Livestock-Geo-Wiki

Manure management component

Timothy Robinson

Global Agenda of Action Focus Area workshop: Waste to worth (FA3)
Bangkok, 19 August 2013
Acknowledgements

- Jeroen Dijkman
- Pierre Gerber
- Steffen Fritz
- Philip Thornton
- Theun Vellinger
- Marius Gilbert
- Simon Hay
Overview

- Context – integrated approach
- Livestock-Geo-Wiki
- Livestock distributions and production systems
- Manure management and mapping
- Feedback methods
- Developments to date and future plans
• Demographic and social changes

► Growth in demand for animal source foods
► Structural changes in the livestock sector
► Impinges on three global public goods associated with the sector:
  • Equity
  • Environment
  • Public health

• These are interlinked, calling for an integrated approach to socially desirable livestock sector development

• This in turn calls for reliable data and information to guide sector development
The global livestock sector

‘The fundamental interconnectedness of all things’
Livestock-Geo-Wiki

- Raising awareness
  - Data visualisation
- Data dissemination
  - Open access
- Data validation
  - Crowdsourcing
  - Field studies (CGIAR)
- Impact assessment
  - Scaling up interventions
- Analytical tools
  - Production models
  - Lifecycle assessment (LCA)
  - Risk models

International Livestock Research Institute
Food and Agriculture Organisation of the UN
International Institute for Applied Systems Analysis
Université Libre de Bruxelles
Wageningen University
University of Oxford
<table>
<thead>
<tr>
<th>Primary modules</th>
<th>Principal data resources</th>
</tr>
</thead>
<tbody>
<tr>
<td>Livestock systems and densities</td>
<td>• Livestock densities</td>
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<td></td>
<td>• Livestock production systems</td>
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<td>Livestock production and economics</td>
<td>• Feed resources and rations</td>
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<td>• Livestock production</td>
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<td>• Demand for animal-source foods</td>
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<td>• Poverty and livestock ownership</td>
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<td>• Marketing and trade</td>
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<td>• Manure management</td>
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<td>• Greenhouse gas emissions</td>
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<td>• Land degradation</td>
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<td>• Carbon sequestration</td>
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<tr>
<td>Livestock and public health</td>
<td>• Disease distribution</td>
</tr>
<tr>
<td></td>
<td>• Disease risk maps</td>
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</tbody>
</table>
Livestock distribution and production

1. Sub-national Livestock data
2. Global livestock maps
   - Data collection, cleaning and geo-registration
   - Livestock distribution modelling
   - Production systems modelling
   - Herd / production modelling
3. Livestock maps by production system
4. Livestock production estimates
Livestock distributions (GLW 2007)

- Gridded Livestock of the World (GLW)
- Global coverage
- 5 km resolution GIS data
- All major livestock species
- Predicted densities, standardised to 2000 and 2005 (FAOSTAT)
- Freely available in graphic, GIS (ESRI) and Google Earth formats

Wint and Robinson (2007)
Livestock distributions

- Pigs
- Chickens
- Ducks

- Updated sub-national statistics
- 1km MODIS data (2001-2008)
- Standardised to FAOSTAT 2006
- New, improved modelling approach
- Accuracy estimates (internal)
- Cluster computing (SIB)

Source: Robinson, Gilbert et al. (2013)
Livestock production systems

**Ruminant systems:**
- Based on land use and agro-ecological potential
- No actual livestock data

**Monogastric systems:**
- Based on scale and intensification
- Use livestock densities

Robinson et al. (2011)
### Ruminant production systems

#### Land cover (GLC 2000, Africover)

<table>
<thead>
<tr>
<th>Agro-ecology (LGP, temperature, elevation)</th>
<th>Rangeland</th>
<th>Cropland</th>
<th>Tree cover</th>
<th>Artificial surfaces</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arid &amp; Semi-arid</td>
<td>LGA</td>
<td>MRA</td>
<td>MIA</td>
<td>Other</td>
</tr>
<tr>
<td>Humid and Sub-humid</td>
<td>LGH</td>
<td>MRH</td>
<td>MIH</td>
<td></td>
</tr>
<tr>
<td>Temperate or Tropical highland</td>
<td>LGT</td>
<td>MRH</td>
<td>MIH</td>
<td>Urban</td>
</tr>
</tbody>
</table>

**Legend:**
- LGA: Rain-fed Rangeland
- MRA: Irrigated Rangeland
- MIA: Tree cover (GLC 2000, Africover)
- LGH: Rain-fed Cropland
- MRH: Irrigated Cropland
- MIH: Other
- Urban: Artificial surfaces

**Note:**
- Agro-ecology classification includes Arid & Semi-arid, Humid and Sub-humid, and Temperate or Tropical highland climates.
- Land cover classification utilizes GLC 2000 and Africover datasets.
Monogastric production systems

- % backyard
- Extensive production
- Mapped based on rural population
- Livestock distribution

- Difference (total – extensive)
- Intensive production
- % intensive
Chicken systems

Log per-capita GDP (US$/person/year)
From World Bank data
Chicken systems

Intensive chicken production

Extensive chicken production
Pig systems

- Industrial pig production
- Semi-Intensive pig production
- Extensive pig production
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| Livestock environment                       | • Manure management  
|                                             | • Greenhouse gas emissions  
|                                             | • Land degradation  
|                                             | • Carbon sequestration                                           |
| Livestock and public health                 | • Disease distribution  
|                                             | • Disease risk maps                                             |
Estimating manure production

Lifecycle Assessment

Herd model
- Herd parameters
- Feed rations
- Breeds

Livestock densities
Production systems
Manure management

Outputs
- Production amount
- Excreted nutrients
- GHG emissions
Manure management (pigs)

- Deposited on pasture
- Burned
- Lagoon
- Liquid/slurry
  - With or without crust
- Solid storage
- Dry lot
- Pit
  - for more or less than 1 month
- Daily spread
- Digester
Manure management (int. pigs)

Proportion of manure managed in the five main systems

- Lagoon
- Dry lot
- Liquid/slurry
- Pit
- Solid storage
Available N (all livestock species)

Available N = total N produced - losses
Available N (all livestock species)

Asia

Latin America
Livestock-Geo-Wiki
Livestock-Geo-Wiki
Crowdsourcing (Howe 2006)
  - Livestock production system
  - Manure management practices by system
  - Maps and tabular coefficients

Mobile phone apps

Targeted competitions

Links to field sites/studies
  - CGIAR Research Programmes (Humidtropics, CCAFS, Livestock and Fish)
Mobile phone app
### Livestock-Geo-Wiki

<table>
<thead>
<tr>
<th>Database values</th>
<th>Operator values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Livestock type</td>
<td>Pig</td>
</tr>
<tr>
<td>Livestock production system</td>
<td>Semi-Intensive</td>
</tr>
<tr>
<td>Location</td>
<td>Vietnam</td>
</tr>
<tr>
<td>Average density (per sq km)</td>
<td>3</td>
</tr>
<tr>
<td>Proportion in that system</td>
<td>%</td>
</tr>
<tr>
<td>Typical manure management method:</td>
<td></td>
</tr>
<tr>
<td>Deposited on land/pasture</td>
<td>0</td>
</tr>
<tr>
<td>Burned</td>
<td>20</td>
</tr>
<tr>
<td>Lagoon</td>
<td>20</td>
</tr>
<tr>
<td>Liquid/slurry</td>
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<tr>
<td>Solid storage</td>
<td>53</td>
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<tr>
<td>Dry lot</td>
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</tr>
<tr>
<td>Pit</td>
<td>0</td>
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<tr>
<td>Daily spread</td>
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<tr>
<td>Digester</td>
<td>0</td>
</tr>
<tr>
<td>Is the manure stored?</td>
<td>y</td>
</tr>
<tr>
<td>Is the manure applied?</td>
<td>y</td>
</tr>
<tr>
<td>GHG emissions from manure storage</td>
<td>#</td>
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<tr>
<td>Excretion of phosphorus</td>
<td>#</td>
</tr>
<tr>
<td>Excretion of nitrogen</td>
<td>#</td>
</tr>
<tr>
<td>Nitrogen lost</td>
<td>#</td>
</tr>
<tr>
<td>Nitrogen remaining</td>
<td>#</td>
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</table>

[Submit Changes]
Looking forward

- Build the Livestock-Geo-Wiki infrastructure (by end of 2013)
- Incorporate new livestock and systems maps (by end of 2013)
- Design and implement the manure management module for the pig sector (by end of 2013)
- Expand to cover all livestock species (by mid-2014)
- Establish link to CGIAR Research programme (CRP) field sites for ground-truthing (by end of 2014)
- Search for funding to develop other modules
Thank You !