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
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- 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
The global livestock sector

• 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
## Livestock-Geo-Wiki

<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&lt;br&gt;• Livestock production systems</td>
</tr>
<tr>
<td>Livestock production and economics</td>
<td>• Feed resources and rations&lt;br&gt;• Livestock production&lt;br&gt;• Demand for animal-source foods&lt;br&gt;• Poverty and livestock ownership&lt;br&gt;• Marketing and trade</td>
</tr>
<tr>
<td>Livestock environment</td>
<td>• Manure management&lt;br&gt;• Greenhouse gas emissions&lt;br&gt;• Land degradation&lt;br&gt;• Carbon sequestration</td>
</tr>
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<td>Livestock and public health</td>
<td>• Disease distribution&lt;br&gt;• Disease risk maps</td>
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</table>
Livestock distribution and production

Sub-national Livestock data → Global livestock maps → Livestock maps by production system → Livestock production estimates

Data collection, cleaning and geo-registration → Livestock distribution modelling → Production systems modelling → Herd / production modelling
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

- 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

### Agro-ecology

<table>
<thead>
<tr>
<th>Agro-ecology</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>Urban</td>
</tr>
<tr>
<td>Temperate or Tropical highland</td>
<td>LGT</td>
<td>MRH</td>
<td>MIH</td>
<td></td>
</tr>
</tbody>
</table>
Monogastric production systems

% backyard → Extensive production

Mapped based on rural population

Livestock distribution

% intensive → Intensive production

Difference (total – extensive)
Chicken systems

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  
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                                          • 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

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: 0%
- Liquid/slurry: 0%
- Dry lot: 0%
- Pit: 100%
- Solid storage: 0%
Available N (all livestock species)

Available N = total N produced - losses
Available N (all livestock species)
Livestock-Geo-Wiki
Livestock-Geo-Wiki
Livestock-Geo-Wiki: Feedback

• 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
### Database values

<table>
<thead>
<tr>
<th>Livestock type</th>
<th>Pig</th>
</tr>
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<tbody>
<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>
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**Typical manure management method:**

- Deposited on land/pasture: 0
- Burned: 20
- Lagoon: 20
- Liquid/slurry: 0
- Solid storage: 53
- Dry lot: 0
- Pit: 0
- Daily spread: 7
- Digester: 0

**Is the manure stored?**

- y

**Is the manure applied?**

- y

**GHG emissions from manure storage**

- #

**Excretion of phosphorus**

- #

**Excretion of nitrogen**

- #

**Nitrogen lost**

- #

**Nitrogen remaining**

- #

### Operator values

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**Is the manure stored?**

- y

**Is the manure applied?**

- y

**GHG emissions from manure storage**

- #

**Excretion of phosphorus**

- #

**Excretion of nitrogen**

- #

**Nitrogen lost**

- #

**Nitrogen remaining**

- #
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!