



Structured resilience phenotyping using big dairy data

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Resilience in cattle

- (and livestock generally)
- Major trait of interest
 - Changing climate
 - Unreliable feed sources
- Challenging to define
- Diverse research ongoing
 - SLU Animal Biosciences

[Home](#) > [Genetics Selection Evolution](#) > [Article](#)

Why breed disease-resilient livestock, and how?

[Review](#) | [Open access](#) | Published: 14 October 2020

Volume 52, article number 60, (2020) [Cite this article](#)

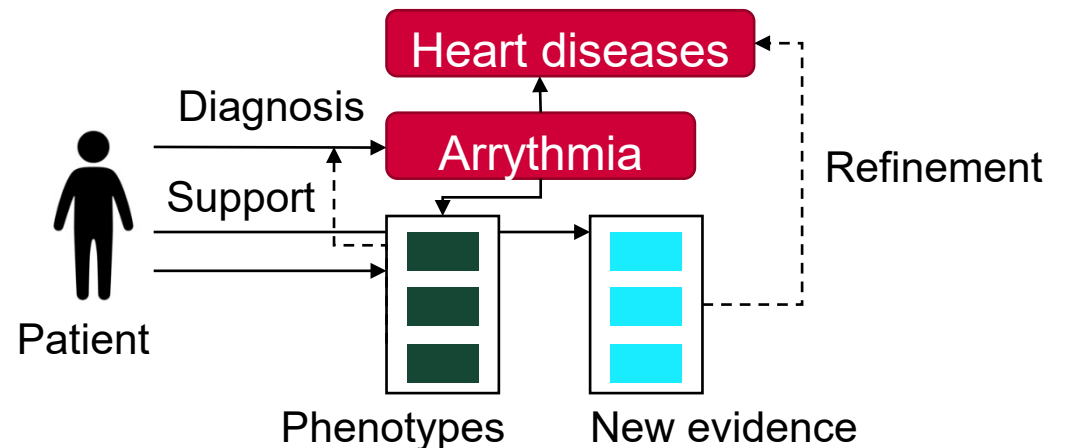
Getting to grips with Resilience: Towards large-scale phenotyping of this complex trait

[N.C. Friggens](#)^{1 4}  , [M. Ithurbide](#)², [G. Lenoir](#)³

Time for structured approach to phenotyping?

Human Phenotype Ontology

- Wide basis of medical data
- Ontology of terms
- Disease phenotypes in patients
- Diagnoses & treatments linked into ontology
- Reinforces with new evidence



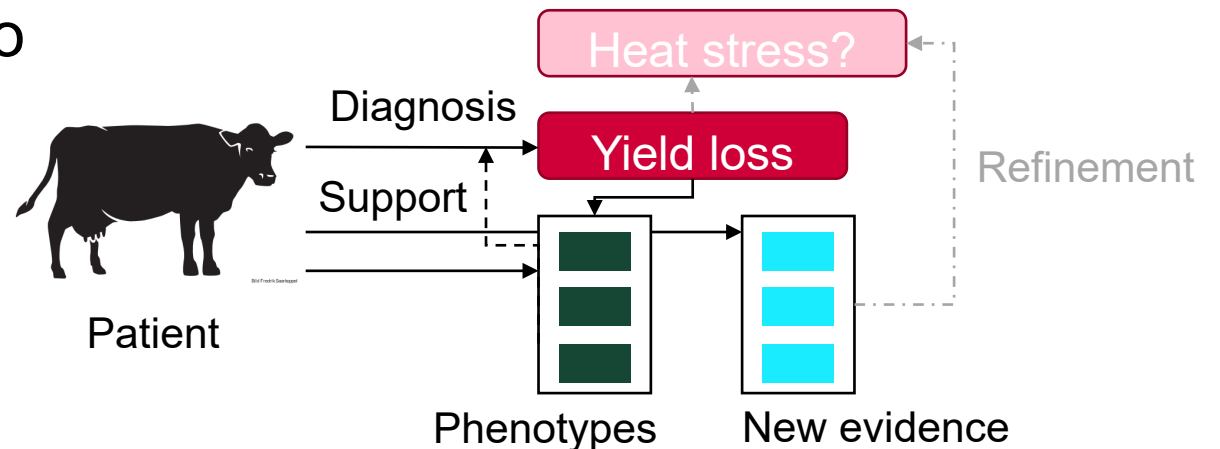
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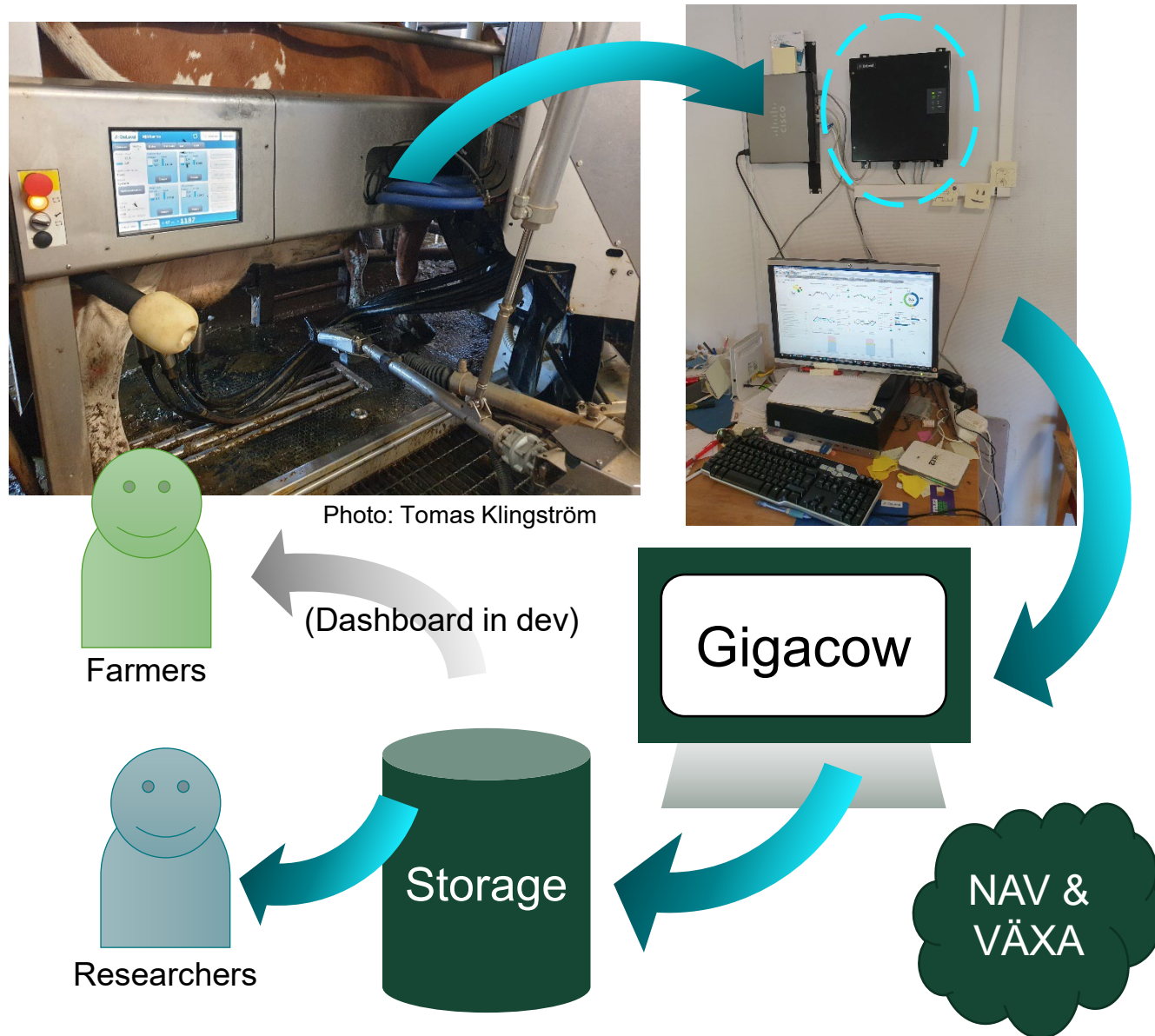
“Cattle Phenotype Ontology?”

- Big data established & growing
- Disease phenotypes known
- ... now what?



Gigacow: Structure

- Connected dairy farms
 - DelPro (++) management system
 - Daily script transfers data to SLU
 - Automates farmer sharing data
- Gigacow server
 - Pseudonymizes identities
 - Unifies data format
 - Transfers to storage
- External data sources
 - SNP genotypes from NAV
 - Växa Kokontrollen
- Data storage
 - Raw data accessible by SQL query
 - R framework available for SQL access



Summary stats SLU Gigacow

tklingstrom.github.io/gigacow_exempladata

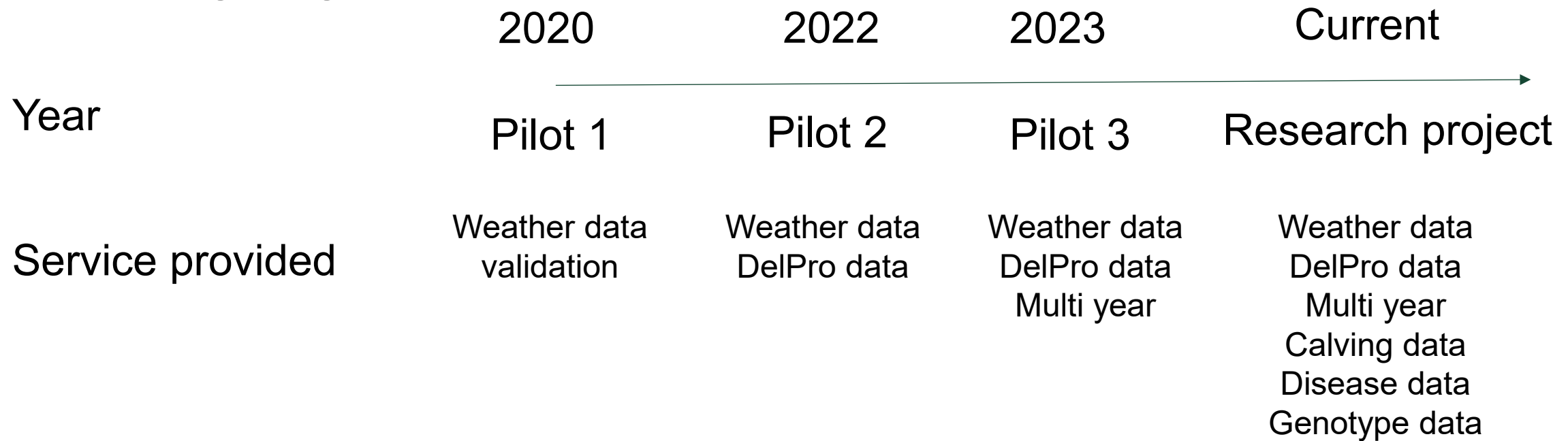
3 973 animals as of
2024-09-01

	2023-05-03	2024-04-29	Increase	# Animals	# Animals	Increase
Total				17 214	19 673	14 %
Milking events	3 589 973	5 164 866	44 %	2 706	3 105	38 %
Robot milkings	1 338 560	2 059 780	54%	1 088	1 523	40 %
Activity data	431 577	620 524	44 %	2 165	2 357	25 %
Feed days	2 907 939	5 011 588	72 %	3 170	4 211	77 %

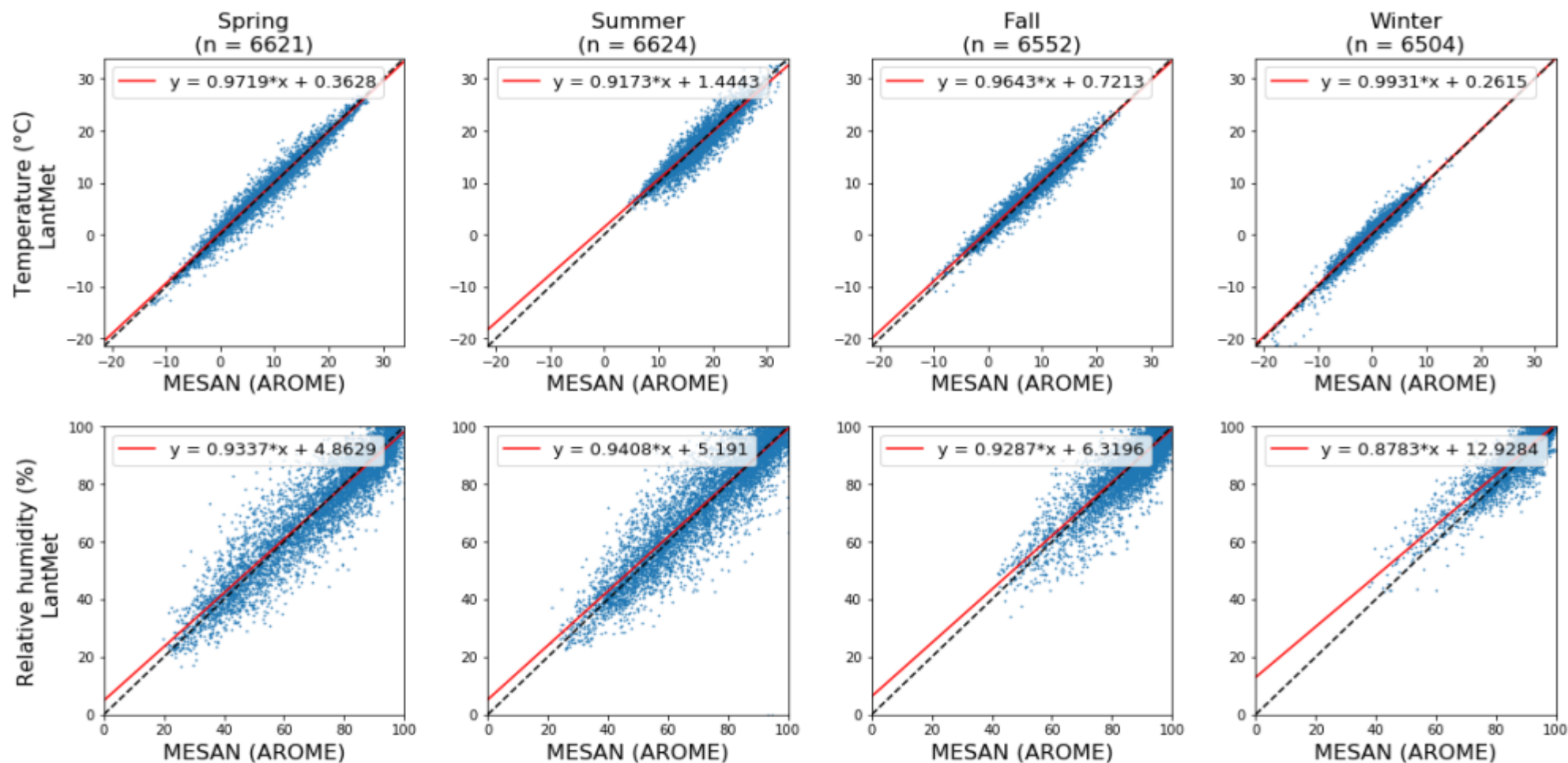
From sensitive to robust athlete

The project is using variation observed among high producing individuals to identify successful strategies of coping with heat stress and evaluate the possibilities for including these traits in a breeding program.

Timeline

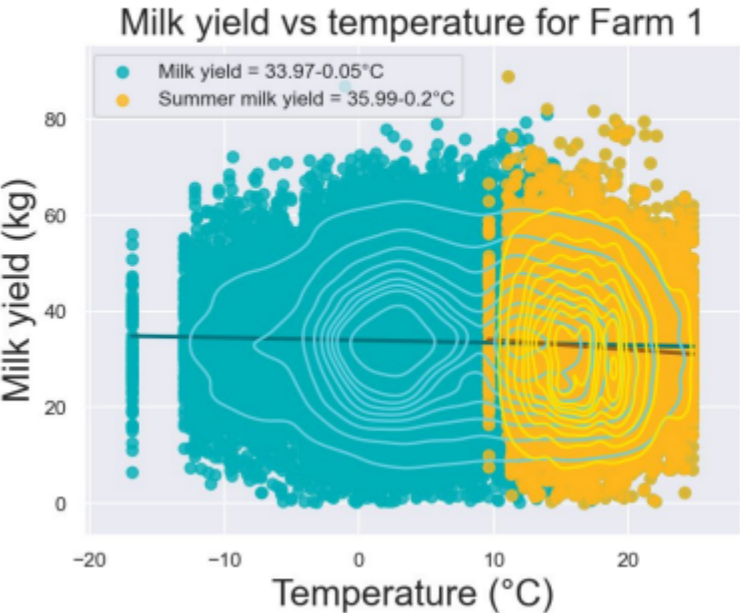


Weather data validation (pilot 1)



Impact of heat stress at a Swedish dairy farm (pilot 2)

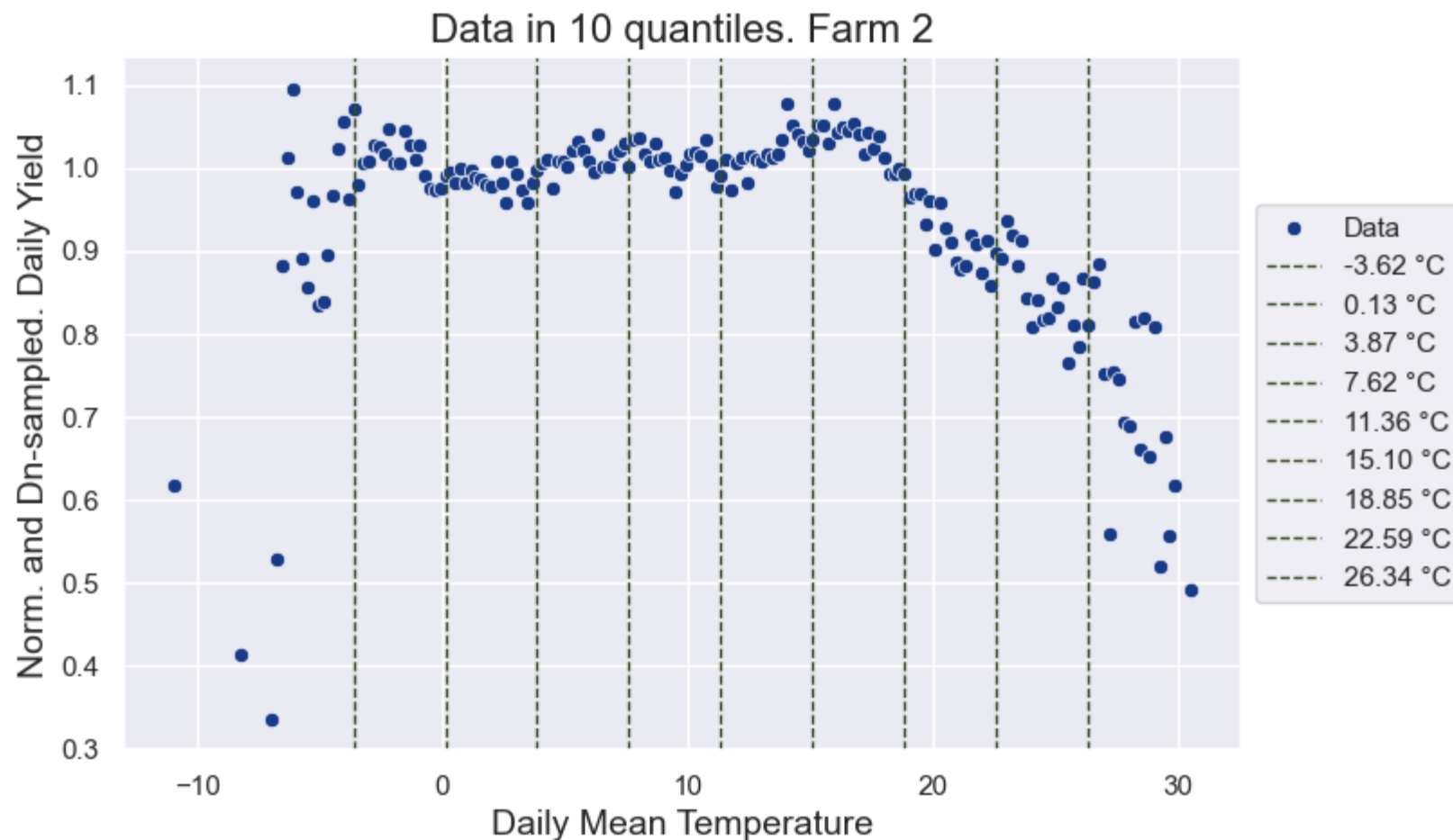
Regression Analysis



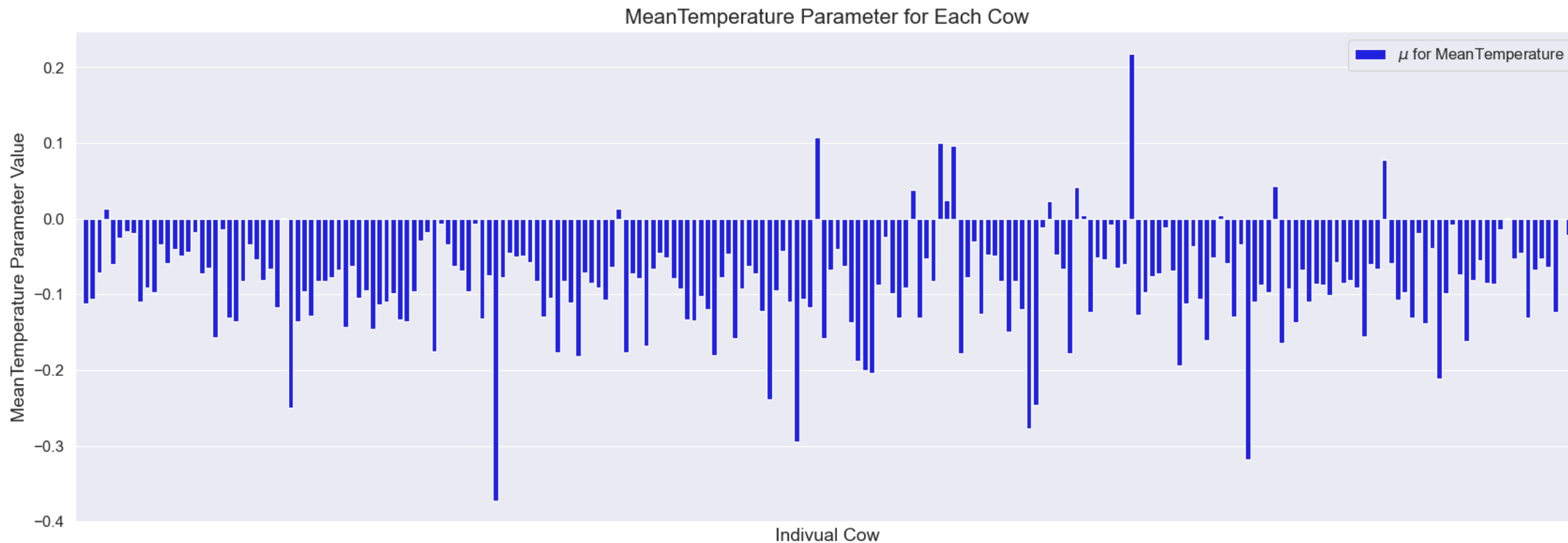
First order linear regression indicates how milk yield (kg) is affected by an increase in temperature (°C).

Farm name	All data		Summer		Top producers	
	kg	kg/°C	kg	kg/°C	kg	kg/°C
Farm 1	33.97	-0.05	35.99	-0.20	39.32	+0.04
Farm 2	33.94	-0.16	36.50	-0.15	43.17	-0.24
Farm 3	37.66	-0.03	37.58	-0.05	43.88	+0.07
Farm 5	37.00	+0.02	41.13	-0.21	45.47	-0.10
Farm 7	40.09	-0.01	39.55	+0.03	47.82	-0.05
Farm 8	33.09	-0.11	36.01	-0.31	39.39	-0.21
Farm 9	29.26	-0.02	32.72	-0.20	37.83	-0.06

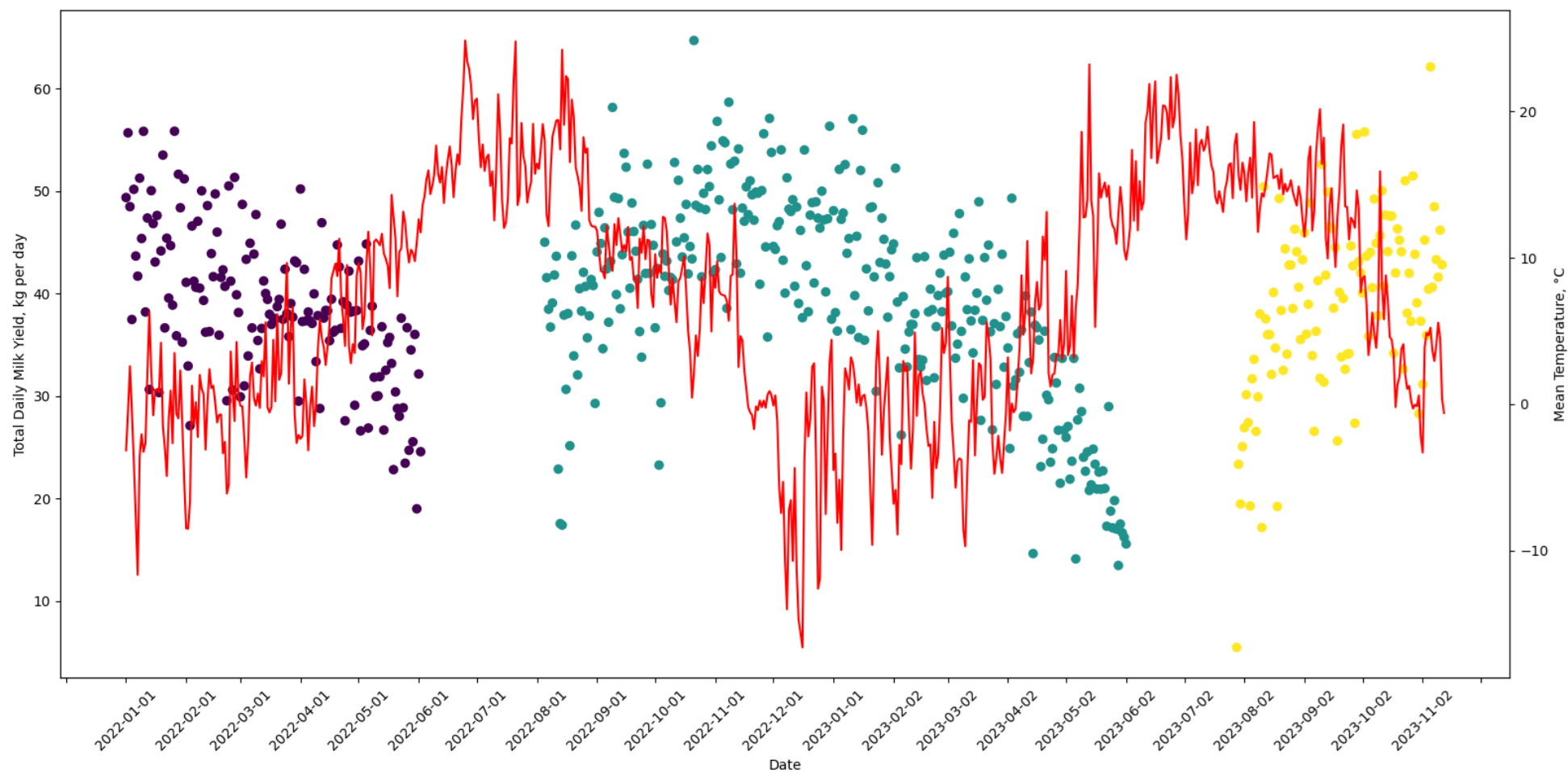
Capturing heat stress at a Swedish dairy farm (pilot 3)



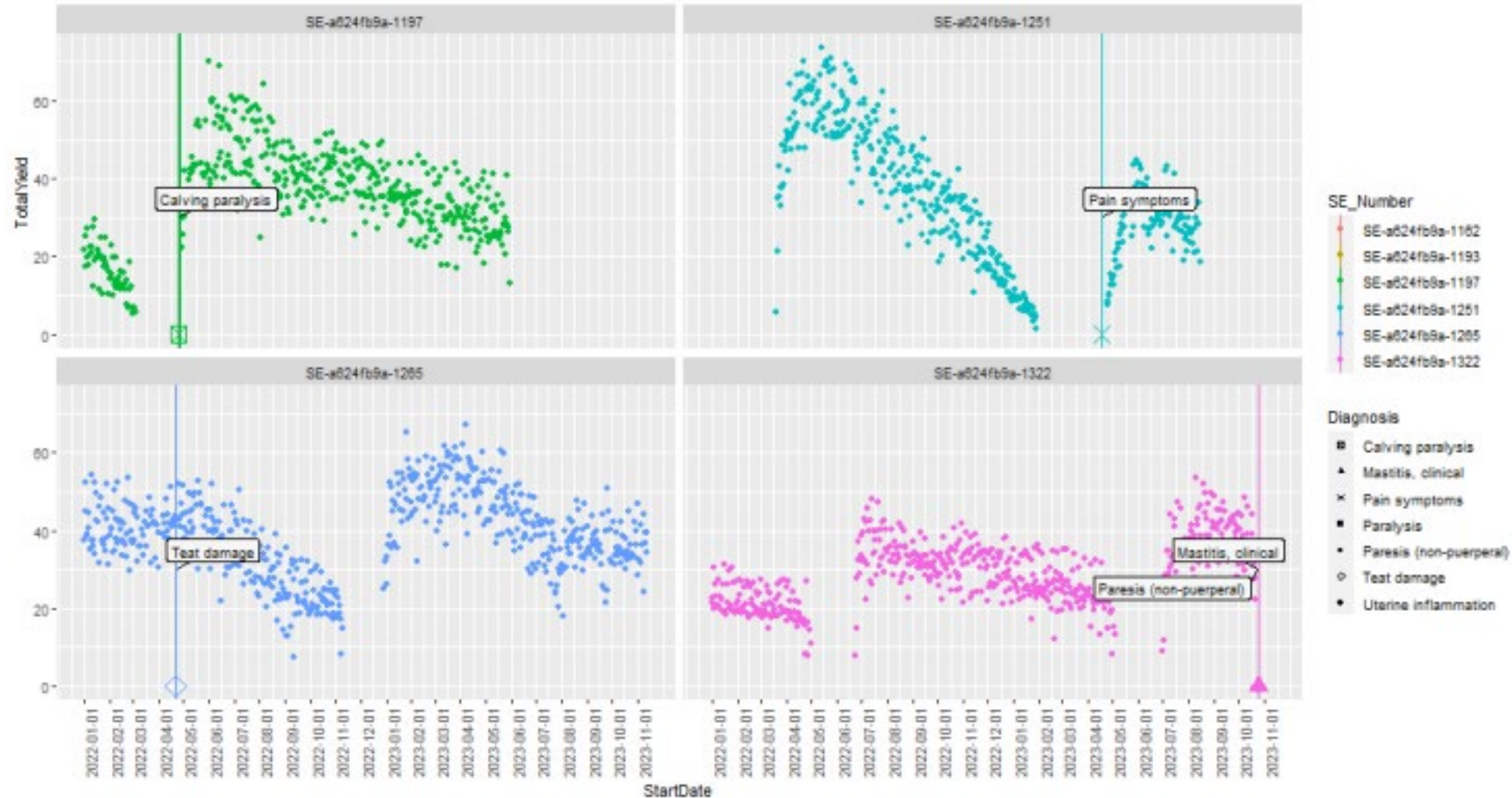
Individual impact (pilot 3)



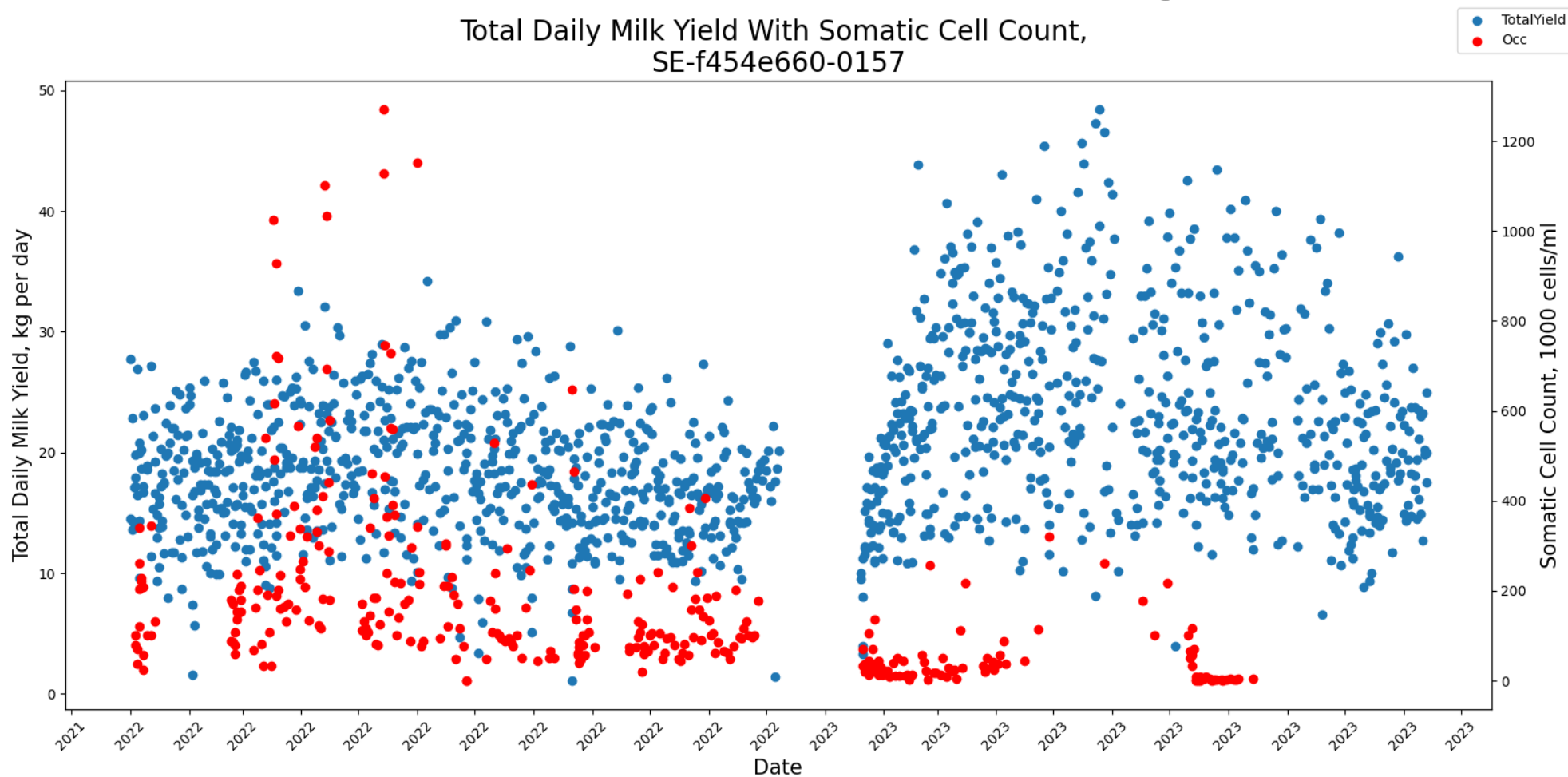
Confounding factors!



Health events (integrating a separate database)



Heat stress vs mastitis vs something?



One project contributes to many others



Heat stress project

- Phenotype – Heat tolerance
- v Phenotype – Pregnancy loss
- Between farm variation

Data & methods
reapplied

- Impact of mastitis
- Resilience indicators
- Microbiome variation
- Lactation length adjustments
- iDDEN integration

Future directions

- Refine phenotyping methods on Gigacow
- Find resilience phenotypes in Swedish dairy cattle
- Expand investigations to local/international breeds
 - Breedmaps: *Bos taurus* pangenome structural variation



Tomas Klingström's Poster:

Owned vs borrowed data: lessons learned from data collection on commercial dairy farms

Session 94 "Living labs and demonstration farms: approaches to improve sustainability of LFS globally".

tklingstrom.github.io/gigacow_exempladata

Current organisation



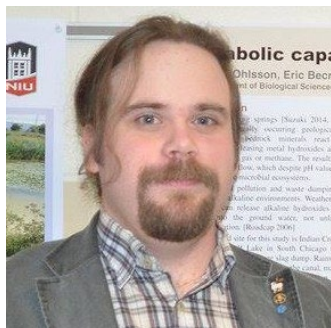
Lena Mari
Tamminen
Research partner



Martin Johnsson
Research partner



Tomas Klingström
Researcher/
Coordinator



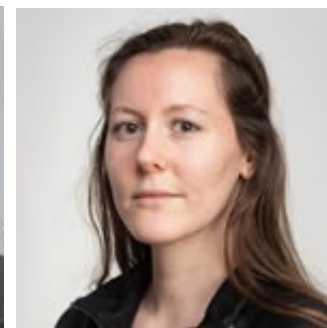
Ingemar Ohlsson
Researcher/
Programmer



D.J. de Koning
P.I



Ivan Clegg
Database developer



Patricia Gullstrand
Researcher



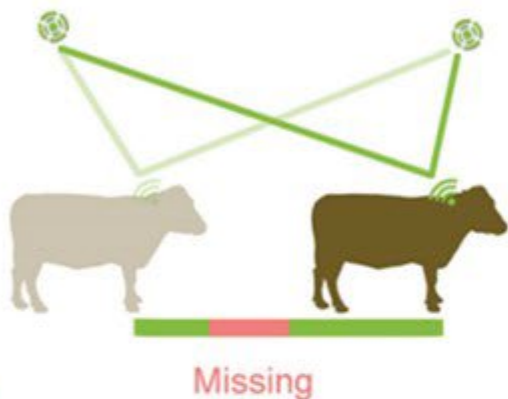
Marcus Pedersen
Sysadmin (Interbull)



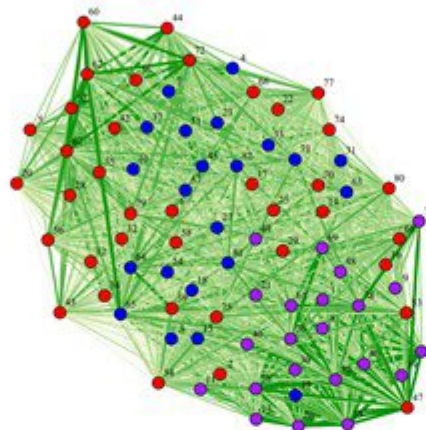
Great thanks to Freddy Fikse, Karl-Johan Petersson, Natalie von der Lehr, Hans Persson, all our farmers and collaborators at SLU, Växa and NAV

Department of Animal Biosciences

Ultra-wideband system



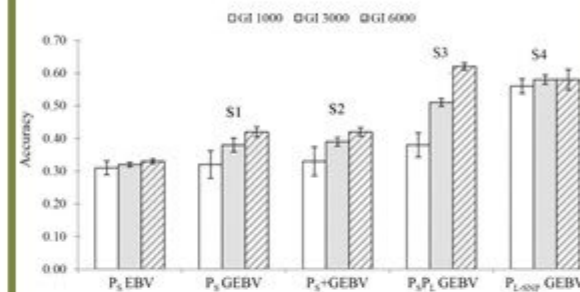
Modelling social networks



Modelling area utilization



Breeding evaluations



CSI:DT website



Lars Rönnegård



Hector Marina



Sreten Andonov