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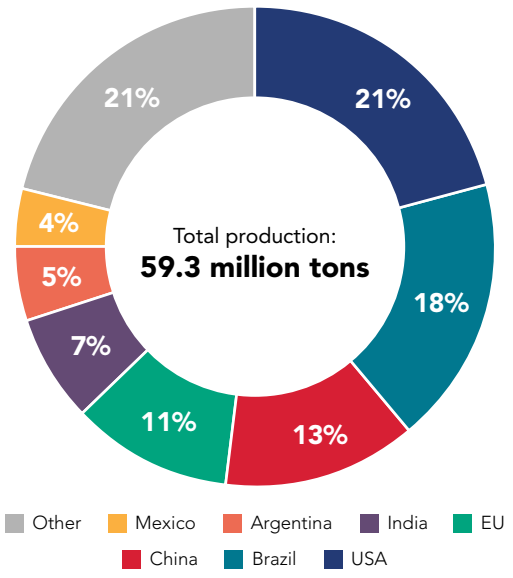
Cattle Briefing Note

Overview of the Global Cattle Supply Chain

Cattle ranching produces beef, dairy products, leather, and other products, making it a major global industry. However, it is also one of the largest drivers of global deforestation and conversion of native vegetation, particularly in Latin America where increasing global demand for beef is driving conversion of land into cattle pastures. Between 2001 and 2015, cattle ranching was responsible for the conversion of 45.1 million hectares of forest—an area roughly the size of Sweden (Weisse and Goldman, 2021). In South America, cattle and soy production are closely linked in deforestation, as soybeans are often planted on land previously converted from natural vegetation for cattle ranching (Kimbrough, 2021).

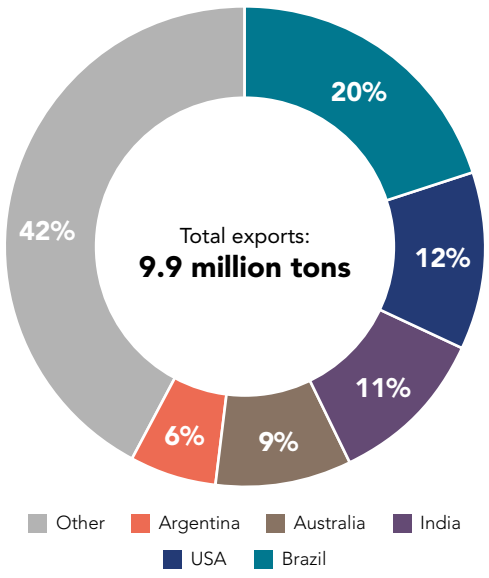
Beef is the third most consumed meat in the world, following pork and chicken (Ceres, 2022). Global demand for beef has been increasingly steadily in recent years. Between 2015 and 2020, global beef consumption increased by 7% driven by rising incomes in developing countries and global population growth (Clay, 2021). The United States and Brazil are the largest producers of beef, collectively accounting for nearly 40% global production (Figure 1), followed by China, the European Union, and India. The top five beef exporters are Brazil, the United States, Australia, Netherlands, and New Zealand while the top five importers are China, the United States, Japan, Republic of Korea, and Germany (Figure 2 and 3).

FIGURE 1 • **Global Beef Production in 2022**



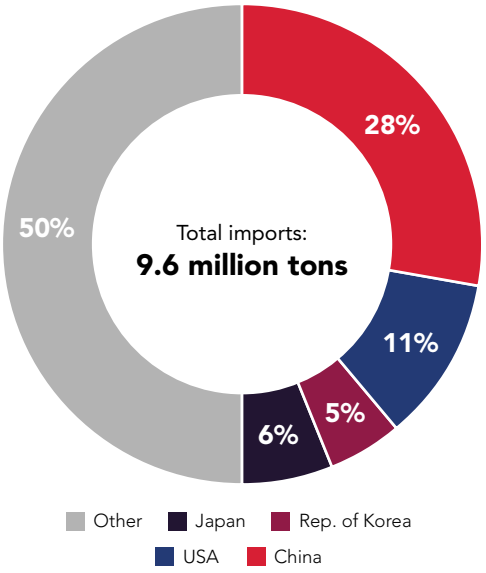
Source: USDA, 2023.

FIGURE 2 • **Global Beef Exports in 2022**



Source: UN Comtrade, 2023.

FIGURE 3 • **Global Beef Imports in 2022**

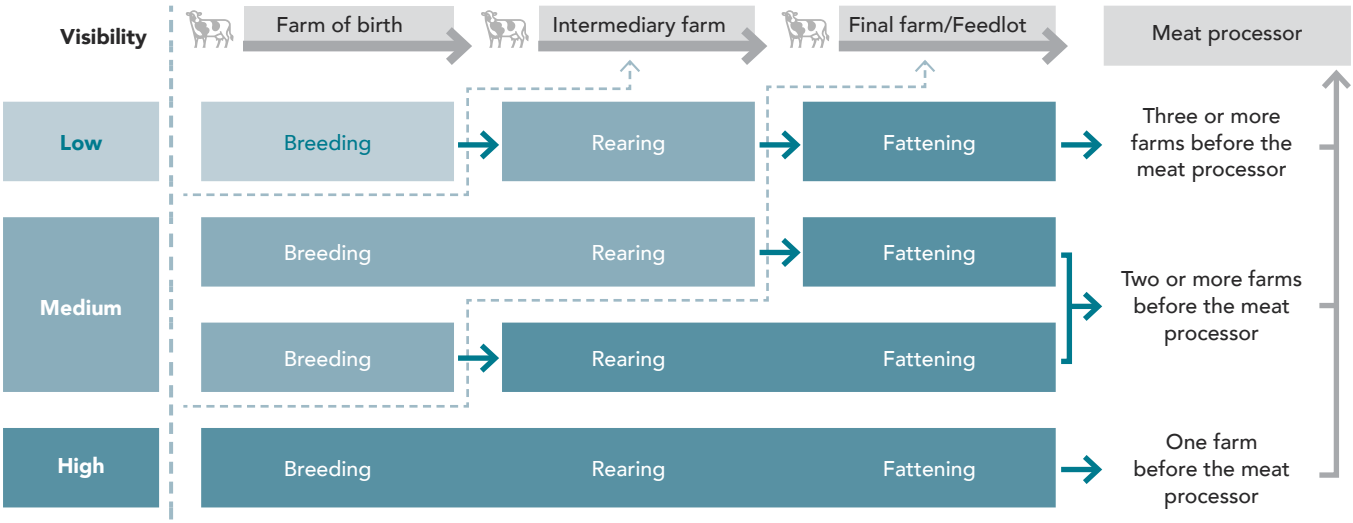


Source: UN Comtrade, 2023.

The cattle supply chain is complex, involving multiple stages: production, transport, processing or meat-packing, retail, and consumption. The production phase includes breeding, rearing, and fattening, which can occur on the same farm or across different farms, depending on the type of productive system and the availability of natural resources (CGF, 2022). Smallholders also play an important role in production, particularly in breeding (TFA et al., 2023).

In recent years, governments, companies, civil society organizations and financial institutions have become increasingly concerned about the role of the cattle industry in global deforestation. Brazil, which has the world's second-largest cattle herd, is the largest beef exporter, accounting for 22% of global exports in 2022 (USDA, 2023). The country's beef production and exports are dominated by three major meat processors: JBS, Marfrig, and Minerva. However, beyond these large companies, the market is highly fragmented. While meatpackers can trace the origins of their direct suppliers, most have yet to map their indirect suppliers, where a significant portion of deforestation occurs (Chain Reaction Research, 2020).

FIGURE 4 • **Example of the Cattle Supply Chain**



Source: Proforest, 2020.

Existing Theories of Change Regarding Halting Deforestation in the Cattle Supply Chain

Various initiatives have emerged to combat deforestation in the cattle supply chain, led by a wide range of stakeholders using different approaches (Appendix I). Some have developed complete Theories of Change (TOCs), while others have outlined objectives and activities to reduce deforestation. The initiatives can be grouped into several key categories:

Multi-stakeholder partnerships

Multi-stakeholder initiatives bring together various actors to address sustainability challenges in the cattle supply chain. The Global Roundtable for Sustainable Beef (GRSB) promotes improvements in the sustainability of the global beef value chain through leadership, science, engagement, and collaboration (GRSB, 2021). The Good Growth Partnership (GGP) connects interventions across global, national, and subnational levels to address sustainable production, demand, and finance in commodity supply chains, including beef. The Innovative Finance for the Amazon, Cerrado, and Chaco (IFACC) Initiative, a collaboration between The Nature Conservancy (TNC), the Tropical Forest Alliance (TFA), and the United Nations Environment Programme (UNEP), supports banks, companies, and investors in promoting deforestation- and conversion-free beef and soy production. In Brazil, the Brazilian Coalition on Climate, Forests, and Agriculture established a Traceability and Transparency Task Force to design national policies for beef and soy supply chains. Landscape and jurisdictional approaches, such as Brazil's Produce, Conserve, and Include (PCI) strategy in Mato Grosso, are gaining traction in the sector.

Producer country policies and initiatives

Governments in producer countries play a critical role in creating enabling environments for deforestation-free supply chains through public policies and traceability programs. In Brazil, the Forest Code requires Amazon farmers to set aside 80% of their land as a forest reserve. Recent efforts include agreements between meatpackers, governments, and NGOs to halt cattle purchases from illegally deforested areas in the Amazon, such as the G4 Zero-Deforestation Agreement and the Terms of Adjustment of Conduct (TAC) agreements (Pereira et al., 2020). The state of Pará launched the Cattle Integrity and Development Program, which mandates tracking cattle to reduce deforestation (TNC, 2023). Paraguay implemented a zero-deforestation law for its eastern region in 2004 (Dam et al., 2019), and Uruguay has operated a national traceability system, SIRA, since 2006, which tracks animals from birth (Fripp et al., 2023).

Consumer country policies and initiatives

Consumer countries are increasingly utilizing policy measures and multilateral initiatives to address deforestation associated with cattle supply chains. The Amsterdam Declarations Partnership committed to eliminating deforestation from agricultural commodity supply chains, including beef and leather, by 2025. The European Union Deforestation Regulation (EUDR) came into effect in June 2023 to prevent commodities and products linked to deforestation and forest degradation, including beef and leather, from being sold in the EU market. Similar regulatory measures have

been proposed in the U.S. and UK to eliminate illegal deforestation from the supply chains of "forest risk" commodities including beef.

Private sector commitments and initiatives

The private sector has made commitments and established initiatives to address deforestation. The Consumer Goods Forum (CGF) formed the Forest Positive Coalition of Action and developed Commodity Roadmaps for beef, providing guidance for manufacturers and retailers to eliminate deforestation and forest degradation from supply chains. At COP27, major beef companies, including JBS and Marfrig, were among 14 agri-commodity traders to launch the Agriculture Sector Roadmap to 1.5°C, prioritizing traceability, rancher outreach, and financial instruments to eliminate deforestation (TFA, 2022). Approximately 160 companies and investors signed the Statement of Support for the Cerrado Manifesto, which aims to halt deforestation and native vegetation loss due to cattle and soy expansion. Meatpackers, manufacturers, and retailers are also increasingly investing in landscape and jurisdictional initiatives to achieve sustainable beef production at scale (TFA et al., 2023).

Certification schemes

Certification schemes have been less prominent in the cattle sector compared to other commodities like palm oil. Rainforest Alliance's cattle certification program in Brazil and Colombia, which included a prohibition on deforestation, ended in 2020 due to low uptake. National beef certification schemes exist in countries such as Brazil, Canada, and Australia (TFA et al., 2023).

Civil society tools and resources

Civil society organizations have developed tools and resources to increase transparency and traceability and support the implementation of commitments in cattle supply chains to address deforestation. The Accountability Framework initiative (AFi), TNC's Environmental Framework for Beef, and the WWF DCF Implementation Toolkit provide guidance for companies and financial actors to implement deforestation- and conversion-free (DCF) commitments. Data platforms like Trase and Global Forest Watch Pro analyze trade flows and deforestation risk associated with commodity supply chains including beef. In Brazil, protocols such as the Voluntary Monitoring Protocol for Cattle Suppliers in the Cerrado and the Monitoring Protocol for Cattle Suppliers in the Amazon establish responsible sourcing criteria to ensure deforestation-free supply chains. The Beef on Track program provides monitoring, traceability, and auditing tools to support deforestation-free commitments in Brazil's Amazon biome.

Photo: Dieny Portinanni

Gaps in TOCs

Limited attention to demand-side policy responses

Many TOCs focus primarily on the supply-side, overlooking the role of demand-side responses Demand-side policies in consumer markets, such as the EU, UK, and U.S., are beginning to support sustainable production and consumption of beef. There is a need to understand how these demand-side measures can create a better enabling environment for sustainable cattle supply chains in producer countries. Additionally, markets such as China, Japan, and Republic of Korea, which have yet to be fully addressed by most TOCs, can play a significant role in tackling deforestation associated with cattle supply chains.

Insufficient traceability with indirect suppliers

A key gap in TOCs is the limited traceability of cattle through indirect suppliers. Ranches often specialize in only one or two phases of production—breeding, rearing, or fattening—and cattle are transferred and sold between ranches via various channels (Fripp et al., 2023). Smallholders, in particular, face challenges in participating in traceability programs due to limited incentives and resources. TOCs have yet to develop effective interventions to fully integrate indirect suppliers into traceability systems, which is critical for enhancing transparency and halting deforestation.

Limited focus on legal frameworks and law enforcement

Many TOCs concentrate on the actions of individual actors in the supply chain, such as producers and traders, while paying insufficient attention to the legal frameworks and law enforcement that shape these actors' behaviors. This focus limits the potential for systemic change, as addressing governance challenges is essential for lasting impact. Legal frameworks must be clarified, law enforcement capacity must be strengthened, and investments in institutional and financial support for monitoring are needed in producer countries. For example, while Brazil's cattle agreements have made strides in reducing deforestation, weak law enforcement, lack of government support, and the complexity of tracking indirect suppliers hinder their full implementation.

Lack of coordination between demand-side and supply-side measures

Current TOCs often lack coordination between consumer and producer countries. Strengthening partnerships between demand-side and supply-side efforts could reduce deforestation by aligning actions, sharing knowledge, and leveraging resources to support sustainable cattle production. Demand-side policy measures need to develop more effective engagement strategies with producer countries to address deforestation associated with cattle ranching. This includes providing financial and technical support for producer countries to implement sustainable practices.

Weaknesses in monitoring and evaluation

Despite efforts to increase transparency in cattle supply chains, monitoring and evaluation remain weak. Many TOCs lack clear indicators and pathways to achieving targets, making it difficult to assess their impact. Reporting on progress is often limited, hindering the ability to learn from past experiences and improve future interventions. Additionally, accountability mechanisms have yet to be incorporated into monitoring and evaluation processes to ensure that actors are held responsible for their commitments and that progress is tracked over time.

Assumptions in TOCs

Effective cooperation and collaboration

Many TOCs assume that different stakeholders – including businesses, governments, NGOs, and local communities – can effectively collaborate towards a common goal through dialogue and cooperation. While multi-stakeholder cooperation is often highlighted as a key component in TOCs, it's not always easy to achieve in practice. Diverging interests, unequal power dynamics, and differing perspectives on how to eliminate deforestation in the cattle supply chain can hinder effective cooperation. Therefore, TOCs must develop a clear narrative that resonates with all stakeholders (TFA et al., 2023). Additionally, pathways for cooperation need to account for the political and economic context of specific geographies to ensure successful collaboration.

Photo: Pisit Heng

Reliance on voluntary measures

TOCs in the cattle sector often rely on voluntary company commitments and sustainability programs to halt deforestation. These voluntary measures include setting no-deforestation targets, adopting traceability systems, engaging with suppliers, and participating in landscape and jurisdictional initiatives. However, the outcomes of these voluntary measures have been limited. For example, only 30% of companies sourcing beef and 28% of companies sourcing leather have deforestation commitments (Global Canopy, 2022). Furthermore, less than half of the companies in the cattle sector report their progress toward eliminating deforestation and conversion from their supply chains. To strengthen the implementation and reporting of zero deforestation commitments, TOCs should increasingly focus on mandatory programs and policies for private sector actors.

No deforestation leakage

Some TOCs assume that deforestation does not shift or "leak" from one geography to another when designing and implementing interventions. However, protecting one area may inadvertently push deforestation to another region where regulations are weaker or market pressure for zero deforestation is limited. For instance, while cattle agreements have reduced deforestation in the Amazon biome, the neighboring Cerrado biome has become a hotspot for deforestation (Levy, 2022). To address this issue, TOCs need to adopt a holistic approach that tackles the underlying drivers of deforestation at a larger scale, rather than focusing on isolated geographies.

Recommendations

Engage indirect suppliers in the supply chain

A significant portion of deforestation is driven by indirect supply chains in the cattle sector. While livestock transfer is an important feature in the cattle sector, TOCs should better integrate indirect suppliers, especially SMEs, as key stakeholders in supply chain initiatives. Governments in producer countries can enhance the transparency of indirect supply chains through public policies and national traceability systems. Meatpackers should involve indirect suppliers and SMEs in their sustainability programs, while civil society organizations can engage them through landscape and jurisdictional initiatives to address deforestation more comprehensively.

Strengthen legal frameworks and enforcement

TOCs should emphasize the importance of robust legal frameworks and law enforcement related to the cattle supply chain. Producer country governments need to strengthen laws and regulations to curb deforestation and ensure rigorous enforcement. Countries like Brazil and Paraguay have made progress in strengthening forest codes and implementing deforestation moratoriums, but enforcement remains a challenge (Climate Policy Initiative, 2020; IUCN, 2020). Strengthened governance frameworks that mandate traceability and rigorous enforcement can enhance the effectiveness of supply chain initiatives. Collaborating with the private sector can also help ensure adherence to these regulations.

Improve coverage and accountability of corporate commitments

TOCs should prioritize expanding and enhancing the accountability of corporate zero deforestation commitments within the cattle supply chain. Strengthening monitoring and evaluation processes with clear accountability mechanisms will help track progress and hold actors responsible for their commitments. Civil society organizations, with their tools and resources, can play a vital role in monitoring the policies and commitments of governments and the private sector, ensuring that promises translate into action.

Increase cooperation between consumer and producer countries

TOCs should incorporate strategies that address both demand and supply, highlighting opportunities for cooperation between consumer and producer countries. Major consumer markets such as the EU, UK, and the U.S. are implementing or developing regulations to reduce deforestation linked to cattle. Strengthening partnerships with producer countries is essential to the success of these measures. For instance, collaboration between consumer and producer countries could include sharing best practices, developing innovative technologies, and providing financial and technical support to cattle producers. Demand-side policies should also include targeted strategies that engage and support sustainable production in producer countries, ensuring smallholder producers are not excluded from the market.

Photo: Henk Nugter

Looking Ahead

Advancements in satellite imagery and data analysis are increasingly shaping efforts to monitor deforestation and enhance traceability in the cattle supply chain. Tools like Global Forest Watch and MapBiomas provide real-time deforestation alerts, offering visual proof of deforestation even in areas with sparse tree cover. Technology platforms such as Visipec, SMGeo, and Connecta are developing cattle-tracing and monitoring tools that allow companies and consumers to trace the origin of cattle products back to the plot of land where the cattle were raised (Fripp et al., 2023). While these platforms have been adopted by major meatpackers in Brazil, widespread adoption among SMEs and smaller slaughterhouses is still needed. With the EUDR coming into effect in June 2023, there is a growing opportunity to design traceability and monitoring systems that not only comply with the regulation but also promote sustainable development agendas in producer countries.

Integrated approaches are becoming increasingly popular in TOCs to address deforestation in the cattle supply chain. Landscape approaches provide an opportunity to develop and implement context-specific interventions to reduce deforestation from agriculture (FAO, 2023). Meatpackers, manufacturers, and retailers are also investing in landscape approaches to meet their deforestation commitments. The Gordon and Betty Moore Foundation's Collaboration for Forests and Agriculture (CFA), in partnership with civil society organizations, focuses on production, finance, and private sector engagement by shaping standards and incentives for deforestation-free beef and soy in South America.

Photo: Jyotirmoy Gupta

Appendix I

Examples of initiatives halting deforestation in the cattle supply chain

Types of Initiatives	Examples
Multi-stakeholder	• Good Growth Partnership • Global Roundtable for Sustainable Beef • Produce, Conserve and Include (PCI) Strategy • Innovative Finance for the Amazon, Cerrado and Chaco (IFACC) • The Brazilian Coalition on Climate, Forests and Agriculture • The New York Declaration on Forests (NYDF)
Private Sector	• CGF Forest Positive Coalition of Action Beef Roadmap • Agriculture Sector Roadmap to 1.5°C • The Cerrado Manifesto • Individual Company Commitments
Producer Country	• Brazilian Forest Code • G4 Zero-Deforestation Agreement • Terms of Adjustment of Conduct (TAC) agreements • The Pará Cattle Integrity and Development Program • VISEC • SIRA
Consumer Country	• EU Deforestation Regulation (EUDR) • UK Environment Act • US FOREST Act • The Amsterdam Declarations Partnership
Civil Society	• The Accountability Framework initiative (AFi) • The Beef Toolkit • Beef on Track • CDP Forests Questionnaire • Beef Deforestation Scorecard • Trase • Global Forest Watch Pro • WWF DCF Implementation Toolkit • The Environmental Framework • Voluntary Monitoring Protocol for Cattle Suppliers in the Cerrado • Monitoring Protocol for Cattle Suppliers in the Amazon
Certification	• Rainforest Alliance

References

Bain & Company, and TNC. 2020. "Brazil's Path to Sustainable Cattle Farming." Bain. October 29, 2020. https://www.bain.com/insights/brazils-path-to-sustainable-cattle-farming/.

Baskin, David. 2020. "Grazing Toward a Sustainable Beef Supply Chain." Walmart. August 7, 2020. https://corporate.walmart.com/newsroom/2020/08/07/grazing-toward-a-sustainable-beef-supply-chain.

Ceres. 2016. "An Investor Brief on Impacts That Drive Business Risks: Beef." Engage the Chain. March 17, 2016. https://engagethechain.org/beef.

CGF. 2022. "CGF Forest Positive Coalition Beef Roadmap Version 1.0." https://www.theconsumergoodsforum.com/wp-content/uploads/2022/02/CGF-FPC-Beef-Roadmap-EN.pdf.

Chain Reaction Research. 2020. "JBS, Marfrig, and Minerva: Material Financial Risk from Deforestation in Beef Supply Chains." https://chainreactionresearch.com/report/jbs-marfrig-and-minerva-material-financial-risk-from-deforestation-in-beef-supply-chains/.

Clay, Jason. n.d. "Deforestation and Conversion-Free: How Argentine Beef Can Lead the Market — Faster and at Scale | Publications | WWF." World Wildlife Fund. Accessed March 23, 2023. https://www.worldwildlife.org/publications/deforestation-and-conversion-free-how-argentine-beef-can-lead-the-market-faster-and-at-scale.

Climate Policy Initiative. 2020. "Where Does Brazil Stand With the Implementation of the Forest Code? A Snapshot of the CAR and the PRA in Brazil's States – 2020 Edition." CPI. 2020. https://www.climatepolicyinitiative.org/publication/where-are-we-at-implementing-the-forest-code-an-x-ray-of-the-car-and-the-pra-in-brazilian-states/.

Dam, Jinke van, Heleen van den Hombergh, and Marianne Hilders. 2019. *An Analysis of Existing Laws on Forest Protection in the Main Soy-Producing Countries in Latin America*. https://portals.iucn.org/library/node/48573.

DeValue, K., N. Takahashi, T. Woolnough, C. Merle, S. Fortuna, and A. Agostini. 2022. "Halting Deforestation from Agricultural Value Chains: The Role of Governments." Rome, Italy: FAO. https://doi.org/10.4060/cc2262en.

EPRS. n.d. "European Union Beef Sector: Main Features, Challenges and Prospects." European Parliamentary Research Service. Accessed April 4, 2023. https://www.europarl.europa.eu/thinktank/en/document/EPRS_BRI(2022)733676.

Fripp, Emily, Jonathan Gorman, Tina Schneider, Sharon Smith, Joe Paul, Till Neeff, Francesca Marietti, Laura Vary, and Ashleigh Zosel-Harper. 2023. "Traceability and Transparency in Supply Chains for Agricultural and Forest Commodities," October. https://www.wri.org/research/traceability-and-transparency-supply-chains-agricultural-and-forest-commodities.

Global Canopy. 2022a. "A Climate Wake-up: But Business Failing to Hear the Alarm on Deforestation." Forest 500. January 2022. https://forest500.globalcanopy.org/.

———. 2022b. "Deforestation Risks High in Beef and Soy Supply Chains." Forest 500. February 10, 2022. https://forest500.org/analysis/insights/deforestation-risks-high-beef-and-soy-supply-chains.

Griffiths, Ellen. 2019. "Is Your Beef Deforestation-Free?" Forest 500. June 18, 2019. https://forest500.org/analysis/insights/your-beef-deforestation-free.

GRSB. 2021. "Global Beef Sustainability Goals." Global Roundtable for Sustainable Beef (blog). May 2021. https://grsbeef.org/wp-content/uploads/2022/01/GRSB-Global-Goals-2021-Public-ENG.pdf.

IUCN. 2020. "Better Monitoring and Enforcement to Tackle Deforestation in Paraguay." Https://Www.Iucn.Nl/En/. 2020. https://www.iucn.nl/en/story/better-monitoring-and-enforcement-to-tackle-deforestation-in-paraguay/.

JBS. 2021. "Supply Chain Protocol - JBS." JBS. 2021. https://jbs.com.br/en/quality/supply-chain-protocol/.

JBS Foods Groups. 2021. "JBS Makes Global Commitment to Achieve Net-Zero Greenhouse Gas Emissions by 2040." March 23, 2021. https://jbsfoodsgroup.com/articles/jbs-makes-global-commitment-to-achieve-net-zero-greenhouse-gas-emissions-by-2040.

Kimbrough, Liz. "Soy and Cattle Team up to Drive Deforestation in South America: Study." Mongabay Environmental News, July 12, 2021. https://news.mongabay.com/2021/07/study-shows-how-soy-cattle-team-up-to-drive-deforestation-in-south-america/.

Levy, Samuel Alexander. 2022. "Can Companies End Deforestation? The Limitations and Potential Opportunities of Zero-Deforestation Commitments in the Brazilian Amazon and Cerrado." PhD Thesis, ETH Zurich. https://www.research-collection.ethz.ch/handle/20.500.11850/539299.

Pereira, Ritaumaria, Lisa L. Rausch, Aline Carrara, and Holly K. Gibbs. 2020. "Extensive Production Practices and Incomplete Implementation Hinder Brazil's Zero-Deforestation Cattle Agreements in Pará." Tropical Conservation Science 13 (January): 194008292094201. https://doi.org/10.1177/1940082920942014.

Proforest. 2017. "Socio-Environmental Monitoring of the Cattle Sector in Brazil." Proforest. June 23, 2017. https://www.proforest.net/resources/publications/socio-environmental-monitoring-of-the-cattle-sector-in-brazil-13547/.

———. 2020. "The Beef Toolkit." The Beef Toolkit. 2020. https://www.beeftoolkit.net.

Seelig, Michaela. 2017. "Upscaling Silvopastoral Systems in South America." IDB: Sostenibilidad (blog). March 21, 2017. https://blogs.iadb.org/sostenibilidad/en/upscaling-silvopastoral-systems-in-south-america/.

Soutar, Robert. 2019. "Can 'Silvopastoral' Farming Benefit Consumers, Cattle and the Climate?" Dialogo Chino (blog). April 18, 2019. https://dialogochino.net/en/agriculture/25826-can-silvopastoral-farming-benefit-consumers-cattle-and-the-climate/.

Stickler, C., A. E. Duchelle, D. Nepstad, and J. P. Ardila. 2018. "Subnational Jurisdictional Approaches: Policy Innovation and Partnerships for Change." Center for International Forestry Research (CIFOR). https://www.cifor.org/knowledge/publication/7072/.

TFA. 2022. "Agriculture Sector Roadmap to 1.5°C." 2022. https://www.tropicalforestalliance.org/en/collective-action-agenda/cop27-roadmap/.

TFA, Proforest, and CDP. n.d. "Starting the Journey: Companies Collaborate for Beef Sustainability at Scale." Accessed November 1, 2023. https://jaresourcehub.org/publications/starting-the-journey-companies-collaborate-for-beef-sustainability-at-scale/.

TNC. "TNC Praises Brazil's First State-Wide Cattle Traceability Program Committed to Reducing Emissions and Preventing Deforestation." The Nature Conservancy, December 2023. https://www.nature.org/en-us/newsroom/brazil-first-statewide-cattle-traceability-program/.

Trase. 2020. "Delivering Transparency for Sustainable Agriculture in Paraguay." Trase Insights. September 12, 2020. https://insights.trase.earth/insights/high-deforestation-risk-for-beef-from-the-paraguayan-chaco.

USDA. 2023a. "Brazil: Livestock and Products Annual." USDA Foreign Agricultural Service. September 1, 2023. https://www.fas.usda.gov/data/brazil-livestock-and-products-annual-10.

———. 2023b. "Livestock and Poultry: World Markets and Trade." October 12, 2023. https://fas.usda.gov/data/livestock-and-poultry-world-markets-and-trade.

Walter, Jonathan. 2022. "Tracking Deforestation Takes Tech – and Old-Fashioned Sleuthing." World Economic Forum. November 2, 2022. https://www.weforum.org/agenda/2022/11/deforestation-tracing-commodities-sustainable-supply-chain/.

Weisse, Mikaela, and Elizabeth Dow Goldman. 2021. "Just 7 Commodities Replaced an Area of Forest Twice the Size of Germany Between 2001 and 2015," February. https://www.wri.org/insights/just-7-commodities-replaced-area-forest-twice-size-germany-between-2001-and-2015.

Zu Ermgassen, Erasmus. n.d. "Agriculture, Environmental Policy, and Climate: Essays on Cattle Ranching in the Brazilian Amazon - ProQuest." Trase Insights. Accessed November 7, 2023. https://www.proquest.com/docview/2402915308/abstract/F44B82A0B57243C7PQ/1.

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