# SmartCow: fostering synergies through mapping cattle research infrastructure, technologies and research databases

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# Concept of SmartCow project

- Better coordination of research infrastructures (RIs) in the cattle sector is necessary to develop more efficient approaches to address the various challenges in cattle breeding and research
- SmartCow is a first step towards the integration of RIs for the European cattle sector, developing:
  - **Networking activities**: **mapping RIs**, adopting common language, the best standardized techniques and data sharing
  - ***Joint research activities***: Improved and new methods to enhance phenotyping of new and more complex animal traits
  - ***Transnational access:*** Giving access to the infrastructures to conduct new research projects

# Mapping activities

- To develop synergies by mapping and linking research projects, needs and major research infrastructures and technologies on cattle in Europe

- **Specific objectives are to create**:
  1. An inventory of European animal RIs (Task leader: Idele)
  2. An inventory of research animal databases and existing sample banks (Task leader: Teagasc)
  3. A catalogue of available equipment and related techniques (Task leader: Teagasc)

# How?

- **Within the consortium, a common database** was designed and sent to each RI

- **Outside the consortium, an online survey is launched**
  - https://www.smartcow.eu/participate-to-smartcow-survey/

- **EAAP is developing an interactive map**
  - Name of the institute, address, website and field of interest
  - Link to page with complete info about institute on map
  - http://www.smartcow.eu/map/

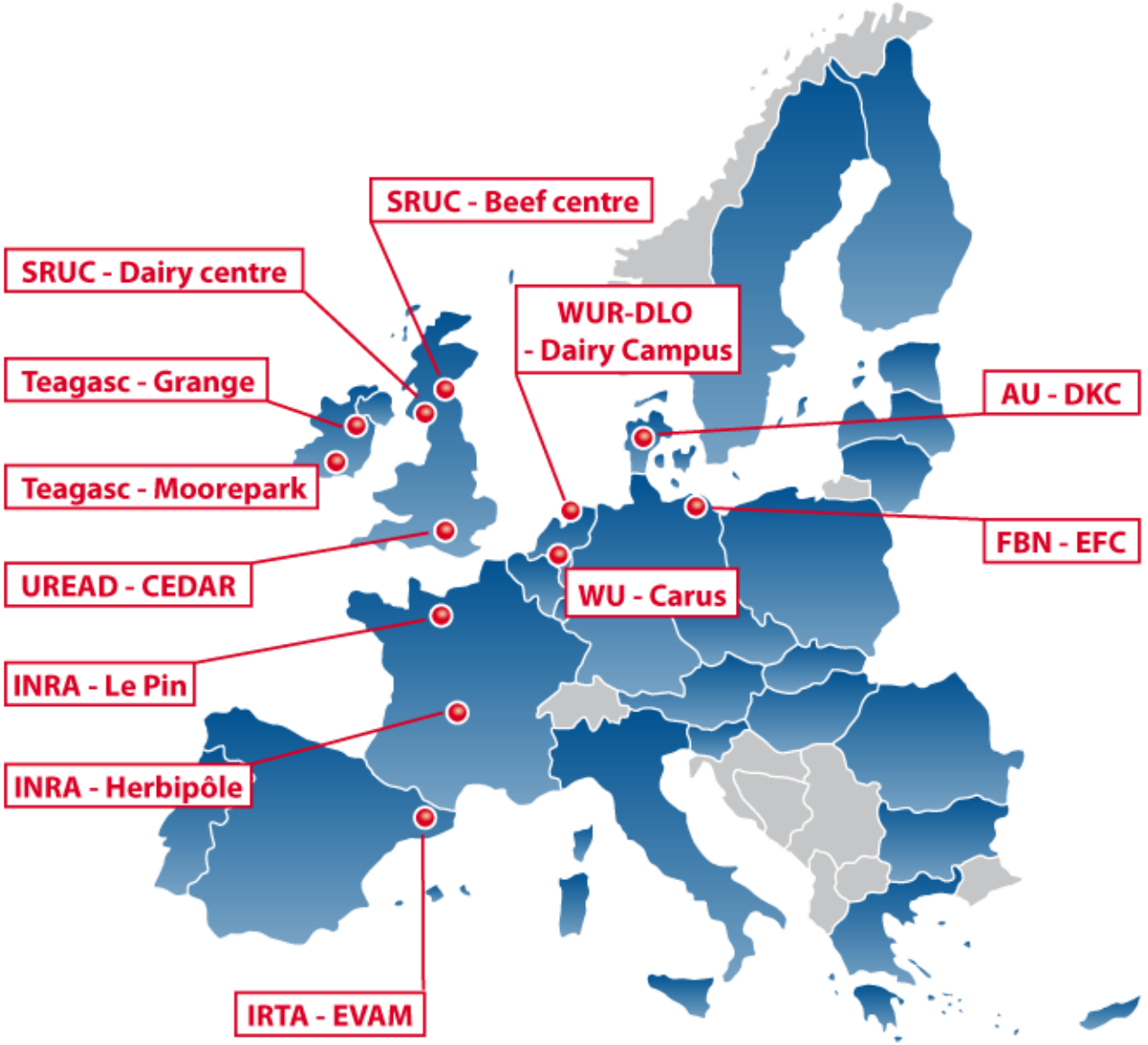
# SmartCow – Database structure

1. General infrastructure characteristics
2. Description of equipment and related techniques
3. Description of animal databases and sample banks

| | A | B | C | I | J | K | L | M | N | O | P | Q | R | S | T | U |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | | | | Staff Numbers | | | | | Description of Facility | | | | | | |
| 2 | Country | Institute | Research Facility/Installation | Stakeholder type | No. Technicians | No. Farm Staff | No. Researchers /Engineers | No. adminstration staff | No. other staff | Soil type | Rainfall (mm) | Climate | Altitude (m) | Total land area (ha) | Grassland area (ha) | Crop |
| 3 | Ireland | Teagasc | Moorepark | Public | 2 | 10 | 24 | 4 | 7 | Free-draining a | 1029.4 | Temperate | 46 | 111 | 101 | 0 |
| 4 | Denmark | Aarhus U | Danish Cattl | Public | 3 | 17 | 20 | 1 | 4 | sand/clay | 906 | Temperate | 40 | 439 | 103 | |
| 5 | The Netherla | Wageninç | Carus | Public | 3 | 15 | 20 | 4 | 5 | Sand / peat | 780 mm/yr | Temperate | 9 | 24 | 24 | |
| 6 | Spain | IRTA | EVAM | Public | 1 | 6 | 1 | 1 | 3 | | 567 | Mediterranear | 60 | 70 | 0 | |
| 7 | France | INRA | Le Pin | Public | 5 | 14 | 4 | 2 | | Clay/loam | 723 | Temperate | 200 | 450 | 400 | |
| 8 | Scotland | SRUC | Easter Howg | | 4 | 7 | 10 | 1 | N/A | Clay/ loam | 1125 | Temperate | 250 | 981 | 920 | |
| 9 | Scotland | SRUC | Dairy Resear | Public | 4 | 8 | 5 | 1 | 0 | Sandy loam | 1200 | Temperate | 100 | 300 | 180 | |
| 10 | Germany | FBN | Barn | Public | 10 | 12 | 1 | 1 | 0 | Clay/loam | 588 | Temperate | 43 | 7 | 7 | |
| 11 | Germany | FBN | RespCham | Public | 5 | 0 | 10 | 1 | 13 | Clay/loam | 588 | Temperate | 43 | 7 | 7 | |
| 12 | Germany | FBN | ExpPhysRoo | Public | 5 | 0 | 10 | 1 | 13 | Clay/loam | 588 | Temperate | 43 | 7 | 7 | |
| 13 | Germany | FBN | BehavArena | Public | 2 | 0 | 9 | 1 | 10 | Clay/loam | 588 | Temperate | 43 | 7 | 7 | |
| 14 | Ireland | Teagasc | Grange | Public | 2 | 4 | 7 | 2 | 10 | Clay/loam | 1192 | Temperate | 83 | 150 | 150 | |
| 15 | France | INRA | Herbipôle-L | Public | 7 | 11 | 4 | 1 | 1 | volcanic andos | 1051 | | 1000 to 1450 | 550 | 550 | |
| 16 | France | INRA | Herbipôle-M | Public | 10 | 11 | 2 | 1 | 2 | volcanic andos | 1160 | | 1000 to 1250 | 390 | 390 | |
| 17 | France | INRA | Herbipôle-T | Public | 14 | 13 | 5 | 1 | 3 | volcanic andos | 771 | | 850 | 160 | 156 | |
| 18 | Belgium | CRAW | Experiment | Public | 4 | 7 | 4 | 1 | 0 | loam | 818 | Temperate | 155 | 24 (300 for all C | 20 | 250 (fo |
| 19 | England | Universit | CEDAR | Public | 7 | 6 | 1 | 1 | 3 | Clay/Gravel | 647 | Temperate | 45 | 760 | 380 | |
| 20 | Netherlands | WUR | Dairy Campu | Public | 0 | 20 | 2 | 2 | 3 | Clay | 800 | Temperate | -2 | 328 | 266 | |
| 21 | | | | | | | | | | | | | | | | |
| 22 | | | | | | | | | | | | | | | | |
| 23 | | | | | | | | | | | | | | | | |

1. Infrastructure | 2. Equipment | 3. Database | Data Validation List

# SmartCow - Research Infrastructures



# RIs main characteristics

- Twelve of the centres are dairy-based and five of the centres are beef focused
- Dairy cow numbers totalled ~2540 across the RIs, the breed type dominated by Holstein-Friesian cows
- Total beef cow numbers were ~740, dominated by Limousin, Angus, Simmental and Charolais breeds
- The calving spread was spring-calving in Ireland, all other countries had calving split between spring and autumn

# RIs – Database exploitation

- **Equipment and related techniques in cattle research**
  - Use of a common language:
    - Animal Trait Ontology: http://www.atol-ontology.com/en/erter-2/
  - List of measurements : Book of methods in cattle physiology
  - Harmonization and refinement of gold standard methods
    - Ring test on CH4 chambers
    - Refinement of digestibility and N balance measurement
- **Animal databases and sample banks (feed, faeces, urine, blood, milk)**
  - Support studies of proxies (biomarkers) of nutrient efficiency and of their determinants

# SmartCow portal of Cattle RIs

## *Interactive Map - http://www.smartcow.eu/map/*

### Institutes Map


### List of Institutes

| Institute | Research Facility/Installation | Address | Farm Type | Stakeholder type | Website |
|---|---|---|---|---|---|
| Aarhus University, Department of Animal Science | Danish Cattle Research Centre | AU Foulum, Blichers Alle 20, 8830 Tjele, Denmark | Experimental Farm | Public | go to website |
| CRAW | Experimental dairy farm | Rue de Liroux 8 5030 Gembloux, Belgium | Experimental Farm | Public | go to website |

# *Online survey to extend the mapping of RIs*

- To inventory the experimentation and demonstration infrastructures of the European cattle sector,
- To give them more visibility through the interactive map and so foster synergies and new cooperation.
- https://www.smartcow.eu/participate-to-smartcow-survey/

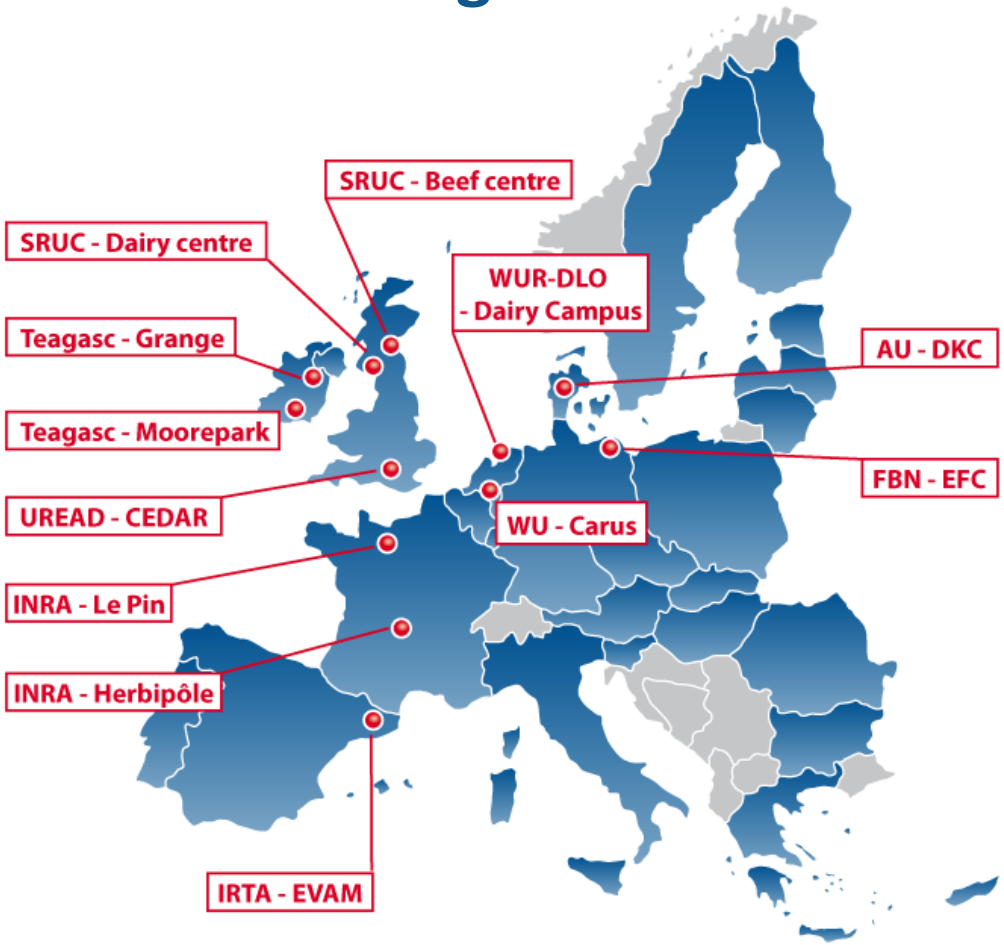
- Final question:
  - Would you like to complete the full Infrastructure database from the SmartCow program ?
  - If you say yes, you will be contacted by SmartCow to complete more detailed information on your infrastructure

# Concluding message

- First step allowed the wider research public to have very good knowledge of what research facilities, infrastructures and methodologies are in place within the consortium
- Next step is to extend the mapping of RIs in SmartCow participating countries and in the rest of Europe
- Fill and disseminate the online survey !

# Thank you for your attention

## SmartCow at a glance




**First-class Cattle Research Infrastructures (RIs) across Europe:**

- 11 major RIs distributed in 7 EU countries
- 12 locations, which include 18 installations
- 2500 dairy and 1000 beef cows

- **Networking of RIs** to inventorize resources, harmonize procedures, and share data
- **Joint research activities** to improve experimental methods and phenotyping capability
- **Interaction with stakeholders** to stay in line with industry needs and improve dissemination

http://www.smartcow.eu/stakeholders/

### TRAINING PROGRAM

For Scientists, Technicians, Stakeholders, PhD students

- Face-to-face training courses
- Free web-conferences
- One-day study tours in 4 different countries

http://www.smartcow.eu/resources/training/

### TRANSNATIONAL ACCESS CALLS

Offers external users (academic and industry) free access to SmartCow RIs

- 30 projects during the 4 years of SmartCow
- Access to around 10,000 cow-weeks

http://www.smartcow.eu/calls/

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# RIs main characteristics

- Staff Numbers
- Description of Facility
- Description of Animals
- Animal Housing
- Animal Handling Facilities
- Ethics -details collected
- Laboratory Facilities

# RIs main equipment and related techniques

- Weather Station
- Water Quality analysis
- Milking and Milk Analysis Facilities
- Bodyweight and Body Condition Score (BCS)
- Blood sample analysis
- Thermography
- Fertility
- Feed Dry Matter Intake (DMI)
- Feed & Intake Technique (eg N-alkane) Processing
- Methane
- Behaviour
- Digestive System Analysis
- Meat Characteristics
- Sample storage
- Freeze Drying
- Near Infrared Spectroscopy (NIRS)

# RIs databases and sample banks

- Database Description- detail recorded
- Animals- details collected
- Animal Behaviour - details recorded
- Welfare - frequency of recording & detail collected
- Health Measurements -details recorded
- Fertility -details recorded
- Thermography details recorded
- Weighing - frequency recorded
- Body Condition Score (BCS)- frequency recorded
- Skeletal Measurements- frequency recorded
- Meat Characteristics- frequency recorded
- Milk Yield- frequency recorded and details collected
- Milk Composition- frequency recorded
- Milk Composition Parameters - details collected
- Diet - details recorded
- Dry Matter Intake (DMI) Measurement - frequency recorded & detail collected
- Blood samples - details collected
- Calorimeter/Metabolism house - details collected
- Samples scanned using Near Infrared Spectroscopy (NIRS) -details recorded