From raw data to optimal sow replacement decisions - an integrated solution

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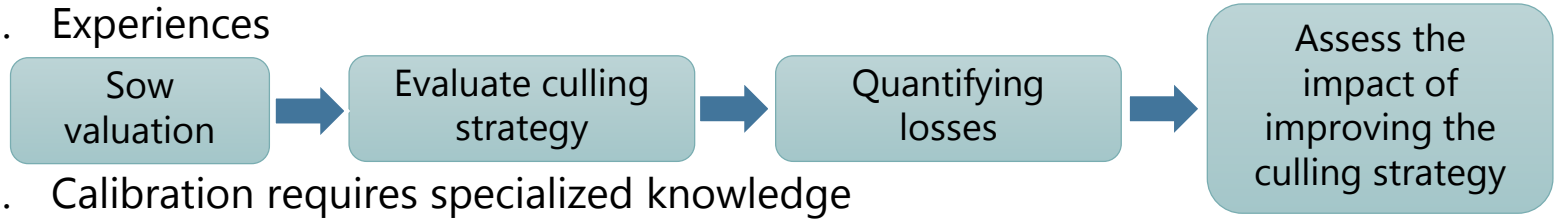
Introduction

Background

- Sow replacement model[1]
  1. Applied in the context of herd analysis
  2. Experiences

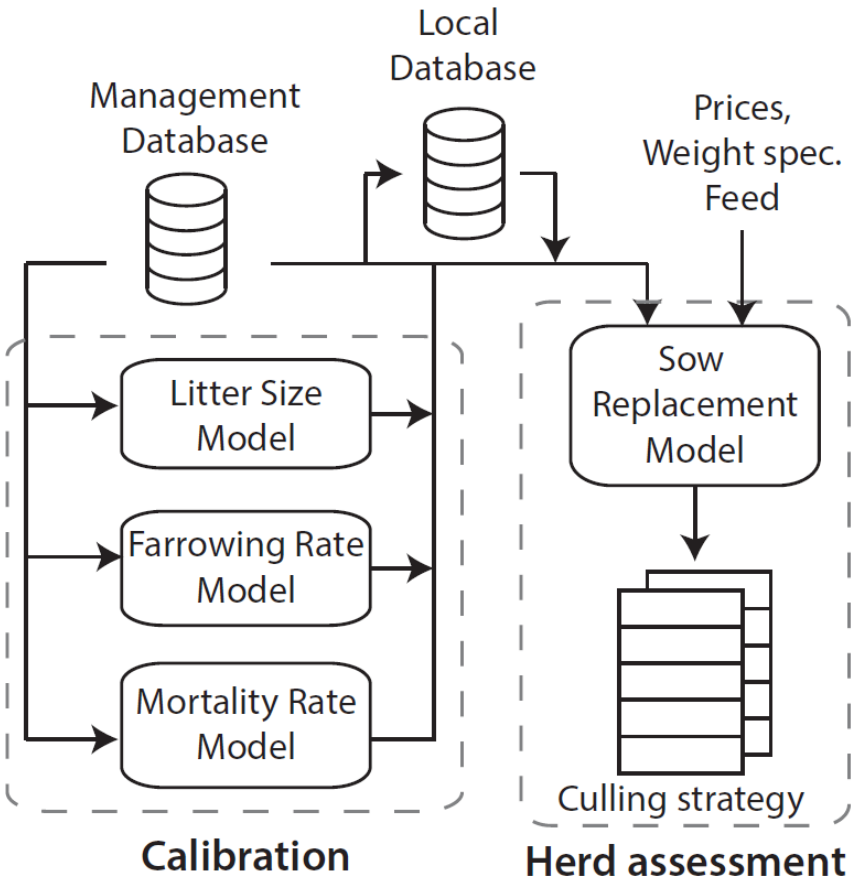


  3. Calibration requires specialized knowledge

Objective

- Develop a an integrated ITC tool to improve culling strategies
  1. Automatic calibration of the replacement model to the individual herd
  2. Direct integration with commercial management information software
  3. Design a user-friendly interface
  4. Performance of each individual animal

System Design



Outcome

- Current animals
- Culled animals
- (Dynamic monitoring system)

Dynamic Monitoring System

- Herd specific trends using Dynamic Linear Models[2]
  - State-space based dynamic regression

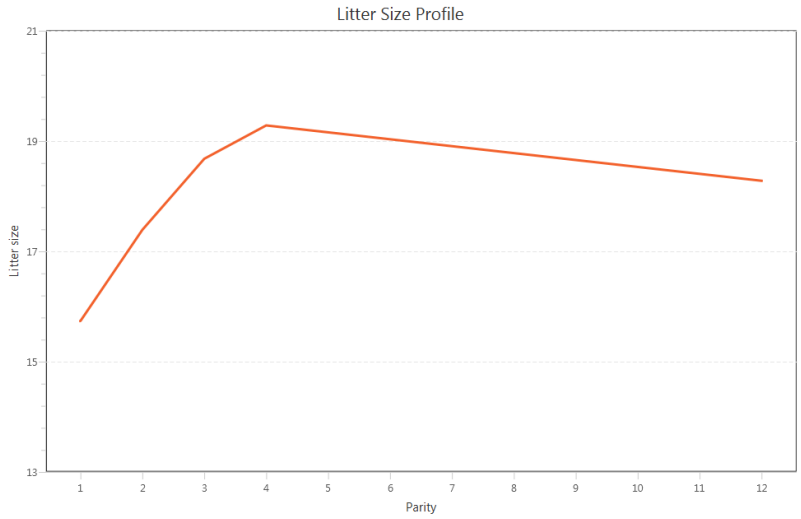
$$Y_t = \boldsymbol{F}_t^T \boldsymbol{\theta}_t + \varepsilon_t \qquad \text{(observation equation)}$$

$$\boldsymbol{\theta}_t = \boldsymbol{G}_t \boldsymbol{\theta}_{t-1} + \boldsymbol{\omega}_t \qquad \text{(evolution equation)}$$

  where
    - $\boldsymbol{\theta}_t$ is the state vector,
    - $\boldsymbol{F}_t$ is the regression vector
    - $\boldsymbol{G}_t$ is the state matrix
  - Updated in line with new data being available
  - Provide a dynamic monitoring system
    - Also provides useful estimates not used for calibration

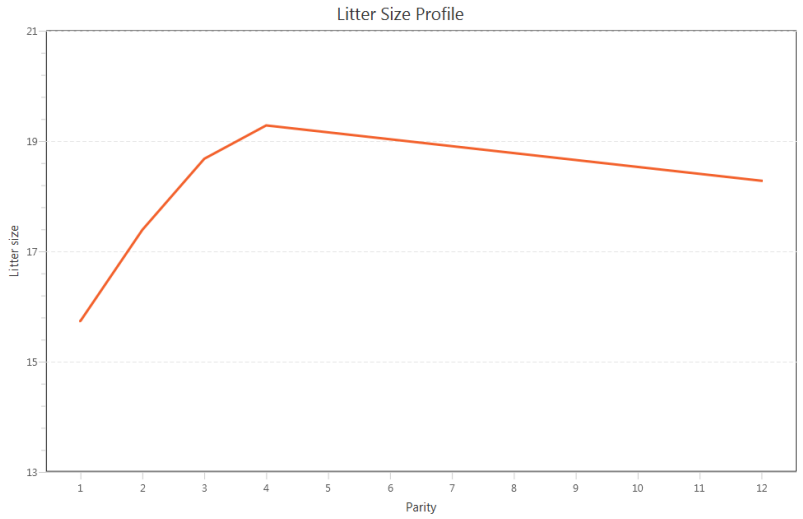
Results

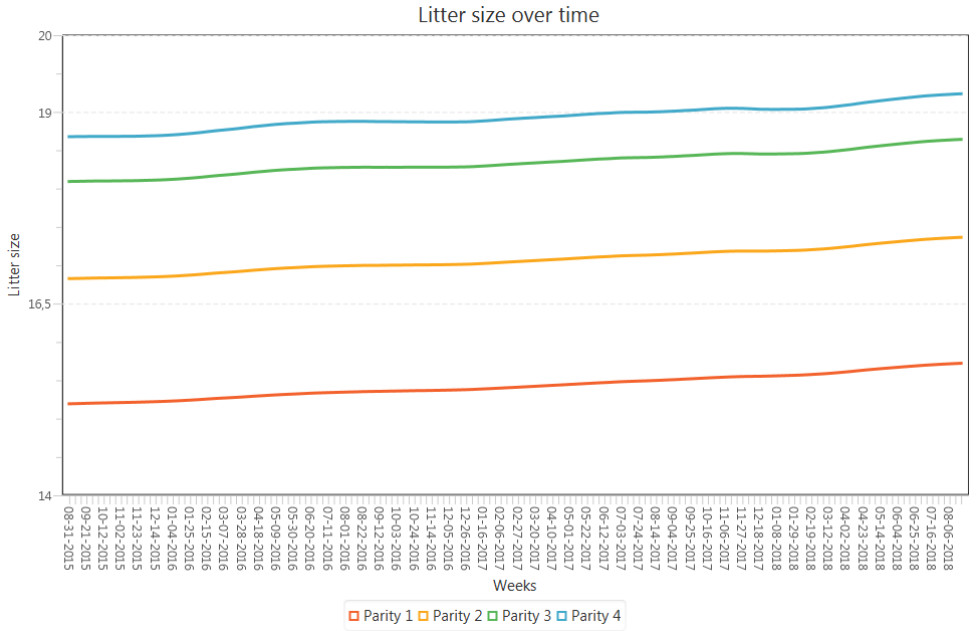
- Dynamic monitoring system



Results

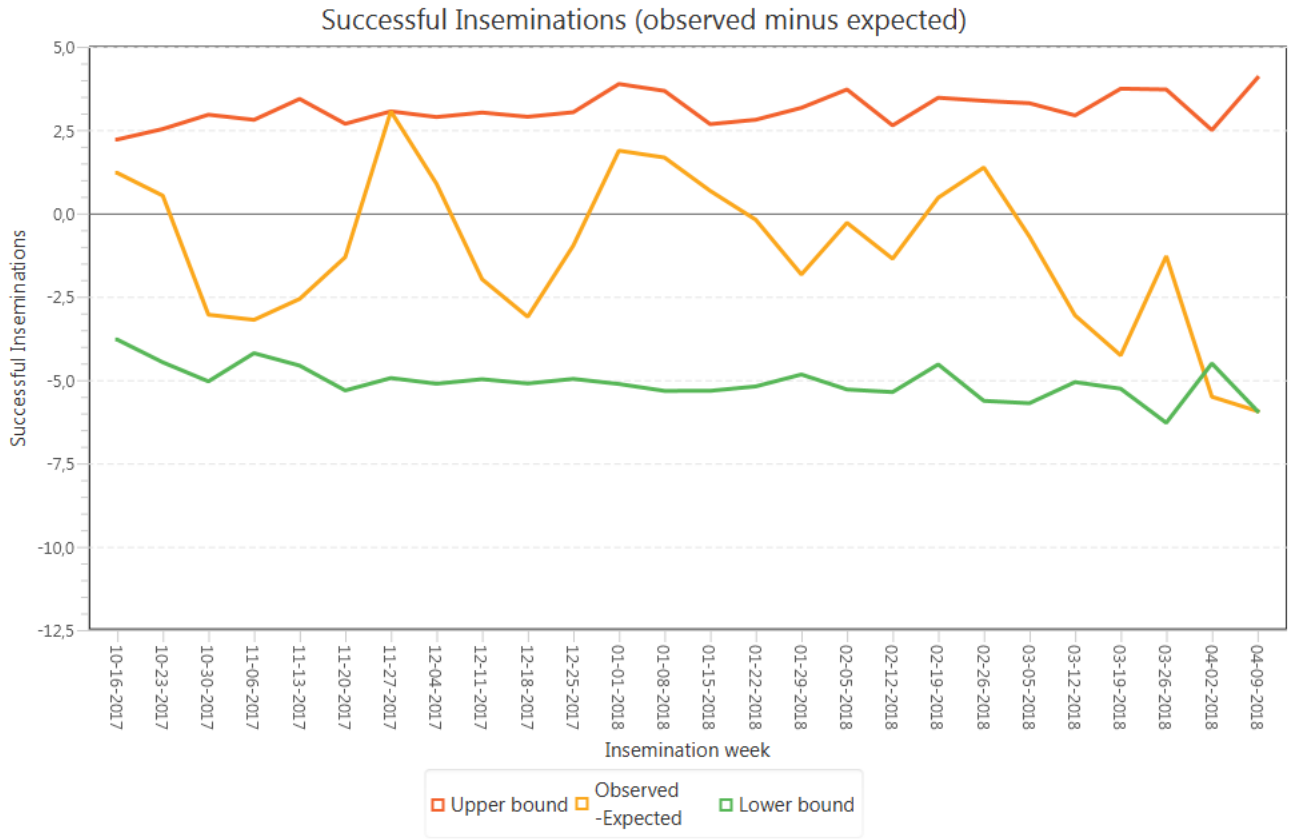
- Dynamic monitoring system





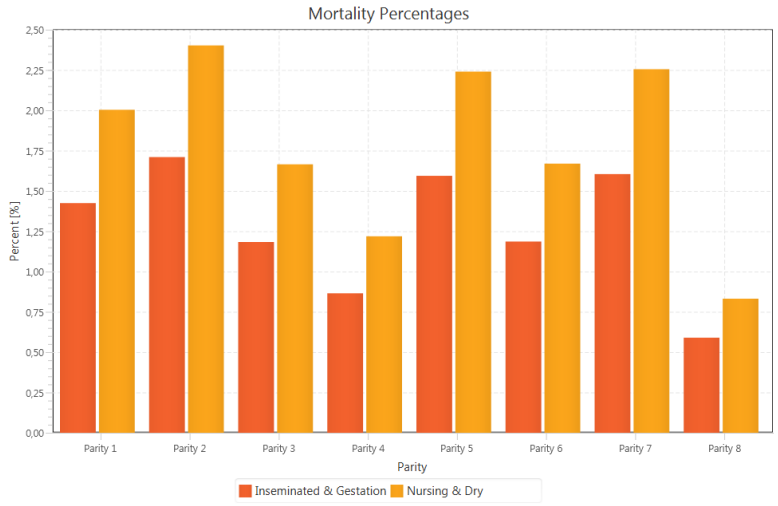
Results

- Dynamic monitoring system



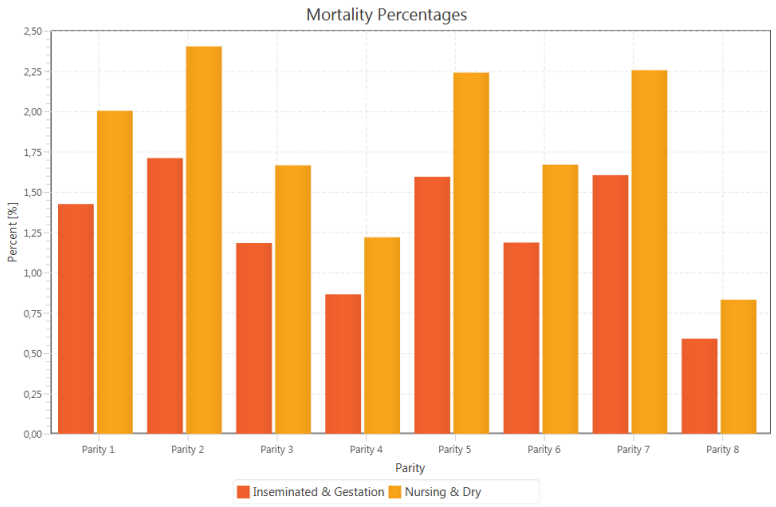
Results

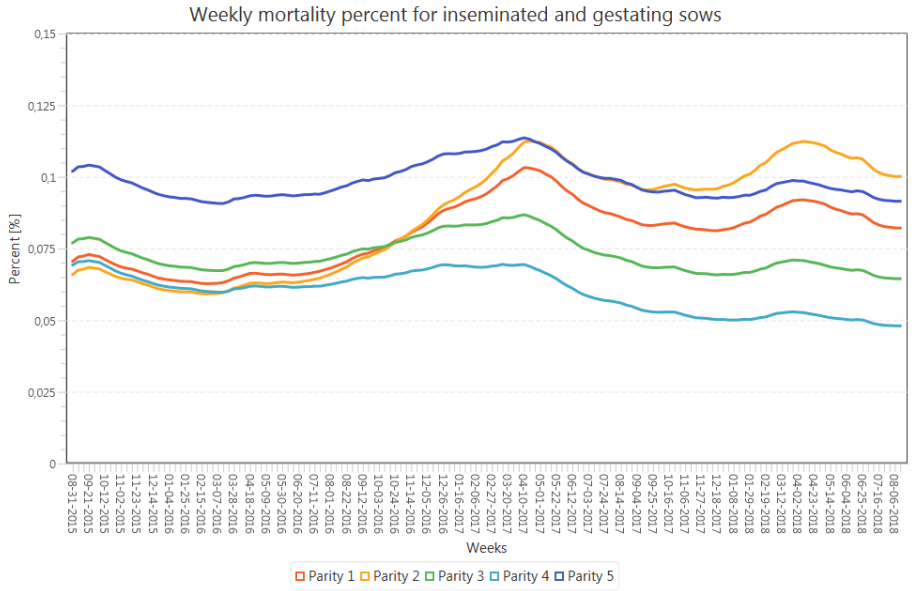
- Dynamic monitoring system



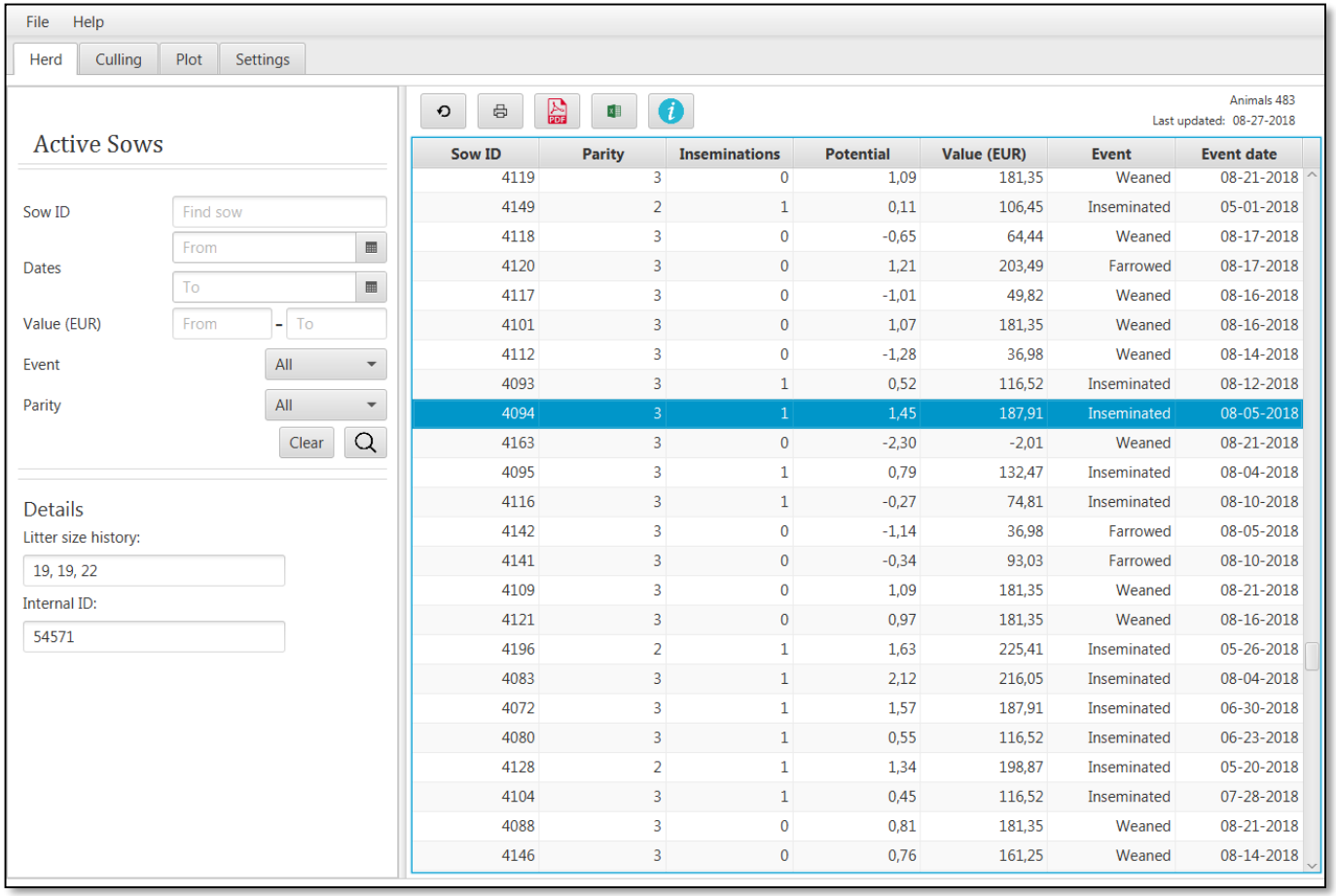
Results

- Dynamic monitoring system

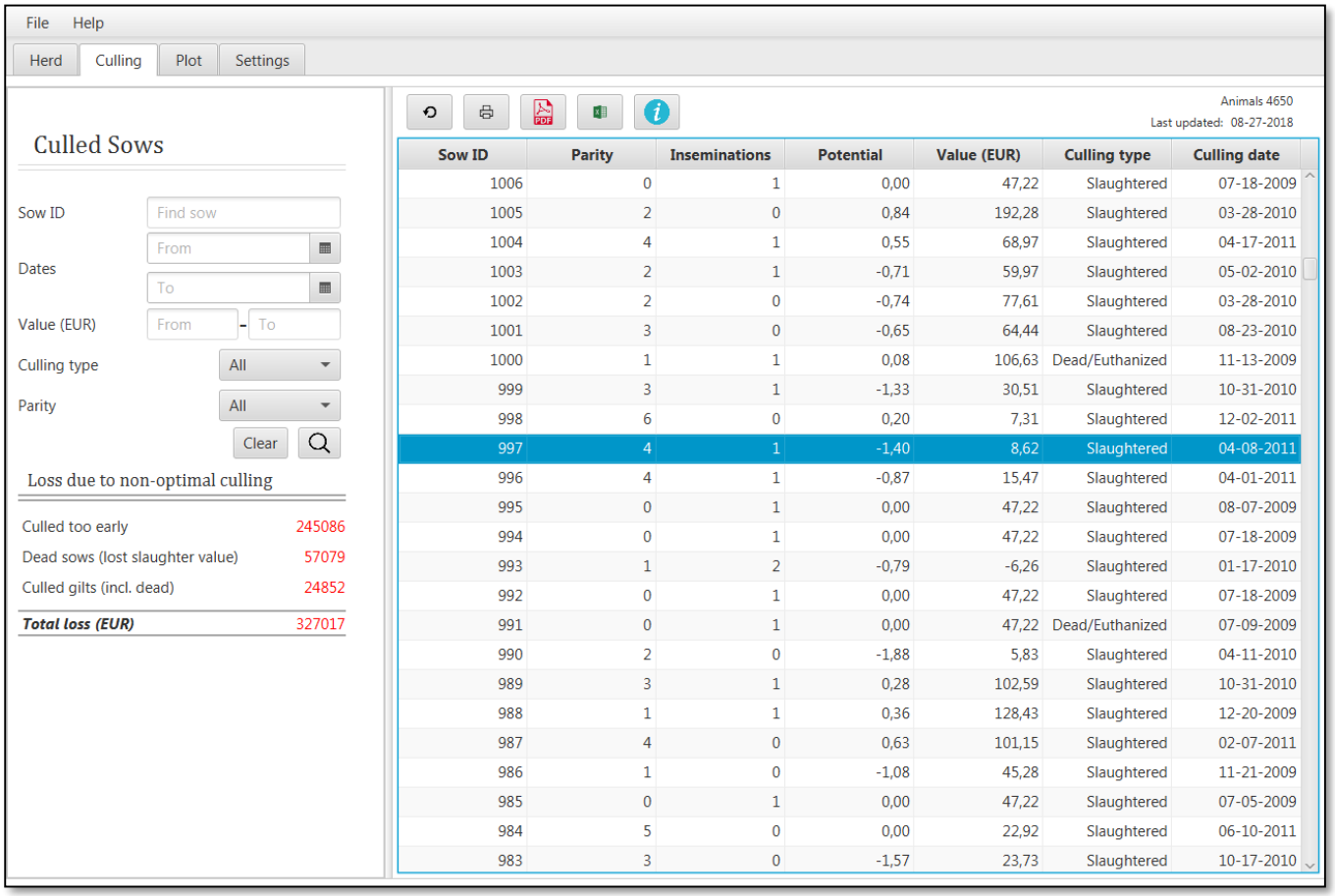




User interface – decision support



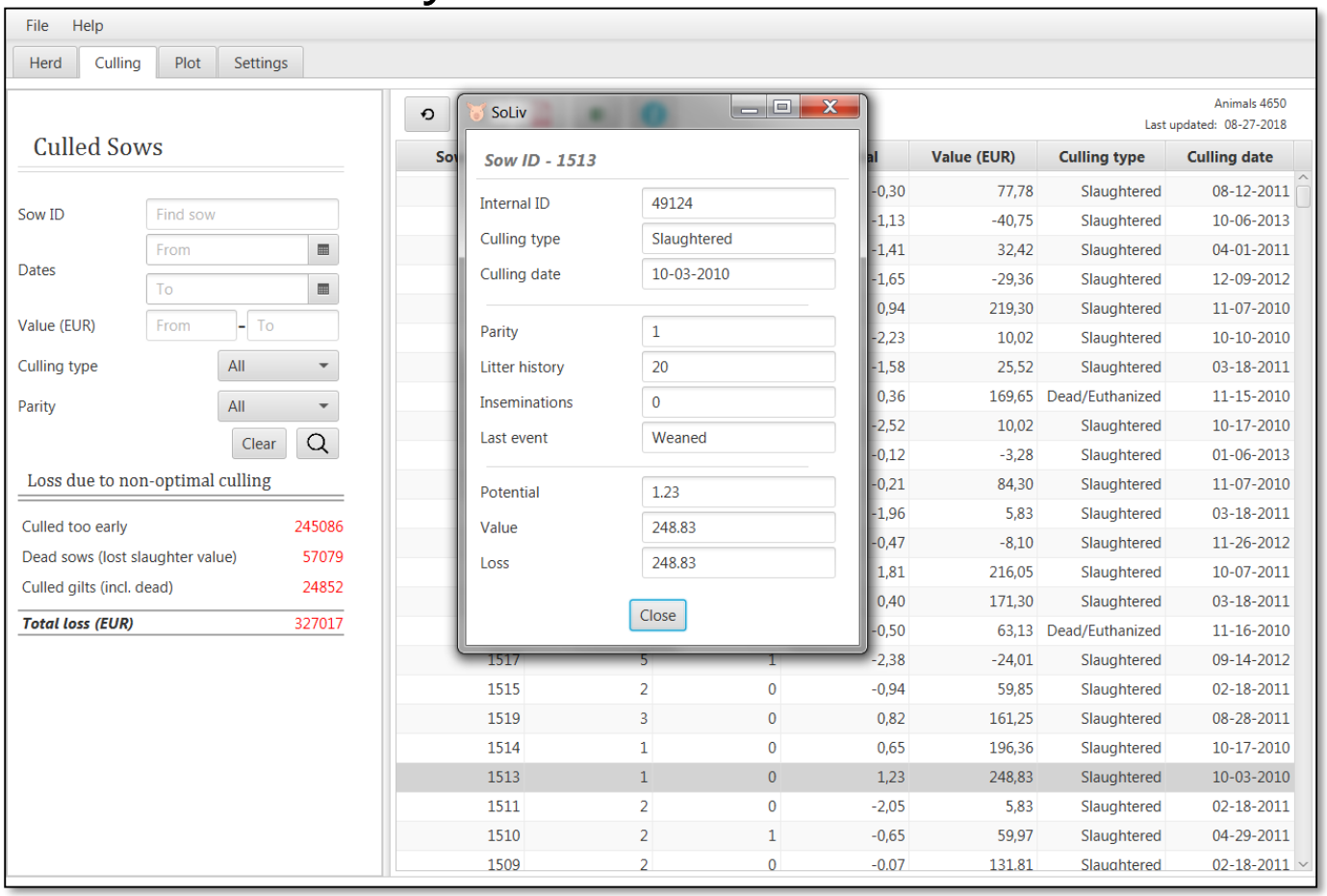
User interface – culling history



Sow ID	Parity	Inseminations	Potential	Value (EUR)	Culling type	Culling date
1006	0	1	0,00	47,22	Slaughtered	07-18-2009
1005	2	0	0,84	192,28	Slaughtered	03-28-2010
1004	4	1	0,55	68,97	Slaughtered	04-17-2011
1003	2	1	-0,71	59,97	Slaughtered	05-02-2010
1002	2	0	-0,74	77,61	Slaughtered	03-28-2010
1001	3	0	-0,65	64,44	Slaughtered	08-23-2010
1000	1	1	0,08	106,63	Dead/Euthanized	11-13-2009
999	3	1	-1,33	30,51	Slaughtered	10-31-2010
998	6	0	0,20	7,31	Slaughtered	12-02-2011
997	4	1	-1,40	8,62	Slaughtered	04-08-2011
996	4	1	-0,87	15,47	Slaughtered	04-01-2011
995	0	1	0,00	47,22	Slaughtered	08-07-2009
994	0	1	0,00	47,22	Slaughtered	07-18-2009
993	1	2	-0,79	-6,26	Slaughtered	01-17-2010
992	0	1	0,00	47,22	Slaughtered	07-18-2009
991	0	1	0,00	47,22	Dead/Euthanized	07-09-2009
990	2	0	-1,88	5,83	Slaughtered	04-11-2010
989	3	1	0,28	102,59	Slaughtered	10-31-2010
988	1	1	0,36	128,43	Slaughtered	12-20-2009
987	4	0	0,63	101,15	Slaughtered	02-07-2011
986	1	0	-1,08	45,28	Slaughtered	11-21-2009
985	0	1	0,00	47,22	Slaughtered	07-05-2009
984	5	0	0,00	22,92	Slaughtered	06-10-2011
983	3	0	-1,57	23,73	Slaughtered	10-17-2010

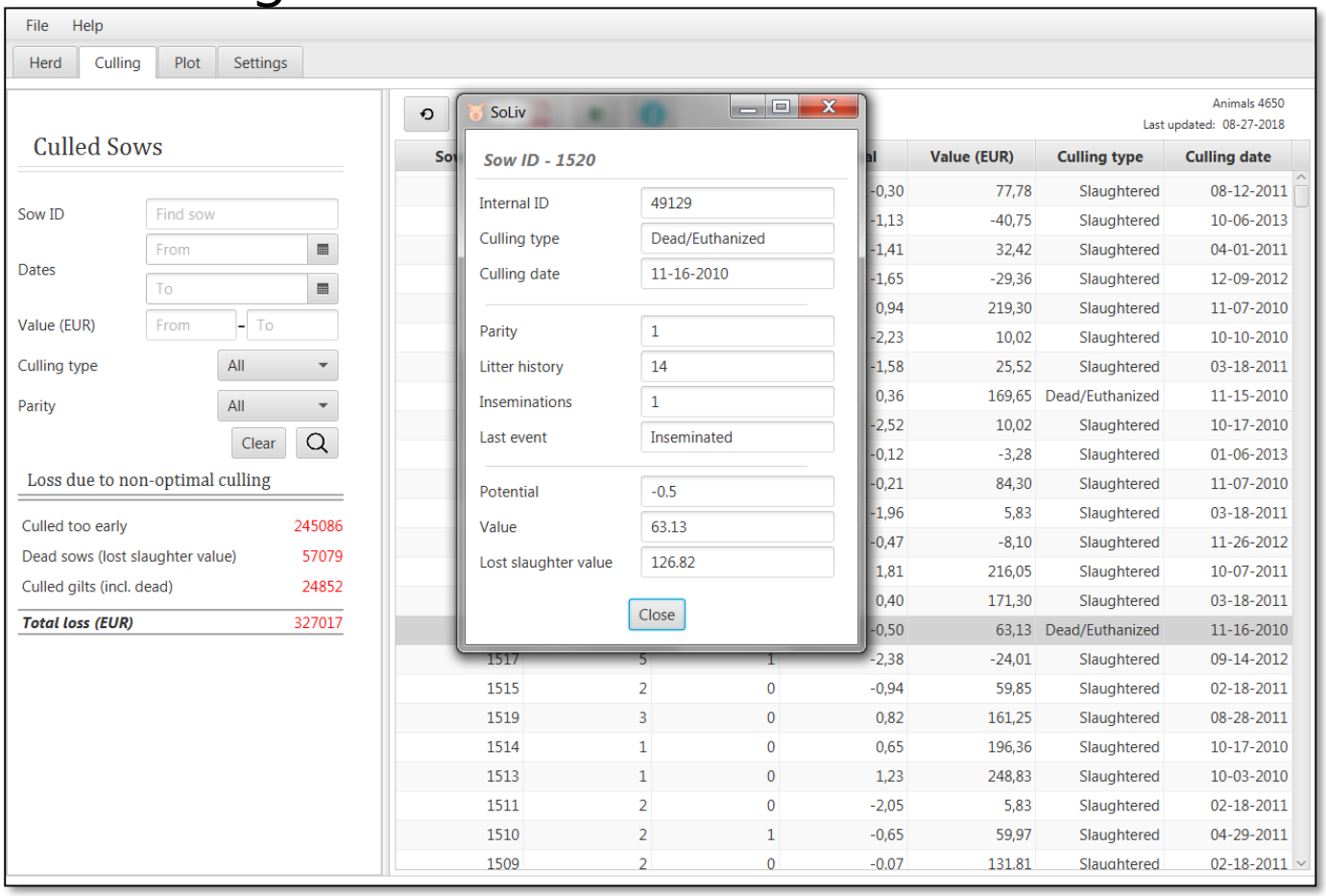
User interface – culling history

Culled too early



User interface – culling history

Lost slaughter value



Summary

- Software tool based on raw data:
  - Decision support in sow replacement
  - Assessing the culling strategy
  - Monitor progress in various parameters in real-time

- Software freely available at www.pigit.ku.dk/SoLiv
  - In Danish and English
  - User-defined currency
  - Compatible with
    - AgroSoft WinPig (.NET version)
    - Cloudfarms
    - Demo is available

Summary

- Financed by

PigIT and Promilleafgiftsfonden (Production levy foundation)

- Bibliography

[1]

Kristensen, A.R. & T.A. Søllested. 2004. A sow replacement model using Bayesian updating in a three-level hierarchic Markov process. I. Biological model. *Livestock Production Science 87*, 13-24.

Kristensen, A.R. & T.A. Søllested. 2004. A sow replacement model using Bayesian updating in a three-level hierarchic Markov process II. Optimization model. *Livestock Production Science 87*, 25-36

Rodríguez, S.V., T.B. Jensen, L.M. Plà & A.R. Kristensen. 2011. Optimal replacement policies and economic value of clinical observations in sow herds. *Livestock Science 138*, 207-219.

[2]

Claudio Bono, Cecile Cornou, Kristensen A.R. 2012. Dynamic production monitoring in pig herds I: Modeling and monitoring litter size at herd and sow level. *Livestock Science 149, 289-300.*

Claudio Bono, Cecile Cornou, Søren Lundbye-Christensen, Kristensen A.R. 2013. Dynamic production monitoring in pig herds II: Modeling and monitoring farrowing rate at herd level. *Livestock Science 155, 92-102*.

Claudio Bono, Cecile Cornou, Kristensen A.R. 2014. Dynamic production monitoring in pig herds III: Modeling and monitoring mortality rate at herd level. *Livestock Science 168, 128-138.*

Want to hear more about our studies?

PigIT closing conference – 13.11.2018, Copenhagen

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