The Nitrogen Cycle and Ammonia Gas Emissions from Beef Cattle

NITROGEN & THE NITROGEN CYCLE

Nitrogen (N) is the seventh element on the Periodic Table and is essential for life. Reactive nitrogen refers to nitrogen that can transform readily and across phases, such as gaseous and aqueous phases. Reactive nitrogen includes all forms of nitrogen except for N_2, which makes up 78% of the Earth's atmosphere.

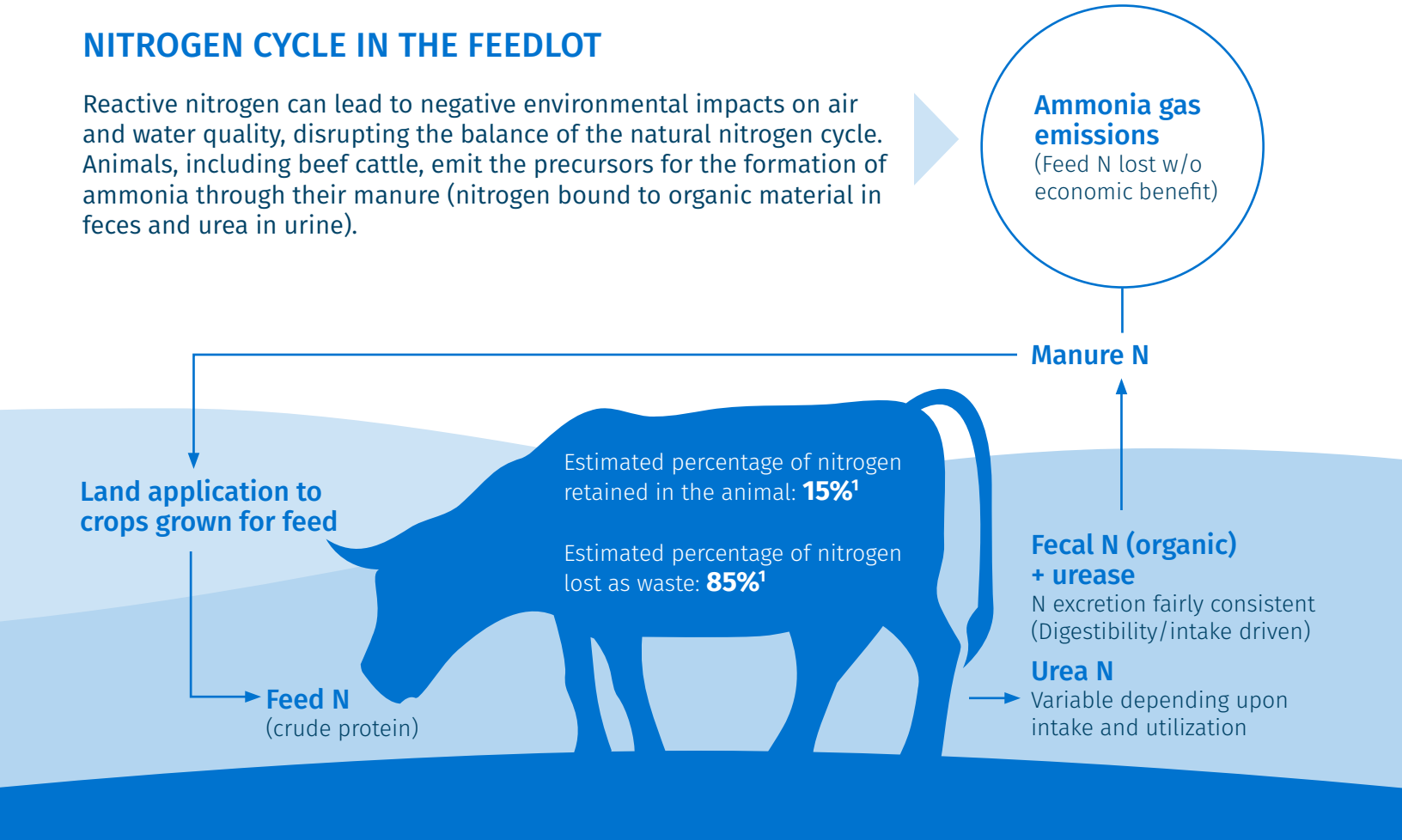
7
N
Nitrogen

Reactive nitrogen forms:

ORGANIC N	AMMONIA N	OXIDES OF N	NITRATES & NITRITES
	Ammonia (NH_3) or Ammonium (NH_4^+)	Nitrogen dioxide (NO_2) Nitric oxide (NO) Nitrous oxide (N_2O)	(NO_3^-) & (NO_2^-)

NITROGEN CYCLE IN THE FEEDLOT

Reactive nitrogen can lead to negative environmental impacts on air and water quality, disrupting the balance of the natural nitrogen cycle. Animals, including beef cattle, emit the precursors for the formation of ammonia through their manure (nitrogen bound to organic material in feces and urea in urine).



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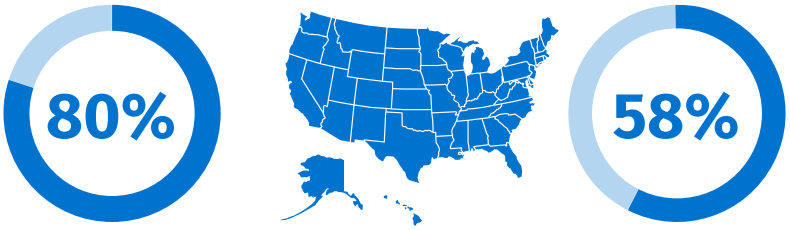
WHY SHOULD BEEF CATTLE PRODUCERS CARE ABOUT AMMONIA GAS EMISSIONS?

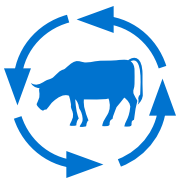
Ammonia gas emissions can negatively impact water quality through eutrophication and acidification and air quality through the formation of fine particles.



In the United States, **80%** of total ammonia gas emissions come from agriculture. **58%** of total emissions specifically come from animal manure[2].

"Air quality and addressing air emissions is a shared responsibility, including for feedyard owners and operators.[3]"

U.S. Roundtable for Sustainable Beef



A lifecycle assessment of U.S. beef cattle production — from birth, including feed production (hay, silage, grains), to packer — estimated that **34%** of U.S. ammonia gas emissions could be attributed to beef cattle production[4].

12%

Approximately **12%** of the ammonia gas emissions in the U.S. come from finishing beef cattle[4].

There are many reasons why beef cattle producers and feedlot operators should pay attention to ammonia gas emissions from their business, including:

ENVIRONMENTAL SUSTAINABILITY	CONSUMER INTEREST	INCREASED NITROGEN UTILIZATION

The entire beef industry has a responsibility to continuously improve its environmental stewardship for generations to come. Proactively addressing ammonia gas emissions now can help improve the environmental sustainability of the industry for the future.

Learn more at **www.Elanco.com/Healthy-Purpose**

[1] Cole, NA, Todd, RW. Nitrogen and phosphorus balance of beef cattle feedyards. Proceedings of the Texas Animal Manure Management Issues Conference [Internet]. 2009 Sep 28 [cited 2020 Sep 17]. 243602:17-24. https://www.ars.usda.gov/research/publications/publication/?seqNo115=243602.
[2] 2014 National Emissions Inventory Report. U.S. Environmental Protection Agency. 2019. https://gispub.epa.gov/neireport/2014/ Accessed 13 August 2020.
[3] U.S. Roundtable for Sustainable Beef. https://www.beefsustainability.us/high-priority-indicators/air-greenhouse-gas. May 2020.
[4] Rotz, CA, Asem-Hiablie, S, Place, S, Thoma, G. Environmental Footprints of Beef Cattle Production in the United States. Agricultural Systems [Internet]. 2019 Feb [cited 2020 Aug 13]. 169:1-13. https://www.sciencedirect.com/science/article/pii/S0308521X18305675