Agenda

- Introduction
  - Carbon Footprinting in SDAS
  - Improving reporting, Increasing visibility
- Version 4 Model Calculation Changes
  - Summary of changes
  - Effect of changes
  - Herd examples
- Accessing Updated Carbon Footprints
  - For farmers
  - For Co-Ops
- Future Development
Carbon Footprinting in SDAS

- Since 2014 over 70,000 SDAS audits have been conducted.
- A carbon footprint has been calculated for 95% of these audits.
- Data used in these calculations comes from
  - The SDAS audit sustainability survey,
  - AIMS
  - Dairy Co-ops
- Figures reported back to farmers and increased visibility now necessary.
- Need to support the understanding of GHG emission counting and carbon footprinting.
- Need to ensure highest level of accuracy possible.
Pre Go-Live Model Data Flows

AIMS
Sustainability Survey
Milk Data, Co-Ops

Bord Bia Systems

INPUTS
Dairy Carbon Footprint Model

OUTPUTS
Dairy Carbon Footprint Model

Carbon Footprint Model & Updates
Teagasc

= Data In
= Data Out
Post Go-Live Model Data Flows

Sustainability Survey

Milk Data, Co-Ops

Carbon Footprint Model & Updates

Bord Bia Systems

Teagasc

ICBF Systems

AIMS

Dairy Carbon Footprint Model

INPUTS

Dairy Carbon Footprint Model

OUTPUTS

= Data In

= Data Out
Improving Accuracy

- Sustainability Survey updates, - now more accurately capturing information relating to;
  - Slurry application methods and timing
  - Types of fertilizer applied including protected urea
  - Concentrate feeding
- Input sources, - improved categorization of animals on farm.
  - AIMS data now available through ICBF eliminating the need for some herd profiling assumptions to be applied.
- Model improvements, - based on more up to date research.
  - Emission factor changes
  - Incorporation of new technologies
Improving Reporting

- Providing farmers with visibility on their own farm performance against previous assessments and peers.
- Aim to outline how farm inputs & activities contribute to GHG emissions and make the carbon footprint metric visible.
- Guidance element was formulated in collaboration with Teagasc and is focused on measures set out in the Teagasc MACC curve.

**Striving for alignment with other reports available to farmer**
Increasing Visibility

- Bord Bia Farm Feedback Report
  - Generated after every SDAS audit
  - Includes carbon footprint and breakdown of emission sources

- SignPost Programme
  - Extensive communications around the SignPost Programme will increase awareness.
  - Being made visible at SignPost Farm walks.
  - “Know your Number” campaign.

- Milk statements
- Co-Op reports
Version 4 Model
Calculation
Changes
Dairy Farm Greenhouse Gases (GHG’s)

- Methane (CH₄)
- Nitrous oxide (N₂O)
- Carbon dioxide (CO₂)

Warming potential of GHG’s measured in terms of CO₂

- 1 kg CH₄ = 25 kg CO₂ equiv.
- 1 kg N₂O = 298 kg CO₂ equiv.
Teagasc Carbon Audit Tool

- Expensive to measure multiple emissions from many farms

- Carbon Audit - Cost effective simulation model i.e. carbon calculator
  - Certified by Carbon Trust in 2012

- Calculates farm’s annual greenhouse gas emissions in carbon equivalents (CO$_2$e)
  - Based on experimental data “Emission factors”
  - Measured farm input and output information
Life Cycle Assessment (LCA)

Includes:
- Greenhouse gas emissions released by on-farm processes
- Greenhouse gas emissions released during the production of farm inputs

Boundary
- Cradle-to-farm gate

Unit
- Global warming potential (kg CO$_2$-eq)
- kg fat and protein corrected milk (FPCM; 4.0%, 3.3%).

Data
- Sustainability Dairy Assessment Scheme

Dairy farm
- Fertiliser
- Concentrate
- Fodder

Inputs
- Fuel
- Electricity
- Livestock
- Chemicals

Harvesting
- Soil

Cattle
- Grazing

Housing
- Manure

Milk
Meat
GHG
Improving and disaggregating N₂O emission factors for ruminant excreta on temperate pasture soils

D.J. Krol 1-4, I. Carolan 5, E. Minet 1, J.L. McGough 6, C.J. Watson 7, P.J. Forrestal 7, G.J. Langan 6, 8, K.G. Richards 9

Reducing nitrous oxide emissions by changing N fertiliser use from calcium ammonium nitrate (CAN) to urea based formulations

M.A. Hart 10, 11, P.J. Forrestal 1, C.J. Watson 12, K.L. McGough 1, I. Carolan 5, C. Elliot 1, D. Krol 1, R.J. Laughlin 13, 12, K.G. Richards 9, G.J. Langan 6, 8

International Fertiliser Society
THE CARRON FOOTPRINT OF FERTILISER PRODUCTION: REGIONAL REFERENCE VALUES

Antoine Fabisz and Per-Arne Christensen
Change 1: Nitrous Oxide (Manure) Update

Nitrous oxide from manure from grazing

Kg $\text{N}_2\text{O}$-N/kg N applied

- Default (IPCC 2006): 0.02
- Dung: 0.0031
- Urine (Krol et al 2016): 0.0118

- 84.5% decrease from Default
- 40% decrease from Dung
Nitrous Oxide (Manure) Update - IMPACT

Average of N2O EMISSIONS FROM MANURE

kg CO2-eq

Average N2O Emissions from Manure per Herd

Version 3 Model  Version 4 Model

36%
Change 2: Nitrous Oxide (Fertiliser Application) Update

### Comparison of Nitrous Oxide Emissions

<table>
<thead>
<tr>
<th></th>
<th>Kg N₂O-N/Kg N applied</th>
</tr>
</thead>
<tbody>
<tr>
<td>Default</td>
<td>0.01</td>
</tr>
<tr>
<td>IPCC 2006</td>
<td></td>
</tr>
<tr>
<td>CAN</td>
<td>0.0149</td>
</tr>
<tr>
<td>49%</td>
<td></td>
</tr>
<tr>
<td>Urea</td>
<td>0.0025</td>
</tr>
<tr>
<td>Harty et al 2016</td>
<td></td>
</tr>
<tr>
<td>Urea+NBPT</td>
<td>0.004</td>
</tr>
<tr>
<td>60%</td>
<td></td>
</tr>
</tbody>
</table>
Change 3: Nitrous Oxide (Fertiliser Production) Update

![Chart showing GHG emissions from N fertiliser production]

- CAN: Version 3 - 7.11
- Urea: Version 3 - 4.66
- CAN: Version 4 - 3.51
- Urea: Version 4 - 3.50

Plume Before
Plume After

Nitrous oxide abatement Catalyst
Nitrous Oxide (Fertiliser) - IMPACT

Average of FERTILISER PRODUCTION AND APPLICATION EMISSIONS

16%

Average in Fertilizer Production and Application Emissions per Herd

Version 3 Model  Version 4 Model
Change 4: Methane From Dairy Cattle

Methane from enteric fermentation

- Gross energy intake lost as \( \text{CH}_4 \) decreased
  - Version 3 = 6.5%
  - Version 4 = 6.3%

- Weight gain now considered
  - 35kg per lactation

- Average live weight of milking cow increased
  - 535 kg

- Heifer live weight at calving increased 90% of mature weight.
Carbon Footprint Farm Activity Influence - V3 to V4

Carbon Footprint of Farm Activity
Version 3 vs. Version 4

Version 3
- CH4 EMISSIONS CATTLE FEED
- N2O EMISSIONS MANURE
- FORAGE AND FEED
- FERT PROD & APPLICATION
- GENERAL EMISSIONS

Version 4
- CH4 EMISSIONS CATTLE FEED
- N2O EMISSIONS MANURE
- FORAGE AND FEED
- FERT PROD & APPLICATION
- GENERAL EMISSIONS
SDAS Average Carbon Footprint Changes - V3 to V4

Average CARBON FOOTPRINTS PER YEAR

<table>
<thead>
<tr>
<th>Year</th>
<th>V3</th>
<th>V4</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013</td>
<td>1.20</td>
<td>1.07</td>
</tr>
<tr>
<td>2014</td>
<td>1.19</td>
<td>1.05</td>
</tr>
<tr>
<td>2015</td>
<td>1.15</td>
<td>1.00</td>
</tr>
<tr>
<td>2016</td>
<td>1.16</td>
<td>1.03</td>
</tr>
<tr>
<td>2017</td>
<td>1.17</td>
<td>1.03</td>
</tr>
<tr>
<td>2018</td>
<td>1.17</td>
<td>1.02</td>
</tr>
<tr>
<td>2019</td>
<td>1.12</td>
<td>0.98</td>
</tr>
<tr>
<td>2020</td>
<td>1.13</td>
<td>0.97</td>
</tr>
</tbody>
</table>

- **Version 3 Model**
- **Version 4 Model**
Herd Carbon Footprint Change
Example 1 - C.A.N only

- 72 Dairy Cows
- 7700 L/Cow
- Recorded C.A.N as the only form of fertiliser.
- 9% reduction in fertiliser emissions.

- V3 CF = 0.99 kg CO2 / kg FPCM
- V4 CF = 0.76 CO2 / kg FPCM
Herd Carbon Footprint Change
Example 2 - Urea only

- 111 Dairy Cows
- 6200 L/Cow
- Recorded Urea as the only form of fertiliser.
- 44% reduction in fertiliser emissions.

- V3 CF = 0.83 kg CO2 / kg FPCM
- V4 CF = 0.68 CO2 / kg FPCM
### Herd Carbon Footprint Change

#### Example 3 - Outlier

<table>
<thead>
<tr>
<th>Metric</th>
<th>Version 3</th>
<th>Version 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon Footprint</td>
<td>0.79</td>
<td>1.84</td>
</tr>
<tr>
<td>AIMS Dairy Cow Count</td>
<td>19</td>
<td>44</td>
</tr>
</tbody>
</table>

AIM Data

- Unusual animal movement activity not captured by assumptions in Version 3 Model.
- No assumptions required.

- Increase in all animal related emissions due to more cows counted.
- Influence of high rates of purchases and sales results on final CF.

![Graph showing emissions by component for Version 3 and Version 4](chart.png)
## EBI and Carbon Footprint

### Co-Op Key Performance Indicators (KPI’s) broken down by Herd EBI

<table>
<thead>
<tr>
<th>KPI Metric</th>
<th>No EBI</th>
<th>Bottom 20%</th>
<th>20-40%</th>
<th>40-60%</th>
<th>60-80%</th>
<th>Top 20%</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average EBI</td>
<td>-</td>
<td>€61</td>
<td>€102</td>
<td>€121</td>
<td>€139</td>
<td>€165</td>
<td>€118</td>
</tr>
<tr>
<td>Number of Herds</td>
<td>1,141</td>
<td>2,936</td>
<td>2,936</td>
<td>2,937</td>
<td>2,937</td>
<td>2,937</td>
<td>15,824</td>
</tr>
<tr>
<td>Average Number of Dairy Cows</td>
<td>59</td>
<td>83</td>
<td>77</td>
<td>86</td>
<td>102</td>
<td>131</td>
<td>93</td>
</tr>
<tr>
<td>% Herds Milk Recording</td>
<td>9%</td>
<td>39%</td>
<td>35%</td>
<td>43%</td>
<td>60%</td>
<td>82%</td>
<td>49%</td>
</tr>
<tr>
<td>% Herds in HerdPlus</td>
<td>10%</td>
<td>34%</td>
<td>39%</td>
<td>50%</td>
<td>70%</td>
<td>90%</td>
<td>53%</td>
</tr>
<tr>
<td>Average Milk LItres per Cow</td>
<td>4,723</td>
<td>5,364</td>
<td>5,146</td>
<td>5,268</td>
<td>5,500</td>
<td>5,648</td>
<td>5,337</td>
</tr>
<tr>
<td>Average Butterfat %</td>
<td>4.04%</td>
<td>4.01%</td>
<td>4.10%</td>
<td>4.16%</td>
<td>4.22%</td>
<td>4.36%</td>
<td>4.16%</td>
</tr>
<tr>
<td>Average Protein %</td>
<td>3.46%</td>
<td>3.43%</td>
<td>3.49%</td>
<td>3.53%</td>
<td>3.57%</td>
<td>3.66%</td>
<td>3.53%</td>
</tr>
<tr>
<td>Average Kgs Milk Solids per Cow</td>
<td>365</td>
<td>410</td>
<td>402</td>
<td>416</td>
<td>441</td>
<td>466</td>
<td>423</td>
</tr>
<tr>
<td>Average SCC</td>
<td>227</td>
<td>206</td>
<td>203</td>
<td>192</td>
<td>174</td>
<td>149</td>
<td>188</td>
</tr>
<tr>
<td>Average Calving Interval (days)</td>
<td>398</td>
<td>407</td>
<td>394</td>
<td>389</td>
<td>382</td>
<td>374</td>
<td>390</td>
</tr>
<tr>
<td>Average Six-Week Calving Rate</td>
<td>62%</td>
<td>56%</td>
<td>61%</td>
<td>65%</td>
<td>70%</td>
<td>79%</td>
<td>66%</td>
</tr>
<tr>
<td>Average of Replacement Rate</td>
<td>13.5%</td>
<td>16.7%</td>
<td>16.4%</td>
<td>17.7%</td>
<td>19.0%</td>
<td>20.5%</td>
<td>17.8%</td>
</tr>
<tr>
<td>Average Parity</td>
<td>3.9</td>
<td>3.7</td>
<td>3.8</td>
<td>3.7</td>
<td>3.6</td>
<td>3.5</td>
<td>3.7</td>
</tr>
<tr>
<td>Kg CO2 / Kg FPCM</td>
<td>1.08</td>
<td>1.04</td>
<td>1.00</td>
<td>0.98</td>
<td>0.95</td>
<td>0.90</td>
<td>0.98</td>
</tr>
</tbody>
</table>
Accessing Updated Carbon Footprint Figures
Retrospective Calculations

- All carbon footprint calculations for all audits to be re-run.
- New values will be stored on the Bord Bia Quality Assurance Database.
- Will be used to populate future reporting for individual farms and full cohort of SDAS membership.
- V3 results will be archived for comparison exercises if needed.
Farmer Access to Updated Carbon Footprint

https://farm.bordbia.ie

Username = Herd Number
PIN = 4 Character Code

Forgot PIN function recently added

Click on Farmer Feedback Report section
Co-Op Access to Updated Carbon Footprints

- Reports available through Co-Op interface with Bord Bia Database.
- Carbon Footprint = Includes carbon footprint for each audit of each supplier.
- Carbon Footprint - Average Annual = Average carbon footprint of suppliers audited in an audit year.
- Certified Producers = Access suppliers Farmer Feedback Report
Opportunities for Continued Evolution of the Carbon Footprintng Process
Sustainability Survey

- Survey to be open to all farmers to complete on an annual basis.
- Will enable more up to date reporting of carbon footprint and GHG emissions for SDAS members.
- Allow farmers see impact of adoption of mitigation actions quickly.
- Allow farmers more accurately track carbon footprint and GHG emission trends.
Support for Annual Carbon Footprint Calculation

- Opportunity for Co-Ops to promote annual updating of farm activity data.
- Annual completion of Sustainability Survey in Jan/Feb will enable this.
- Promote to farmers participating in Joint Programmes and other Co-Op farm initiatives.
- Highlight to interested suppliers through Co-Op communication channels.
- If completed, data will not need to be collected as part of SDAS audit.
- Can be completed on Bord Bia farmer portal by farmer or with assistance from Helpdesk.
Future Developments

Data
Develop linkages with other databases:
- Pasture Base
- Feed Merchants
- Fertiliser merchants

Model
- Country specific emission factors
- Carbon sequestration
- Annual review/update
- Development of decision support tool
Support for Links to Merchant Databases

- Potential to pilot use of merchant feed and fertiliser data with consent of the farmer to increase accuracy of inputs further.
- Would support annual carbon footprint calculations.
- Support the development of a long term solution
  - Improving accuracy
  - Removing burden from farmer
- All feed and fertiliser inputs would need to be accounted for.
- Pilot with farms and Co-Ops in a closed loop system.
Thank you for your attention