Sustainable intensification of smallholder livestock production: fact and fiction

Henk Udo
Animal Production Systems
Wageningen University
Livestock Revolution: 2050, 9 billion people who want to consume more eggs, meat and dairy

FAO: Population growth 77% increase in meat and 86% in milk; income increase main contributor in only few countries (Pica-Ciamarra and Otte, 2009)

Intensification of livestock production needed: low producing livestock in areas were increasing demand is expressed

‘improvements in feeding can increase milk production 4 times’

Intensive systems the least environmental damage per unit product (Livestock’s Long Shadow, 2006; CG policy paper, 2013)
Context

- Smallholder crop-livestock households 20% world population producing: meat 65%, milk 75% in developing world
- Crop-livestock farms the dominant farming system, this will not change for another 20 years
- 900 million hungry people, 1 billion overweight people
- 1.2 billion poor people (less than 1.25 $ d\(^{-1}\)), 75% in rural areas
- Intensification smallholder livestock unique opportunity for improving livelihoods

Opinions based on facts?
Intensification

- Increased use inputs and services to increase output quantity or value
- Why?
  - Improving income rural households
  - Meeting the increasing demands
  - Environmental sustainability
- Living up to these expectations?
Intensification

Change in management, feeding system, other breeds, increase in numbers
Intensification
Contributions to livelihoods

Quantification approach in $

Bosman, Moll, Udo, 1997

products

manure
draught

insurance
finance
status
Contributions to livelihoods

Quantification

- Quantifying different benefits in different systems
- Understanding decision making farming households
  - allocation of resources
  - decisions not at optimum biological moment
- Smallholders more productive than often assumed
Contributions to livelihoods  Livestock ladder
Village poultry

- Three quarters of rural households keep them.

- Drivers:
  - ‘the first and last resource of the poor’
    - (Aklilu, 2007)
  - promoted to improve livelihoods of poor women
Village poultry  Contributions to livelihoods

- People prefer local chickens and eggs
  - better taste
  - better prices
- Production low, economic results low
- Productivity very high
- Environmental impact?
- Poverty alleviation?
- Safety net: sold when small cash is needed
Village poultry  Intensification does it work?

- Simulations of innovations
  - technical results improved remarkably, except for crossbreeding
  - often innovations negative economic impact: Ethiopia, Kenya, Mozambique, Tanzania

![Graph showing benefits, costs, and returns over time](image-url)
Village poultry

Intensification how?

- Only small step, low cost improvements will work
  - NCD vaccination, predation, ....
- Local marketing networks needed
- Not able to supply growing urban markets
Commercial poultry

- Large- or small-scale?
- Needs cash inputs, feed, labour
- Market-oriented
  - competition with other farmers
  - competition with imports
  - markets easily collapse
due to economic crises or imports
  (Brasil, Dutch inferior cuts)
- Easy to learn, local expertise available
Small ruminants

- Numbers increase, least developed countries
- Literature: small ruminants can help the poor
- Sheep and goat farmers among poorer groups in society
- Tool in poverty alleviation or sign of poverty?
Small ruminants

- 4-6 animals; 4 h d\(^{-1}\)
- More animals will not match farmer’s resources
- Intensification cropping: grazing lands disappear
- Labour productivity below minimum wage
- Farmers do not consider the family labour as real costs
- A very much appreciated secondary activity
- Safety net (urgent cash needs), Manure
- Religious festivities: sheep (males of 25 kg or more)
- Local market plus market in major cities through traders
- Poverty alleviation?
Smallholder dairy  

Kenya

Drivers: demands, reduced land sizes, agro-ecology

Intensification: Free-grazing → Zero-grazing

Change in breeds

(Bebe, 2003)
Smallholder dairy

- 650,000 (maybe 2 \times 10^6) households in dairying, 80% of milk production
- Labour productivity higher than for crops and wage labour
- Also dairy cattle have various livelihoods functions
- Feed the main constraint: quality!
- Milk yield about 5 kg per lactation day
- Households with dairy cattle relatively well-off

(Bebe, Udo, Thorpe, 2004)

(Moll, Staal, Ibrahim, 2007)
Smallholder dairy  Contributions to livelihoods

- Dairying gives substantial income improvement: Bhutan, India, Tanzania, Philippines, Kenya

- Not for the really poor

- Milk production 5-6 kg lactation day\(^{-1}\) plus milk for calf

- Market the major pull factor
  - informal market the largest share
  - higher prices for farmers, lower prices for consumers
  - Kenya: 12-18 fte employment for every 1000 kg handled

- Smallholders competitive: family labour, less investments
  (diseconomies of scale)
Contributions to livelihoods

- Contributions $hh^{-1}$
  - Village poultry
  - Sheep, goats
  - Pigs
  - Village poultry

- Paying back animals/loans
  - ++++
  - - -

- Helping the poor
  - - -

- Dairy cattle
  - - -
  - local cattle
  - - -
  - - -

- Local cattle
  - - -
  - - -
  - - -

- Sheep, goats
  - - -
  - - -
  - - -

- Pigs
  - - -
  - - -
  - - -

- Village poultry
  - - -
  - - -
  - - -

- Contributions $hh^{-1}$
  - +
  - ++
  - +++
  - ++++

- Paying back animals/loans
  - ++++
  - - -

- Helping the poor
  - - -

- Dairy cattle
  - - -
  - local cattle
  - - -
  - - -

- Local cattle
  - - -
  - - -
  - - -

- Sheep, goats
  - - -
  - - -
  - - -

- Pigs
  - - -
  - - -
  - - -

- Village poultry
  - - -
  - - -
  - - -
Meeting demands

- Can smallholders meet the increasing demands?
- Supply and demand
- Asia: 80% increase in demands from commercial pigs and poultry
- Livestock revolution is bypassing the poor?
- Collapse commercial poultry sector (small and large-scale) in W. Africa due to imports from Brazil and Europe (inferior cuts)
### Meeting demands

### Dual structure

<table>
<thead>
<tr>
<th>Smallholder livestock</th>
<th>Rural markets</th>
<th>Urban markets</th>
<th>Large-scale livestock</th>
</tr>
</thead>
<tbody>
<tr>
<td>Village poultry</td>
<td>✓ ✓</td>
<td>✓ ✓ ✓</td>
<td>Commercial poultry</td>
</tr>
<tr>
<td>Small comm. poultry</td>
<td>✓</td>
<td>✓</td>
<td>Commercial pigs</td>
</tr>
<tr>
<td>Small ruminants</td>
<td>✓</td>
<td>✓</td>
<td>Grazing systems</td>
</tr>
<tr>
<td>Pigs</td>
<td>✓</td>
<td>✓ ✓</td>
<td>Dairy cattle</td>
</tr>
<tr>
<td>Local cattle</td>
<td>✓</td>
<td>✓ ✓</td>
<td></td>
</tr>
<tr>
<td>Dairy cattle</td>
<td>✓</td>
<td>✓ ✓ ✓</td>
<td></td>
</tr>
</tbody>
</table>

✓: small contribution; ✓ ✓: large contribution

- **Cooperation or competition?**
Impact on environment

- **Hypothesis:** intensive systems the least environmental damage per unit product  
  (Livestock Long Shadow, 2006; Gerber, Vellinga, Opio, Steinfeld, 2011; CG Policy paper, 2013)

- **Two case-studies:**
  - Integrated Agriculture-Aquaculture (IAA) systems Vietnam
  - dairying Kenya
Impact on environment  IAA systems Vietnam

Impact farm components on environmental categories (LCA) (Phong, 2010)

- impact pigs (hybrids) due to off-farm feed production
Impact on environment  IAA systems Vietnam

- Integrated Agriculture-Aquaculture systems:
  - pigs or poultry: impacts per kg similar
  - impacts 1.6 (global warming) to 1.8 (land use) higher per kg pig and poultry protein than per kg fish protein

  (Phong, de Boer, Udo, 2011)

- Environmental comparison specialised (430 t ha$^{-1}$) and integrated striped catfish production (3.5 t ha$^{-1}$):
  - specialised systems higher impact per t for 7 out of 9 environmental impact categories
  - feed production contributed most
  - environmental performance better in integrated systems

  (Kluts, Potting, Bosma, Phong, Udo, 2012)
Impact on environment

- FAO: Greenhouse gases and milk yields

Greenhouse gas emission and milk output per cow for different countries

(Gerber, Vellinga, Opio, Steinfeld, 2011)
Impact on environment

Dairying Kenya

<table>
<thead>
<tr>
<th></th>
<th>Free-grazing</th>
<th>Zero-Grazing</th>
<th>Large</th>
<th>Very Large</th>
<th>Sub-Sah. Africa</th>
</tr>
</thead>
<tbody>
<tr>
<td>farm size (ha)</td>
<td>2.4</td>
<td>1.1</td>
<td>16</td>
<td>61</td>
<td></td>
</tr>
<tr>
<td>for cattle (ha)</td>
<td>0.3</td>
<td>0.3</td>
<td>6</td>
<td>61</td>
<td></td>
</tr>
<tr>
<td>herd size (n)</td>
<td>5.6</td>
<td>3.2</td>
<td>27</td>
<td>178</td>
<td></td>
</tr>
<tr>
<td>cows (n)</td>
<td>2.6</td>
<td>1.5</td>
<td>14</td>
<td>107</td>
<td></td>
</tr>
<tr>
<td>milk (kg.d⁻¹)</td>
<td>4.5</td>
<td>5.3</td>
<td>9</td>
<td>9</td>
<td>1.0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Impact on environment</th>
<th>Mitigation options</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manure management</td>
<td>Yes, but effect will not be big</td>
</tr>
<tr>
<td>Shift from ruminants to poultry</td>
<td>Asia: increase in production 80%</td>
</tr>
<tr>
<td></td>
<td>due to commercial pigs and poultry;</td>
</tr>
<tr>
<td></td>
<td>Grains, cropland?</td>
</tr>
<tr>
<td></td>
<td>Other functions ruminants?</td>
</tr>
<tr>
<td>Better diets for ruminants</td>
<td>Possible?</td>
</tr>
<tr>
<td>• improved pasture management</td>
<td></td>
</tr>
<tr>
<td>• legumes</td>
<td></td>
</tr>
<tr>
<td>• improved fodder technologies</td>
<td></td>
</tr>
<tr>
<td>• supplements, concentrates</td>
<td></td>
</tr>
</tbody>
</table>
Better diets

- Global studies, impact better diets: ‘productivity increase will satisfy increasing demands and offers a mitigation option’
  
  (Gerber, Vellinga, Opio, Steinfeld, 2011)

- FAO e-conference 2010: why improved feed technologies not adopted?
  - weakness of transfer/extension services
  - top-down research approaches
  - research has failed to demonstrate the economics

- Technologies too expensive, not meeting labour and land resources

- Global studies overestimate opportunities, underestimate constraints
Impact on environment

- Feed assessments needed
  - also future smallholder production will be based on resources

- Small step feed improvements
  - Gujarat: modelling and field studies indicate 20% increase in milk production possible by optimal use local feeds (Patil, 2006)

- Feeding has to be done every day in contrast to other innovations

Conclusions
Impact on environment

- Be careful in generalizing global data
- Impacts and trade-offs should be assessed at local level
- Trade-offs: impacts per unit product vs impact per unit area; biodiversity; water footprint
- Allocation method will influence mitigation options recommendations
- Livelihoods lens needed
What will happen?

- Dorward (2009), strategies:
  - stepping up
  - hanging in
  - stepping out

- Stepping out: labour scarcity outside agriculture needed
Sustainable intensification

Drivers: increasing demands, policies, climate change
reducing land sizes, intensification cropping, competition

labour, capital, land, feeds, health;
family situation

credit
services
institutions
farmers’ groups
knowledge
research support
policy support

smallholder crop-livestock systems

developments outside agriculture

revolution

move out

evolution
Sustainable intensification of smallholder livestock production: fact and fiction