Livestock, land and the environmental limits of animal source-food consumption

Mario Herrero, Daniel Mason-D’Croz, Cecile Godde, Jeda Palmer, Philip Thornton, Maggie Gill

CSIRO / CCAFS-ILRI / U. Aberdeen
The demand for livestock products 1990 - 2015

<table>
<thead>
<tr>
<th>Region</th>
<th>Fish, Seafood</th>
<th>Milk - Excluding Butter</th>
<th>Eggs</th>
<th>Meat</th>
<th>Bovine Meat</th>
<th>Mutton &amp; Goat Meat</th>
<th>Pigmeat</th>
<th>Poultry Meat</th>
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</table>

Change in kg/person/year between 1990-2015

-60.0 | 60.0
The demand for livestock products 1990 - 2015

3 storylines of per capita demand:

Pork, and poultry especially, growing at an accelerated pace everywhere, but mostly in the developing world

Dairy growing in low and middle income countries, stagnating in OECD

Red meats stagnating everywhere
Supply dynamics
1990-2015
Win more, lose less: Capturing synergies between SDGs through agricultural research.

Land use dynamics

Global cropland area increased by 3% since 1990.
Pasture area by 1% over the same period.

Ramankutty et al. 2018
The environmental efficiency of livestock has been improving...

62% less land to produce 1 kcal of livestock

45% less GHG

...but we have traded lower land use and emissions for increased N use

188% increase in N use

Davis et al. (2015) ERL
Production growth in ruminant meat and milk still driven largely by growth in animal numbers, with a few exceptions

2) Mixed crop-livestock systems
Will there be a role for smallholders? Temporarily for poultry and pork producers

Win more, lose less: Capturing synergies between SDGs through agricultural research

Gilbert et al 2015
Scary feed projections
Grain as food to double, but as feed to QUADRUPLE

Herrero et al. 2014
What if the livestock sector had to contribute significantly to mitigation targets?

Tilman and Clark vegetarian
Tilman and Clark mediterranean
Tilman and Clark pescetarian
Hedenus flexitarian
Hedenus climate carnivore
Bajzelj 2
Bajzelj 1
Sehfest no animal products
Sehfest no meat
Sehfest mediterranean
Sehfest Health diet

Technical potential of supply side measures

Herrero et al 2016
Decoupling livestock from land through a circular economy

Region
- Africa
- Asia
- Europe
- Latin America & Caribbean
- Middle East
- North America
- Oceania

Default livestock min and max values
Transformational options: Turning waste into high quality feed
New feed sources key to ambitious climate targets

Use of algae for energy and feed could reduce emissions to meet the 2°C degree climate target.
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