



The carbon footprint of beef transportation in Colombia: market connections and distribution networks

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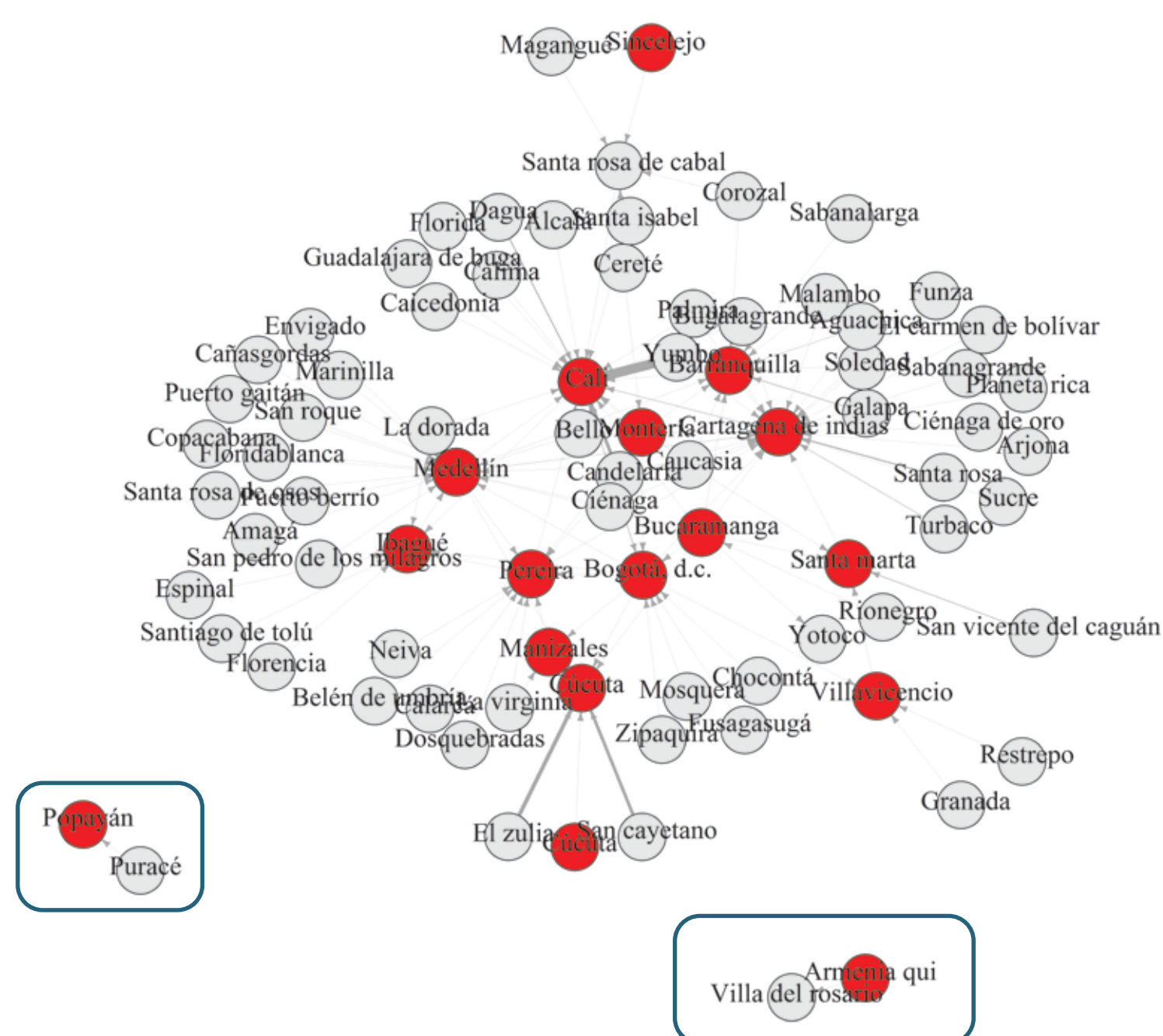
Introduction

- Besides the notable impact of cattle value chains on the total greenhouse gas emissions (GHGE) within food systems, there is an increasing apprehension regarding the persistent prevalence of globalized value chains and their environmental pressure across the supply network.
- Nevertheless, comprehensive assessments of the extent to which cattle contribute to GHGE have predominantly concentrated on farm-level management and animal feed intake efficiency, rather than delving into the structure and expansion of the beef supply network. This perspective offers valuable insights into enhancing our comprehension of the overall food system's carbon footprint (CF).

Objective

Measuring the GHGE and CF associated with beef transportation within the Colombian supply network, while also evaluating its environmental efficiency, and subsequently comparing these metrics with alternative animal proteins such as chicken and pork.

Results



- The beef supply network in Colombia displays a fat-tail distribution, indicating that numerous supplying regions dispatch beef to a limited set of trading partners (depicted as red circles). Furthermore, the network demonstrates high centrality, with specific nodes – such as Bogotá, Barranquilla, Cali, Medellín, Cúcuta, and Cartagena – concentrating trade relationships and supply linkages.

Figure 2. Beef supply network, 2022

- The weighted average distances covered by carcass beef to reach the primary cities exceed 120 km. In contrast, chicken surpasses 170 km, and pork goes beyond 350 km.
- Between 2020 and 2021, there was a decline in the volumes transported for all three meat categories, possibly attributed to the impact of the COVID-19 pandemic. However, the market rebounded in 2022, with chicken taking the lead in transportation with over 68,000 tons, trailed by beef and pork at 51,000 and 26,000 tons, respectively.
- The analysis reveals that, despite the relatively shorter distances and moderate volumes transported, beef transportation accounted for the most substantial environmental impact. The CF stemming from beef transportation measured 0.347 tons of CO₂eq per ton of carcass weight moved. In contrast, chicken registered a CF of 0.234 tons, while pork stood at 0.22 tons per ton of product mobilized (refer to Figure 3).

References

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Methodology

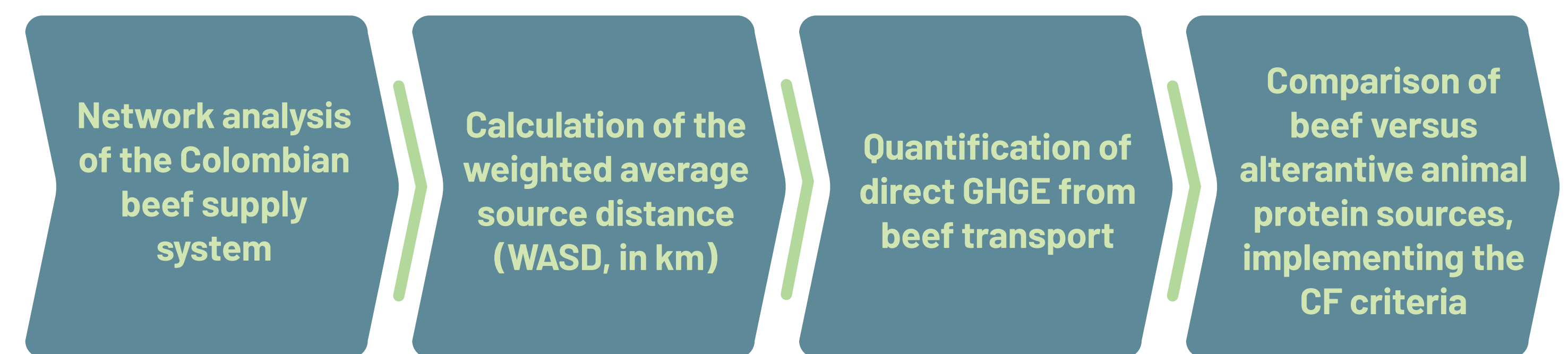


Figure 1. Methodological steps summary

- The study focuses on the transport routes for carcass beef, originating from municipal-level wholesale markets and culminating in major cities such as Bogotá, Barranquilla, Cali, Cartagena, Cúcuta, and Medellín – areas densely populated by consumers. The period of analysis is 2019 to 2022.
- Data were obtained from a) the Agricultural Sector Information System (SIPSA-DANE): for prices and supply, b) IPCC: for conversion factors, c) Google Maps: for route distances, and d) Mining-Energy Planning Unit (UPME) and the Ministry of Transportation of Colombia: for vehicles used in the transport (axle 2, 3, and 4 type trucks) and fuel requirements.

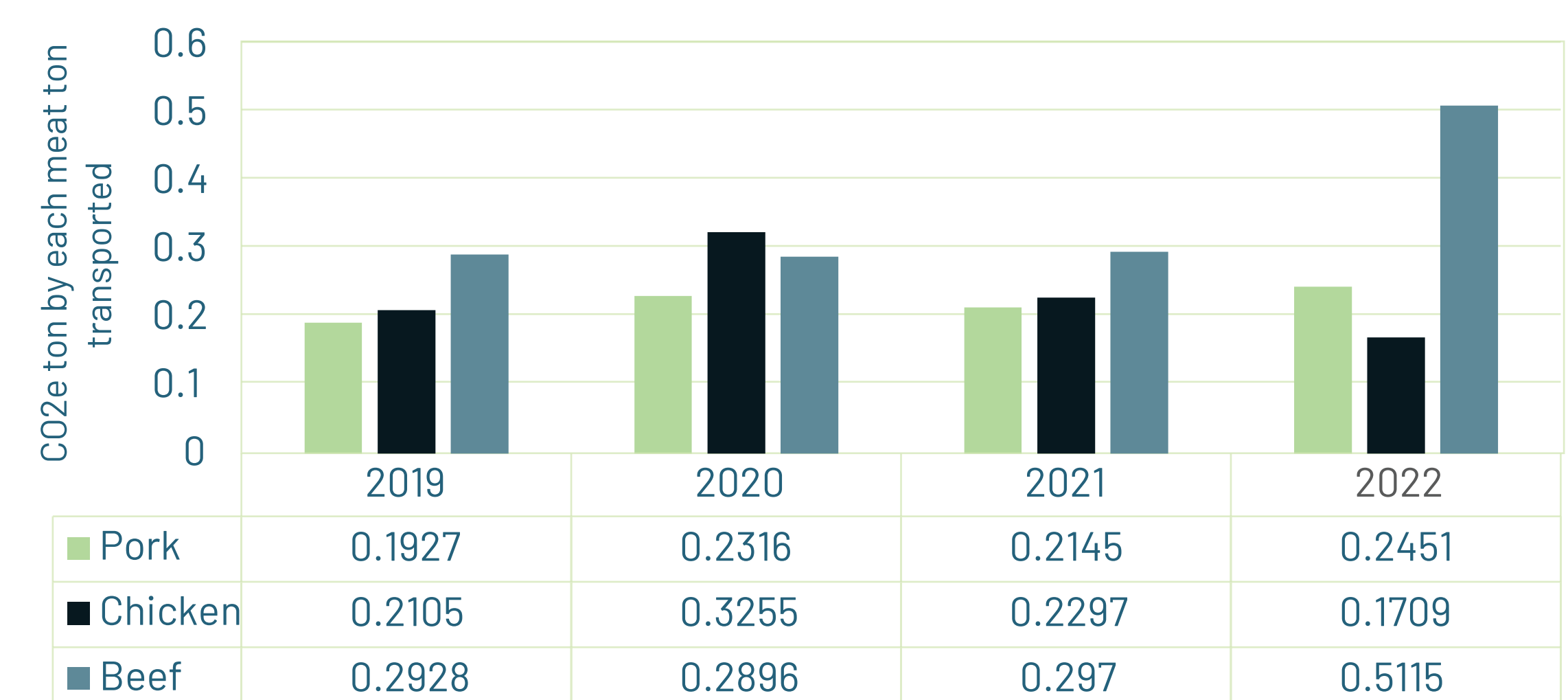


Figure 3. Carbon footprint from meat transportation in Colombia, 2019–2022

Conclusions

- Our results underscore the necessity of formulating comprehensive approaches and strategies aimed at curtailing emissions stemming from livestock production. These efforts should encompass a holistic consideration of factors such as the beef supply network, transportation distances, infrastructure, and technology. This broader perspective is vital for addressing GHGE from the cattle sector beyond the confines of the farm.
- The pronounced intensity and reliance observed within the beef supply structure unveil potential vulnerabilities and risks inherent in the system, particularly in the face of external disruptions like the COVID-19 pandemic. With an intermediation rate of 40%, it is evident that out of 100 cargo trips, 40 culminate in the same producing municipalities. This phenomenon is a consequence of public health measures that forced the closure of numerous informal slaughterhouses and beef markets, thereby emphasizing the situation. This matter is resurfacing in the political discourse, as governmental plans to revise regulations aim to enable the functioning of municipal slaughterhouses. This strategic move, designed to curtail beef prices, holds the potential to influence the carbon footprint associated with transportation.

Acknowledgments

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