LiveM
The Challenge of Sustainability

• “The challenge for global agriculture is to grow more food on not much more land, using less water, fertiliser and pesticides than we have historically done.” – Sir John Beddington, 2009

• Agriculture needs to meet the demand for food whilst balancing
  – environmental impact
  – human health requirements
  – competition for land, water and energy
  – but also mitigate the effects of climate change
Example: Livestock sector

- Expanded rapidly as demand for meat and dairy continues to grow
- An increase of 68% by 2030 from 2000 base figure has been estimated
- The world’s largest user of land resources:
  - grazing land occupying 26% of land surface
  - 33% of cropland dedicated to production of feed
Challenges for food systems

- more resilient production systems
- reduce dependency of the food chain on fossil fuels
- enhance ecosystem services (i.e. soil and water)
- radically reduce greenhouse gas emissions produced by food system (80% by 2050)
Additional grain required by 2050

1048 million tonnes of which:

– 430 million tonnes for livestock

– 480 million tonnes for humans

(IAASTD 2009)
Sources of feed for animal production

Human - inedible materials:

• Forages from land not able to grow crops
• Crop residues
• Food and fiber processing by-products
Grassland systems

grassland carbon sequestration has the potential to play a significant role in mitigating the GHG balance of ruminant production systems

(Soussana et al. 2010)
Global demand for vegetable protein rapidly increasing

Demand for soyameal increased 3000% in China since 1990
UK plant-derived protein (supply and demand)

• UK uses 2.6 million tonnes/annum of plant-derived protein for animal feed
  • 37% from home-grown cereals (ca. 1 million tonnes)
  • 3% from home-grown pulses (ca. 0.09 million tonnes from dry peas and field beans)
  • 55% from imported soya (ca. 1.4 million tonnes)
  • 5% from imported maize (ca. 0.13 million tonnes)
Average productivity increases of UK crops necessary to match US soya bean per hectare protein yield (1.33 T/Ha)

<table>
<thead>
<tr>
<th>Tonnes/ha</th>
<th>Current yield</th>
<th>Required yield</th>
<th>% increase</th>
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<tbody>
<tr>
<td>Wheat</td>
<td>7.9</td>
<td>11.0</td>
<td>39</td>
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<tr>
<td>Barley</td>
<td>5.8</td>
<td>13.2</td>
<td>128</td>
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<tr>
<td>Field bean</td>
<td>3.6</td>
<td>4.6</td>
<td>26</td>
</tr>
<tr>
<td>Dry pea</td>
<td>3.1</td>
<td>5.5</td>
<td>77</td>
</tr>
<tr>
<td>Dry bean</td>
<td>-</td>
<td>5.5</td>
<td>-</td>
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</tbody>
</table>

The UK is vulnerable to global competition for soya bean and needs a 5 tonne/ha protein crop as an alternative “break” from cereals: -a target for legume improvement

Crute, 2010
Key components of LiveM

Grassland

Building and exploring datasets and climate change models on CC in relation to livestock and grassland
(Dave Bartley, Moredun Research Institute)

Livestock

Model intercomparison on climate change in relation to livestock and grassland
(Gianni Bellocchi, INRA)

Climate Change

Improving the assessment of climate change impact on livestock and grassland at farm level
(Nick Hutchings, Aarhus University)

Cross-cutting activities and integration at regional level
(Tommy Dalgaard, Aarhus University)