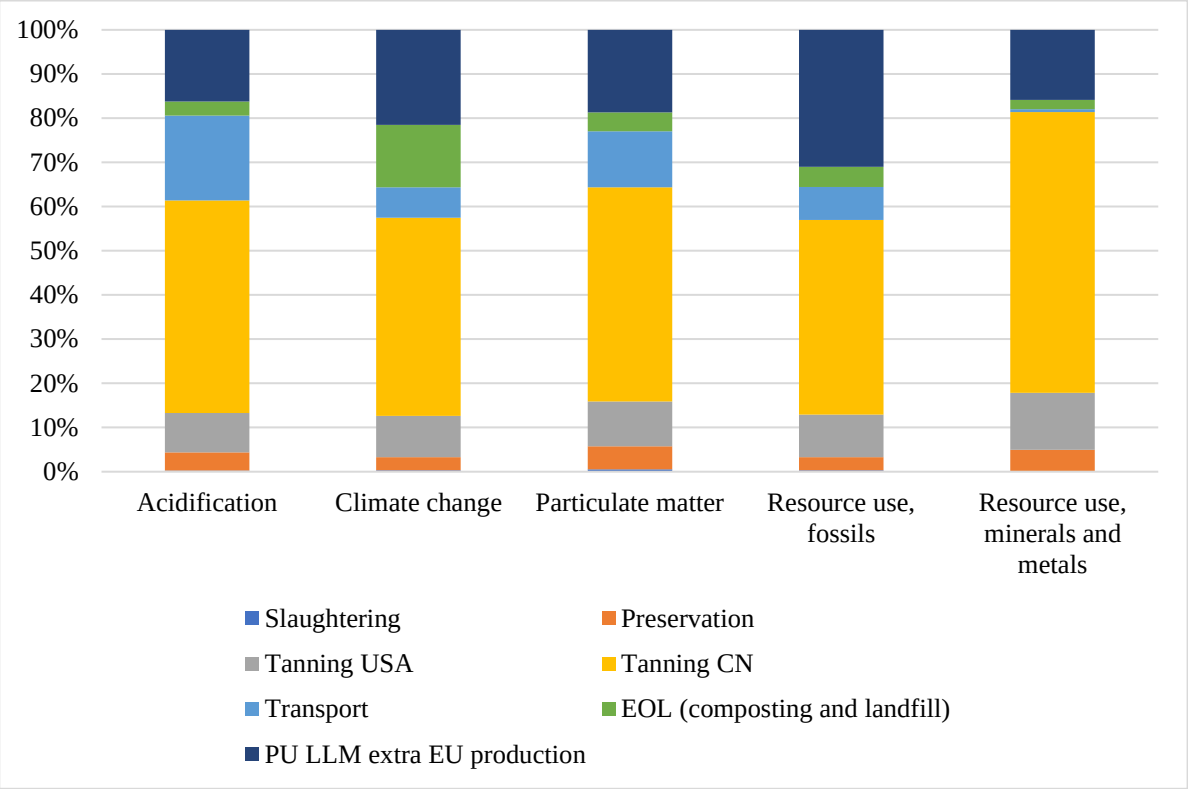

Figure 11 – Scenario B hotspot analysis, most relevant LC stages.

In B scenario the most relevant processes for all most relevant impact categories are tanning in China (CN) and the extra-production on PU LLM in Europe. Impacts of the Chinese tanning range from 44% in Resource use, fossils to 64% in Resource use, minerals and metals. Impacts of PU LLM range from 16% in Resource use, minerals and metals to 31% in Resource use, fossils. Transport is relevant for Acidification (19%) and Particulate matter (13%) categories; tanning in USA is relevant for Resource use categories (10% for fossils and 13% for minerals and metals) and End of Life (EOL) activities, such as incineration and open dump landfilling of raw hides and skins, are relevant for climate change (14%).

5.5.2 Considerations about durability

In the context of this life cycle assessment study, downstream activities – such as further manufacturing of tanned leather and PU LLM intermediate products into finished consumer products, distribution to customers, use phase and end-of-life treatment of used products – are excluded. As a result, ignoring the different durability of different raw materials, i.e. genuine leather and other leather like materials (LLM), could lead to an incomplete and misleading impact assessment. Physical properties like durability are important to be accounted for because they are perceived drawbacks for LLMs (Nithyaprakash et al., 2020; Ramchandani & Coste-Maniere, 2020).

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As reported in the "International Fair Claims Guide For Consumer Textiles Products" (Drycleaning Institute of Australia Ltd (2015)), the textile life expectancy rates vary considerably in relation to the type of finished product and the type of fabric used. Considering the product group "coats, jackets and blazers", plastics show a 2 year life expectancy, whilst leather has a 5 year life expectancy. Considering "upholstery fabrics", vinyl (assumed similar to plastic LLM) has 2 year life expectancy and leather 10 years.

In order to assess the environmental impacts of different leather fabrics (genuine and LL plastic materials) used for different purposes (coat and upholstery) and showing a different life expectancy, two life cycle comparative studies were conducted. The functional unit is 1 m2 of fabric and in case of plastic LLM it is multiplied first by the coefficient 2,5 and then by the coefficient 5, in the case respectively of coat and upholstery fabric production, to consider its shorter life expectancy compared to that of genuine leather.

The results of the studies are presented in the following Table 15 and Figure 12.

Impact category	**Unit**	**Baseline**	**PU LLM – coat (coeff. 2,5)**	**PU LLM - upholstery fabric (coeff. 5)**
Acidification	mol H+ eq	9.42E-02	5.08E-02	1.02E-01
Climate change	kg CO_2 eq	14.08	11.79	23.57
Particulate matter	disease inc.	7.80E-07	4.71E-07	9.42E-07
Resource use, fossils	MJ	200.55	225.96	451.92
Resource use, minerals and metals	kg Sb eq	1.51E-04	7.15E-05	1.43E-04

Table 15 – LCA results of different leather fabrics, considering durability.

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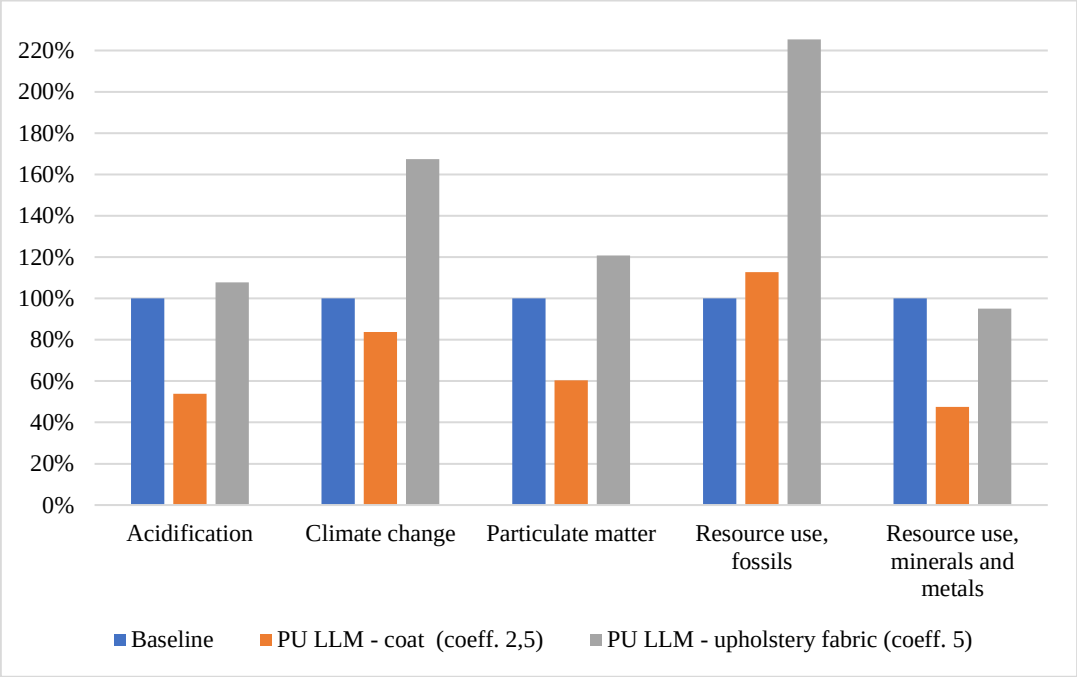

Figure 12 – LCA results of different leather fabrics, considering durability.

5.6 Task 3 Conclusions

The LCA analysis conducted highlights that all alternative scenarios that could arise after the introduction of the Regulation 2023/1115/EU lead to an increase in potential environmental impacts. **The overall environmental footprint of the alternative scenarios is 40% (A scenario) and 36% (B scenario) higher than the environmental single score of the baseline scenario, that represents the business-as-usual situation**.

When considering the extra production of alternative leather-like materials to compensate the shift of production of genuine bovine finished leather from European to extra-European countries, durability is an important issue that should be taken into account for a comprehensive and reliable comparative study.

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6. Overall conclusion

This study has undertaken a comprehensive examination of the implications of including leather within the scope of Regulation 2023/1115/EU, which aims to establish deforestation-free supply chains in the EU. The analysis has been multifaceted, considering the technical-scientific, socio-economic, and environmental dimensions of such a regulatory change. The primary conclusions are drawn from a critical review of existing literature, stakeholder interviews, and scenario-based analyses.

The **technical-scientific review** substantiated the well-documented link between cattle raising and deforestation. However, it revealed **a significant gap in direct evidence linking leather production to deforestation**. While some authors hypothesize an indirect link due to the economic value of leather as an export product, no quantitative data or rigorous analysis supports this claim. The consensus among the studies reviewed is that **leather is predominantly a by-product of the meat industry**, with its production not directly driving cattle raising or deforestation.

Interviews with a diverse range of **stakeholders**, including representatives from public and private sectors, **reinforced the findings from the literature review**. Most stakeholders acknowledged the connection between cattle raising and deforestation but viewed leather as a secondary product, with primary outputs being meat and dairy. The interviews highlighted the complexity and fragmentation of the leather supply chain, the economic and logistical challenges of implementing comprehensive traceability systems, and the potential socio-economic impacts on the EU leather industry.

Stakeholders largely concurred that the proposed regulation would likely lead to a **geographical shift in the leather market away from the EU**, resulting in negative socio-economic consequences for European tanneries and related businesses. These include increased production costs, loss of market share, and potential job losses.

The socio-economic analysis employed scenario-based modeling to estimate the effects of the EUDR on the leather industry. The findings indicate that implementing stringent traceability requirements would significantly disrupt the supply chain, leading to increased costs and reduced demand for leather. A projected **demand reduction of 9.3% to 15.5%** could have profound implications for the industry, comparable to the downturn experienced during the European debt crisis.

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This contraction in demand is expected to result in decreased wealth creation, business closures, and **job losses within the EU leather sector**. The persistence of these economic shocks suggests long-term challenges for maintaining the workforce and supporting communities dependent on leather production. It is important to note that the **job losses** will not be evenly distributed across Europe but will **heavily impact specific areas** such as leather production districts, thus intensifying the economic impact in these regions.

Furthermore, the EUDR's stringent traceability requirements pose a direct risk to businesses and workers within the leather industry. Additionally, there are **indirect effects on associated workers** such as electricians, mechanics, plumbers, and employees in service companies that support the leather industry. These secondary impacts on ancillary services highlight the **broader economic implications of the EUDR**, extending beyond the primary sector.

The reduction in demand due to traceability requirements can cause **ripple effects throughout the supply chain**, influencing not just leather producers but also downstream industries that rely on leather products. This holistic view underscores the widespread ramifications of the EUDR, stressing the need for comprehensive mitigation strategies to support affected sectors and regions.

The **environmental impact assessment** compared a baseline scenario with two alternative scenarios to evaluate the potential changes resulting from the EUDR implementation. The baseline scenario assumed current practices, while the alternatives considered shifts in processing locations and increased production of synthetic leather substitutes.

The results showed that both alternative scenarios would lead to higher environmental impacts than the baseline. Specifically, scenario A (shift to China) and scenario B (redistribution between the USA and China with increased PU leather production in Europe) **would increase overall environmental footprints** by 40% and 36%, respectively. The primary contributors to these impacts were the environmental burdens associated with tanning processes in China and the production of polyurethane leather-like materials (PU LLM).

Key Findings of the study can be summarized as follows:

- **Physical link but not a driver**: While leather is physically linked to cattle, its status as a by-product or waste product disqualifies it from being a primary driver of deforestation.
- **Socio-economic risks**: The inclusion of leather in the EUDR scope is likely to cause substantial economic damage to the EU leather industry, affecting wealth creation, business continuity, and employment.

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- **Unintended environmental consequences**: Rather than achieving the intended environmental benefits, the regulation may inadvertently increase other environmental burdens due to geographical shifts in production and greater reliance on synthetic alternatives.

Given the study's findings, several recommendations emerge:

- **Reevaluate leather's inclusion**: Policymakers should reconsider the inclusion of leather in the EUDR, given the lack of direct evidence linking leather production to deforestation and the significant socio-economic and environmental risks.
- **Targeted interventions**: Instead of broad regulations, more targeted interventions that address specific practices within the leather supply chain could be more effective in mitigating environmental impacts without causing undue economic harm.
- **Support for transition**: If the regulation proceeds, there should be substantial support for the EU leather industry to transition towards compliant practices. This could include financial assistance, technological upgrades, and capacity-building initiatives.
- **Promote sustainable practices globally**: Efforts should be made to promote sustainable practices in leather production globally, encouraging transparency and traceability while recognizing the complexities of international supply chains.
- **Further research**: Ongoing research is needed to quantify the specific socio-economic and environmental impacts of the regulation and to develop strategies for mitigating adverse effects. This research should include a broader range of stakeholders and consider long-term implications for global trade dynamics.

The proposed inclusion of leather in the scope of Regulation 2023/1115/EU raises significant concerns across multiple dimensions. While the regulation aims to reduce deforestation and associated climate impacts, the study reveals that **leather, as a by-product of cattle raising, does not directly drive deforestation**. Furthermore, **the socio-economic consequences for the EU leather industry could be severe**, leading to job losses, business closures, and diminished economic vitality in regions dependent on leather production. Additionally, **the potential environmental benefits are questionable**, with a risk of increased environmental burdens due to shifts in production and reliance on synthetic alternatives.

A more nuanced approach, balancing environmental goals with economic realities and industry capacities, is essential for achieving sustainable outcomes. Policymakers must carefully consider these findings and work collaboratively with industry stakeholders to develop effective, equitable,

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and achievable regulations that genuinely contribute to global sustainability goals without unintended adverse consequences.

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7. References

Blumetto, O., Ruggia, A., Tiscornia, G., (2023). "Reconciling the design of livestock production systems and the preservation of ecosystems" in "Sustainable Development and Pathways for Food Ecosystems: Integration and Synergies" by Accorsi, R., and Bhat, R., Chapter 4, 69-114. ISBN: 9780323908856. https://doi.org/ 10.1016/B978-0-323-90885-6.00012-0

Brandão Jr., A., Rausch, L., Munger, J., Gibbs, H.K., (2023). Mapping Slaughterhouse Supply Zones in the Brazilian Amazon with Cattle Transit Records. *Land*, 12, 1782. https://doi.org/10.3390/land12091782

Canals, L.M.i., Domènèch, X., Rieradevall, J., Puig, R., Fullana, P., (2002). Use of Life Cycle assessment in the procedure for the establishment of environmental criteria in the catalan ECO-label of leather. *Int. J. Life Cycle Assess*., 7, 39-46. https://doi.org/10.1007/BF02978908

Casagranda, Y.G., Wiśniewska-Paluszak, J., Paluszak, G., Mores, G.D.V., Dal Moro, L., Malafaia, G.C., Azevedo, D.B.D., Zhang, D., (2023). Emergent Research Themes on Sustainability in the Beef Cattle Industry in Brazil: An Integrative Literature Review. *Sustainability*, 15(5), 4670. https://doi.org/10.3390/su15054670

Cederberg, C., Persson, U.M., Neovius, K., Molander, S., Clift, R., (2011). Including carbon emissions from deforestation in the carbon footprint of brazilian beef. *Environ. Sci. Technol.*, 45(5), 1773-1779. https://doi.org/10.1021/es103240z

Cohn, A.S., Mosnier, A., Havlík, P., Valin, H., Herrero, M., Schmid, E., O'Hare, E., Obersteiner, M., (2014). Cattle ranching intensification in Brazil can reduce global greenhouse gas emissions by sparing land from deforestation. *Soc. Sci.*, 111(20), 7236-7241. https://doi.org/10.1073/pnas.1307163111

Cooper, M., Gutterres, M., Nilson, M., (2011). Environmental developments and researches in Brazilian leather sector. *J. Soc. Leather Technol. Chem.*, 95(6), 243-249.

Dávalos, L.M., Holmes, J.S., Rodríguez, N., Armenteras, D., (2014). Demand for beef is unrelated to pasture expansion in northwestern Amazonia. *Biol. Conserv.*, 170, 64-73. http://dx.doi.org/10.1016/j.biocon.2013.12.018

De Oliveira Silva, R., Barioni, L.G., Moran, D., (2021). Fire, deforestation, and livestock: When the smoke clears. *Land Use Policy*, 100, 104949. https://doi.org/10.1016/j.landusepol.2020.104949

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De Rosa-Giglio, P., Fontanella, A., Gonzalez-Quijano, G., Ioannidis, I., Nucci, B., Brugnoli F., (2018). Product environmental footprint category rules (PEFCR) leather pilot. https://ec.europa.eu/environment/eussd/smgp/pdf/PEFCR_leather.pdf.

Dhakal, D., Shrestha, S.M., Anal, A.K., (2018). Bioprocessing of Beef and Pork Meat Processing Industries, 'Waste to Value-Add' in "Food Processing By-Products and their Utilization", First Edition, pp. 395-415. Edited by Anil Kumar Anal. John Wiley & Sons Ltd. Published 2018 by John Wiley & Sons Ltd. ISBN 978-1118432884

Eri, M., Antonio da Silva Junior, C., Lima, M., La Scala Júnior, N., Francisco de Oliveira-Júnior, J., Teodoro, P.E., Capristo Silva, G.F., Caione, G., Peres, C.A., (2020). Capitalizing on opportunities provided by pasture sudden death to enhance livestock sustainable management in Brazilian Amazonia, *Environ. Dev.*, 33, 100499. https://doi.org/10.1016/j.envdev.2020.100499

Ferreira da Silva, P.P., (2023) Environmental performance of leather and leather-like materials applied to footwear. MS thesis. NTNU.

Garcia, E., Filho, F.S.V.R., Mallmann, G.M., Fonseca, F., (2017). Costs, benefits and challenges of sustainable livestock intensification in a major deforestation frontier in the Brazilian amazon. *Sustainability*, 9(1), 158. https://doi.org/10.3390/su9010158

Gibbs, H.K., Munger, J., L'Roe, J., Barreto, P., Pereira, R., Christie, M., Amaral, T., Walker, N.F., (2016). Did Ranchers and Slaughterhouses Respond to Zero-Deforestation Agreements in the Brazilian Amazon?. *Conserv. Lett.*, 9(1), 32-42. 32-42. https://doi.org /10.1111/conl.12175

Hauschild, M.Z., Rosenbaum R.K., Olsen S.I., (2018). Life cycle assessment. Theory and Practice Vol. 2018. Springer International Publishing. doi.org/10.1007/978-3-319-56475-3

Hoelle, J., (2017). Jungle beef: consumption, production and destruction, and the development process in the Brazilian Amazon. *J. Political Ecol.*, 24(1), 743762. https://doi.org/10.2458/V24I1.20964

Holmann, F., Rivas, L., Pérez, E., Castro, C., Schuetz, P., Rodríguez, J., (2008). The beef chain in Costa Rica: Identifying critical issues for promoting its modernization, efficiency, and competitiveness. *Livest. Res. Rural. Dev.*, 20(4).

Jayathilakan, K., Sultana, K., Radhakrishna, K., Bawa, A.S., (2012). Utilization of byproducts and waste materials from meat, poultry and fish processing industries: a review. *J. Food Sci. Technol.*, 49(3), 278-293. https://doi.org/10.1007/s13197-011-0290-7

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Karstensen, J., Peters, G.P., Andrew, R.M., (2013). Attribution of CO_2 emissions from Brazilian deforestation to consumers between 1990 and 2010. *Environ. Res. Lett.*, 8, 024005. https://doi.org/10.1088/1748-9326/8/2/024005

Klingler, M., Richards, P.D., Ossner, R., (2018). Cattle vaccination records question the impact of recent zero-deforestation agreements in the Amazon. *Reg. Environ. Change*, 18, 33-46. https://doi.org/10.1007/s10113-017-1234-1

Koloka, O., Moreki, J.C., (2010). Performance of hides and skins subsector in Botswana: A critical review. *Livest. Res. Rural. Dev.*, 22(5).

Levy, S.A., Cammelli, F., Munger, J., Gibbs, H.K., Garrett, R.D., (2023). Deforestation in the Brazilian Amazon could be halved by scaling up the implementation of zero-deforestation cattle commitments. *Glob. Environ. Change*, 80, 102671. https://doi.org/10.1016/j.gloenvcha.2023.102671

Limeneh, D.Y., Tesfaye, T., Ayele, M., Husien, N.M., Ferede, E., Haile, A., Mengie, W., Abuhay, A., Gelebo, G.G., Gibril, M., Kong, F., (2022). A Comprehensive Review on Utilization of Slaughterhouse By-Product: Current Status and Prospect. *Sustainability*, 14(11), 6469. https://doi.org/10.3390/su14116469

McCabe, B.K., Harris, P.W., Schmidt, T., Antille, D.L., Lee, S., Hill, A., Baillie, C.P., (2018). Bioenergy and bioproducts in the Australian red meat processing industry: A case study. *ASABE 2018 Annual International Meeting*, 1800980. https://doi.org/10.13031/aim.201800980

Mammadova, A., Masiero, M., Pettenella, D., (2020A). Embedded Deforestation: The Case Study of the Brazilian–Italian Bovine Leather Trade. *Forests*, 11, 472. https://doi.org/10.3390/f11040472

Mammadova, A., Behagel, J., Masiero, M., (2020b). Making deforestation risk visible. Discourses on bovine leather supply chain in Brazil. *Geoforum*, 112, 85-95. https://doi.org/10.1016/j.geoforum.2020.03.008

Mammadova, A., Behagel, J., Masiero, M., Pettenella, D., (2022). Deforestation as a Systemic Risk: The Case of Brazilian Bovine Leather. *Forests*, 13, 233. https://doi.org/10.3390/f13020233

Memedovic, O., Mattila, H., (2008). The global leather value chain: the industries, the main actors and prospects for upgrading in LDCs. *Int. J. Technol. Learn. Innov. Dev.*, 1(4), 482-519. https://doi.org/10.1504/IJTLID.2008.021965

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Milán, M.J., González, E., (2023). Beef–cattle ranching in the Paraguayan Chaco: typological approach to a livestock frontier. *Environ. Dev. Sustain.*, 25, 5185-5210. https://doi.org/10.1007/s10668-022-02261-2

Mora, L., Toldra-Reig, F., Reig, M., Toldrá, F., (2019). Possible Uses of Processed Slaughter Byproducts. *Sustainable Meat Production and Processing*, 145-160. https://doi.org/10.1016/B978-0-12-814874-7.00008-0

Müller-Hansen, F., Heitzig, J., Donges, J.F., Cardoso, M.F., Dalla-Nora, E.I., Andrade, P., Kurths, J., Thonicke, K., (2019). Can Intensification of Cattle Ranching Reduce Deforestation in the Amazon? Insights From an Agent-based Social-Ecological Model. *Ecol. Econ.*, 159, 198-211. https://doi.org/10.1016/j.ecolecon.2018.12.025

Najeb, S.T., (2020). The reality of the extension service provided in the field of livestock in Iraq: a review. *Plant Archives*, 20(2), 416-421. e-ISSN:2581-6063 (online), ISSN:0972-5210

Nithyaprakash, V., Niveathitha, S., Shanmugapriya, V., (2020). Designer Activism Strategies for Sustainable Leather Product Designs. Em S. S. Muthu (Org.), *Leather and Footwear Sustainability: Manufacturing, Supply Chain, and Product Level Issues*, 57–89. doi.org/10.1007/978-981-15-6296-9_4

Patel, K., Munir, D., Santos, R.M., (2022). Beneficial use of animal hides for abattoir and tannery waste management: a review of unconventional, innovative, and sustainable approaches. *Environ. Sci. Pollut. Res.*, 29, 1807-1823. https://doi.org/10.1007/s11356-021-17101-5

Pendrill, F., Persson, U.M., Godar, J., Kastner, T., Moran, D., Schmidt, S., Wood, R., (2019). Agricultural and forestry trade drives large share of tropical deforestation emissions. *Global environmental change*, 56, 1-10. doi.org/10.1016/j.gloenvcha.2019.03.002

Pedrosa, L.M., Hoshide, A.K., Abreu, D.C., Molossi, L., Couto, E.G., (2021). Financial transition and costs of sustainable agricultural intensification practices on a beef cattle and crop farm in Brazil's Amazon. *Renew. Agric. Food Syst.*, 36, 26-37. https://doi.org/10.1017/S1742170519000413

Pereira, R., Rausch, L.L., Carrara, A., Gibbs, H.K., (2020). Extensive Production Practices and Incomplete Implementation Hinder Brazil's Zero-Deforestation Cattle Agreements in Para. *Trop. Conserv. Sci.*, 13, 1-13. https://doi.org/10.1177/1940082920942014

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Piazza Martiri della Libertà, 24 - 56127 Pisa
tel. 050 88.39.83-82 - fax 050 883.936
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Prieto, M., Garcia-Lopez, M.L. (2014). Meat By-Products (Chapter 14). In "Meat Inspection and Control in the Slaughterhouse" (Edited by Thimjos Ninios, Janne Lundén, Hannu Korkeala and Maria Fredriksson-Ahomaa) John Wiley & Sons, Ltd., pp 385-398.

Puig R., Martí E., De Camillis, C., (2007). In: Puig R., Notarnicola B., Raggi A., (2007). Industrial Ecology in the cattle-to-leather supply chain. Milan, Italy: Franco Angeli, 16-31.

Ramchandani, M., Coste-Maniere, I., (2020). Leather in the Age of Sustainability: A Norm or Merely a Cherry on Top? Em S. S. Muthu (Org.), *Leather and Footwear Sustainability: Manufacturing, Supply Chain, and Product Level Issues*, 11–22. doi.org/10.1007/978-981-15-6296-9_2

Ruviaro, C.F., Barcellos, J.O.J., Dewes, H., (2014). Market-oriented cattle traceability in the Brazilian Legal Amazon. *Land Use Policy*, 38, 104-110. https://doi.org/10.1016/j.landusepol.2013.08.019

Said, M.I., (2021). Potential of animal leather as a strategic commodity for the livestock industry: A review. *IOP Conf. Ser.: Earth Environ. Sci.*, 788, https://doi.org/012116. 10.1088/1755-1315/788/1/012116

Sandoval, D.F., Florez, J.F., Enciso Valencia, K.J., Sotelo Cabrera, M.E., Stefan, B., (2023). Economic-environmental assessment of silvo-pastoral systems in Colombia: An ecosystem service perspective. *Heliyon*, 9, e19082. https://doi.org/10.1016/j.heliyon.2023.e19082

Santos, A.B., Costa, M.H., (2018). Do large slaughterhouses promote sustainable intensification of cattle ranching in Amazonia and the Cerrado?, *Sustainability*, 10(9), 3266. https://doi.org/10.3390/su10093266

Scanes, C.G., (2018). Animal Attributes Exploited by Humans (Nonfood Uses of Animals). *Animals and Human Society*. 13-40. https://doi.org/10.1016/B978-0-12-805247-1.00002-2

Toldrá, F., Mora, L., Reig, M., (2016). New insights into meat by-product utilization. *Meat Science*, 120, 54-59. http://dx.doi.org/10.1016/j.meatsci.2016.04.021

Tranfield, D., Denyer, D., Smart, P., 2003. Towards a methodology for developing evidence-informed management knowledge by means of systematic review. *Br. J. Manag.*, 14 (3), 207-222. https://doi.org/10.1111/1467-8551.00375

Vale, R., Vale, P., Gibbs, H., Pedrón, D., Engelmann, J., Pereira, R., Barreto, P., (2022). Regional expansion of the beef industry in Brazil: from the coast to the Amazon, 1966–2017. *Reg. Stud. Reg. Sci.*, 9(1), 641-664. https://doi.org/10.1080/21681376.2022.2130088

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tel. 050 88.39.83-82 - fax 050 883.936
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Walker, N.F., Patel, S.A., Kalif, K.A.B., (2013). From Amazon pasture to the high street: deforestation and the Brazilian cattle product supply chain. *Trop. Conserv. Sci.*, 6(3), 446-467. https://doi.org/10.1177/1940082913006003

West, T.A.P., Rausch, L., Munger, J., Gibbs, H.K., (2022). Protected areas still used to produce Brazil's cattle. *Conserv. Lett.*, 15(6), e12916. https://doi.org/10.1111/conl.12916

Xia, J., Zhou Z., Chen C., (2010). "Synthetic leather articles and methods for producing the same." U.S. Patent No. 7,662,461.

Zu Ermgassen, E.K.H.J., Godar, J., Lathuillière, M.J., Löfgren, P., Gardner, T., Vasconcelos, A., Meyfroidt, P., (2020). The origin, supply chain, and deforestation risk of Brazil's beef exports. *Proc. Natl. Acad. Sci. U.S.A.*, 117(50), 31770-31779. https:///doi.org/10.1073/pnas.2003270117

"GREY" LITERATURE

Abiec Associação Brasileira das Indústrias Exportadoras de Carnes, (2022). Beef Report 2022. https://www.abiec.com.br/wp-content/uploads/Beef-Report-2022_atualizado_jun2022.pdf

Aiama, D., Carbone, G., Cator, D., Challender, D., (2016). Biodiversity Risks and Opportunities in the Apparel Sector. IUCN (International Union for Conservation of Nature), https://portals.iucn.org/library/efiles/documents/Rep-2016-001.pdf

Bain & Co. Libera, C. Mirote, S & Horta, A. (2020). Brazil's Path to Sustainable Cattle Farming. https://www.bain.com/insights/brazils-path-to-sustainable-cattle-farming/

Brester, G.W., Swanser, K., (2021). Quantifying the relationship between U.S. cattle hide prices/value and U.S. cattle production. https://www.usleather.org/sites/default/files/documents/BresterSwanser2021.pdf

Chathman House (2013). Deforestation-related Commodity Supply Chain Controls. Workshop summary. https://www.chathamhouse.org/sites/default/files/public/Research/Energy,%20Environment%20and%20Development/180413summary.pdf

Collective Fashion Justice, (2022). Under their skin: leather's impact on people. https://static1.squarespace.com/static/5f5f02dd9b510014eef4fc4f/t/64025bb2fba47129d19444e5/1677876164910/Leather%27s+impact+on+people+report.pdf

Collective Fashion Justice, (2022). Under their skin: leather's impact on the planet. https://static1.squarespace.com/static/5f5f02dd9b510014eef4fc4f/t/64025b58f16f565c702635cf/1677876106157/Leather%27s+impact+on+the+planet+report.pdf

Collective Fashion Justice, (2023). Under their skin: a just transition beyond leather. https://static1.squarespace.com/static/5f5f02dd9b510014eef4fc4f/t/6447013fc313933929b754c0/1682375029994/CFJ+a+just+transition+beyond+leather.pdf

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Piazza Martiri della Libertà, 24 - 56127 Pisa
tel. 050 88.39.83-82 - fax 050 883.936
idm@sssup.it

Collective Fashion Justice, (2023). Under their skin: leather's impact on animals. https://static1.squarespace.com/static/5f5f02dd9b510014eef4fc4f/t/63fe6c7a4305dc76ee40a43c/1677618365889/Leather%27s+impact+on+animals+report.pdf

Commissione Europea, (2023). REGOLAMENTO (UE) 2023/1115 DEL PARLAMENTO EUROPEO E DEL CONSIGLIO relativo alla messa a disposizione sul mercato dell'Unione e all'esportazione dall'Unione di determinate materie prime e determinati prodotti associati alla deforestazione e al degrado forestale e che abroga il regolamento (UE) n. 995/2010. https://eur-lex.europa.eu/legal-content/IT/TXT/HTML/?uri=CELEX%3A32023R1115

COTANCE (2020). Rapporto socio-ambientale 2020. Industria Conciaria Europea. https://www.euroleather.com/doc/SER/Industria%20Conciaria%20Europea%20-%20Rapporto%20socio-ambientale%202020%20-%20IT%20web.pdf

Cuypers, D., Geerken, T., Gorissen, L., Lust, A., Peters, G.A., Karstensen, J., Prieler, S., Fischer, G.W., Hizsnyik, E., & Velthuizen, H.V., (2013). The impact of EU consumption on deforestation: Comprehensive analysis of the impact of EU consumption on deforestation. https://pure.iiasa.ac.at/id/eprint/14868/1/1.%20Report%20analysis%20of%20impact.pdf

De Koning, P.C., (2020). Deforestation related to Beef & Leather Supply Chains in Latin America and export to Europe, Mekon Ecology. https://mekonecology.net/wp-content/uploads/2020/12/Mekon-Ecology-2020-Beef-Leather-Supply-Chain-Latin-America-Europe-vFINAL.pdf

De Rosa-Giglio P., Fontanella A., Gonzalez-Quijano G., Ioannidis I., Nucci B., Brugnoli F. on behalf of the Leather Pilot Technical Secretariat, (2018). Product Environmental Footprint Category Rules, Leather. Final version. http://nordic-peforg2.serv14.powerhosting.dk/wp-content/uploads/2021/08/pefcr_leather.pdf

Dummett, C., Blundell, A., Canby, K., Wolosin, M., Eszter Bodnar, (2021). Illicit Harvest, Complicit Goods. The State of Illegal Deforestation for Agriculture. Forest Policy Trade and Finance Initiative, Forest Trends. https://www.forest-trends.org/wp-content/uploads/2021/05/Illicit-Harvest-Complicit-Goods_rev.pdf

Earthsight, (2020). Grand Theft Chaco. https://www.earthsight.org.uk/grandtheftchaco-en#group-Key-findings-vLkWw53jPE

Environmental Investigation Agency (EIA), (2022). Deforestation in the Driver's Seat. Illegal Cattle Ranching, Amazon Deforestation, and the Automotive Leather Industry. https://us.eia.org/wp-content/uploads/2022/12/EIA_US_Brazil_Leather_report_1022_US_Format_FINAL_EDITS_09-02-23.pdf

European Commission, (2021). Commission Staff Working Document – Impact Assessment. Minimising the risk of deforestation and forest degradation associated with products places on the EU market. Part 1/2. https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52021SC0327

European Commission, (2021). Commission Staff Working Document – Impact Assessment Report. Minimising the risk of deforestation and forest degradation associated with products places on the

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Piazza Martiri della Libertà, 24 - 56127 Pisa
tel. 050 88.39.83-82 - fax 050 883.936
idm@sssup.it

EU market. Part 2/2. https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52021SC0327

European Commission, (2021). COMMISSION STAFF WORKING DOCUMENT. The 3 Billion Tree Planting Pledge For 2030. https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52021SC0651

European Commission, (2007). Communication from the commission to the Council and the European Parliament on the Interpretative Communication on waste and by-products. https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52007DC0059

COMMISSION STAFF WORKING DOCUMENT. The 3 Billion Tree Planting Pledge For 2030. https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52021SC0651

European Parliament, (2009). REGULATION (EC) No 1069/2009 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 21 October 2009 laying down health rules as regards animal by-products and derived products not intended for human consumption and repealing Regulation (EC) No 1774/2002 (Animal by-products Regulation).

FAO, (2006). Livestock's long shadow. Environmental issues and options. Rome, https://www.fao.org/3/a0701e/a0701e.pdf

FAO, (2016). World statistical compendium for raw hides and skins, leather and leather footwear1999-2015. Rome, ISBN 978-92-5-109213-2. https://www.fao.org/3/i5599e/i5599e.pdf

FAO, (2018). World Livestock: Transforming the livestock sector through the Sustainable Development Goals. Rome. 222 pp. https://doi.org/10.4060/ca1201en. Licence: CC BY-NC-SA 3.0 IGO.

FAO, (2022). FRA 2020 Remote Sensing Survey. FAO Forestry Paper No. 186. Rome. https://doi.org/10.4060/cb9970en

Fripp, E., J. Gorman, T. Schneider, S. Smith, J. Paul, T. Neeff, F. Marietti, L. Vary, A. Zosel-Harper (2023). "Traceability and transparency in supply chains for agricultural and forest commodities: A review of success factors and enabling conditions to improve resource use and reduce forest loss." Report. Washington, DC: World Resources Institute.

Greenpeace, (2009). Slaughtering the Amazon. https://www.greenpeace.org/usa/wp-content/uploads/legacy/Global/usa/planet3/PDFs/slaughtering-the-amazon.pdf

Jös A. Castro A. (2022). More sustainable materials? The case of leather and its alternatives. Nachhaltigkeitsblog. https://nachhaltigkeitsblog-hda.de/2022/03/03/more-sustainable-materials-the-case-of-leather-and-its-alternatives/

Lawson, S., Blundell, S. Cabarle, B., Basik, N., Jenkins, M. and Kerstin Canby (2014). Consumer goods and deforestation: an analysis of the extent and nature of illegality in forest conversion for agriculture and timber plantations. Forest Trends. https://www.forest-trends.org/wp-content/uploads/imported/for168-consumer-goods-and-deforestation-letter-14-0916-hr-no-crops_web-pdf.pdf

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tel. 050 88.39.83-82 - fax 050 883.936
idm@sssup.it

Leather UK, (2020). Deforestation - is leather to blame? https://leatheruk.org/trade_news/deforestation-is-leather-to-blame/

MacFarquhar C., Morrice A., Vasconcelos A., (2019). Hidden deforestation in the Brazil -China beef and leather trade. Globa canopy. https://globalcanopy.org/wp-content/uploads/2020/12/Hidden-deforestation-in-the-Brazil-and-China-beef-and-leather-trade.pdf

Marti D., Johnson R., Mathews K.H.Jr, (2011). Where's the (Not) Meat? Byproducts From Beef and Pork Production. Economic Research Service United States Department of Agriculture (ERS USDA). https://www.ers.usda.gov/webdocs/outlooks/37427/8801_ldpm20901.pdf?v=4649.1

McKendree, M.G.S., Tonsor, G.T., Schroeder, T.C., Hendricks, N.P. (2020). Impacts of Retail and Export Demand on United States Cattle Producers, American Journal of Agricultural Economics, 102(3), 866-883. https://doi.org/10.1093/ajae/aaz034

Meyer, M., Dietrich, S., Schulz, H., Mondschein, A., (2021). Comparison of the Technical Performance of Leather, Artificial leather, and Trendy Alternatives. C oatings, 11, 226. https://doi.org/10.3390/coat-ings11020226

Neeff, T., Linhares-Juvenal, T., (2017). Zero deforestation initiatives and their impacts on commodity supply chains. Discussion paper prepared for the 57th Session of the FAO Advisory

NINT Natural Intelligence (2023). The impact of a shift in global demand for leather on Brazilian slaughterhouses. https://dv719tqmsuwvb.cloudfront.net/documents/Economic-study-of-shift-in-global-leather-demand-on-Brazilian-slaughterhouses-report-by-NINT-for-Rainforest-Foundation-Norway.pdf

Committee on Sustainable Forest-based Industries. FAO, Rome. https://www.fao.org/3/i6857e/i6857e.pdf

OECD/FAO, (2023), OECD-FAO Business Handbook on Deforestation and Due Diligence in Agricultural Supply Chains, OECD Publishing, Paris, https://doi.org/10.1787/c0d4bca7-en.

Persson, U.M., Bager, S., Bellfield, H., Burley, H., Green, J., Bastos Lima, M.G., Sartorato Silva França, C., Gardner, T.A., Kastner, T., Lathuilliere, M.J., Meyfroidt, P., Pendrill, F., West, C. (2020). A broad EU deforestation approach can help protect climate and biodiversity. Sustainable Consumption and Production – SEI York. Trase. 10.13140/RG.2.2.35893.91369

Pettenella, D., Masiero, M. (a cura di) (2020). Deforestation made in Italy. Leresponsabilità delle imprese e dei consumatori italiani nella deforestazione dei paesi tropicali. ETIFORSrl – Spin-off dell'Università di Padova. Padova, Italia. https://www.researchgate.net/profile/Giorgio-Vacchiano/publication/344668325_Deforestation_Made_in_Italy_Le_responsabilita_delle_imprese_e_dei_consumatori_italiani_nella_deforestazione_dei_paesi_tropicali/links/5f8ff480299bf1b53e379ff4/Deforestation-Made-in-Italy-Le-responsabilita-delle-imprese-e-dei-consumatori-italiani-nella-deforestazione-dei-paesi-tropicali.pdf

RealLeather, (2022). Rewind series episode four, Our future. https://s.chooserealleather.com/wp-content/uploads/2022/11/RLSD-Rewind-Factsheet_Episode-4.pdf

Istituto di Management
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Piazza Martiri della Libertà, 24 - 56127 Pisa
tel. 050 88.39.83-82 - fax 050 883.936
idm@sssup.it

RealLeather, (2022). Rewind series episode one, Farming. https://s.chooserealleather.com/wp-content/uploads/2022/10/RLSD-Rewind-Factsheet_Episode-1_V8.pdf

RealLeather, (2022). Rewind series episode three, Food. https://s.chooserealleather.com/wp-content/uploads/2022/11/RLSD-Rewind-Factsheet_Episode-3.pdf

RealLeather, (2022). Rewind series episode two, Farming. https://s.chooserealleather.com/wp-content/uploads/2022/10/RLSD-Rewind-Factsheet_Episode-2.pdf

Redwood, M., (2021). Leather and livestock improve biodiversity and poverty. Redwood Comment, https://internationalleathermaker.com/leather-and-livestock-improve-biodiversity-and-poverty/.

Rehn-Groenendijk, J., Lehmann, K., Schenten, J., (2022) Handbook of Leather Design for Sustainable Development. A systematic transdisciplinary approach. First Ed., Hochschule Darmstadt Germany. ISBN: 978-3-96187-013-4. https://sne.h-da.de/fileadmin/Einrichtungen/sne/TV8_Leder-Chemie/HandbookLeatherDesign.pdf

Sartorato Silva França, C., (2017). Is leather a forest-risky commodity? Exploring embodied deforestation in the Brazilian leather supply chain. Double M.Sc. Degree Sustainable Tropical Forest thesis. http://doi.org/10.13140/RG.2.2.34439.34727

Smeraldi, R., May, P. (2009). A Hora da Conta: Pecuária, Amazônia e Conjuntura. São Paulo: Amigos da Terra – Amazônia Brasileira. https://amigosdaterra.org.br/wp-content/uploads/2017/06/ahoradaconta.pdf

Stand Research Group, (2021). Nowhere to Hide: How the Fashion Industry Is Linked to Amazon Rainforest Destruction. *Available at:* https://stand.earth/resources/nowhere-to-hide-how-the-fashion-industry-is-linked-to-amazon-rainforest-destruction/

Sustainable Leather Foundation, (2021). Sustainable Leather Foundation's pathway to no-deforestation and preservation of biodiversity. Deforestation & Biodiversity V1.0. https://www.sustainableleatherfoundation.com/wp-content/uploads/2021/04/DeforestationandBiodiversityversion1.0.pdf

Swedish tanners, (2022). Leather and deforestation; not to blame but willing to help. https://www.swedishtanners.se/2022/03/01/leather-and-deforestation-not-to-blame-but-willing-to-help/

Textile Exchange, Leather Working Group, (2023). Deforestation-Free Call to Action for Leather. Policy Guide. Policy & Management. https://textileexchange.org/app/uploads/2023/06/DFCTA_Policy-Guide-1.pdf

Thomson, E. and Fairbairn, A., (2023). 2023: A watershed year for action on deforestation, Global Canopy, Oxford, UK. https://forest500.org/sites/default/files/forest_500-2023_annual_report.pdf

Thomson, E. and Rogerson, S., (2020). Forest 500 annual report 2019 - the companies getting it wrong on deforestation, Global Canopy: Oxford, UK. https://forest500.org/sites/default/files/forest500_annualreport2019_final_0.pdf

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tel. 050 88.39.83-82 - fax 050 883.936
idm@sssup.it

United Nations Economic Commission for Europe (UNEC), (2023). Business Process Analysis for Sustainability and Circularity in the Leather Value Chain. https://unece.org/sites/default/files/2023-09/E320_BPA-SVC-leather.pdf

UNIC Italian Tanneries, (2019). Sustainability Report 2019. https://unic.it/storage/Rapporto%20sostenibilit%C3%A0%202019/Report_UNIC_2019_ENG.pdf

UNIC Italian Tanneries, (2022). Sustainability Report 2022. https://unic.it/storage/Sustainability%20Report%20UNIC%20Italian%20Tanneries%20Y2022.pdf

UNIC Italian Tanneries, (2023). The Sustainability of Leather and the Italian Tanning Industry. 7th world footwear congress. Istanbul, 8 November 2023.

WWF, (2017). Deforestation and social risks in the UK's commodity supply chains. https://www.wwf.org.uk/sites/default/files/2017-10/Risky%20Business%20-%20October%202017.pdf

WWF, (2020). Quanta foresta avete mangiato, usato o indossato oggi? Deforestazione incorporata nei consumi. WWF-UK. https://www.wwf.it/uploads/commodities_last__1_.pdf

WWF, (2021). Deforestation fronts drivers and responses in a changing world. WWF International,https://wwfeu.awsassets.panda.org/downloads/deforestation_fronts___drivers_and_responses_in_a_changing_world___full_report_embarg_1.pdf

WWF, (2021). Stepping up: The continuing impact of EU consumption on nature. https://www.wwf.nl/globalassets/pdf/stepping-up-the-continuing-impact-of-eu-consumption-on-nature-worldwide.pdf

WWF, (2022). Leather Also Has a Role to Play in the Fight Against Deforestation. The markets institute at WWF, Business Case. https://files.worldwildlife.org/wwfcmsprod/files/Publication/file/3gs7vgqvmc_DCF_Leather_Business_Case_10_22_v4.pdf?_ga=2.249014528.662231899.1703191825-1012786049.1702395145

WWF, (2022). A Journey Toward Deforestation Free Leather. https://www.worldwildlife.org/blogs/sustainability-works/posts/a-journey-toward-deforestation-free-leather

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tel. 050 88.39.83-82 - fax 050 883.936
idm@sssup.it

WEBSITES

https://leather-council.org/introduction-to-leather/industry-position-statement-on-deforestation/

https://www.youtube.com/watch?v=eYbUA_WWcMY&list=PLtlfAQ5PQvuqpf1w5dMmWvbtbnGM3T0Mv&index=19

https://sustainability-lab.net/2023/09/26/pelle-allevamenti-e-deforestazione/

https://www.leatherworkinggroup.com/our-impact/traceability/

https://tesaf.unipd.it/sites/tesaf.unipd.it/files/4_Mammadova.pdf

https://www.theguardian.com/environment/2023/mar/06/collagen-linked-brazilian-deforestation

https://ijnet.org/en/story/collagen-and-deforestation-how-we-uncovered-dirty-origins-beloved-wellness-product

https://textileexchange.org/news/world-wildlife-fund-wwf-joins-as-a-partner-for-deforestation-free-call-to-action-for-leather-alongside-textile-exchange-and-leather-working-group/

https://ilmpodcast.libsyn.com/leather-and-deforestation-how-can-the-industry-be-part-of-the-solution

https://www.usleather.org/press/Using_leather_does_not_mean_more_cattle_are_reared_finds_research#main-content

https://www.leathernaturally.org/wp-content/uploads/2023/02/LN-MODERN-COW-LEATHER-PROCESSING-OFFICIAL-1028.pdf

https://www.leathernaturally.org/

https://www.usleather.org/sites/default/files/documents/210511_Infographic.pdf

https://www.gminsights.com/toc/detail/collagen-market

https://www.usleather.org/

https://refed.org/

https://www.youtube.com/watch?v=MR78JQ_yu68&list=PL8E18BA1F93125591&index=7&t=3s&pp=gAQBiAQB

https://www.youtube.com/watch?v=_89Q8Xl3rPQ&list=PL8E18BA1F93125591&index=6&pp=gAQBiAQB

https://www.youtube.com/watch?v=P4hmwwDBvgY&list=PL8E18BA1F93125591&index=5&pp=gAQBiAQB

https://www.youtube.com/watch?v=o7w2qA1cwKw&list=PL8E18BA1F93125591&index=4&t=1s&pp=gAQBiAQB

https://www.harrisranchbeef.com/

https://qmscotland.co.uk/news/increased-competition-and-changing-trends-impact-global-leather-demand

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Piazza Martiri della Libertà, 24 - 56127 Pisa
tel. 050 88.39.83-82 - fax 050 883.936
idm@sssup.it

https://internationalleathermaker.com/leather-and-livestock-improve-biodiversity-and-poverty/.

https://nachhaltigkeitsblog-hda.de/2022/03/03/more-sustainable-materials-the-case-of-leather-and-its-alternatives/

https://www.earthsight.org.uk/grandtheftchaco-en#group-Key-findings-vLkWw53jPE

https://leatheruk.org/trade_news/deforestation-is-leather-to-blame/

https://imazon.org.br/en/publicacoes/will-meat-packing-plants-help-halt-deforestation-in-the-amazon/

https://brasil.mapbiomas.org/

https://www.scotconsultoria.com.br/cotacoes/indicadores/

https://sor.epa.gov/sor_internet/registry/termreg/searchandretrieve/termsandacronyms/search.do?search=&term=by-product&matchCriteria=Exact&checkedAcronym=true&checkedTerm=true&hasDefinitions=false

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Piazza Martiri della Libertà, 24 - 56127 Pisa
tel. 050 88.39.83-82 - fax 050 883.936
idm@sssup.it

8. Annex 1

2023	Bovine Meat Export to EU	Bovine Meat Export to EU on Domestic Bovine Meat Production	Bovine Raw Hides Export to EU	Total Bovine Raw Hides Export	Bovine Raw Hides Export to EU on Total Bovine Raw hides Export	Bovine Wet Blue Hides Export to EU	Bovine Crust Hides Export to EU	Total Bovine Wet Blue and Crust Hides Export	Bovine Wet Blue/Crust Hides Export to EU on Total Bovine Wet Blue/Crust Hides Export	Bovine Wet Blue/Crust Hides Export to EU on Total Bovine Wet Blue/Crust Hides Export
Countries	*tons*	*tons*	*%*	*tons*	*tons*	*&*	*tons*	*tons*	*tons*	*%*
Albania	2	NA	NC	2,112	2,571	82%	472	13	486	100%
Algeria	0	138,000	0.0%	0	925	0%	1,353	0	3,425	39%
Argentina	48,473	3,300,000	1.5%	3,953	138,151	3%	5,247	2,191	55,388	13%
Australia	6,023	2,220,000	0.3%	694	NA	NC	13,102	0	NA	NC
Azerbaijan	0	NA	NC	0	NA	NC	42	25	2,291	3%
Bangladesh	0	NA	NC	0	4,073	0%	349	1,069	0	NC
Belarus	0	305,000	0.0%	0	NA	NC	1,525	1	1,535	99%
Bolivia	0	NA	NC	0	9,078	0%	4,383	3	10,135	43%
Bosnia and Herzegovina	4	NA	NC	6,499	10,445	62%	255	23	317	88%
Botswana	1,238	31,500,000	0.0%	0	509	0%	0	0	163	0%
Brazil	56,790	10,950,000	0.5%	55	31,281	0%	80,547	219	355,460	23%
Cambodia	0	NA	NC	0	NA	NC	0	0	2,714	0%
Cameroon	0	NA	NC	0	0	NC	0	0	0	NC

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tel. 050 88.39.83-82 - fax 050 883.936
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2023	Bovine Meat Export to EU	Bovine Meat Export to EU on Domestic Bovine Meat Production	Bovine Raw Hides Export to EU	Total Bovine Raw Hides Export	Bovine Raw Hides Export to EU on Total Bovine Raw hides Export	Bovine Wet Blue Hides Export to EU	Bovine Crust Hides Export to EU	Total Bovine Wet Blue and Crust Hides Export	Bovine Wet Blue/Crust Hides Export to EU on Total Bovine Wet Blue/Crust Hides Export	Bovine Wet Blue/Crust Hides Export to EU on Total Bovine Wet Blue/Crust Hides Export
Countries	*tons*	*tons*	*%*	*tons*	*tons*	*&*	*tons*	*tons*	*tons*	*%*
Canada	1,154	1,330,000	0.1%	5,566	82,813	7%	33	0	217	15%
Chile	285	188,000	0.2%	483	12,135	4%	2,247	0	3,492	64%
China	0	7,530,000	0.0%	0	11,904	0%	311	30	23,620	1%
Colombia	0	719,000	0.0%	246	7,423	3%	153	0	4,599	3%
Cuba	0	NA	NC	0	973	0%	34	0	34	100%
Dominican Republic	0	63,000	0.0%	629	6,001	10%	0	0	577	0%
Ecuador	0	NA	NC	0	NA	NC	31	0	31	100%
Egypt	0	395,000	0.0%	0	NA	NC	872	878	0	NC
Georgia	0	NA	NC	40	2,616	2%	0	0	NA	NC
Ghana	0	NA	NC	0	14	0%	0	0	NA	NC
Hong Kong	3	NA	NC	0	606	0%	0	0	2,504	0%
Iceland	76	NA	NC	489	694	70%	0	0	NA	NC
India	0	4,470,000	0.0%	277	11,925	2%	38	19	358	16%
Indonesia	0	NA	NC	0	NA	NC	0	1	240	1%
Iraq	0	NA	NC	432	19,989	2%	9	0	41	21%
Israel	0	104,000	0.0%	2,184	2,942	74%	0	0	4	1%

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tel. 050 88.39.83-82 - fax 050 883.936
idm@sssup.it

2023	Bovine Meat Export to EU	Bovine Meat Export to EU on Domestic Bovine Meat Production	Bovine Raw Hides Export to EU	Total Bovine Raw Hides Export	Bovine Raw Hides Export to EU on Total Bovine Raw hides Export	Bovine Wet Blue Hides Export to EU	Bovine Crust Hides Export to EU	Total Bovine Wet Blue and Crust Hides Export	Bovine Wet Blue/Crust Hides Export to EU on Total Bovine Wet Blue/Crust Hides Export	Bovine Wet Blue/Crust Hides Export to EU on Total Bovine Wet Blue/Crust Hides Export
Countries	*tons*	*tons*	*%*	*tons*	*tons*	*&*	*tons*	*tons*	*tons*	*%*
Japan	586	502,000	0.1%	0	15,720	0%	0	0	495	0%
Kazakhstan	0	NA	NC	0	5,859	0%	842	0	3,918	21%
Kenya	0	NA	NC	0	5,666	0%	1,376	48	2,600	55%
Kosovo	0	NA	NC	1,674	NA	NC	0	0	NA	NC
Kyrgyzstan	0	NA	NC	0	9,114	0%	20	0	2,583	1%
Lebanon	0	NA	NC	160	4,382	4%	0	0	NA	NC
Madagascar	0	NA	NC	0	308	0%	0	0	NA	NC
Malaysia	0	30,000	0.0%	0	1,195	0%	0	0	6	0%
Mauritius	0	NA	NC	0	46	0%	0	0	17	0%
Mexico	0	2,220,000	0.0%	63	0	NC	1,077	201	0	NC
Moldova	0	NA	NC	345	1,095	31%	0	1	1	100%
Mongolia	0	NA	NC	0	7,154	0%	120	0	592	20%
Morocco	20	603,000	0.0%	0	NA	NC	426	956	NA	NC
Namibia	5,826	24,780,000	0.0%	2	241	1%	430	0	1,771	24%
New Zealand	3,532	748,000	0.5%	3,685	29,911	12%	27,361	0	36,696	75%
Nicaragua	0	171,000	0.0%	0	7,016	0%	92	0	1,303	7%

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Countries	*tons*	*tons*	*%*	*tons*	*tons*	*&*	*tons*	*tons*	*tons*	*%*
North Macedonia	0	NA	NC	69	NA	NC	0	0	NA	NC
Norway	586	90,600	0.6%	15,117	16,098	94%	0	3	8	33%
Pakistan	0	NA	NC	13	615	2%	0	91	1,112	8%
Panama	0	NA	NC	0	218	0%	3,129	64	NA	NC
Paraguay	3,667	540,000	0.7%	0	75	0%	22,806	5	36,314	63%
Peru	0	NA	NC	0	1,961	0%	23	0	279	8%
Philippines	0	182,000	0.0%	0	3	0%	0	0	27	0%
Russia	0	1,365,000	0.0%	67	311	22%	119	200	1,255	25%
Saudi Arabia	0	42,000	0.0%	0	2,547	0%	49	0	496	10%
Senegal	0	NA	NC	0	18	0%	0	0	NA	NC
Serbia	314	66,900	0.5%	7,074	9,310	76%	783	31	959	85%
Singapore	26	NA	NC	0	167	0%	0	0	19	0%
South Africa	0	999,000	0.0%	1,008	25,577	4%	4,740	17	19,268	25%
South Korea	0	345,000	0.0%	0	112	0%	1	1	8,025	0%
Switzerland	1,259	82,000	1.5%	14,085	14,060	100%	0	13	NA	NC
Taiwan	0	NA	NC	43	49	88%	4	21	25	98%

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Countries	*tons*	*tons*	*%*	*tons*	*tons*	*&*	*tons*	*tons*	*tons*	*%*
Tajikistan	0	8,000	0.0%	0	2	0%	0	0	16,440	0%
Tanzania	0	NA	NC	0	NA	NC	155	0	NA	NC
Thailand	0	NA	NC	0	6,334	0%	0	0	428	0%
Tunisia	0	NA	NC	0	319	0%	15	1	31,289	0%
Türkiye	0	NA	NC	997	4,038	25%	39	3	NA	NC
Uganda	0	NA	NC	109	121	90%	3,981	135	12,146	34%
Ukraine	1	NA	NC	0	92	0%	1,976	0	2,963	67%
United Arab Emirates	0	211,000	0.0%	83	104	80%	5,827	6	6,807	86%
United Kingdom	0	18,000	0.0%	0	0	NC	0	19	0	NC
United States	84,355	901,000	9.4%	38,982	69,686	56%	8,380	18	8,848	95%
Uruguay	14,335	12,290,000	0.1%	7,820	302,508	3%	45,042	17	334,592	13%
Uzbekistan	31,960	600,000	5.3%	68	18,991	0%	2,593	0	24,102	11%
Venezuela	0	NA	NC	0	111	0%	1,831	74	13,227	14%
Vietnam	0	NA	NC	0	7,705	0%	971	3	2,277	43%

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Countries	*tons*	*tons*	*%*	*tons*	*tons*	*&*	*tons*	*tons*	*tons*	*%*
Zimbabwe	0	280,000	0.0%	0	8,007	0%	752	0	0	NC
TOTAL	**260,516**	**110,286,500**	**-**	**115,124**	**935,929**	**-**	**245,989**	**6,398**	**1,038,519**	**-**

Sources for Domestic Bovine Meat Production:

- USDA (https://fas.usda.gov/data/production/commodity/0111000)
- Namibia & Botswana & Serbia: https://knoema.fr/atlas/Namibie/topics/Agriculture/Production-dorigine-animale-Quantit%c3%a9-de-production/Viande-de-b%c5%93uf-et-de-buffle
- Norway: https://www.ssb.no/en/jord-skog-jakt-og-fiskeri/jordbruk/statistikk/kjotproduksjon
- Morocco: https://www.foodbusinessafrica.com/morocco-to-import-30000-heads-of-cattle-from-brazil-and-uruguay-as-a-lifeline-to-the-struggling-red-meat-sector/

Sources for Export data: Eurostat (EU import mirror data), Trade Map ITC, UNIC estimates on USATrade pcs data

Bovine Meat Export to EU on Domestic Bovine Meat Production = the relative interest of the supplying country to implement a cattle traceability system for EUDR compliance; the incentive for UK, Uruguay, Switzerland and Argentina with the biggest interest is not strong enough.

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"**Bovine Raw Hides Export to EU on Total Bovine Raw hides Export**" + "**Bovine Wet Blue/Crust Hides Export to EU on Total Bovine Wet Blue/Crust Hides Export**" = the countries which have most to lose if the country has no incentive to implement a cattle traceability system

Main results:

- the countries which have the highest incentives to implement a cattle traceability system are relatively minor suppliers of HSL to the EU
- the most important supplying countries of HSL to the EU have virtually no interest to implement a cattle traceability system for EUDR compliance