Optimization of production efficiency and environmental impact within the Austrian cattle production

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Environmental circumstances

- World human population expected to reach 9.6 billion people in 2050 (UN, 2013)

- Increasing demand for animal products and pressure on resources (land, water, energy,..)

- Reduction of environmental footprint of cattle; reduction of emissions

- Economic interest in efficient use of resources

  – expected increase in prices for concentrates, energy,..

Traits related to „**efficiency**"
increase in importance!

New desired traits – Fleckvieh
(Steininger, 2013)

Not important (dark red) to very important (dark blue)
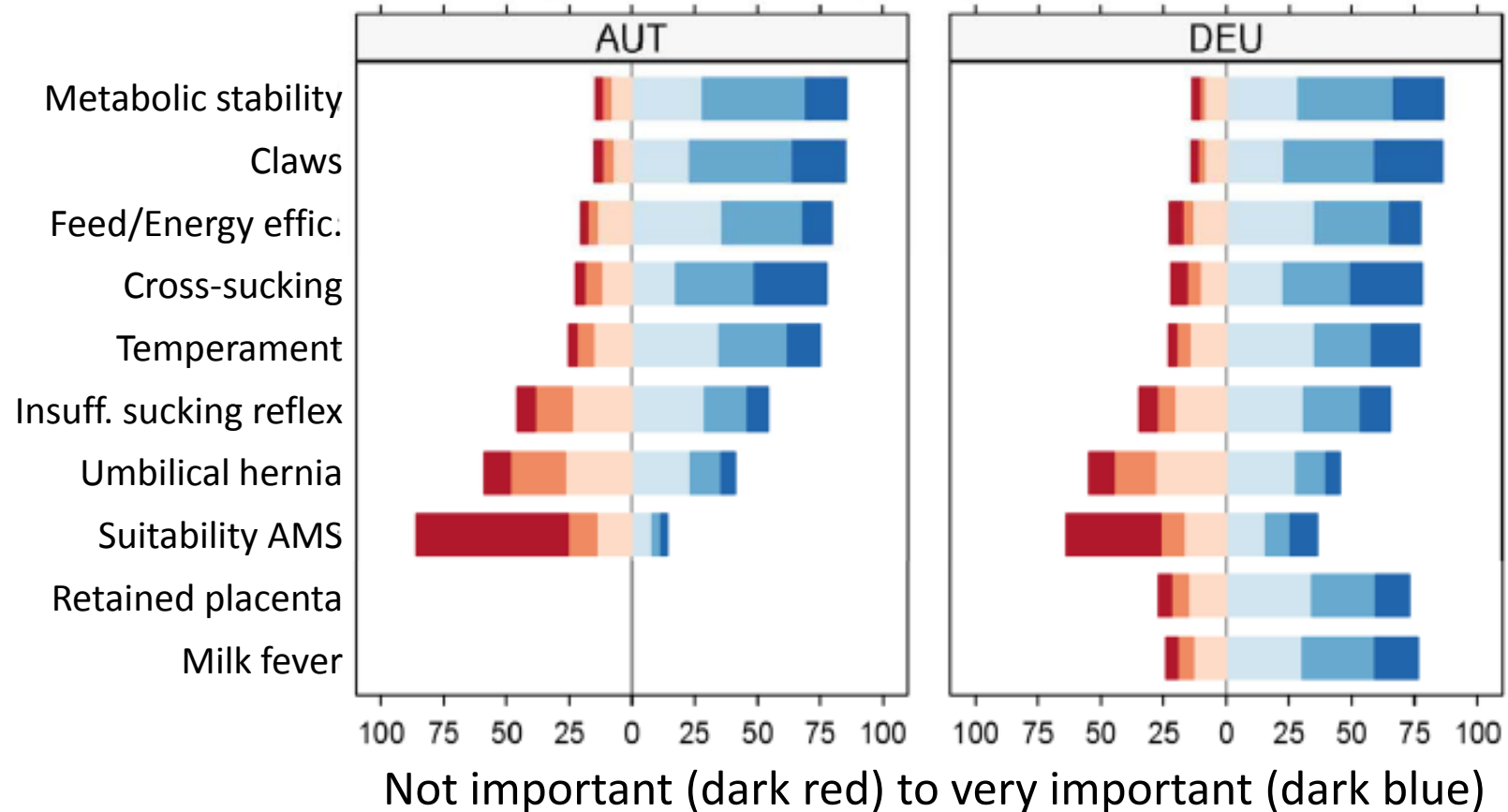
„Efficient Cow"
project aims/measures

- Elaboration of **efficiency parameters**

- Analyses of **genetic possibilities** to **improve** production efficiency

- Evaluation of the **optimal body weight** to achieve the highest nutrient and energy efficiency

- Relationship between **efficiency** and **functional** traits

- Analyses of **environmental impact** of cattle production under Austrian conditions

Efficiency?

- Presumably efficiency is an outcome of a **combination of already existing traits**: milk, beef and functional traits and traits aiming at feeding efficiency and health – production efficiency!

- Focus on dual-purpose cows (Fleckvieh) and dairy cows (Holstein, Brown Swiss) – are there differences?

Project organisation

- **Responsible organisation:** ZAR (Austrian Association of cattle breeders)
- **Project partners:**
  – BOKU, ZuchtData, LFZ Raumberg-Gumpenstein, LKVs, Vetmeduni, AGÖF, ARGE BV, ARGE Holstein, LK Ö
- **Project period:**
  – 4 years: 1.12.2012 – 31.10.2016
- **Data recording:**
  – 2014 at each time of performance recording
- **Funding:**
  – Ministry of Agriculture, ZAR and Austrian Federal States

Approach
field data for novel traits

- **Preselection of farms** with higher degree of phenotype recording (AMS, health recording,..)

- **Distribution** of farms across different **production conditions** and levels of intensity in Austria

- Extended data recording on-farm on **170 farms in Austria** with app. 5,500 cows for one year (1.1.2014 – 31.12.2014)
  - 3,200 Fleckvieh (Simmental)
  - 1,200 Brown Swiss
  - 1,100 Holstein

- Comparison with data of limited number of cows from **research stations**

Complex data collection of on-farm information

Land: pasture, silage, hay,..- resources of farm

Farm: housing information, climate,..

Feed supply: ration composition, nutrient profiles,...

Milking: yield, composition, MIR,..

Farmer: health observations, veterinarian diagnoses, claw health,...

Others: body weight, BCS, lameness, conformation recording, intake, slaughter traits,...

Data recorded I

- **General information** about farm (housing, feeding system, pasture, fodder supplies,.....)
- **Feeding information** (diets, analyes of feed stuff, amount of concentrates eaten,..)
- Recording of **health data** (veterinarian diagnoses and observations by farmers)
- Documentation of **claw trimming**
- Test for **ketosis** based on milk
- **Linear scoring** of all cows across lactations and additional recording of some body measures

Data recorded II

- <u>At each time of milk recording in 2014</u>:

   (cows, dried off cows, heifers to calve in 2014)

   – body weight

   – body measures (muscularity, height,..)

   – body condition score

   – lameness scoring

- Information about diet and feed intake

- Routine information about milk recording + MIR-spectra (additional project)

Novel phenotypes

- Lameness, claw health
- BCS, body weight, test for ketosis
- Diet and feed intake
- Data from automation (AMS,..)
- Information on health status
- MIR-spectra,..

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LFl, Pesenhoferr, 2014

Genomics

- Cooperation with Gene2Farm
- Genotyping of 2,000 Fleckvieh (Simmental) cows and 1,000 Brown Swiss Cows with 70K SNP-Chip
- Genomic studies on different trait complexes within Gene2Farm
  - Reproduction
  - Metabolism
  - Feet and legs
  - ,..

Conclusions
expected outcome

- **Genetic parameters** for newly defined **efficiency traits** and other novel traits and genetic correlations to traits within the TMI (health,..).

- Recommendation for **routine recording** of traits associated with production efficiency, either as direct or as auxiliary traits.

- E**nvironmental impact** is modeled by using genotypes with different feed efficiency.

- Within Gene2Farm genomic aspects of these trait complexes are planned to be analyzed.

Acknowledgement

- Federal Ministry of Agriculture, Forestry, Environment and Water Management (BMLFUW) in Austria, Federal States of Austria and the Federation of Austrian Cattle Breeders for the support within the projects „Efficient cow".

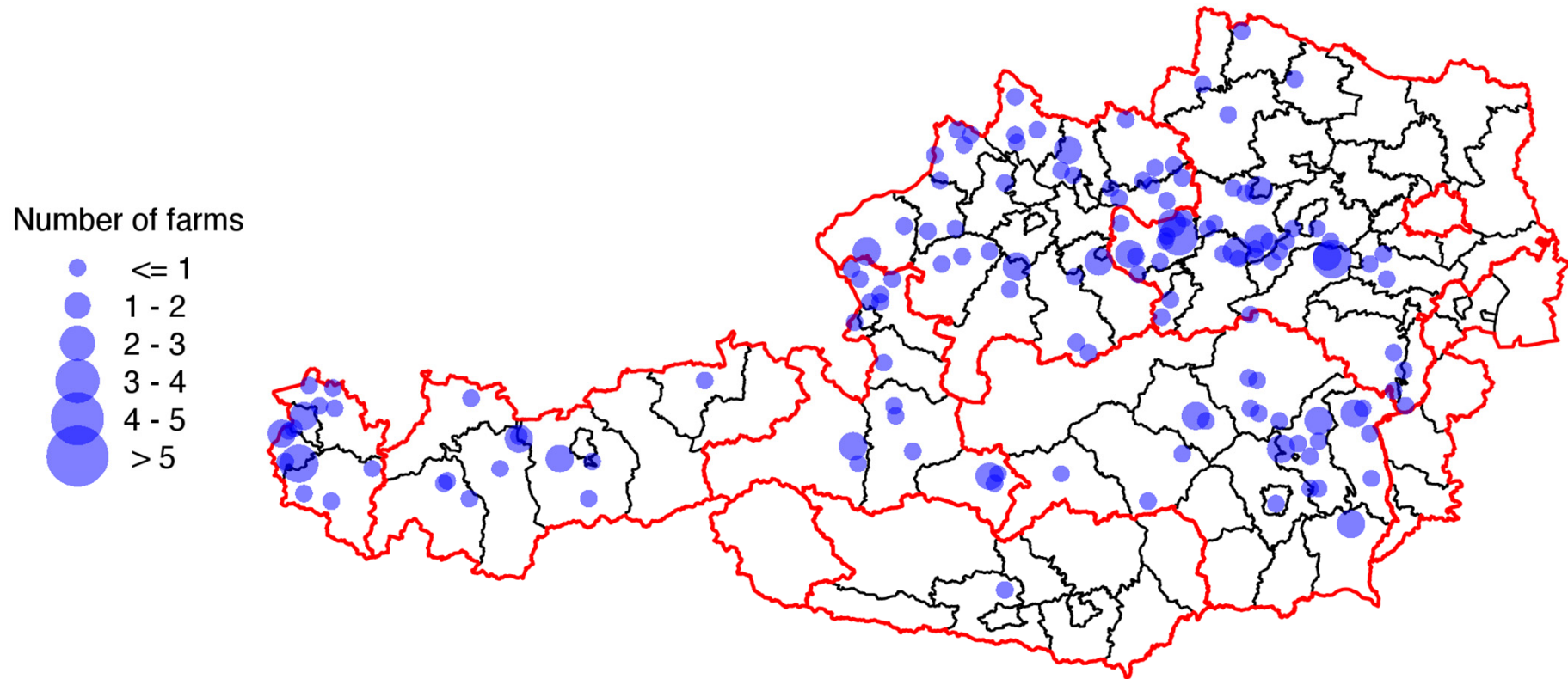- Project partner within the project „Efficient Cow".

- Gene2Farm (EU-FP7-KBBE-2011-5-PNr.: 289592).

Thank you for your attention!

Distribution of farms across Austria

Number of farms in postal code region

Number of farms

- <= 1
- 1 - 2
- 2 - 3
- 3 - 4
- 4 - 5
- > 5

State: 2014-08-23

Research questions concerning phenotyping of novel traits

- Which relevant traits (heritable, repeatable) can be easily recorded on many animals on-farm with low costs (focus on efficiency and health) ?

- Value of on-farm information about feeding for predicting efficiency?

- Are there auxiliary traits (indicator traits) which could be easily and routinely recording on many farms? How can they be included in the Total Merit Index?

- Benefits of genotyping of herds with extensive recording of novel phenotypes?