Low-emission pathways for sheep & goat systems

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Key messages

Improving livestock sustainability means investing in better feed, animal health, and manure management, while ensuring productivity gains don't lead to larger herds. This helps farmers boost or maintain production with fewer animals, supporting food security and livelihoods without raising environmental impact.



Why this matters

Drylands make up **46%** of the world's land area and support **44%** of agricultural systems, including half of the world's livestock.

We tested whether productivity improvements in **sheep and goats** can maintain protein production while limiting future emissions.

How the three scenarios were modeled

We used the FAO GLEAM-i model (life-cycle GHG emissions to the farm gate) to project outcomes for sheep and goat systems in **China, Indonesia, and Thailand**, comparing three distinct **scenarios for 2030 and 2040** based on a 2020 baseline.

Three pathways		
Business-as-Usual (BAU): Current trajectory	**Higher productivity**	**Higher productivity + stable herds**
Current practices continue	Better feed, health and manure management	Same improvements, with stable animal numbers
Herds keep growing	Animals produce more efficiently	Productivity rises without continued herd growth

BAU most closely follows a >2°C emissions pathway, Productivity a 1.8–2°C pathway, and Productivity + Stable Herds a 1.5°C pathway.

Comparing the three pathways

Pathway	Protein output	Total GHG	GHG/kg protein
BAU	100 %	100 %	100%
Higher productivity	↑ 19–34%	↑ 18–15%	↓ 9–15% lower
Higher productivity + stable herds	↑ 9–14 %	↓ 12–13% lower	↓ 20–23% lower

Values compare each pathway with the BAU projection for the same country, species, and year. GHG/kg protein represents emission intensity.
Lower total GHG means emissions avoided relative to BAU, not necessarily a reduction below 2020.

Three main findings



Produce more efficiently
9–34% lower GHG emissions per kg of protein under the productivity pathways.



Efficiency alone is not enough
Total emissions may still rise if improvements in productivity are accompanied by continued herd growth.



Combine productivity with stable herds
Up to 14% of projected emissions can be avoided relative to BAU, while maintaining protein output at or above BAU levels.

Three recommendations

- Invest in better feed, animal health and manure management.
- Pair productivity improvements with strategies that avoid continued herd expansion.
- Support farmers to produce more-or the same amount-with fewer or stable animal numbers, without compromising food security or livelihoods.

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