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The perspective of cattle breeding organisations in Switzerland

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Qualitas AG

RuminOmics Regional Workshop
5/6 October 2015
Lodi

Dairy Cattle breeding in Switzerland

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- 1,560,000 cattle
  - 700,000 cows (84% dairy cows)

BRAUNVIEH

swiss herdbook

HOLSTEIN SWITZERLAND

Herdbook cows	Herdbook cows	Herdbook cows
194,000	**244,700**	**115,400**
Brown Swiss	Simmental	Holstein
Original Braunvieh	Swiss Fleckvieh	
	Red Holstein	
	Holstein	
	Montbeliarde	

National greenhouse gas inventory Switzerland 2013

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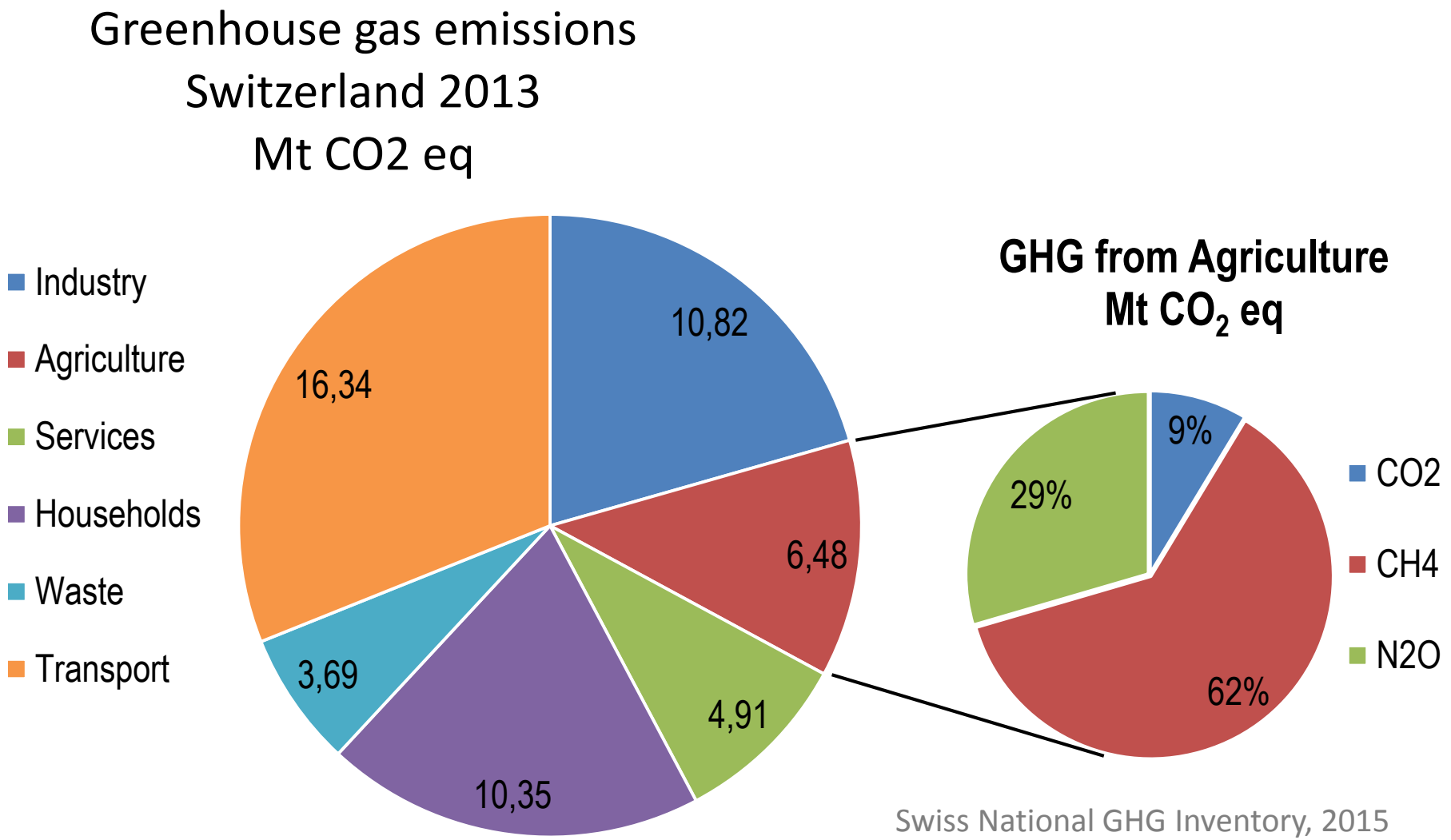

Swiss National GHG Inventory, 2015

CH_4 emissions from dairy production

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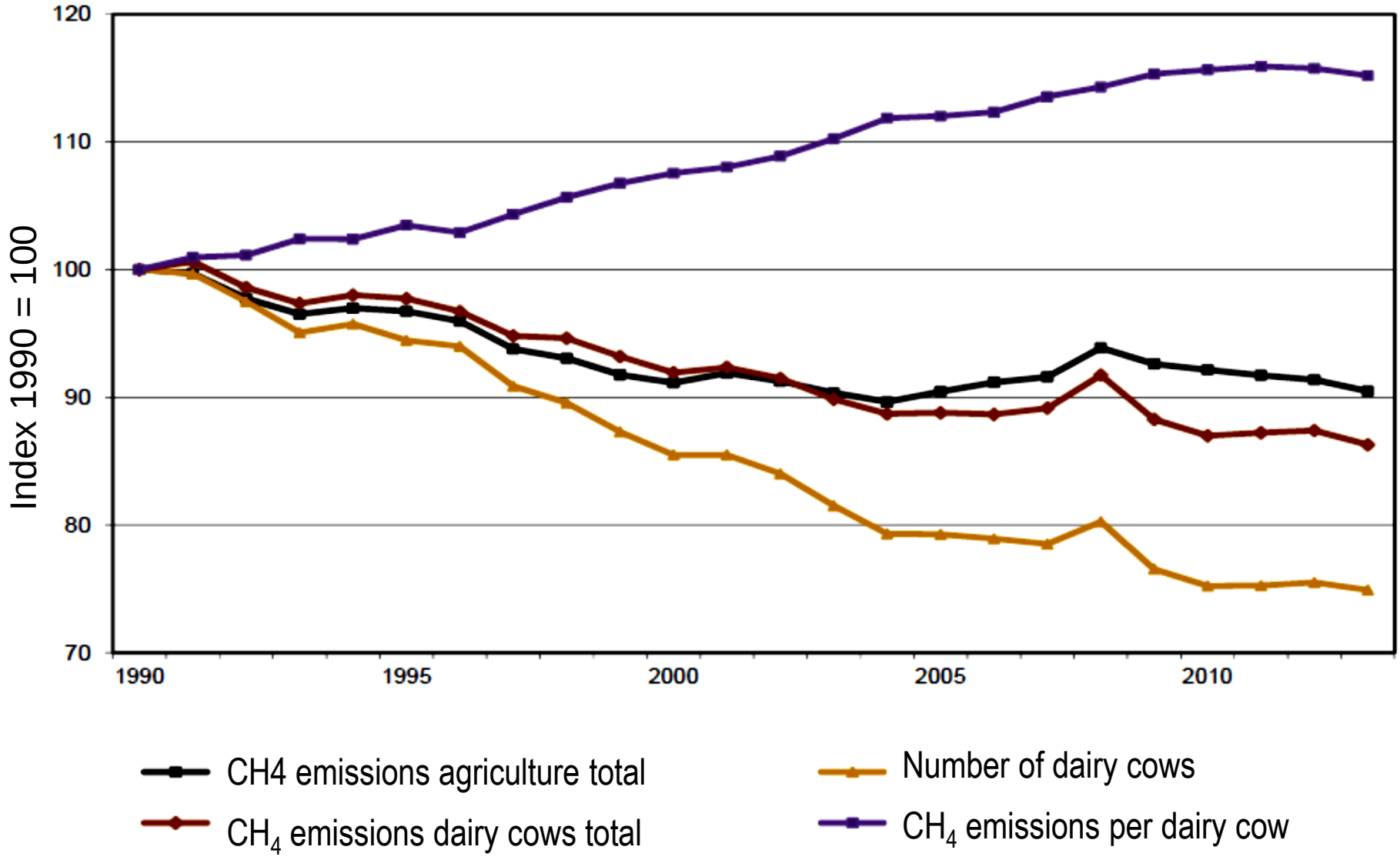
Swiss National GHG Inventory, 2015



CH_4 emissions from dairy production

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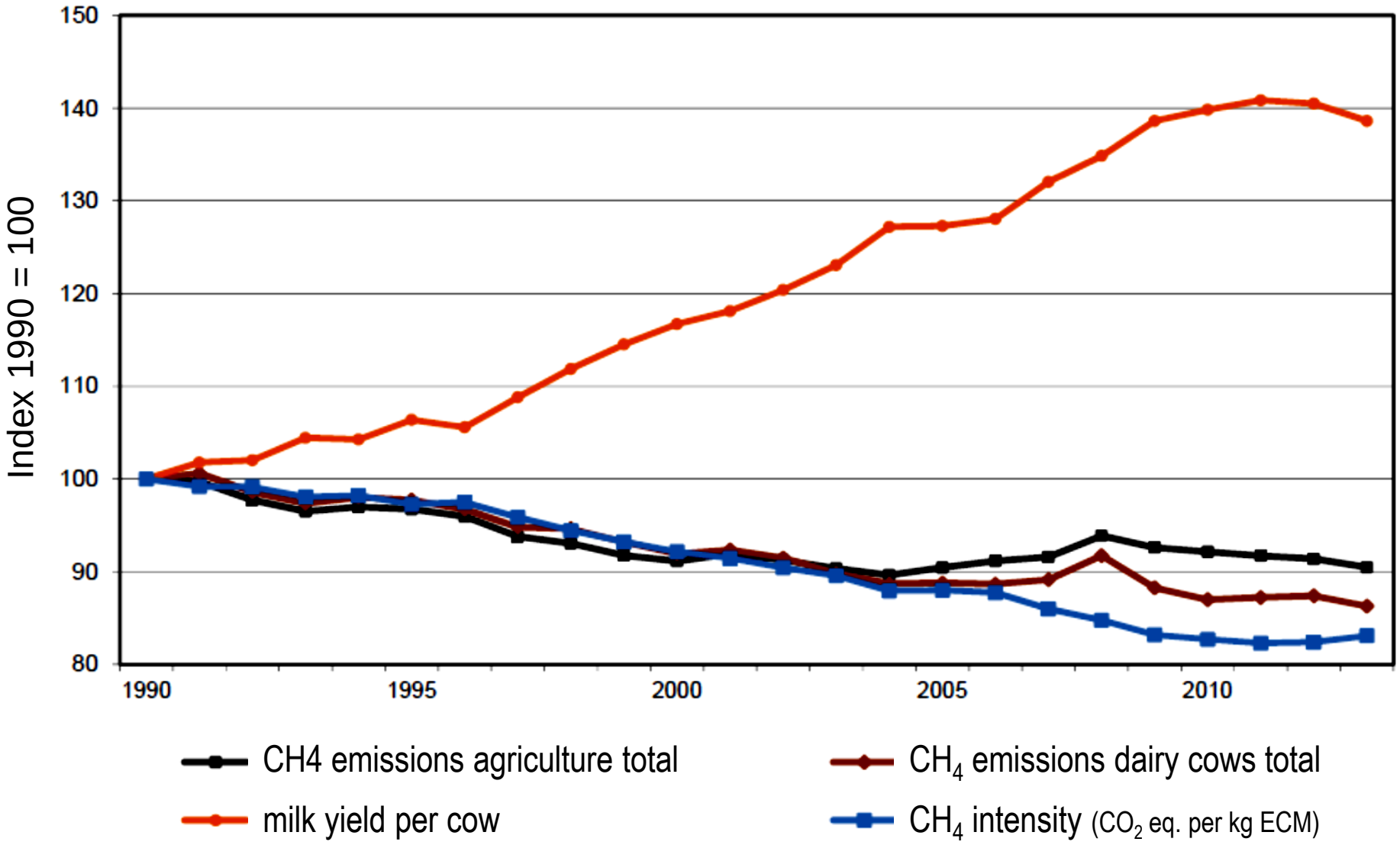
Swiss National GHG Inventory, 2015



Global Challenges

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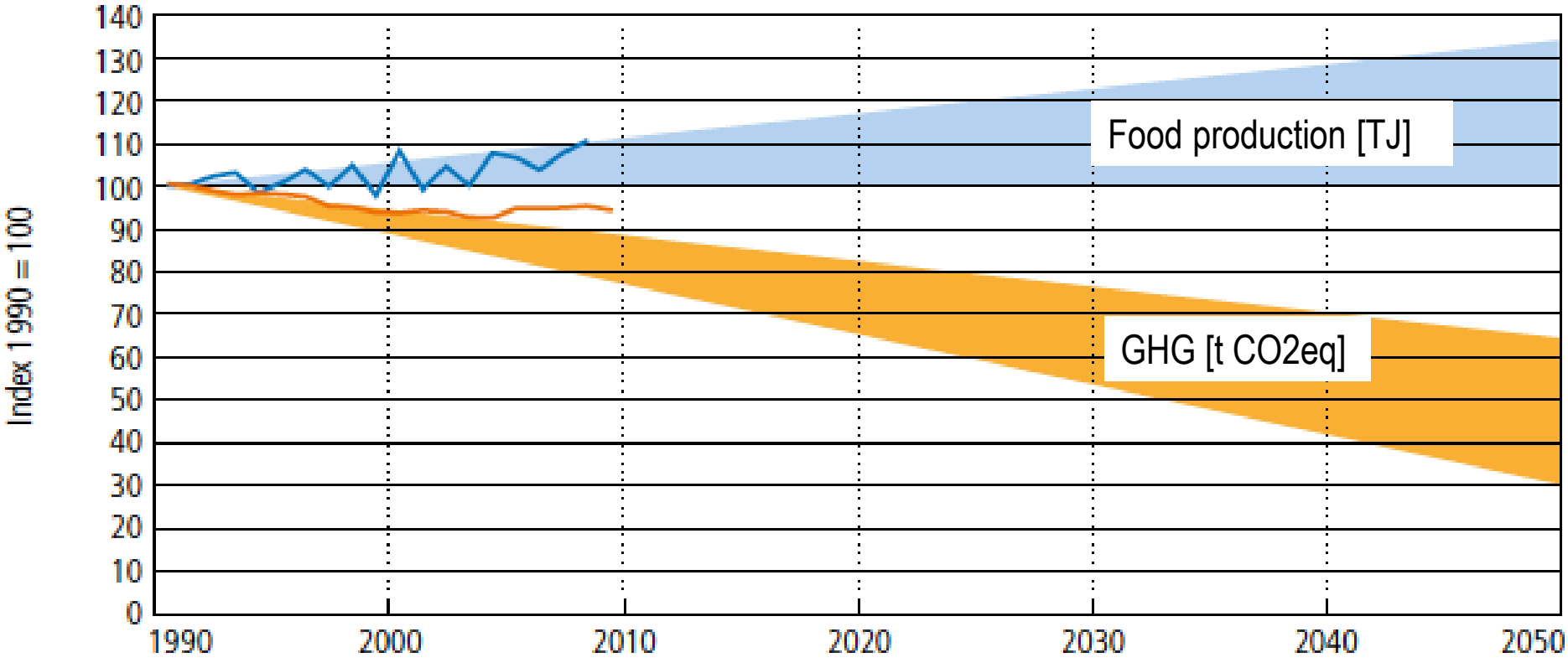
- World human population expected to reach > 9 billion people in 2050 (UN, 2013)
- Increasing demand for animal products (protein, ...) and pressure on resources (land, water, ...)
- Reduction of environmental footprint of cattle → reduction of GHG
- Economic interest → efficient use of resources

- **„Efficiency“ traits more and more important**

Climate strategy for Swiss agriculture



Federal Office of Agriculture, 2013

Why bother about methane and feed efficiency in the breeding goal?

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- Contribution of genetics to GHG mitigation possible (genetic background)
- Methane is loss of energy
- Feed efficiency directly economically relevant trait (feed costs)
- Internationally HOT TOPIC – competition across countries/breeds

What are we doing?

COST action FA1302 METHAGENE

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METHAGENE

Large-scale methane measurements on individual ruminants for genetic evaluation – www.methagene.eu

- 51 Researchers (animal breeding and animal nutrition) from 19 countries
- Successful breeding programs require large data sets of individual methane measurements, which cannot be generated by a single country alone
- Smaller data sets could be combined across countries
- **Aims to discuss**
  - Protocols to harmonise large-scale methane measurements using different techniques
  - easy to measure and inexpensive proxies for methane emission to be used for genetic evaluations
  - Approaches for incorporating methane emissions in national breeding programs

Project – MethaGENE plus:

Assessment of indicator traits for genetic evaluation of methane emission and feed efficiency in dairy cattle

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Partners

- ETH-Zürich and Agrovet-Strickhof (Prof. Michael Kreuzer)
- Agroscope – Institute of Animal Science (Dr. Frigga Dohme-Meier
- University Liége, Belgium (Prof. Nicolas Gengler)
- University Halle, Germany (Prof. Hermann Swalve)
- „Efficient Cow“ Project Austria (Dr. Christa Egger-Danner, Dr. Leonhard Gruber)
- Qualitas AG

Project – MethaGENE plus

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Aims and Objectives

- Validation of methods
  - Direct methods to measure individual methane emission
  - Test low-cost proxies of individual methane emission

- What is the influence of
  - Diet type
  - Feed intake
  - Milk yield
  - Digesta retention time
  - Stage of lactation
  - Immune status of cows

Project – MethaGENE plus

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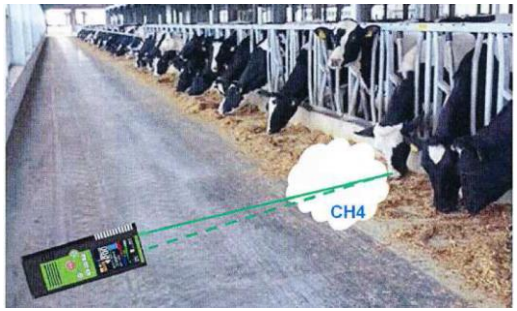
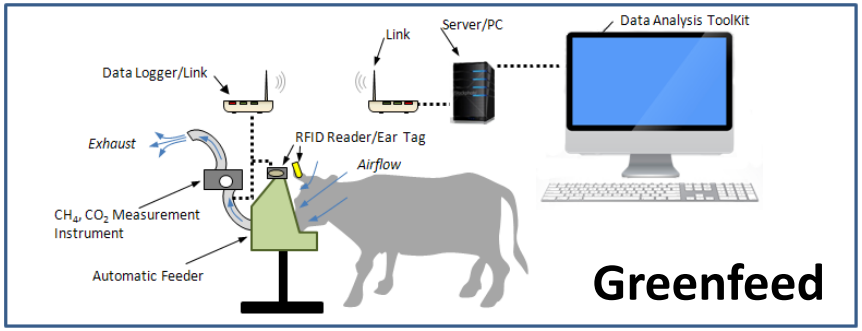
Laser



Respiration chamber

SF6

Methods/Techniques to measure/estimate CH4



Project – MethaGENE plus

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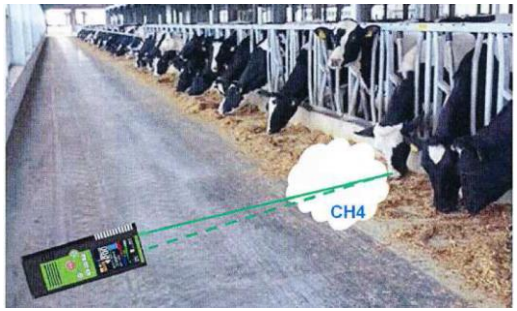
Laser



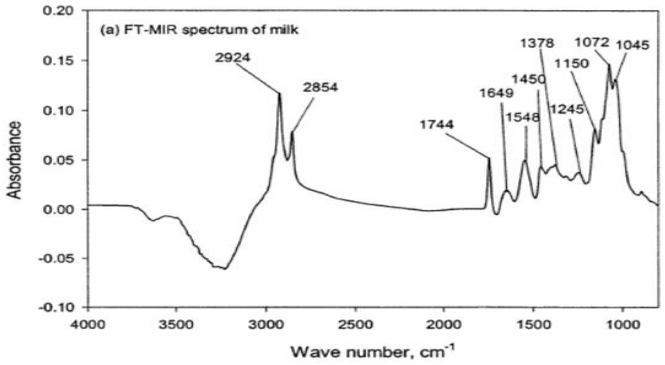
Respiration chamber

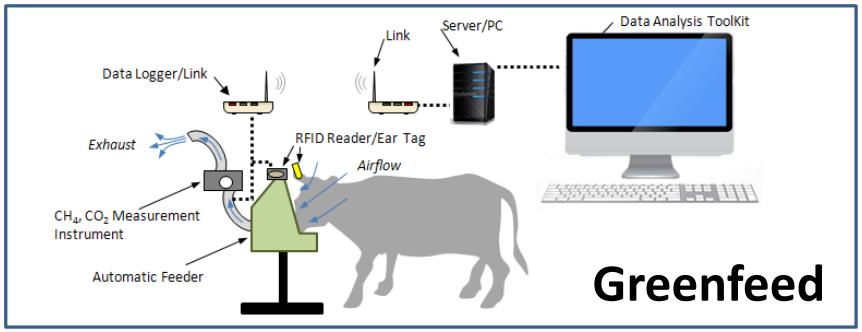
Microbiom

SF6

Methods/Techniques to measure/estimate CH4

MIR-spectra of milk





Greenfeed

Increasing feed efficiency and reducing methane emissions through genomics: a new promising goal for the Canadian dairy industry

International partners

- University of Guelph and CGIL (Dr. Filippo Miglior)
- University Alberta (Dr. Paul Stothard)
- Scottland‘s Rural Collage, UK (Prof. Eileen Wall)
- Biosciences Research Division, Australia (Dr. Jennie Pryce)
- USDA, Beltsville (Dr. Erin Connor)
- Canadian Dairy Network and Qualitas AG

Increasing feed efficiency and reducing methane emissions through genomics: a new promising goal for the Canadian dairy industry

GenomeCanada

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Aims and objectives

- Share data between partners and build reference for:
- Genomic selection for feed efficiency and methane emission
- Develop MIR calibration equation to estimate these traits
- Use of whole genome sequence data for genomic selection and GWAS

Testing a MIR CH_4 prediction equation on an external dataset

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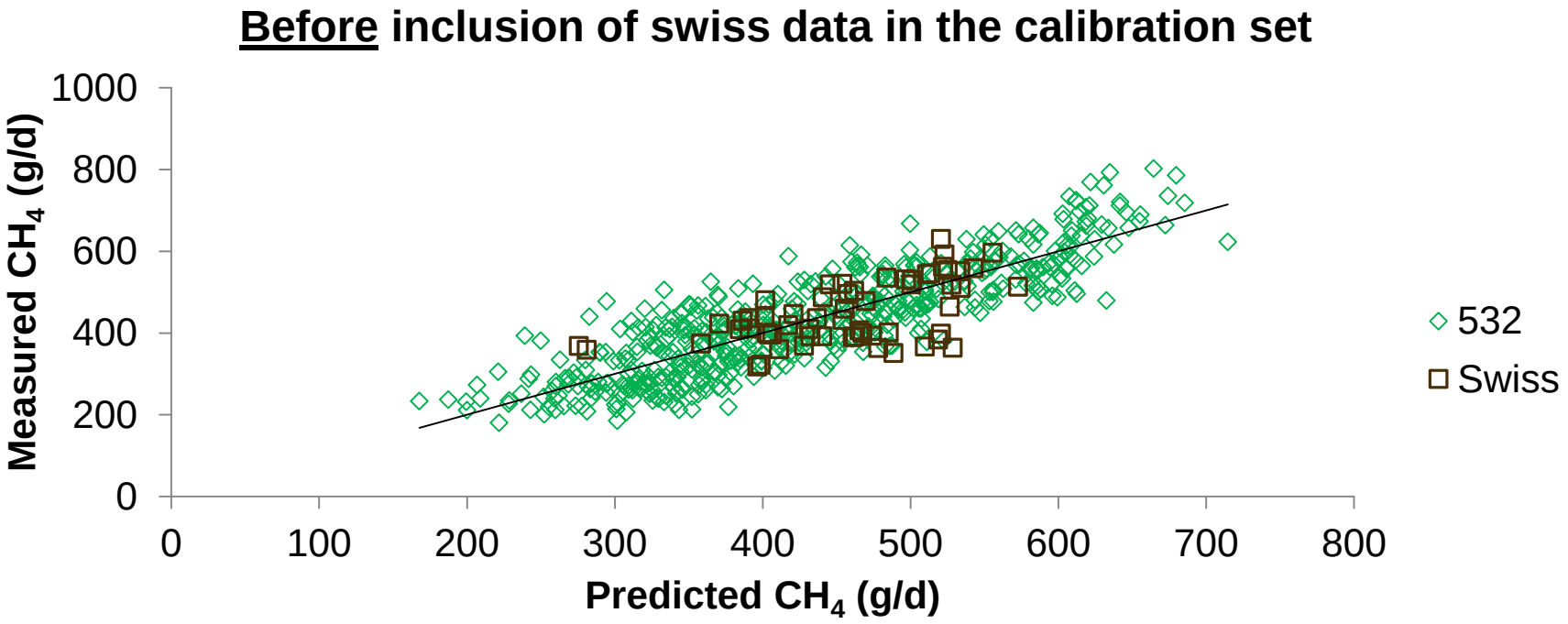
Vanlierde et al., 2015

Calibration set 532 reference data from 165 cows	***vs.***	**Test dataset** 60 reference data from 30 cows
SF_6	**Method**	**Respiration chambers**
Belgium, Ireland	**Country**	**Switzerland**
Holstein, Jersey, Hol x Jer	**Breed**	**Brown Swiss**
Fresh grass or silage based, w or w/o linseed supplem.	**Diet**	**Hay and maize silage based, w or w/o concentrate**

Testing a MIR CH_4 prediction equation on an external dataset



Vanlierde et al., 2015

Testing a MIR CH_4 prediction equation on an external dataset

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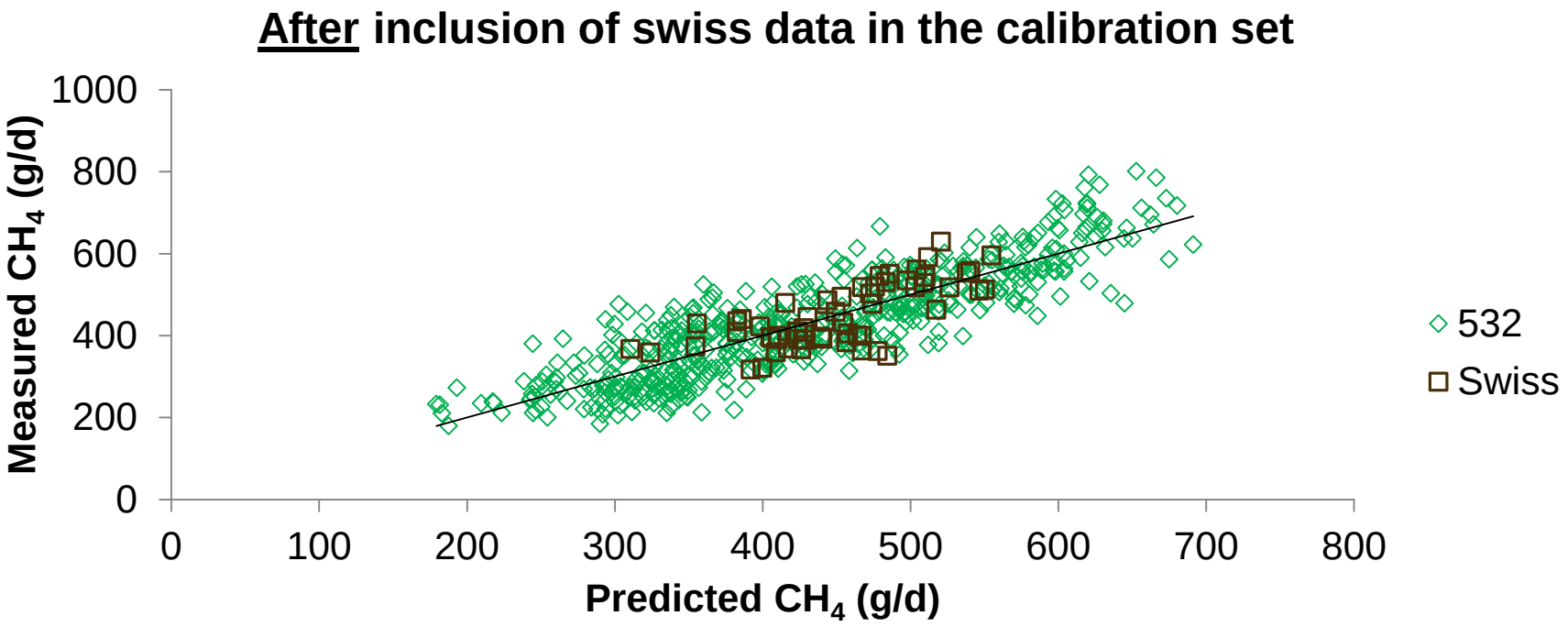

Equation (g/d)	N	SD	R^2c	R^2cv	SEC	SECV
CH_4	532	129	0.74	0.7	66	70
CH_4 + Swiss data	592	125	0.74	0.7	64	69

Vanlierde et al., 2015

Conclusions - Challenges

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- Genetic selection can contribute to reduce CH4 emission
- International collaboration needed to create large data sets for genetic evaluation
- What is the best phenotype/definition to use?
- What is the best measuring technique – best proxies?
- What is the motivation for farmers (economic weight?)
- Relationship between methane emission/feed efficiency and other traits in the breeding goal

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Thanks for your attention!

Research on livestock GHG emissions in Switzerland

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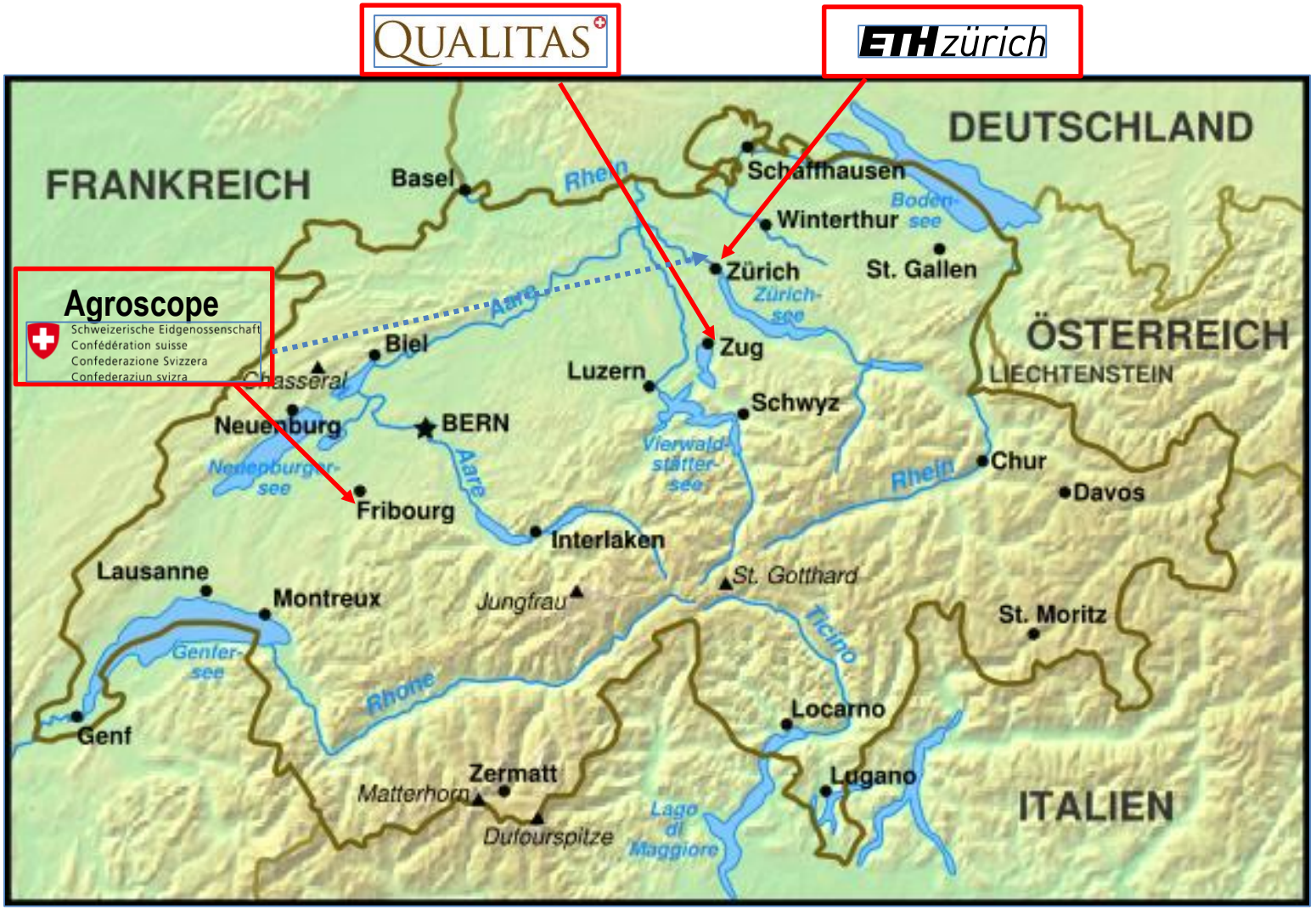
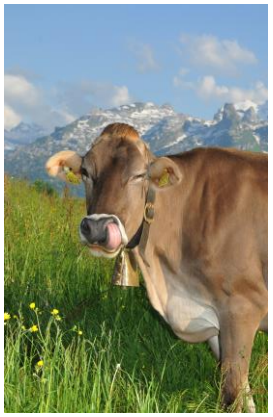


Total merit index (TMI)
Braunvieh



Trait	TMI BV %	
Mkg	10	Milch 45
EWkg	27	
EW%	8	
Fundament	3	Exterieur 13
Euter	10	
Persistenz	4	Fitness 42
Nutzungsdauer	10	
Zellzahl	9	
Fruchtbarkeit	15	
Milchfluss	4	

Grazing index Braunvieh (WZW)

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- Hilfsmittel für die Zucht einer robusten Raufutterkuh mit einer hohen Milchproduktionseffizienz
- Anteil der Milchproduktion am gesamten Futterenergiebedarf einer Kuh inkl. Erhaltungsbedarf
- Bei gleicher Leistung ist die leichtere Kuh effizienter.
- Körpergewicht wird mittels ZW für Kreuzbeinhöhe, Körpertiefe und Beckenlänge geschätzt
- Körpergewicht im WZW negativ gewichtet

Merkmal	WZW %	
Mkg	10	Milch 40
EWkg	22	
EW%	8	
Fundament	4	Exterieur 10
Euter	6	
Persistenz	5	Fitness 40
Nutzungsdauer	5	
Zellzahl	6	
Fruchtbarkeit	20	
Milchfluss	4	
Körpergewicht (KG)	10	KG 10