



The role of technology in achieving net-zero carbon emissions in livestock agriculture.

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Improving productivity reduces environmental impacts

Modelling study involving 777 Angus cattle finished at ABP research farm. Finishing at ideal time (not heaviest weight) improved profit by 45% and cut carbon footprints by 32%.



AI applications: Growth performance in beef cattle

550 back and top-view cattle photos plus weight data analysed with a deep semantic segmentation model and machine learning. The r^2 between predicted and actual weights was 0.98.



AI applications: Precision nutrition

1779 observations from 436 scientific publications trained models to predict protein intake and duodenal N flow. Knowing exactly how much protein is needed reduces waste, ammonia and nitrous oxide



AI applications: Methane and the microbiome

Microbiome samples and CH₄ emissions from 2,190 dairy cows given feed additives. 15.7 million metagenomic shotgun sequencing reads per sample. Predicted additive effectiveness, with 27% decrease in CH₄ emissions.



AI applications: Overgrazing

Drone imagery and a tailored deep learning model used to detect grazing livestock in Chinese pastures. Quantified grazing pressure and enabled stocking density planning to avoid overgrazing.



Animal disease is a major sustainability concern

**Lost:
20%**



**Harvested:
80%**

**More than 20% of
global animal
protein losses are
linked to animal
diseases
(WOAH, 2024).**

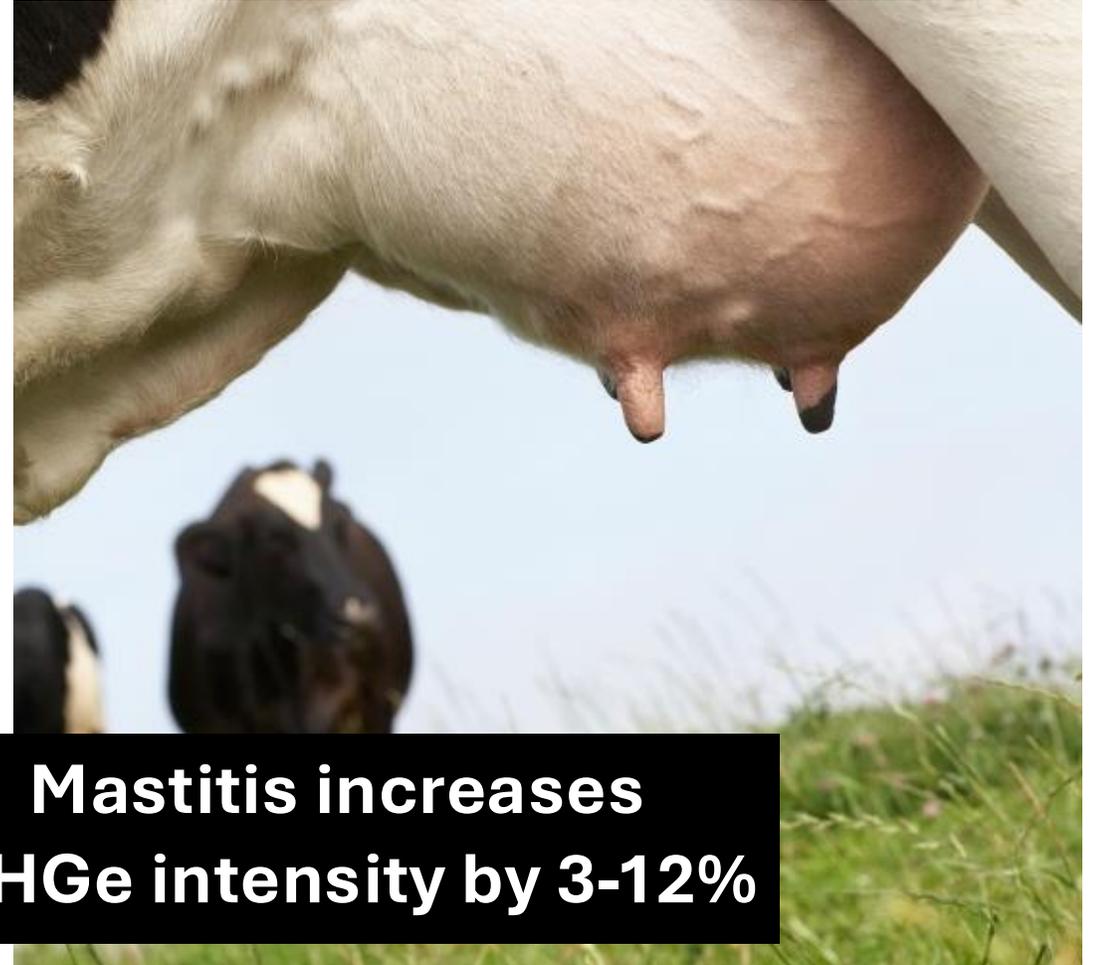


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Source: Created by Jude L. Capper, 2025. Data from: World Organization for Animal Health (WOAH). 2024. <https://www.woah.org/en/what-we-do/global-initiatives/one-health/>

AI applications: Detecting mastitis

Deep learning network based on filtering enhancement of thermal images was used to automatically detect dairy cow eyes and udders and compare temperatures. Detected mastitis with an accuracy of 83.3%.



**Mastitis increases
GHGe intensity by 3-12%**



AI applications: Dairy cow lameness

Farm and dairy herd data from 6 farms, combined with weather and high-frequency sensor data was used to predict new future lameness events, from +1 day to +3 weeks, with a precision score of up to 93%.



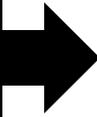
AI applications: Broiler mortality

Lifetime CCTV monitoring in 74 commercial broiler flocks. From analysis of whole flock movement at 1-2 days of life, researchers could accurately predict both mortality and end-of-life hockburn.



African swine fever – significant sustainability impacts

African swine fever spread into China and East Asia



**150-200 million pigs died
(30% of Chinese herd)**



17-38% increase in world pork prices



**Pigmeat losses would have supplied
403-538 million people with their
annual pork demand**



Will AI always have the answer?



Human behaviours are not always predictable or logical. What are the implications for AI and animal health/welfare?

AI concerns relating to animal welfare



Trade-offs with other metrics?



Technical failures?



Inaccurate predictions/decisions?



Less focus on stockmanship?



Increased animal instrumentalism?



ChatGPT: “Draw me a picture of a herd of low-carbon cows”



**AI is a tool – but
is not “the” tool –
at present it
doesn’t
necessary see or
show the bigger
picture.**

Thank you!



SCAN ME

