

Forum: United Nations Environmental Programme (UNEP)

Issue: Mitigating the environmental impact of the meat industry

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Introduction (Effie Chen)

According to Cassandra Brooks from Stanford's Institute for the Environment, the global meat industry provides food for billions of people worldwide but also results in increasingly damaging environmental impacts for our world. In fact, consumption of livestock doubled in 2020 compared to the last decade. The growth of the meat industry largely mirrors the increase in global populations, and especially within developing countries, demands are raised even higher with the wealthy incorporating animal products within their diets. This has caused the production of meat to become more industrialized, with factories replacing once farms with freely roaming animals. According to the Food and Agriculture Organization (FAO), currently over 75% of the world's poultry, 50% of pork, and two-thirds of egg supplies come from meat factories.

As reported by the Livestock, Environment, and Development (LEAD), more than two-thirds of all agricultural land is currently being devoted to raising and feeding livestock, and only 8% is used for growing direct food consumption for humans. Especially within the Western world, where demands for livestock and meat are high, an additional two-thirds of land would be needed globally. Yet, this large-scale land usage greatly contributes to freshwater scarcity, deforestation, soil erosion, and other pollutants that lead to dead zones. As such, when natural lands are converted to agricultural fields, they increase the production of carbon emissions and worsening current conditions of climate change.

These fields are then treated with toxic chemicals as they are doused in fertilizers. Since it is for animals, fertilizers are used in larger quantities than necessary for plants, resulting in the runoff that pollutes surrounding waterways. When not being sprayed onto fields, fertilizers are stored in lagoons, pond-like bodies of water used for storing wastewater, which are susceptible to overflowing during floods. As the manure decomposes, it releases harmful chemicals such as antibiotics, bacteria, and other gases such as methane.

Definition of Key Terms (Effie Chen)

Feed Sourcing

Production of feed crops requires extensive land usage, resulting in loss of biodiversity and disruption of ecosystems. Growing feed crops also contribute to water scarcity, as some often are water-intensive, such as soybeans. Soybeans, often grown within regions such as the Amazon rainforest, are linked to deforestation, and also the displacement of indigenous communities. As farmers moved deeper into the forest for low-cost lands, indigenous territories, and reserves were illegally occupied and deforested.

Manure Processing

Manure Processing often leads to serious pollution issues, as improperly managed manure can result in runoff during floods, can lead to water pollution, and further harm marine ecosystems. Manure management can also lead to the production of ammonia, especially within concentrated animal feeding operations (CAFOs) or industrial animal farms. Since many farmers don't produce their feed, excess manure is untreated and disposed of, further building up waste produced by the meat industry. In situations where an excess amount of manure is applied to fields, soil erosion, and runoff are results, overflowing storage units and infecting groundwater. Such contribution to pollution leads to health detriments for communities near such farms, increasing odors and health issues including asthma, especially found in children.

Concentrated Animal Feeding Operations (CAFOs)

CAFOs serve as a low-cost source of meat, milk, and eggs, which is a production of efficient feeding and grouping of animals. They increase the economy of communities nearby, and the effects cause increased taxes that lead to improved funds and infrastructure. However, CAFOs bring negative environmental health effects, such as contaminating groundwater. According to EPA's 2000 National Water Quality Inventory, 29 states revealed that identified that feeding operations contribute to degradation of water quality.

Livestock, Environment, and Development (LEAD)

This multi-stakeholder Initiative, coordinated by FAO's Animal Production and Health Division was formed to address the environmental consequences of livestock production, particularly in the light of the rising demand for food products of animal origin and the increasing pressure on sustaining natural resources.

Greenhouse Gas Emissions

As stated by the FAO, 14.5% of all greenhouse gas emissions caused by humans can be attributed to livestock farming. Livestock, especially cows, produce methane or eructations during their digestion, further contributing to current greenhouse gas emission issues. Production and transportation of feed and animals also increase carbon footprints within meat production. Methane and nitrous oxide, another gas released during livestock production, although not remaining in the atmosphere as long as carbon dioxide emissions, such gases have 25 times more threat and potential to contribute to climate change. In order to reach carbon neutrality goals by 2050, 2 tons of carbon equivalents per person would have to be cut, which only accounts for the total amount contributed by European meat eaters.

Dead Zones

Such zones are caused by excessive nitrous oxide formed by human activities, specifically meat production, and currently over 550 dead zones exist today, a majority due to agriculture and industrial pollution. An example is the dead zone within the Gulf of Mexico, the largest recorded currently. The meat industry is the main cause, as toxins from manure and fertilizer runoff pollute waterways, promoting further growth of algae, creating oxygen-deprived zones that lead to deaths and destroying of marine ecosystems.

Background Information (Henry Kuosim)

Greenhouse Gas Emissions

It is revealed that meat production globally is responsible for nearly 60% of all greenhouse gases from food production, with animal use causing double the pollution of plant-based foods. The entire food production system, including farming machinery, fertilizer spraying, and transportation, contributes to 17.3 billion metric tonnes of greenhouse gases annually, surpassing the entire emissions of the US and constituting 35% of global emissions. Raising and culling animals for food, particularly beef, contributes 57% of food production emissions, emphasizing the substantial environmental impact of meat production. The study calls for a reconsideration of dietary habits and farming practices to address the climate crisis effectively.

Enteric Fermentation in Livestock

Enteric fermentation, a natural aspect of the digestive process in ruminant animals like cattle, sheep, goats, and buffalo, involves microbes in the rumen producing methane during food decomposition. These methane emissions contribute up to 30% of global methane emissions, influenced by factors like feed quality, animal size, and environmental temperature.

Manure Management

Effective manure management, encompassing capture, storage, treatment, and utilization, plays a pivotal role in both farm productivity and environmental impact. Properly applied, manure can enhance productivity by reducing the reliance on commercial fertilizers. Installing anaerobic digesters on livestock operations enables the production of biogas from manure, serving as an eco-friendly energy source. This not only generates electricity but also mitigates greenhouse gas emissions associated with manure handling. However, mismanagement can adversely affect water quality, with over-application of manure nutrients posing a risk of nutrient runoff into surface water, contributing to nutrient pollution and "dead" zones in regions like the Chesapeake Bay and Gulf of Mexico. Research explores the interplay of agricultural and environmental policies, market dynamics, and evolving animal agriculture structures in shaping manure management decisions, farm income, and environmental outcomes.

Deforestation

Forests play a crucial role in the planet's health, serving as habitats for a vast array of life forms and influencing rainfall patterns, water quality, and flood prevention. More than half of the world's land-based plants and animals, along with three-quarters of all birds, inhabit or rely on forests. Additionally, millions of people directly depend on forests for their homes or livelihoods. Beyond their ecological significance, trees act as carbon sinks, absorbing and storing carbon dioxide. Deforestation poses a significant risk by releasing stored carbon dioxide and other greenhouse gases, contributing to approximately 10% of global warming. To address the climate crisis, halting deforestation is imperative, emphasizing the urgent need to safeguard and preserve forests.

Sustainable Land Use Practices

Sustainable land management is an approach that combines economic, social, and environmental needs to ensure the responsible use of land resources. Employing key indicators like nutrient balance and yield trends, this approach involves methods such as conservation agriculture, agroforestry, and integrated pest management to maintain land health. The benefits of sustainable land management encompass increased soil quality, biodiversity, carbon sequestration, food security, improved livelihoods, and minimized environmental degradation. Successful case studies from around the world, including farmer-managed natural regeneration in Niger and terracing in China, showcase the positive impact of these practices. Trees play a crucial role in sustainable land management, offering benefits such as preventing soil erosion, regulating the water cycle, and contributing to carbon sequestration. These examples emphasize the significance of adopting sustainable land practices for a thriving and sustainable future.

Alternative Protein Sources for Animal Feed

The availability of alternative protein sources for human consumption and animal feed, both terrestrial and aquatic, is on the rise in the commercial market. These products, ranging from meat analogs and insects to specific woody plants and algae like seaweed, hold substantial potential for providing sustainable protein for food and feed, with the potential to significantly mitigate climate and land use impacts.

Certification and Traceability

The concept of traceability has evolved as a crucial aspect of food quality and safety management, particularly in the context of sustainable agriculture. It serves as a new quality index and a foundation for trade, emphasizing documented transparency. In the realm of meat production, "traceable meat" signifies that the meat originates from an identified animal raised on a registered farm, accompanied by detailed information about its origin and processing. This information encompasses details about the specific animal or batch, the farming location, and the slaughterhouse involved in meat production. Traceability is integral for establishing robust quality assurance systems, enabling corrective measures at various stages of the value chain in response to deviations in quality parameters. Over the past two decades, many countries, driven by concerns such as disease control and export enhancement, have implemented rigorous livestock traceability systems.

Water Footprint

The term "water footprint" reflects the fresh water used in various processes, notably in agriculture for growing and processing crops and livestock. The water footprint of food, especially animal products like meat, dairy, and eggs, is substantial. Individual diets contribute significantly to personal water footprints, emphasizing the importance of reducing food waste. Water footprints involve three components: blue (surface and groundwater for irrigation), green (rainwater for dry farming), and grey (water for pollution dilution). Agriculture in the U.S. accounts for 80% of water consumption, with diets constituting over two-thirds of individual water footprints. Meat, particularly beef, has a high water footprint, influenced by factors like industrial versus pasture-raised practices. Global meat consumption constitutes 27% of humanity's water footprint, with the majority attributed to animal feed production. Processed foods and the origin of food impact water footprints, and transportation over long distances further exacerbates water usage. Agriculture significantly affects water resources, emphasizing the need to comprehend and minimize individual water footprints through informed choices and waste reduction strategies. Utilizing tools like the Water Footprint Calculator and the Water Footprint of Food Guide can aid in this awareness and action.

Major Countries and Organizations Involved (Henry Kuosim)

Brazil

In 2021, Brazil was ranked as the number one beef exporter in the world. Agriculture is a large part of Brazilian exports and food production has accounted for 74% of the country's greenhouse gas emissions in 2021. Usually, the emissions stem from deforestation to convert the native vegetation into farms and pastures. Of the 1.8 billion tons of greenhouse gasses that were released into the atmosphere in 2021, around 78% of the emissions were associated with beef production. In order to reduce the amount of greenhouse gas emissions, Brazil has agreed to cut its emissions in half by 2030 at COP26.

United States

The United States is a major contributor in the global meat industry, and its large-scale industrial farming practices contribute to greenhouse gas emissions, water pollution, and other environmental issues. In 2022, the United States produced 28.43 billion pounds of beef in 2022, up 354.9 million pounds from the year before and it was the most beef ever produced in the United States on record. However, with the increasing beef consumption, around 17,900 deaths are caused from agricultural air pollution. At the same time, the meat production of the U.S. also harms oceans, with runoff pollutants being a common cause of pollution. In order to protect the water quality, the U.S. Environmental Protection Agency has implemented policies to regulate wastewater discharge and to improve the cleanliness of water sources.

China

China's role in meat pollution is substantial due to its vast and rapidly growing meat industry. The country's large-scale livestock farming contributes to significant greenhouse gas emissions, particularly methane and nitrous oxide. A study reveals that a shift towards meat-heavy diets causes 75,000 premature deaths annually in China due to increased air pollution. The study, the first to quantify the impact of Chinese dietary changes from 1980-2010, links rising meat production to a 433% increase in ammonia emissions from fertilizer and livestock manure. This ammonia contributes to fine particulate matter air pollution associated with respiratory issues and cardiovascular diseases. The study estimates that 5% of 1.83 million Chinese deaths related to particle pollution in 2010 were due to dietary changes, primarily increased meat consumption. Reducing meat intake could decrease ammonia emissions and improve public health. In response to the situation, China's government has proposed reducing citizens' meat consumption by 50% through new dietary guidelines, with a recommended daily intake of 40g to

75g of meat per person. The guidelines, released every decade, aim to improve public health and cut greenhouse gas emissions, potentially reducing carbon dioxide equivalent emissions by 1bn tonnes by 2030.

Indonesia

Indonesia plays a significant role in meat pollution, contributing to the global environmental challenges associated with the meat industry. The country's escalating meat consumption, evident in a 21.43% increase from 2009 to 2014, has led to a surge in the livestock population, primarily chickens, ducks, goats, and others. This surge results in heightened manure production and greenhouse gas (GHG) emissions from the livestock sector. As Indonesia committed to a 26% reduction in carbon emissions by 2020, addressing the environmental impact of its expanding meat industry becomes crucial. The nation's role in meat pollution emphasizes the need for sustainable practices and international cooperation to mitigate environmental consequences. In 2015, Indonesia pledged to cut greenhouse gas emissions by 29% by 2030 compared to its current trajectory, with a potential 41% reduction if it receives \$6 billion in aid. The country, ranked the world's sixth-largest producer of greenhouse gas emissions due to deforestation, aims to address global warming concerns. However, the World Resources Institute criticizes Indonesia's plan for lacking transparency and clear accountability measures, emphasizing the importance of a comprehensive approach, including a ban on all future forest clearance, to effectively protect land and reduce emissions.

Argentina

Argentina, despite not being the highest greenhouse gas (GHG) emitter, faces scrutiny for its per capita emissions, exceeding the G20 average in 2016. The composition of Argentina's GHGs, with a significant portion being methane (27%), primarily from meat production, highlights its role in meat pollution. With Argentinians consuming an average of 55.9 kgs of beef per year and the country having 51 million cattle, addressing methane pollution poses a challenge, considering methane's potent warming effect and the cultural significance of meat consumption in Argentina. Argentina's 2030 national strategy for reducing carbon emissions focuses on a \$185 billion plan with 250 public policy measures. Prioritizing natural gas as a transitional fuel, the plan also targets emissions reduction in agriculture, livestock, and emphasizes water management improvements. While aiming for lower emissions, concerns exist regarding the lack of defined metrics for monitoring progress, and the plan highlights the role of natural gas in the energy sector, proposing Vaca Muerta as crucial for increasing natural gas production. The plan also addresses transport, aiming for a shift from oil, and addresses land use and

adaptation through water resource management. The major challenge lies in securing international financing for implementation.

Australia

Australia's beef industry is under scrutiny for its significant contribution to environmental degradation through meat-related pollution. A recent satellite analysis has exposed the industry's involvement in substantial deforestation, with 13,500 hectares cleared across 57 beef cattle properties in Queensland since 2018. The deforestation, driven primarily by beef production, poses a threat to habitats of endangered species, including koalas and various birds and frogs. This revelation raises concerns about the potential environmental impact and the role of Australian meat exports, particularly in the context of the UK-Australia trade deal, which has been criticized for potential deforestation-linked beef entering the global market. The National Farmers Federation of Australia has endorsed a nationwide target for achieving net-zero emissions by 2050, while Meat & Livestock Australia is setting its sights on achieving carbon neutrality by 2030.

Russia

Since the late 1990s, the substantial increase in meat consumption in Russia has become a source of escalating environmental concerns, particularly due to the heavy dependence of the livestock industry on imports of genetically modified soybeans. This reliance has been associated with alarming consequences, including deforestation and a considerable surge in greenhouse gas emissions. The agricultural sector's expansion is further impeded by a critical shortage of labor, a matter emphasized by Sergey Yushin, the head of the Russian National Meat Association. Despite grappling with these formidable challenges, there has been a noteworthy upswing of 24% in Russia's poultry meat exports in 2022, amounting to an impressive 336,000 tonnes.

India

With meat consumption soaring in India, particularly with chicken being the most sought-after meat, there is a growing interest in lab-grown or cultured meat to tackle greenhouse gas emissions from livestock farming. Despite India's significant livestock population contributing to over 200 million tons of CO₂ emissions annually, a joint initiative by the Humane Society International and the Centre for Cellular

and Molecular Biology aims to advance lab-grown meat technologies, with the first production expected by 2025.

Mexico

Mexico's beef industry, projected to become the tenth-largest exporter by 2023, with more than 80% of its exports destined for the U.S., underwent a transformation in 2015, transitioning from a historical beef importer to a net exporter. This shift had repercussions on U.S. cattle imports. The rapid expansion of exports, spearheaded by companies like Sukarne, has been driven by increased feedlot capacity, leading to substantial imports of U.S. feed grain. However, Mexico's expanding domestic production of fed beef and advancements in boxed beef technology may limit the growth of U.S. beef exports, influencing prices and export incentives. Concurrently, a proposed legislation for farmed animals in Jalisco by Animal Equality seeks to safeguard the welfare of over 200 million animals, building on earlier initiatives such as the Jalisco Without Cruelty law, which targeted issues within Mexico's farming practices.

Nigeria

Meat consumption in Nigeria, estimated at a million cows, sheep, and goats monthly, has significant climate impacts. The meat industry contributes to environmental issues such as burning two million tires monthly in slaughterhouses, releasing harmful substances, and causing atmospheric pollution. Additionally, large-scale deforestation for grazing reserves has led to a loss of 25.2 million hectares, worsening global warming and increasing temperatures and greenhouse gas levels. To address deforestation linked to traditional Kilishi (meat jerky) production, Nigeria, with support from the World Bank, is constructing a solar-powered plant in Yaba village. Launched in 2020, the initiative aims to improve hygiene, reduce environmental impact, and create economic opportunities by replacing wood with solar panels, cutting production time, and meeting growing demand, particularly in cities like Abuja and Lagos.

Timeline of Events (Effie Chen)

Date	Description of event
1870s-1939s	Refrigeration and meat packing introduced, allowed for larger production and storing of meat

1958-1975	Industrialization of the meat industry begins, processed and prepared meats increasingly appear in diets
November 29th, 2006	FAO releases the report “Livestock’s Long Shadow,” emphasizing the environmental impact of the meat industry, linking livestock farming to global environmental issues
June 26th, 2014	The film “Cowspiracy: The Sustainability Secret” is released, a documentary that addresses environmental destruction issues and how animal agriculture is a large source of greenhouse gas emissions, ocean dead zones, and deforestation
December 12th, 2015	The Paris Agreement, including action plans to prevent the escalation of global warming, is signed, including ideas on sustainable agriculture, addressing the emissions from the meat industry
August 8th, 2019	The Intergovernmental Panel on Climate Change (IPCC) releases “Climate Change and Land,” discussing sustainable land usage, including having citizens modify their dietary habits revolving meat

Relevant UN Resolutions and Treaties (Effie Chen)

- Increasing the Production and Use of Edible Protein, 15 December 1967 (**A/RES/2319**)
- Guidelines for the Humane Handling, Transport, and Slaughter of Livestock, April 2001
- International Treaty on Plant Genetic Resources for Food and Agriculture, 29 June 2004
- Global Plan of Action for Animal Genetic Resources, September 2007
- United Nations Declaration on the Rights of Indigenous Peoples, 13 September 2007 (**A/RES/61/295**)
- 2030 Agenda for Sustainable Development, 25 September 2015 (**A/RES/70/1**)
- Work of the Statistical Commission pertaining to the 2030 Agenda for Sustainable Development, 6 July 2017 (**A/RES/71/313**)

Possible Solutions (Henry Kuosim)

Adopting sustainable feed sourcing practices to mitigate environmental impacts associated with meat production. This solution involves engaging with suppliers committed to preventing agricultural run-off pollution, soil erosion, and ecosystem clearance in their supply chain. Practices include implementing cover crops, conservation tillage, diverse crop rotations, and nutrient optimization plans. Stakeholders include meat producers, feed suppliers, and regulatory bodies. Implementation requires rigorous verification processes, supplier education, and policy enforcement against ecosystem clearance. Challenges may arise in ensuring universal compliance, as some suppliers may resist or lack resources for sustainable practices. Ongoing monitoring and enforcement are essential, and potential cost implications for producers may need to be addressed.

Implementing responsible manure management practices to mitigate nutrient pollution and environmental degradation. This solution involves establishing centralized processing facilities for efficient manure handling and enforcing policies against locating new or expanding CAFOs in impaired watersheds. Stakeholders include meat producers, regulatory bodies, and communities. Implementation requires infrastructure development, policy formulation, and community engagement. Financial constraints may hinder the establishment of processing facilities, and resistance from the livestock industry may be encountered. Policy enforcement may face challenges, and alternative solutions for waste management need exploration.

Setting time-bound goals to reduce greenhouse gas emissions throughout the meat production supply chain. This solution involves requiring meat suppliers to implement emission reduction strategies in direct operations, contract suppliers, and feed production. Stakeholders include meat producers, supply chain partners, and regulatory bodies. Implementation necessitates goal setting, supplier collaboration, and monitoring mechanisms. Resistance from suppliers, lack of uniform standards, and the need for continuous monitoring pose challenges. Potential cost implications for suppliers may require financial incentives or support.

Questions for Further Research (Henry Kuosim)

1. What innovative technologies are currently being explored to reduce the carbon footprint of livestock farming and meat production?
2. How can sustainable farming practices be effectively integrated into large-scale meat production systems to mitigate environmental degradation?

3. What role do alternative protein sources, such as plant-based and lab-grown meats, play in reducing the environmental impact of traditional meat production?
4. How can government policies and regulations incentivize environmentally friendly practices within the meat industry?
5. What strategies exist for minimizing water usage and preventing water pollution in meat production processes?
6. To what extent do consumer choices and behaviors influence the environmental sustainability of the meat industry, and how can this influence be leveraged for positive change?
7. What are the socio-economic implications of transitioning towards more environmentally friendly practices within the meat industry for farmers, workers, and communities?
8. How do different livestock management systems impact biodiversity, and what practices can be implemented to promote ecological balance in meat production?
9. What lifecycle assessments exist for various meat production methods, and how do these assessments inform sustainable decision-making within the industry?
10. In what ways can global collaboration and knowledge-sharing contribute to developing and implementing effective strategies for mitigating the environmental impact of the meat industry?

Bibliography

“Deforestation-Free’ Soya Farms Still Tearing down the Amazon.” *The Bureau of Investigative Journalism* (En-GB), <https://www.thebureauinvestigates.com/stories/2022-02-10/farms-touting-deforestation-free-soya-still-tearing-down-the-amazon>. Accessed 21 Jan. 2024.

“Fact Check: How Bad Is Eating Meat for the Climate? – DW – 10/30/2022.” Dw.Com, <https://www.dw.com/en/fact-check-is-eating-meat-bad-for-the-environment/a-63595148>. Accessed 26 Jan. 2024.

Hribar, Carrie. *Understanding Concentrated Animal Feeding Operations and Their Impact on Communities*. 2010. *Centers of Disease and Control*, https://www.cdc.gov/nceh/ehs/docs/understanding_cafos_nalboh.pdf.

Loria, Joe. “Here’s Why the Gulf of Mexico’s Dead Zone Is a Bigger Problem Than You Think.” *Mercy For Animals*, 3 Aug. 2017, <https://mercyforanimals.org/blog/report-meat-industry-cause-of-largest-dead/>.

Meat's Environmental Impact | Stanford Woods Institute for the Environment. 25 July 2011, <https://woods.stanford.edu/news/meats-environmental-impact>.

The Meat Industry – Environmental Issues & Solutions | Clean Water Action. <https://cleanwater.org/meat-industry-environmental-issues-solutions>. Accessed 21 Jan. 2024.

24, Rob Cook | Published on: Jan. “U.S. Beef Production by Year (USDA).” *Beef2Live*, beef2live.com/story-beef-production-year-0-107550. Accessed 26 Jan. 2024.

Esther Amaka Okoye a, et al. “Metal Pollution of Soil, Plants, Feed and Food in the Niger Delta, Nigeria: Health Risk Assessment through Meat and Fish Consumption.” *Environmental Research*, Academic Press, 12 May 2021, www.sciencedirect.com/science/article/abs/pii/S0013935121005673. Accessed 26 Jan. 2024.

Philip Thornton 1, et al. “Alternative Sources of Protein for Food and Feed.” *Current Opinion in Environmental Sustainability*, Elsevier, 29 Mar. 2023, www.sciencedirect.com/science/article/abs/pii/S1877343523000246#:~:text=Alternative%20protein%20sources%20include%20meat,%2C%20technological%2C%20and%20socioeconomic%20impacts. Accessed 26 Jan. 2024.

Brazil Food Sector Accounts for 74% of Emissions: Study | Reuters, www.reuters.com/sustainability/cop/brazil-food-sector-accounts-74-emissions-study-2023-10-24/. Accessed 25 Jan. 2024.

Buchholz, Katharina, and Felix Richter. “Infographic: The Biggest Exporters of Beef in the World.” *Statista Daily Data*, 27 Apr. 2021, www.statista.com/chart/19122/biggest-exporters-of-beef/. Accessed 26 Jan. 2024.

Cavallito, Matteo. “Nigeria Is Acting against Deforestation Trought Sustainable Dried Meat.” *Re Soil Foundation*, Matteo Cavallito https://resoilfoundation.org/Wp-Content/Uploads/2020/01/Logo_resoilfoundation.Png, 14 Oct. 2021, resoilfoundation.org/en/environment/nigeria-deforestation-meat/. Accessed 26 Jan. 2024.

“China’s Plan to Cut Meat Consumption by 50% Cheered by Climate Campaigners.” *The Guardian*, Guardian News and Media, 20 June 2016, www.theguardian.com/world/2016/jun/20/chinas-meat-consumption-climate-change. Accessed 26 Jan. 2024.

Contributors. "Labour Shortage Hinders Russian Agri and Poultry Exports." *Poultry World*, 24 July 2023, www.poultryworld.net/the-industrymarkets/market-trends-analysis-the-industrymarkets-2/labour-shortage-hinders-russian-agri-and-poultry-exports/. Accessed 26 Jan. 2024.

"Don't Cry for Meat Argentina." *Global Policy Journal*, www.globalpolicyjournal.com/blog/30/11/2018/dont-cry-meat-argentina. Accessed 26 Jan. 2024.

Editor. "What Is Sustainable Land Management?" *DGB Group*, Dutch Green Business Group, 24 July 2023, www.green.earth/blog/what-is-sustainable-land-management#:~:text=Sustainable%20land%2Dmanagement%20practices%20such,infiltration%2C%20and%20reduce%20soil%20degradation. Accessed 26 Jan. 2024.

"Enteric Fermentation." *Climate & Clean Air Coalition*, 6 Dec. 1970, www.ccacoalition.org/projects/enteric-fermentation#:~:text=Enteric%20fermentation%20is%20a%20natural, methane%20as%20a%20by%2Dproduct. Accessed 26 Jan. 2024.

"Explore Scientific, Technical, and Medical Research on ScienceDirect." *ScienceDirect.Com | Science, Health and Medical Journals, Full Text Articles and Books.*, www.sciencedirect.com/. Accessed 26 Jan. 2024.

Gibbens, Sarah. "Meat Production Leads to Thousands of Air Quality-Related Deaths Annually." *Environment*, National Geographic, 11 May 2021, www.nationalgeographic.com/environment/article/meat-production-leads-to-thousands-of-air-quality-related-deaths-annually. Accessed 26 Jan. 2024.

Global Plan of Action for Animal Genetic Resources and the Interlaken Declaration |Policy Support and Governance| Food and Agriculture Organization of the United Nations . <https://www.fao.org/policy-support/tools-and-publications/resources-details/en/c/453629/>. Accessed 26 Jan. 2024.

Government of Canada, Department of Justice. Backgrounder: United Nations Declaration on the Rights of Indigenous Peoples Act. 12 Apr. 2021, <https://www.justice.gc.ca/eng/declaration/about-apropos.html#:~:text=need%20this%20legislation%3F-,The%20United%20Nations%20Declaration%20on%20the%20Rights%20of%20Indigenous%20Peoples,on%2Ddiscrimination%20and%20good%20faith>.

"How Australia's Meat Industry Could Be Part of the Climate Solution." *The Guardian*, Guardian News and Media, 16 Sept. 2020,

www.theguardian.com/australia-news/2020/sep/17/how-australias-meat-industry-could-be-part-of-the-climate-solution. Accessed 26 Jan. 2024.

Ihedioha, JaneFrances N, et al. "Health Risk Assessment of Zinc, Chromium, and Nickel from Cow Meat Consumption in an Urban Nigerian Population." *International Journal of Occupational and Environmental Health*, U.S. National Library of Medicine, Oct. 2014, www.ncbi.nlm.nih.gov/pmc/articles/PMC4164878/#:~:text=While%20meat%20provides%20an%20important,be%20contaminated%20with%20heavy%20metals. Accessed 26 Jan. 2024.

"Indonesia to Cut Carbon Emissions by 29% by 2030." *The Guardian*, Guardian News and Media, 24 Sept. 2015, www.theguardian.com/environment/2015/sep/21/indonesia-promises-to-cut-carbon-emissions-by-29-by-2030. Accessed 26 Jan. 2024.

Ingizza, Carolina, and Michael Pooler. "Brazil's Beef Industry Starts to Tackle Methane Emissions." *Financial Times*, 1 Mar. 2022, www.ft.com/content/ab9ceb79-0777-499e-a04a-beb412039159. Accessed 26 Jan. 2024.

Jain, Rishabh. "Lab-Grown Meat Industry Is on the Rise in India." *FairPlanet*, 15 Mar. 2023, www.fairplanet.org/story/inside-indias-foray-into-the-lab-grown-meat-market/#:~:text=According%20to%20a%20joint%20report,of%20which%20is%20culture%20meat. Accessed 26 Jan. 2024.

"Learn the Effects of Deforestation." *WWF*, www.wwf.org.uk/learn/effects-of/deforestation/#:~:text=If%20forests%20are%20cleared%2C%20or,forests%20now%20more%20than%20ever. Accessed 26 Jan. 2024.

Lewkowicz, Javier. "Argentina's New Plan for Reducing Carbon Emissions - Analysed in Depth." *Dialogo Chino*, 8 June 2023, dialogochino.net/en/climate-energy/362482-argentinas-new-plan-for-reducing-carbon-emissions-analysed-in-depth/. Accessed 26 Jan. 2024.

"Manure Management." *USDA ERS - Manure Management*, www.ers.usda.gov/topics/farm-practices-management/crop-livestock-practices/manure-management/#:~:text=Manure%20management%E2%80%94how%20manure%20is,the%20need%20for%20commercial%20fertilizer. Accessed 26 Jan. 2024.

"Meat Accounts for Nearly 60% of All Greenhouse Gases from Food Production, Study Finds." *The Guardian*, Guardian News and Media, 13 Sept. 2021,

www.theguardian.com/environment/2021/sep/13/meat-greenhouses-gases-food-production-study.

Accessed 26 Jan. 2024.

“The Meat Industry – Environmental Issues & Solutions.” *Clean Water Action*, cleanwater.org/meat-industry-environmental-issues-solutions. Accessed 26 Jan. 2024.

Meat Industry | Encyclopedia.Com.

<https://www.encyclopedia.com/humanities/encyclopedias-almanacs-transcripts-and-maps/meat-industry>.

Accessed 26 Jan. 2024.

Nugrahaeningtyas, Eska, et al. “Greenhouse Gas Emission Intensities for the Livestock Sector in Indonesia, Based on the National Specific Data.” *MDPI*, Multidisciplinary Digital Publishing Institute, 7 June 2018, www.mdpi.com/2071-1050/10/6/1912. Accessed 26 Jan. 2024.

Peel, Derrell. “Mexican Beef and Cattle Industry Development Continues.” *Beef Magazine*, 26 July 2023, www.beefmagazine.com/cattle-market-outlook/mexican-beef-and-cattle-industry-development-continues. Accessed 26 Jan. 2024.

Reporters, African Climate. “African Climate Reporters.” *African Climate Reporters*, 7 Oct. 2018, africanclimaterporter.com/2018/10/07/effects-of-meat-consumption-on-climate-change-in-nigeria-what-needs-to-change/. Accessed 26 Jan. 2024.

Resolution Adopted by the General Assembly on 25 September 2015. Transforming Our World: The 2030 Agenda for Sustainable Development — European Environment Agency. <https://www.eea.europa.eu/policy-documents/resolution-adopted-by-the-general>. Accessed 26 Jan. 2024.

Special Report on Climate Change and Land — IPCC Site. <https://www.ipcc.ch/srccl/>. Accessed 26 Jan. 2024.

Steinfeld, Henning, et al. *Livestock’s Long Shadow*. 2006. www.fao.org, <https://www.fao.org/3/a0701e/a0701e00.htm>.

Tenniswood, Kerri. “How Effective Is Cowspiracy?” *Faunalytics*, 11 July 2022, <https://faunalytics.org/how-effective-is-cowspiracy/>

US to Toughen Water Pollution Rules for Meat Plants | *Reuters*, www.reuters.com/business/environment/us-toughen-water-pollution-rules-meat-plants-2023-03-01/.

Accessed 25 Jan. 2024.

"The Water Footprint of Food." *FoodPrint*, 18 Jan. 2024, foodprint.org/issues/the-water-footprint-of-food/. Accessed 26 Jan. 2024.

What Is the History of the Paris Agreement (2015) on Climate Change? - Ask DAG!
<https://ask.un.org/faq/120272#:~:text=The%20Paris%20Agreement%20came%20out,adopted%20on%2012%20December%202015>. Accessed 26 Jan. 2024.

X, Science. "Meat-Eating Causes 75,000 Chinese Deaths a Year through Pollution." *Phys.Org*, 16 Dec. 2021, phys.org/news/2021-12-meat-eating-chinese-deaths-year-pollution.html#google_vignette. Accessed 26 Jan. 2024.

Zach Boren, Alice Ross. "Australian Beef Industry Linked to Destruction of Forests Home to Threatened Species." *Unearthed*, 24 Apr. 2022, unearthed.greenpeace.org/2021/12/15/australia-beef-deforestation-climate-brexite-trade-deal/. Accessed 26 Jan. 2024.