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UN EMG Nexus Dialogue on Sustainable Nitrogen Management

Why focusing on sustainable nitrogen management in agrifood systems?

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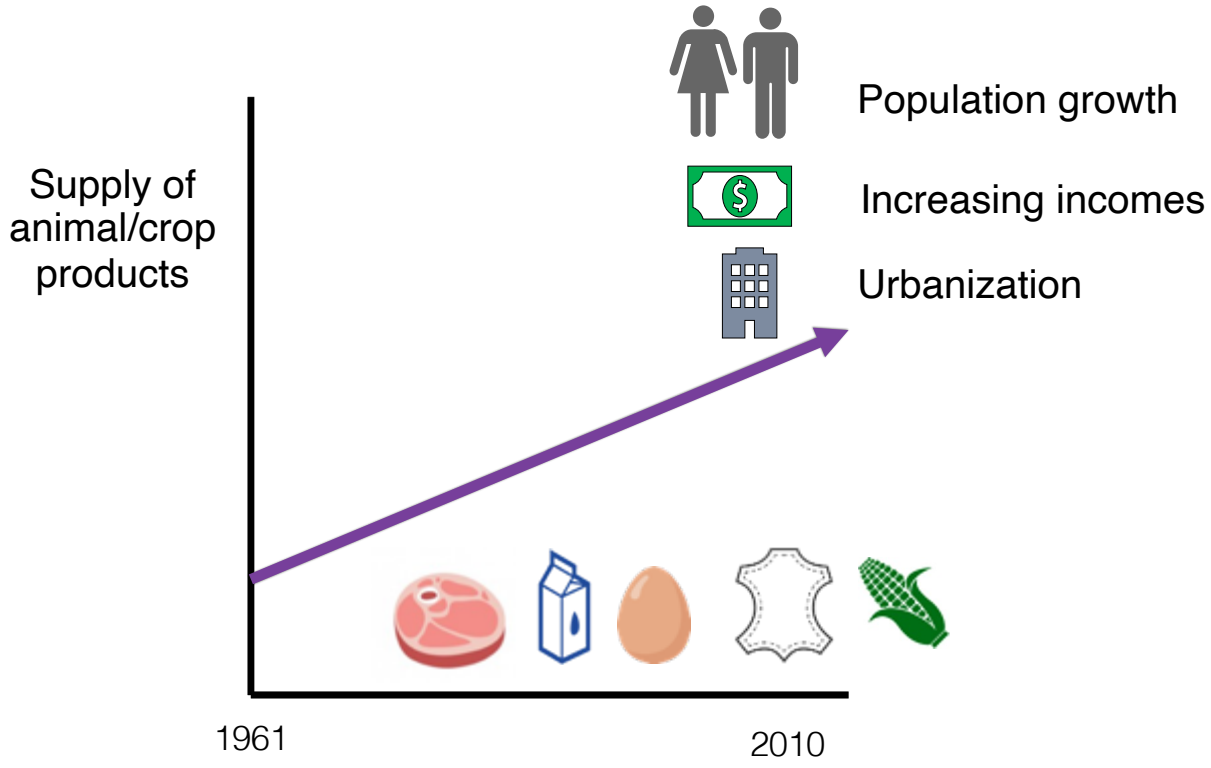
Livestock Policy Officer

Food and Agriculture Organization of the United Nations

CHANGES IN AGRIFOOD SYSTEMS



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Growth of agrifood sector

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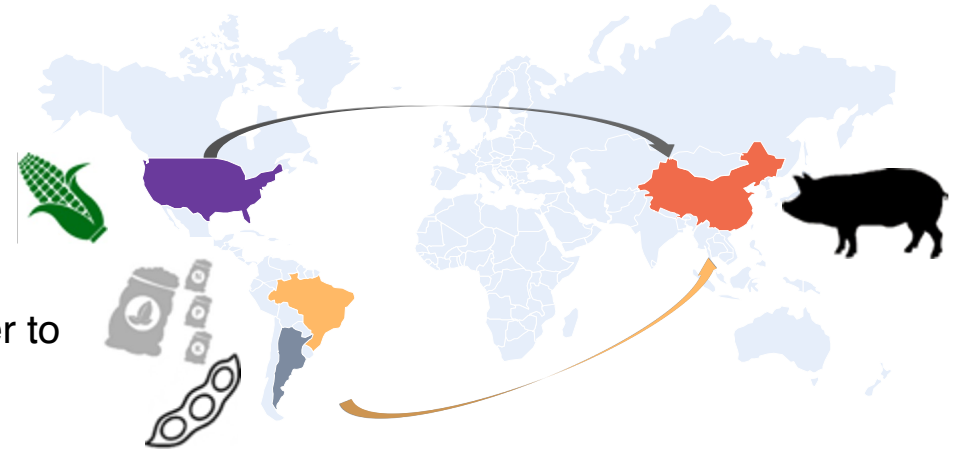
COMPLEX AND LONG SUPPLY CHAINS

Small-scale farms

Disconnection between feed production and animal production

Large-scale and geographically concentrated farms



Large use of synthetic fertilizer to produce feed

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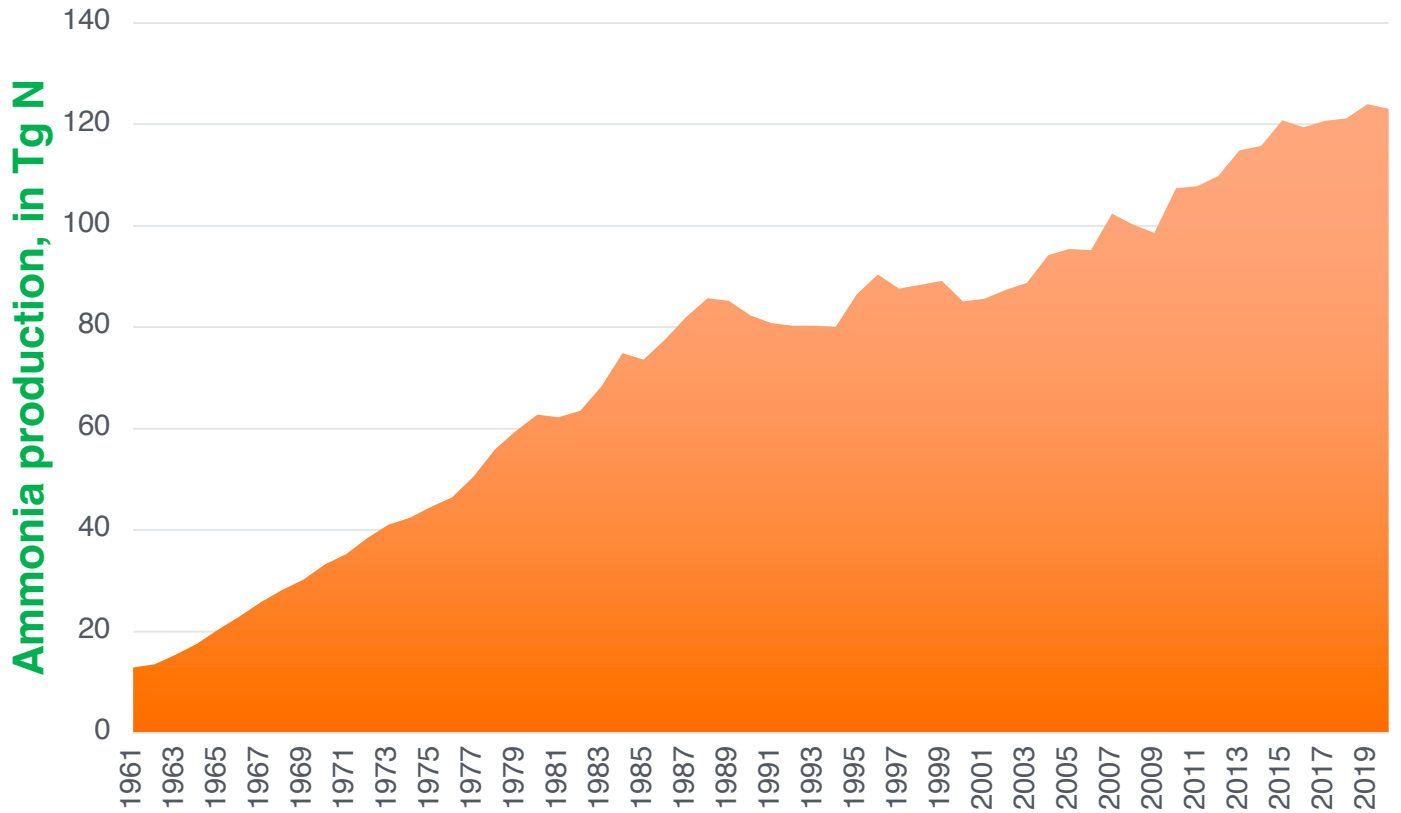
HUGE DEPENDANCE ON AMMONIA FERTILIZER



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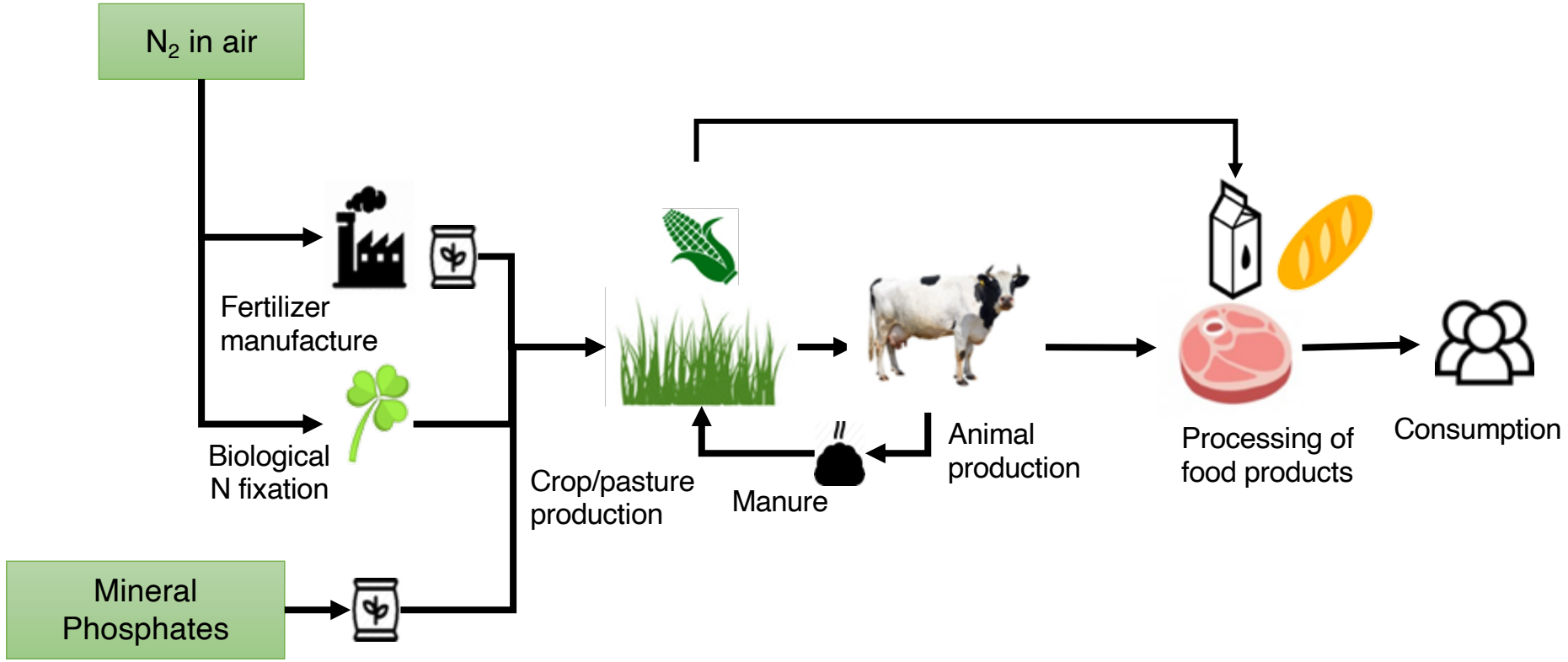

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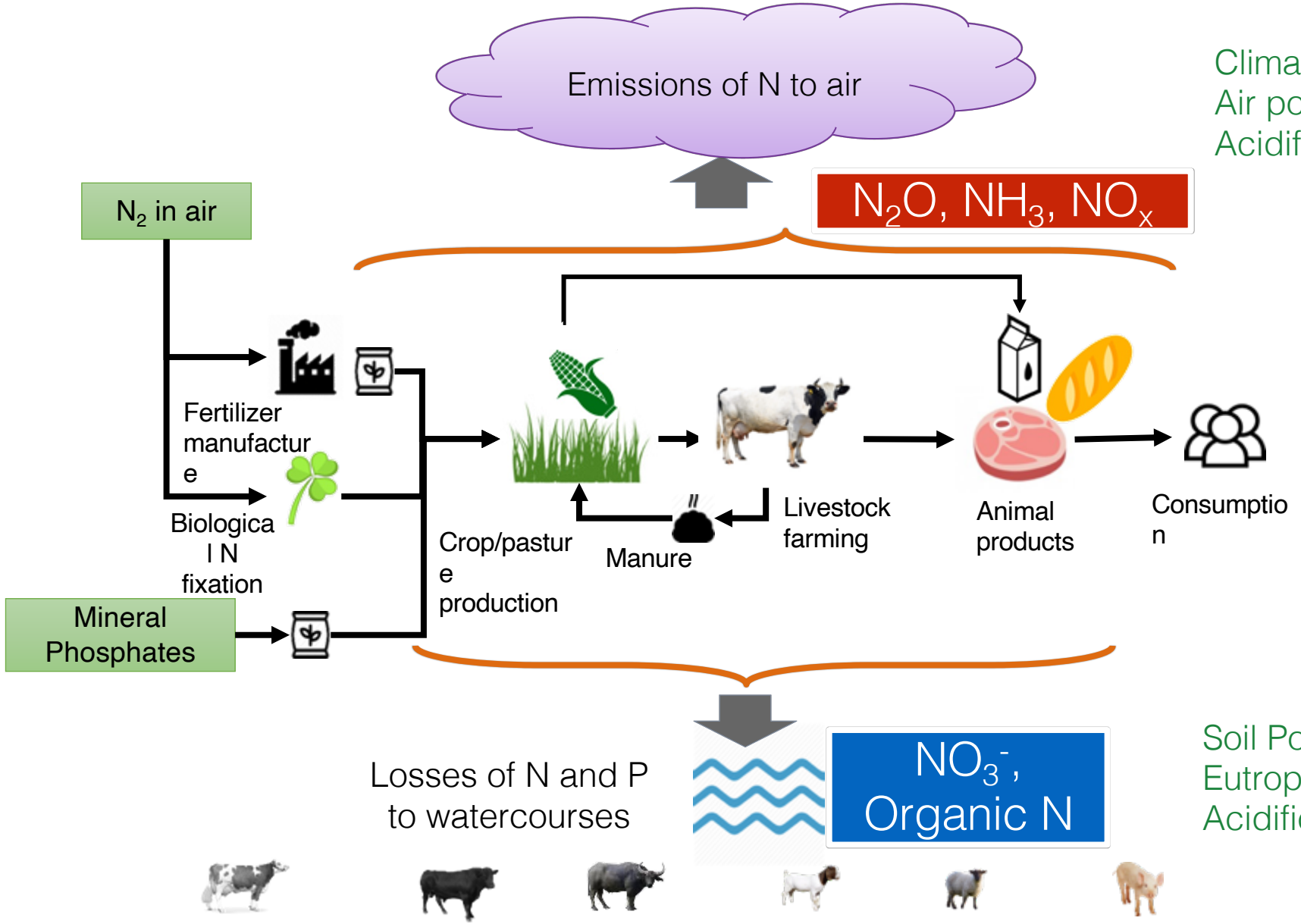
SIGNIFICANT CONTRIBUTION OF LIVESTOCK TO ENVIRONMENTAL IMPACTS



Climate change
Air pollution (PM2.5)
Acidification

Soil Pollution
Eutrophication
Acidification

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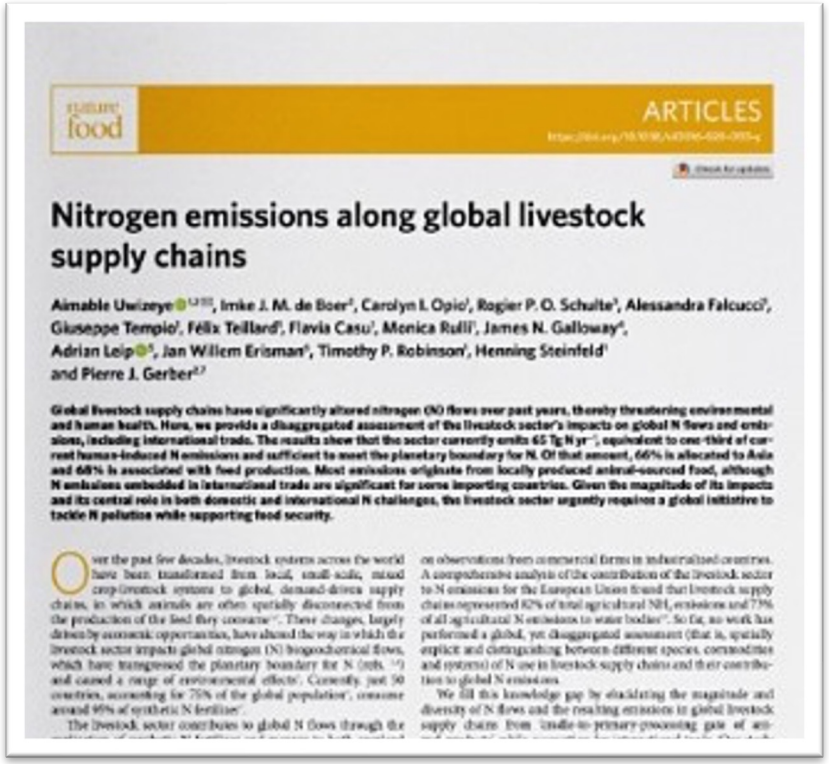
GLOBAL NITROGEN USE EFFICIENCY ASSESSMENT



nature food

ARTICLES

Nitrogen emissions along global livestock supply chains

Aimable Uwizeye, Imke J. M. de Boer, Carolyn I. Opio, Rogier P. O. Schulte, Alessandra Falcucci, Giuseppe Tempio, Félix Teillard, Flavia Casu, Monica Rulli, James N. Galloway, Adrian Leip, Jan Willem Erisman, Timothy P. Robinson, Henning Steinfeld and Pierre J. Gerber

Global livestock supply chains have significantly altered nitrogen (N) flows over past years, thereby threatening environmental and human health. Here, we provide a disaggregated assessment of the livestock sector's impacts on global N flows and emissions, including international trade. The results show that the sector currently emits 65 Tg N yr^{-1}, equivalent to one-third of current human-induced N emissions and sufficient to meet the planetary boundary for N. Of that amount, 66% is allocated to Asia and 68% is associated with feed production. Most emissions originate from locally produced animal-sourced food, although N emissions embedded in international trade are significant for some importing countries. Given the magnitude of its impacts and its central role in both domestic and international N challenges, the livestock sector urgently requires a global initiative to tackle N pollution while supporting food security.

Over the past few decades, livestock systems across the world have been transformed from local, small-scale, mixed crop–livestock systems to global, demand-driven supply chains, in which animals are often spatially disconnected from the production of the feed they consume[1–3]. These changes, largely driven by economic opportunities, have altered the way in which the livestock sector impacts global nitrogen (N) biogeochemical flows, which have transgressed the planetary boundary for N (refs. [4,5]) and caused a range of environmental effects[6]. Currently, just 50 countries, accounting for 75% of the global population[7], consume around 95% of synthetic N fertilizer[8].

The livestock sector contributes to global N flows through the [illegible] on observations from commercial farms in industrialized countries. A comprehensive analysis of the contribution of the livestock sector to N emissions for the European Union found that livestock supply chains represented 82% of total agricultural NH_3 emissions and 73% of all agricultural N emissions to water bodies[10]. So far, no work has performed a global, yet disaggregated assessment (that is, spatially explicit and distinguishing between different species, commodities and systems) of N use in livestock supply chains and their contribution to global N emissions.

We fill this knowledge gap by elucidating the magnitude and diversity of N flows and the resulting emissions in global livestock supply chains from 'cradle-to-primary-processing gate' of ani-

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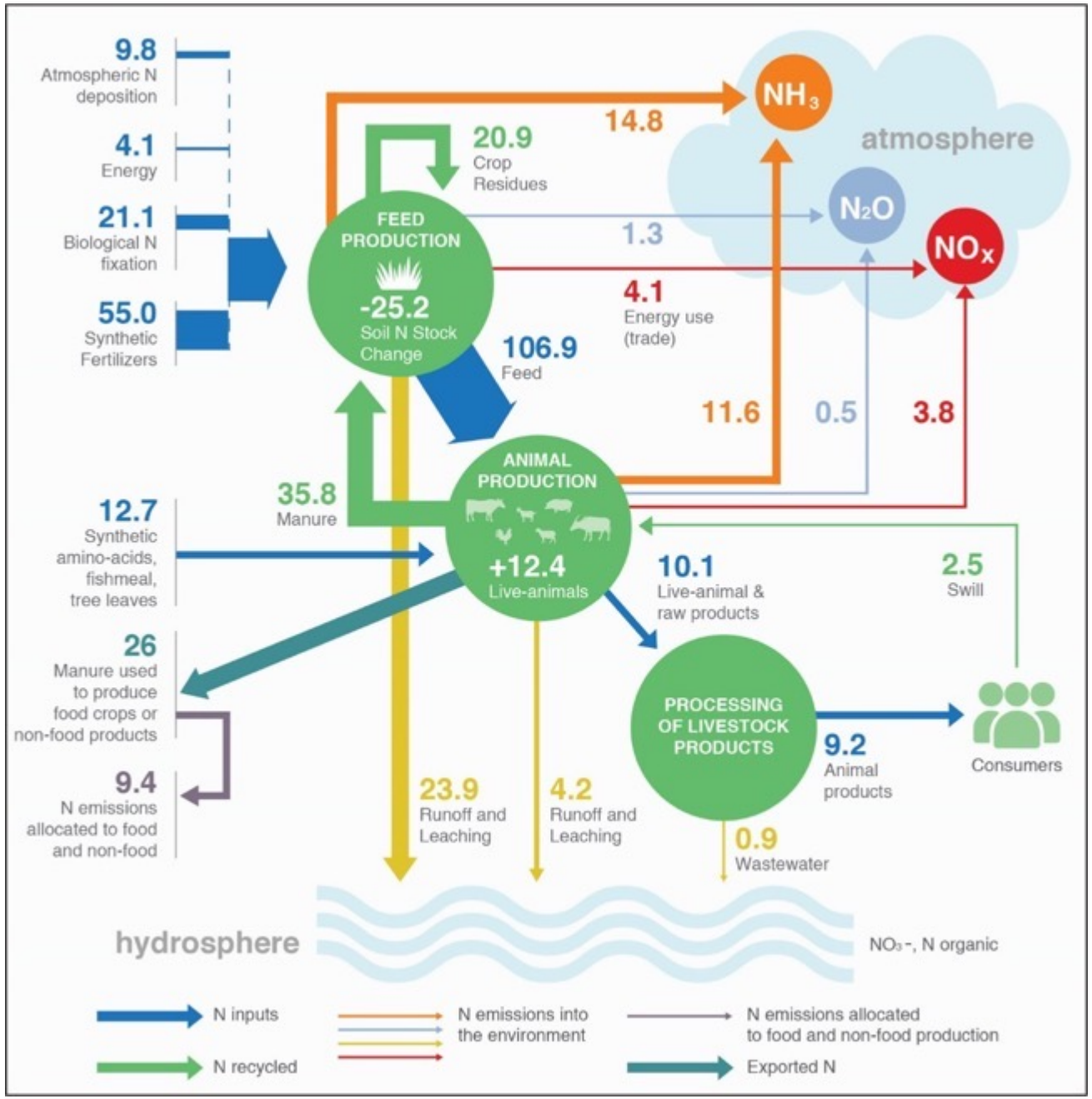
GLOBAL CONTRIBUTION OF THE LIVESTOCK SECTOR TO NITROGEN EMISSIONS

65 Tg N EMISSIONS



Uwizeye et al 2020







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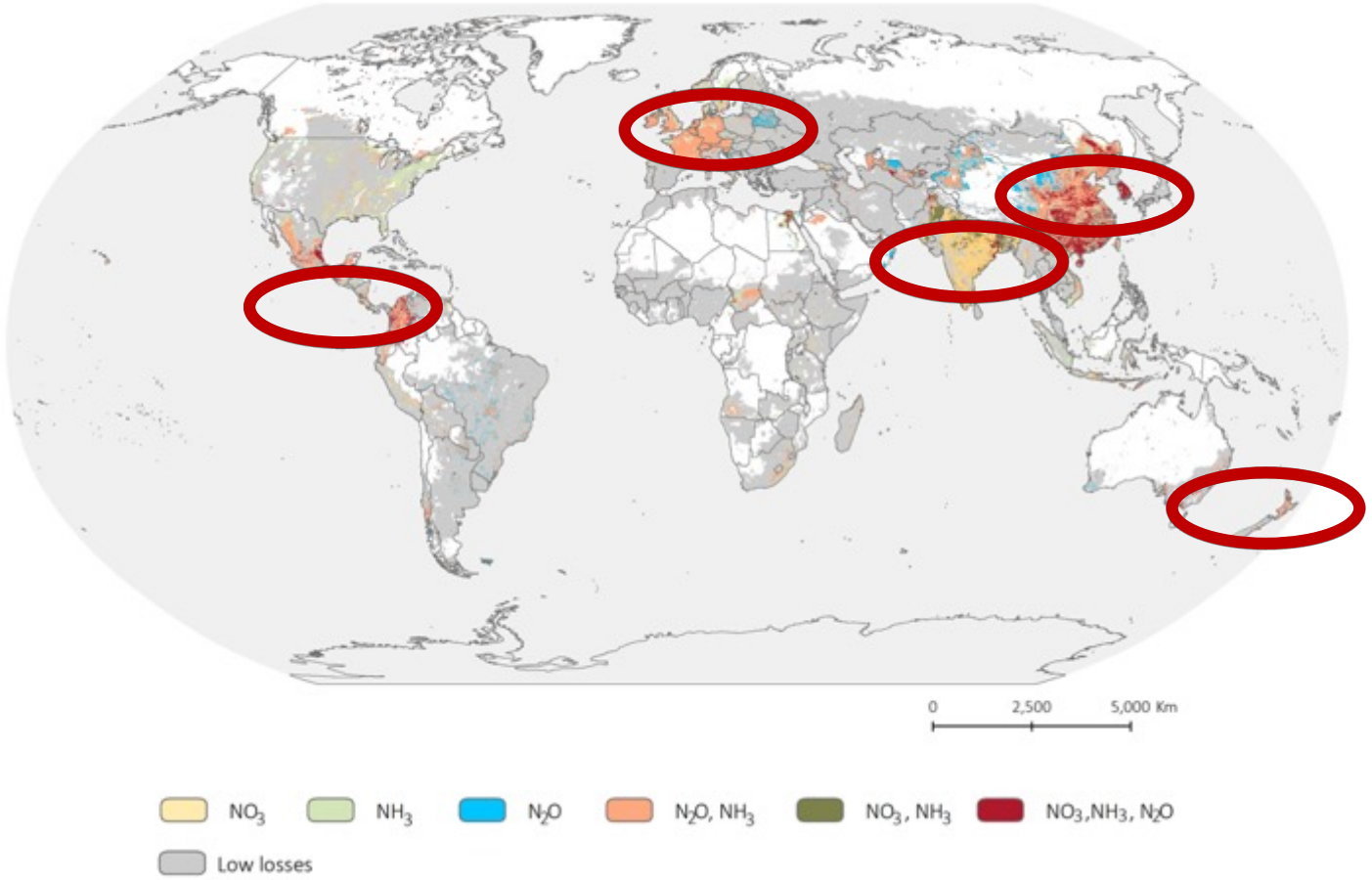
AREAS OF CONCENTRATION OF N EMISSIONS - POLLUTION



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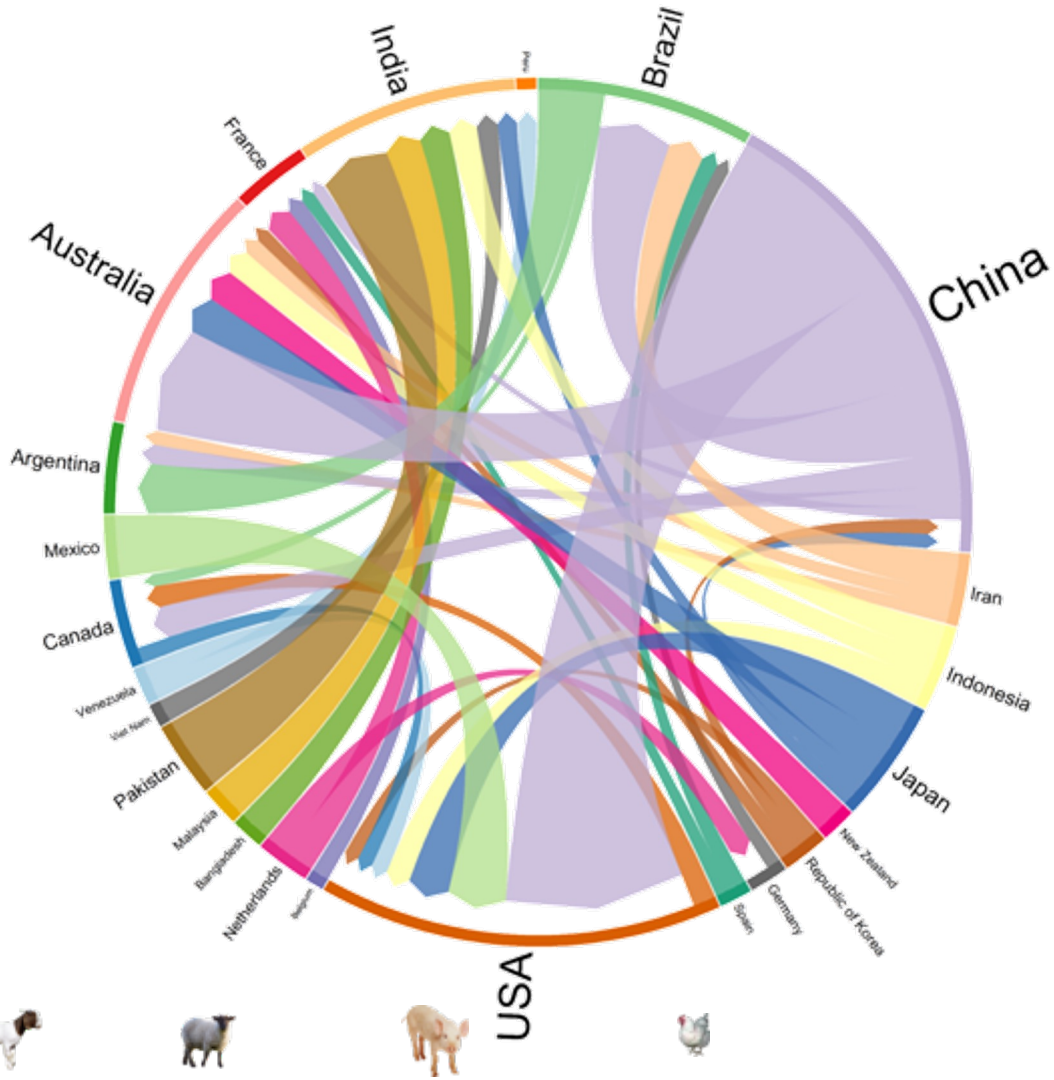
EMBEDDED N EMISSIONS/POLLUTION IN TRADED FEED COMMODITIES

Embodied N emissions = 1.5 Tg N
(2.3% of total N emissions)
Commodities: Cereals (Barley, Wheat, Maize) : 53%,
Soybean: 38%



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POTENTIAL OF INNOVATIVE CIRCULAR PIG SYSTEMS TO REDUCE N LOSSES

Pigs are omnivores

Traditionally, pigs are fed with food wastes

Practice abandoned in industrial production for animal health and food safety risks and transport costs

1.3 billion tonnes of food wastes each year

It is possible to use food wastes as animal feed safely

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POTENTIAL OF INNOVATIVE CIRCULAR PIG SYSTEMS TO REDUCE N LOSSES

	Change	
Regions	**Life-cycle-NUE$_N$**	**N losses in feed production stage**
South Asia	+30%	-53%
North America	+6%	-28%
Western Europe	+13%	-33%
East and South East Asia	+17%	-56%
Eastern Europe	+12%	-35%
Oceania	+13%	-31%
Latin America	+9%	-50%
Russian Federation	+18%	-53%
Sub-Saharan Africa	+7%	-11%
Near East and N. Africa	+17%	-49%

Feeding food waste to pigs

Substitution of grains and soybean by feed from food wastes for industrial pork supply chains

Credit: E. Zu Ermgassen

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JAPANESE CIRCULAR BIO-ECONOMY

Food waste recycling law
Health Promotion law

Feed safety
Fermented feed
Traceability

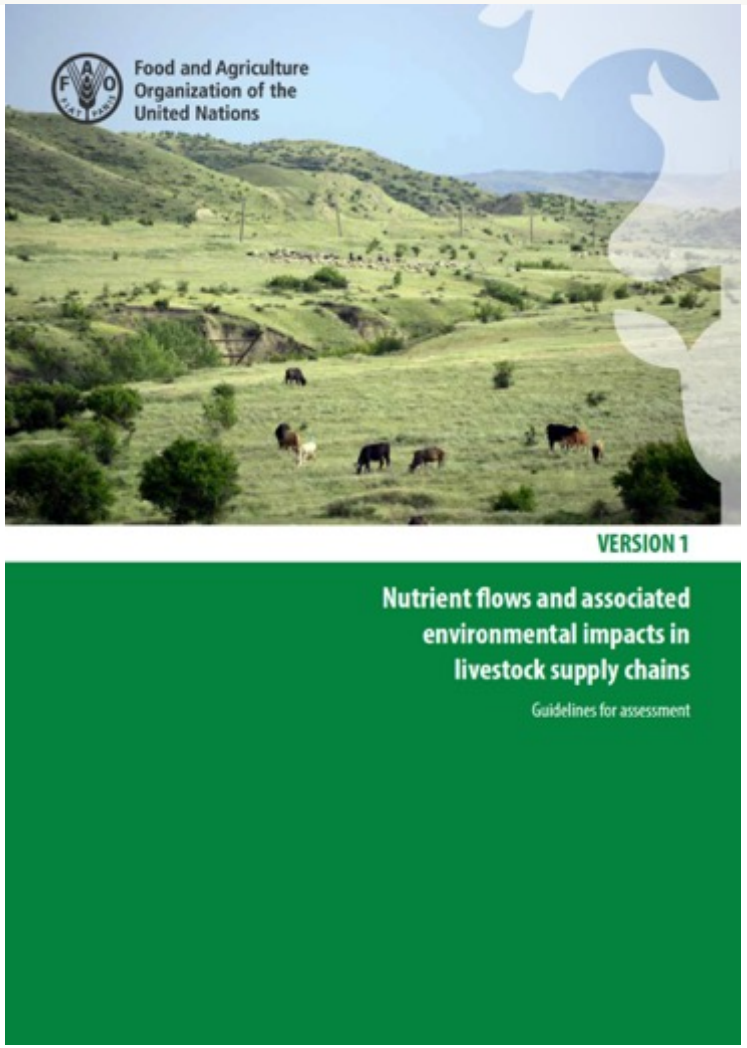
Access to veterinary services
Cooperative structure

50% lower feed cost

Market premium - Ecofeed

DEVELOPMENT OF THE GUIDELINES TO ASSESS THE NITROGEN FLOWS AND LOSSES

FAO LEAP guidelines on Nutrient Flows and associated environmental impacts in livestock supply chains



Bioeconomy | Climate change | Nitrogen pollution | Nitrogen use efficiency

- Can N_2O emissions offset the benefits of soil organic carbon storage?
- Nitrogen emissions along global livestock supply chains
- A climate-dependent global model of ammonia emissions from chicken farming
- Improved accuracy and reduced uncertainty in greenhouse gas inventories by refining the IPCC emission factor for direct N_2O emissions from nitrogen inputs to managed soils
- Bioeconomy for sustainable food and Agriculture
- The soil microbiome: a game changer for food and agriculture
- Indicators to monitor and evaluate the sustainability of bioeconomy
- Sustainable and circular bioeconomy in the climate agenda: Opportunities to transform agrifood systems
- Sustainable and circular bioeconomy in the biodiversity agenda
- FAOSTAT data: Nitrogen budget in collaboration with partners

UNFCCC Decision – Koronivia Joint Work on Agriculture

- 2(d) improved nutrient use and manure management
- Summary of UNFCCC workshop on topic 2(d) Improved nutrient use and manure management towards sustainable and resilient agricultural systems
- FAO's submission on topic 2(d)
- Analysis of all submissions by Parties and Observers on topic UNFCCC – Koronivia Topic 2(d) Improved nutrient use and manure management towards sustainable and resilient agricultural systems

Fertilizer code

The International Code of Conduct for the Sustainable Use and Management of Fertilizers was endorsed by member countries at the 41st session of the FAO Conference.

The Code aims to guarantee an effective and efficient use of fertilizers and address issues of global importance including:

- Global food production and food security;
- The preservation of fundamental ecosystem services
- The maximization of economic and environmental benefits;
- The reduction of negative impact of excess nutrients in ground and surface waters;
- The minimization of negative effects and potential toxicity of contaminants in fertilizers;
- The improvement of food safety, diets, nutritional quality and human health.