Derivation of economic values for Red breeds

Breeding goals & conservation strategies for the European Red Dairy Breeds

Barbara Kosińska-Selbi, Christin Schmidtmann, Sarune Marasinskiene, Morten Kargo

Work Package VII

ReDiverse, 2019

AARHUS UNIVERSITY

C A U Christian-Albrechts-Universität zu Kiel

Wrocław University of Environmental and Life Sciences

Lithuanian University of Health Sciences

Consortium & collaborations

- Morten Kargo (Aarhus University, Leader WP 7)
- Jehan Ettema (Aarhus University, SimHerd developer)
- Søren Østergaard (Aarhus University)
- Christin Schmidtmann (Kiel University)
- Georg Thaller (Kiel University)
- Dirk Hinrichs (Kassel University)
- Barbara Kosińska-Selbi (Wroclaw University)
- Joanna Szyda (Wroclaw University)
- Sarune Marasinskiene (Lithuanian University of Health Science)
- Ruta Sveistiene (Lithuanian University of Health Science)
- Violeta Juskiene (Lithuanian University of Health Science)

AARHUS UNIVERSITY

C A U Christian-Albrechts-Universität zu Kiel

Wrocław University of Environmental and Life Sciences

Lithuanian University of Health Sciences

Project interactions

ReDiverse, 2019

Project goals

Formulate a breeding plan, which simultaneously assures economic viability and maintain genetic variation of European Red Dairy breeds

ReDiverse, 2019

Objectives

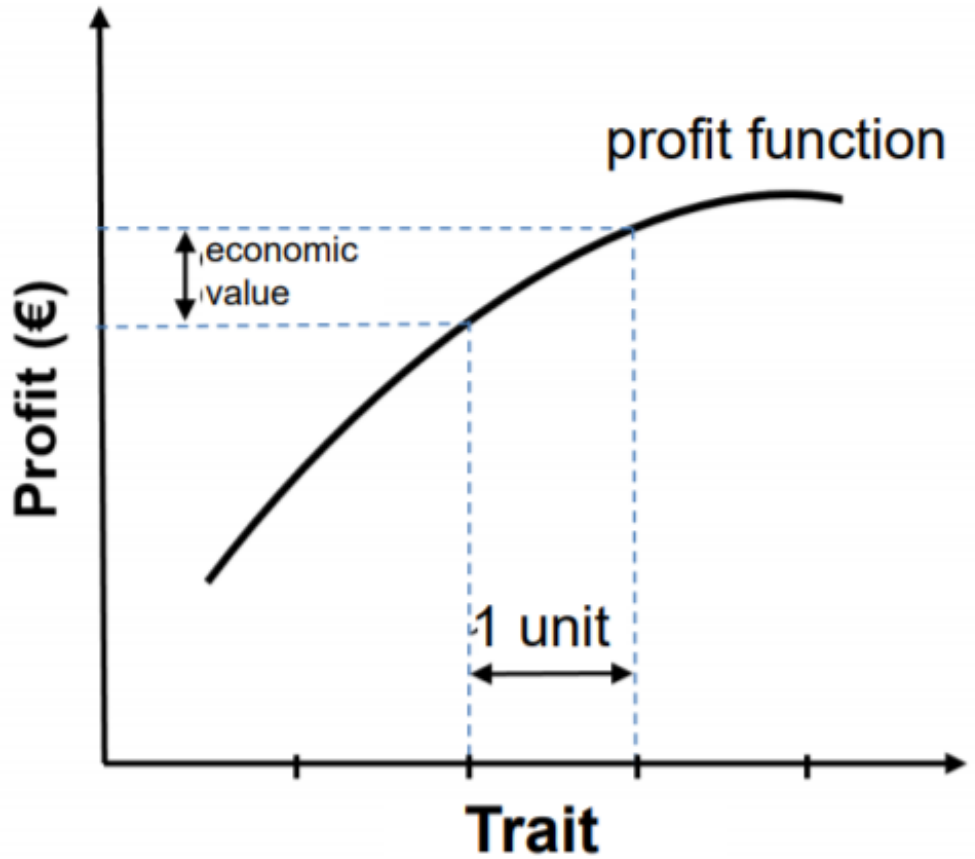
1. Formulate of breeding goals for ERDB
   - estimate the economic values
2. Optimization of breeding schemes
   - Stochastic simulation of breeding schemes
3. Benefits
   - Long-term genetic gain
   - Genetic diversity
   - Uniqueness of ERDB

Breeding goals (BG)

A **breeding goal** is the specification of the traits to be improved including the emphasis given to each trait. It gives the direction in which we want to improve the population.

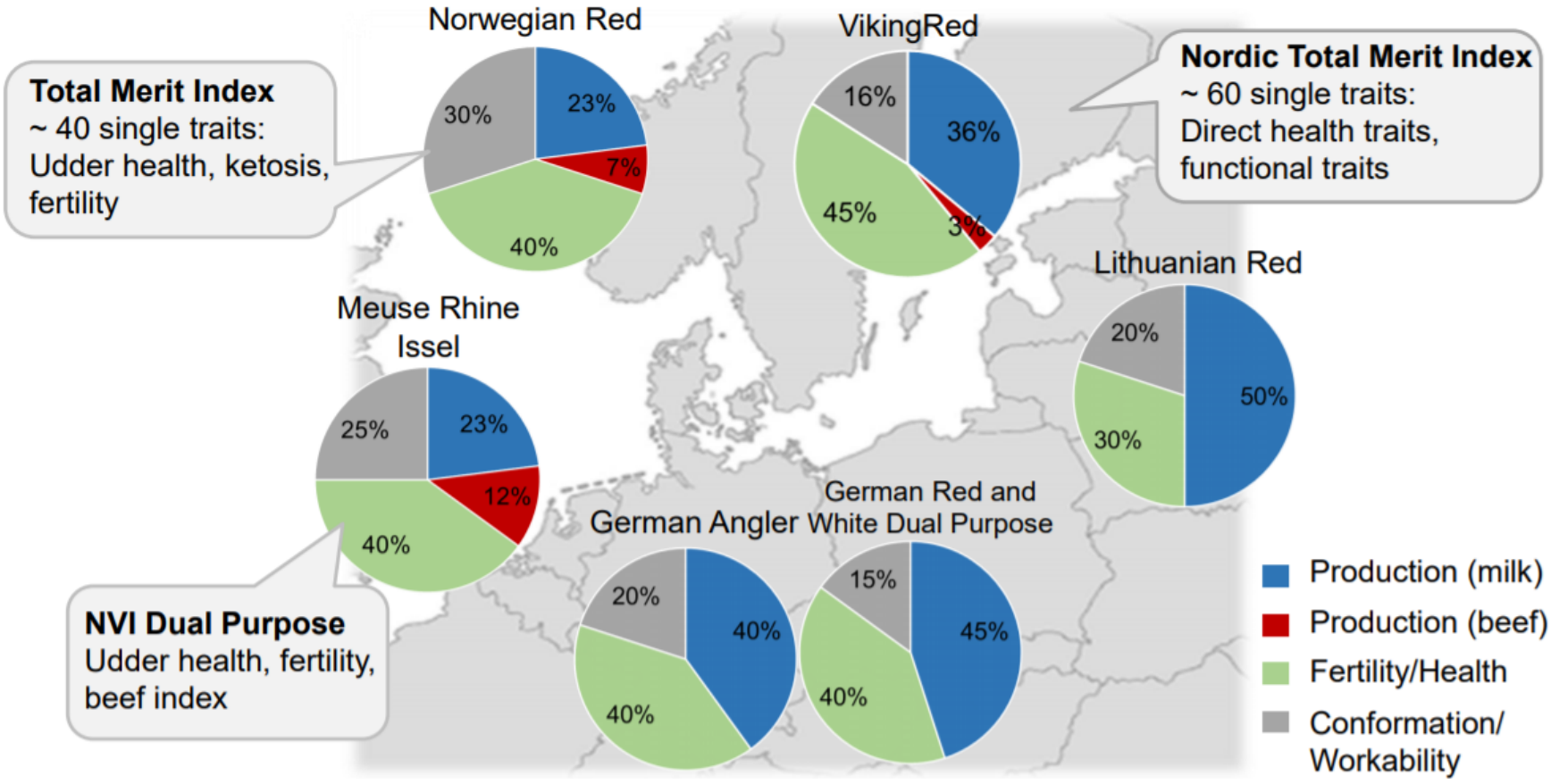
$$\text{TMI} = \text{EV}_1 * \mathit{trait}_1 + \mathit{EV}_2 * \mathit{trait}_2 + \ldots + \mathit{EV}_n * \mathit{trait}_n$$

Economic value (EV)



ReDiverse, 2019

Breeding goals for European Red Dairy Cattle



Schmidtmann, 2019

ReDiverse, 2019

Methodology of delivering EV

- Input biological parameters of Your herds
- SimHerd simulations
- Simulated 40 years uncorrected economic values
- Correction for double counting

Methodology/Bio-economic software SimHerd

- Software used for delivering EV through stochastical simualations
- Developed at Aaarhus University as decision tool for cattle farmers
- Allows to evaluated the economic consequences in different scenarios (e.g. different feeding systems)

- **INPUT**: biological & management parametrs of the herd
- **OUTPUT**: Annual net return & structural parameters of the herd

Østergaard et al., 2005

ReDiverse, 2019

Methodology/Bio-economic software SimHerd

HERD is treated as a biological system !!

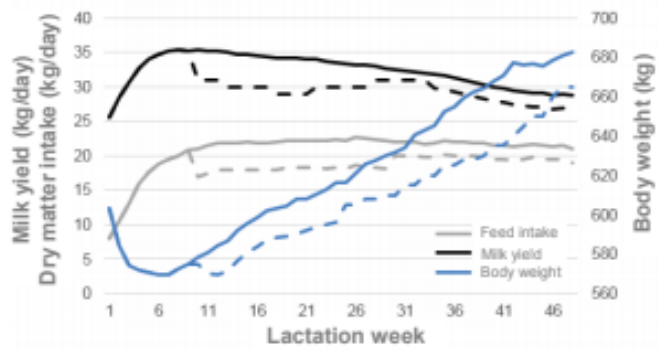
ReDiverse, 2019

Derivation of economic values in SimHerd

Bio-economic model SimHerd (Østergaard et al., 2005)

SimHerd
Improves Your Decisions

Dynamic



→ Milk yield, body weight and feed intake are calculated every week using cow-specific lactation curves and energy requirements

→ Influencing factors: age, parity, lactation stage, reproductive status, health status

Stochastic

- Heat observation rate
- Conception rate
- Sex and viability of born calves
- Diseases → Basis risk + risk factors

↑

- Lactation stage
- Parity number
- Production level
- BCS
- Existence of other diseases

→ Generating natural occuring variation

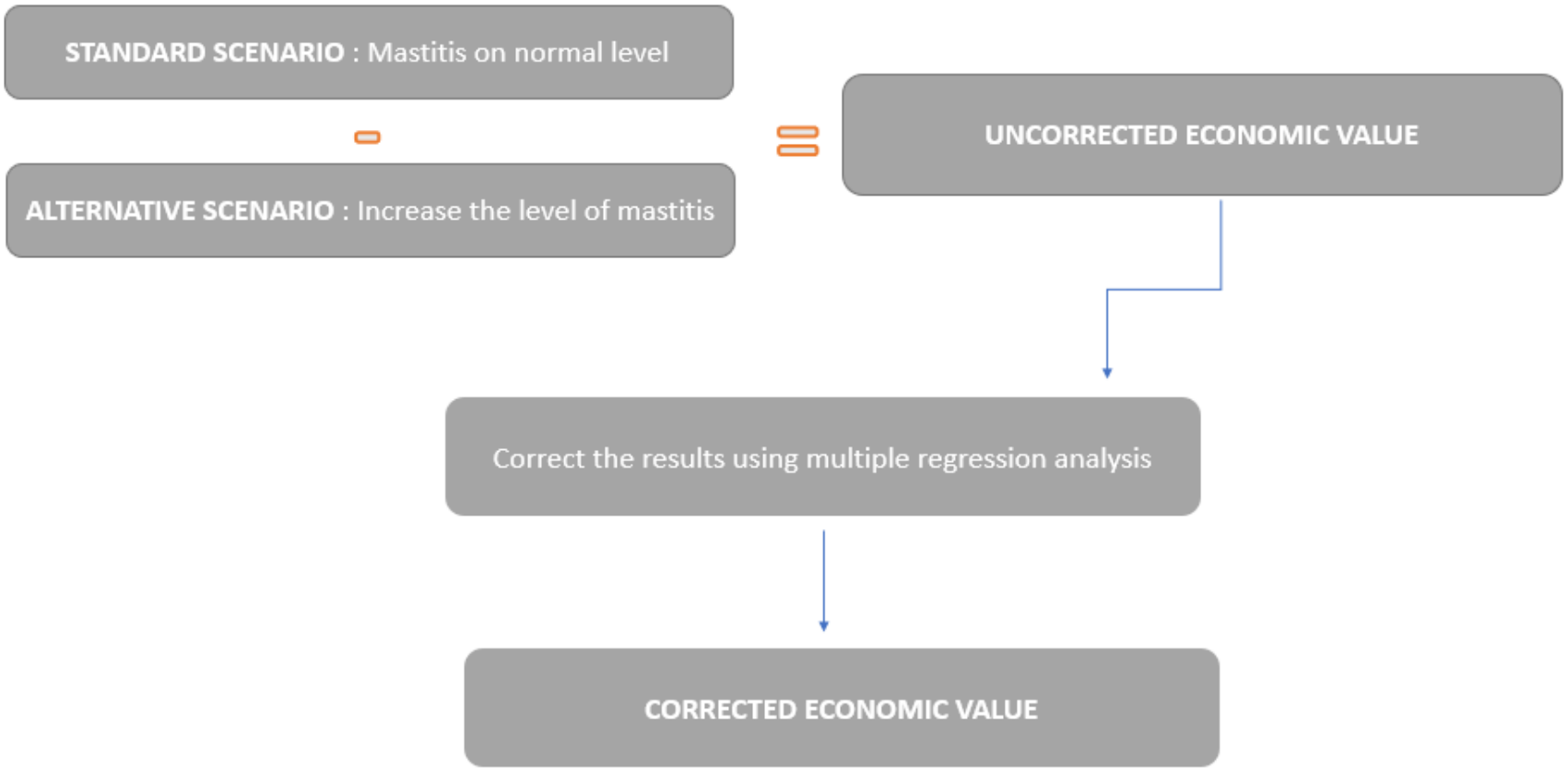
Mechanistic

- Summing up all revenues and costs of all animals in the herd

→ Annual net return

ReDiverse, 2019

Methodology/Simulation of herd data

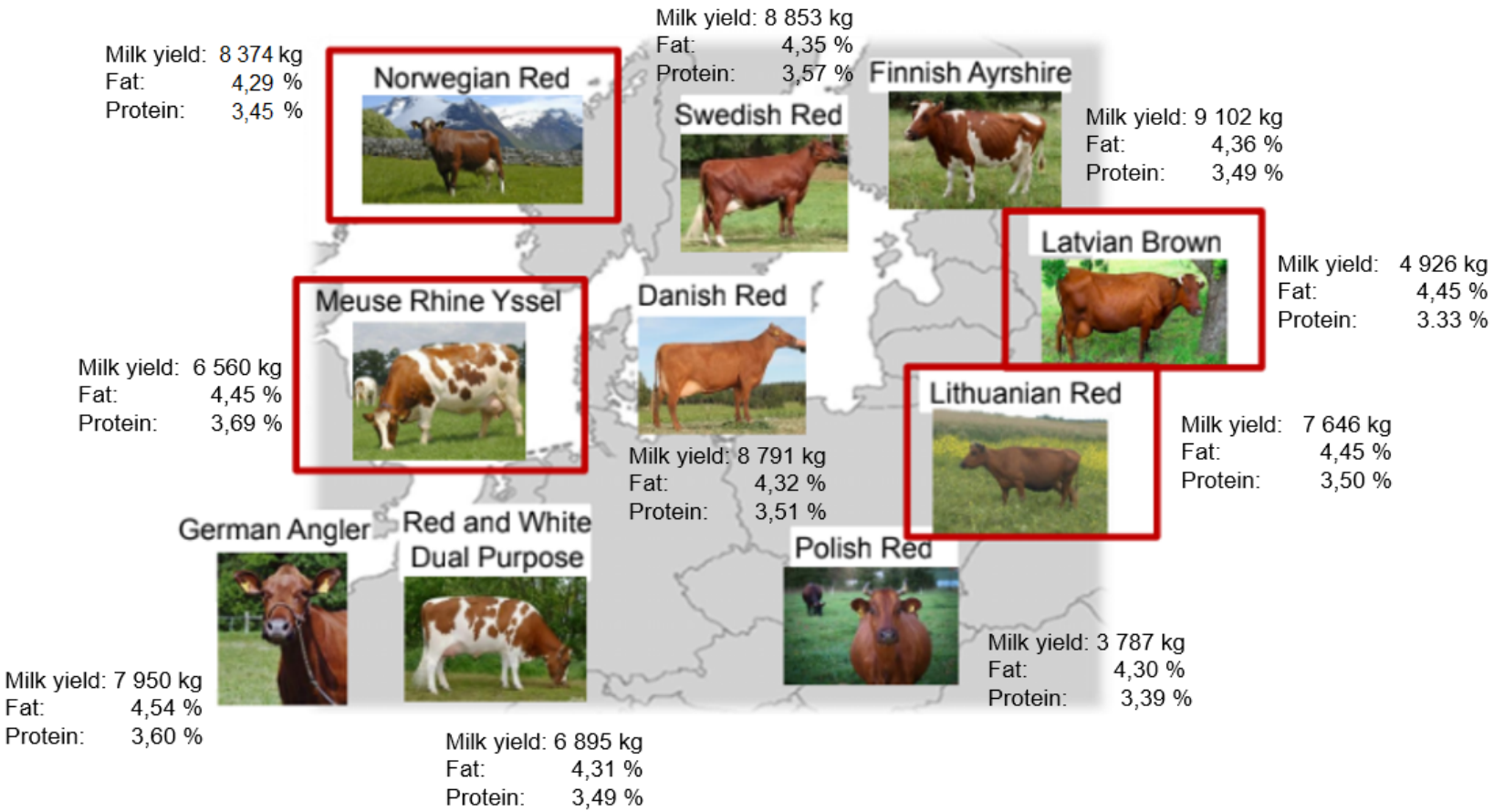


Methodology/traits used for analysis

Production	Health	Fertility	Calving traits	Survival
Energy corrected Milk (ECM)	Ketosis	Conception rate heifers/cows	Stillbirth	Cow mortality
Fat	Mastitis	Insemination rate heifers/cows		Calf mortality early/late
Protein	Lameness			
	Metritis			

ReDiverse, 2019

Methodology/Red Breeds



ReDiverse, 2019

Economic parameters

Prices and costs of different items used for the derivation of economic values

	Sweden	Denmark	Finland	Germany	Poland
Standard milk (€/kg)	0.36	0.36	0.34	0.32	0.32
Fat (€/kg)	4.14	4.14	2.52	2.33	?
Protein (€/kg)	5.97	5.97	6.93	4.68	?
Liveweight (€/kg)	1.90	1.50	1.25	1.60/1.90	1.60
Springing heifer (€/heifer)	1160	1160	1220	1500	1100
Mastitis (€/treatment)	126	87	144	110	70
Ketosis (€/treatment)	89	104	111	50	40
Metritis (€/treatment)	142	88	111	70	76
Dystocia (€/treatment)	232	209	165	180	70

Highest treatment costs in Scandinavian countries

ReDiverse, 2019

Results

Complex	Trait	German Angler	Red and White DP	Danish Red	Swedish Red	Finnish Ayshire
Production	ECM (€/kg)	0.16	0.17	0.21	0.20	0.18
	Fat (€/kg)	1.16	1.19	3.12	3.09	1.40
	Protein (€/kg)	3.17	3.18	4.24	4.12	5.04

Better utilization of roughage
→ lower feed costs

Feed costs: Denmark < Sweden < Finland
Fat price: much lower in Finland
Protein price: higher in Finland

Results

Complex	Trait	German Angler	Red and White DP	Danish Red	Swedish Red	Finnish Ayshire	Polish Red
Health	Mastitis (%)	-2.69	-2.57	-2.56	-2.82	-3.10	-1.11
	Lameness (%)	-3.05	-2.70	-2.54	-2.62	-2.65	-1.21
	Ketosis (%)	-1.87	-1.67	-2.62	-2.17	-2.38	-0.71
	Metritis (%)	-1.74	-1.73	-2.05	-2.54	-1.86	-0.80

⇒ Differences in EV's are mainly caused by: different treatment costs, withdrawal milk, structural herd effects

Results

Complex	Trait	German Angler	Red and White DP	Danish Red	Swedish Red	Finnish Ayshire	Polish Red
Fertility	Conception rate cows (%)	2.49	1.42	1.77	1.98	2.49	0.84
	Conception rate heifers (%)	1.30	0.84	0.73	1.08	1.19	1.22
	Insemination rate cows (%)	2.12	1.15	1.16	1.27	1.79	0.58
	Insemination rate heifers (%)	0.96	0.73	0.71	0.87	1.15	1.07

ReDiverse, 2019

Why does Polish Red differ from other breeds?

Szarek et al., 2004

ReDiverse, 2019

Next steps

Presentation of ideas for common breeding schemes

AARHUS UNIVERSITY

Christian-Albrechts-Universität zu Kiel

Wrocław University of Environmental and Life Sciences

Lithuanian University of Health Sciences

Stockholm Workshop, 2019

ReDiverse, 2019

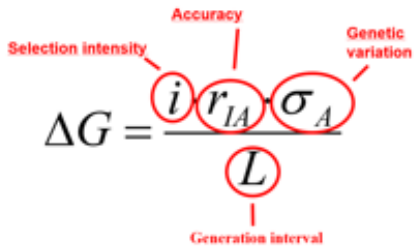
Interactions between genetics and production systems

Fedding

Production systems

Products

INTERACTIONS



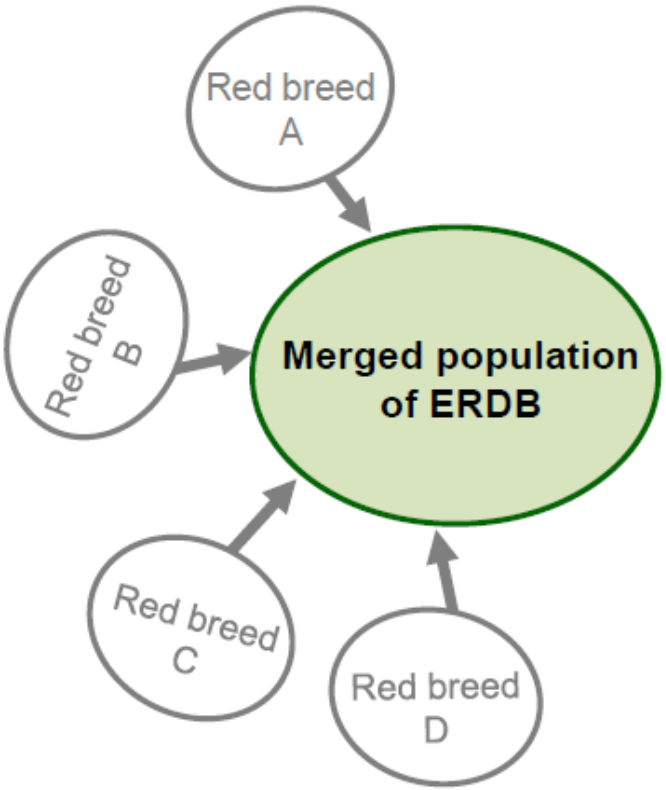
$H = g_1 * EV_1 + g_2 * EV_2 + \ldots + g_n * EV_n$

Breeding goal (traits included, weighting of traits, recording)

Breeding scheme (progeny testing, genomic selection)

Technologies (MOET, IVF, sexed semen)

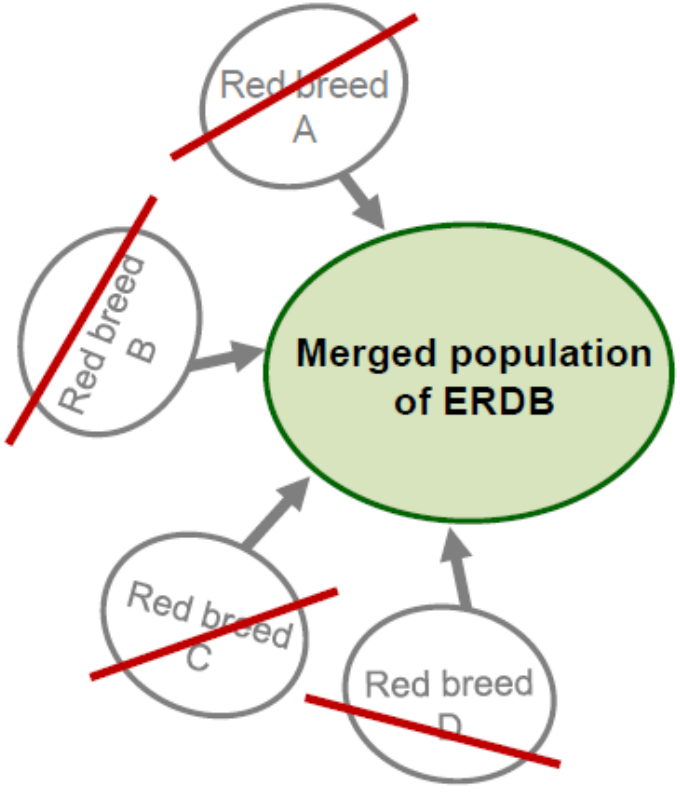
The idea in the beginning . . .



- Creating one large ERDB population with a common breeding goal
  → Loss of genetic diversity between breeds

ReDiverse, 2019

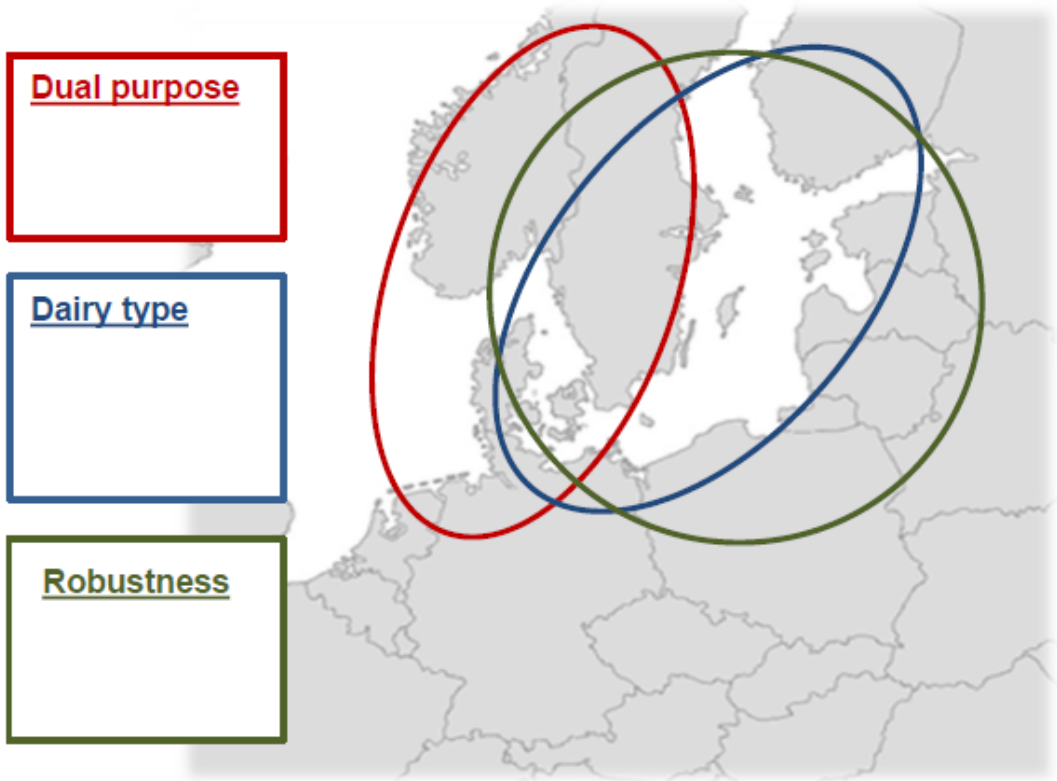
The idea in the beginning . . .



- Forming one large ERDB population with a common breeding goal
  → Loss of genetic diversity between breeds
- A joint breeding population but keeping pure lines of individual breeds
  → Trade-off between genetic progress in the merged population and conservation of genetic diversity within and between breeds
  → Keeping parts of the smaller Red breeds „pure“ for cultural reasons or niche production

ReDiverse, 2019

Three different breeding lines ?



- Formation of three commercial breeding lines
- Simulation of consequences for genetic gain and inbreeding

What is needed?

→ Assumptions for simulation of different cluster in ADAM

ReDiverse, 2019

Arguments for separate breeding lines

Dairy type

- Higher yielding breeds
- Considering fertility and health (counterpart to Holstein Friesians)
- Kept in intensive housing systems
- Intensive feeding

→High yielding but healthy and fertile dairy breed

Dual purpose

- Higher focus on beef traits (average daily gain, meat quality)
- Economic benefits when milk price is low
- Promotion of good functional traits
- Metabolic robustness
- „Ecofriendly“ breed

→Lower yielding breed, special emphasis on beef

Robustness

- Lower yielding breeds
- Better health and fertility compared to higher yielding breeds
- High longevity
- Kept outside, pasture-based in harsh environments

→Resilient breed suitable for „low-input“ conditions

ReDiverse, 2019

ADAM - simulation software

ADAM → Software to simulate breeding schemes in livestock using stochastic simulation (Pedersen et al., 2009)

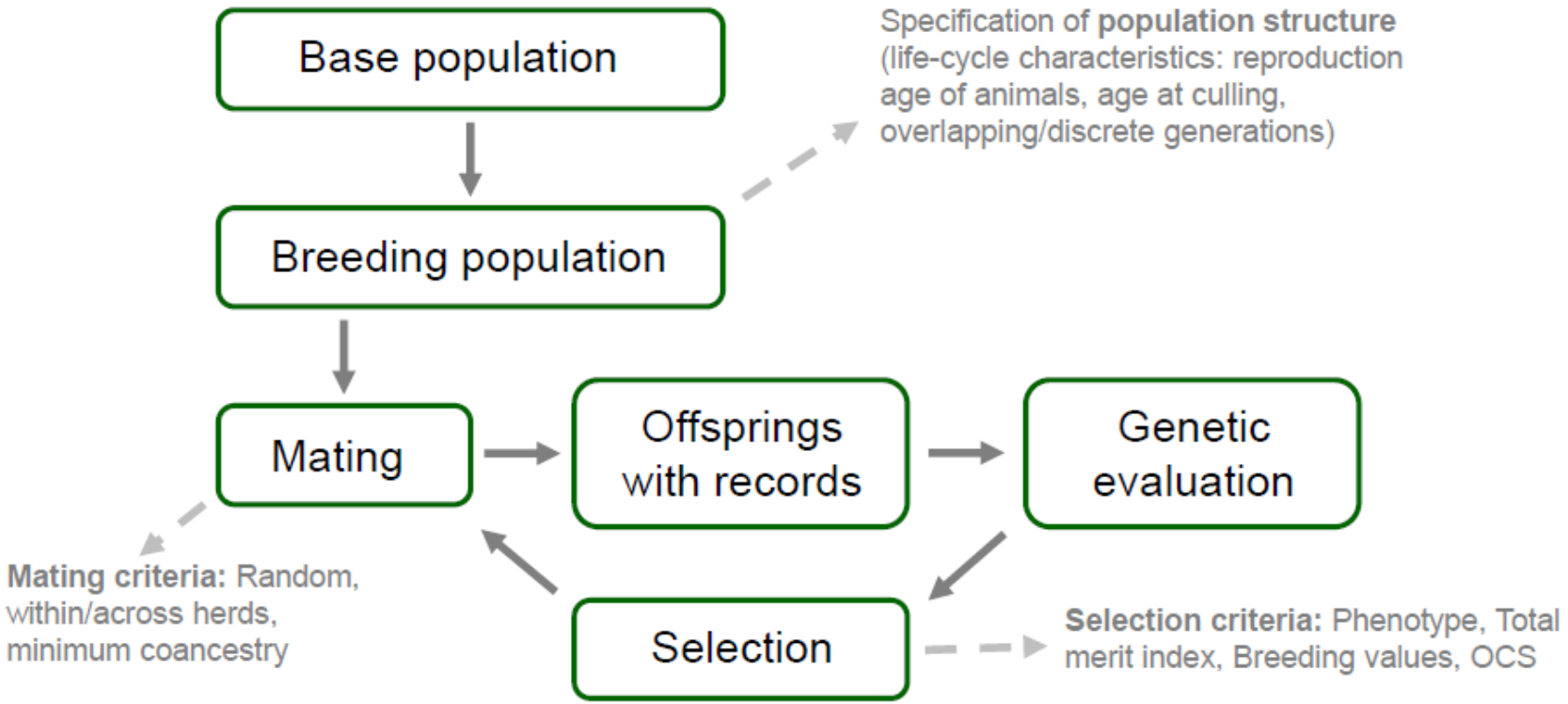
What is possible with ADAM?

- Development and comparison of breeding strategies
- Simulation of a large variety of breeding programs
- Evaluation of consequences using different technologies (genomic selection, MOET, sexed semen, …)
- Support of decision processes

} **Genetic gain**

} **Inbreeding**

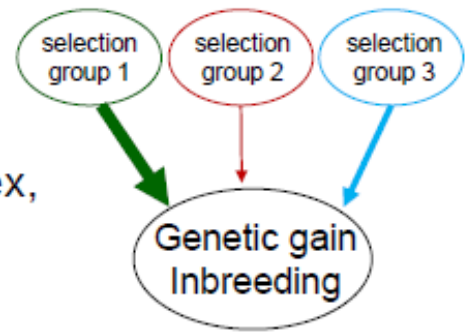
Workflow in ADAM



ReDiverse, 2019

What can ADAM do?

- **Flexible definition of selection groups**
  → Smallest unit of breeding programs
  → Within a selection group, all animals have the same breed, sex, source of information, selection intensity, …



- **Breeding traits**
  - Multiple traits
  - Test-day traits
  - Sex specific traits
  - Traits recorded at slaughter
  - Selective phenotyping
  - Simulation of progeny testing

ReDiverse, 2019

Suggestions – Breeding schemesProgeny testing/ genomic selection

- Genomic breeding schemes in all three main stream clusters?
- Genomic breeding schemes in the smaller national populations?
- Optimal contribution selection to be used in all populations?
  - Considering different genetic lines within populations
    - Eg. In the dairy cluster Angler, RDM, SRB, FAY, BS, RHF

Suggestions – Breeding schemes How many bulls tested per year?

- At least 100 bulls tested per year in the three main stream clusters?
- 10-20 in the smaller national populations?
- Optimal contribution selection to be used in all selection paths

Suggestions – Breeding schemes Number of genotyped calves?

- At least 3,000 bull calves within each main stream cluster (OCS)
- At least 3,000 heifer calves within each main stream cluster (OCS)
- 200-500 heifer and bull calves in the smaller national populations (OCS)

closing remarks

WP7, ReDiverse, 2019