Pasture Management for Carbon and Livestock Methane and Nitrous Oxide

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Livestock Production and GHG Emissions

In spite of relatively similar levels of production of meat and milk, GHG emissions from livestock are much higher in developing than in developed regions

- Enteric: 150% higher
- N$_2$O PRP: 90% higher
- Manure: 10% lower
- LULUCF emissions and biomass burning were not considered. These are most significant in developing regions
Two different, complementary strategies

- **Already efficient systems** (mostly in developed regions)
  - Limited options for mitigation based on reducing animal population
  - Focus on research (e.g., New Zealand’s PGgRc) aiming at reducing emissions per animal (and per unit product).
  - Need to consider land use emissions associated with production of feed.

- **Less efficient systems** (mostly in developing regions)
  - Intensification of pastoral systems provides the best opportunities (large area of grassland). Adoption of mixed crop/livestock systems in cropland would also be effective.
  - Rapid implementation is possible, synergies with adaptation, food security and SD.
  - Focus on integral approach (AFOLU) including consideration of avoidance of deforestation, C sequestration in soils and N₂O to reduce emissions per unit product
Productivity and GHG Emissions per unit product (milk)

Consideration of N₂O emissions from manure magnify the differences between regions.

Graphs are based on the following sources:
- IPCC tier 1 default emission factors for enteric fermentation for different regions and their underlying assumptions
- US-EPA 2005
- FAO Fertilizers Statistics

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## Beef cattle: Emissions per unit product

<table>
<thead>
<tr>
<th>System</th>
<th>GHG emissions (kg CO₂-eq/kg CW)</th>
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</thead>
<tbody>
<tr>
<td>High-quality pasture (NZ)</td>
<td>12-18</td>
</tr>
<tr>
<td>Grain-fed, Medium-quality pasture</td>
<td>20-40</td>
</tr>
<tr>
<td>Poor quality pasture (tropical)</td>
<td>40-100</td>
</tr>
<tr>
<td>Tropical pasture + recent deforestation</td>
<td>&gt;&gt;100</td>
</tr>
<tr>
<td>Global average</td>
<td>&gt;40?</td>
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</tbody>
</table>

Substitution of high carbon intensity systems (extensive grazing of grassland, particularly on recently deforested land) by more productive systems would enable large emission reductions.

Adoption of mixed livestock-crop systems (e.g., crop and pasture rotations) may also be very effective in reducing emissions.
Opportunities for reducing emissions through pasture improvement and/or adoption of mixed systems

• Meat (and, to a lesser extent, dairy) production is based on low-quality pastures in large areas.

• Adoption of pasture improvement on those areas would bring about:
  – Reduced methane CH\textsubscript{4} and PRP soil N\textsubscript{2}O emissions per unit product (somewhat offset by small increases in N\textsubscript{2}O from soils if legumes followed by soil tillage or N fertilizers are used).
  – Increased CO\textsubscript{2} removals (sequestration in soils)
  – Reduced emissions from deforestation (where it is driven by expansion of grazing areas).

• Associated benefits
  – Improved land productivity and resilience, soil conservation
  – Optimization of land use, risk management through diversification
  – Reduced emissions from deforestation (where it is driven by expansion of grazing areas or by procurement of timber) and reduced pressure on land.
Productivity and CH₄ Emissions from Enteric Fermentation

Small increases in productivity may yield substantial reduction in emissions per unit product.

Graphs are based on IPCC tier 1 default emission factors for enteric fermentation for different regions and their underlying assumptions.