Using real time cow information for daily grazing management

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Introduction

- Autograssmilk – FP7 SME-project EU
  - Objective
    - Develop and implement improved sustainable farming systems that integrate the grazing of dairy cows with Automatic Milking
  - Partners
    - Ireland (IGA and Teagasc)
    - Netherlands (LTO and WLR)
    - Denmark (VFL and AU)
    - France (CNIEL and IDELE)
    - Sweden (SDF and SLU)
    - Belgium (CDL and ULg)

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Introduction

- Focus of project on integration of AM with cow grazing
  - WP1 - Feeding strategies
  - WP2 - New technologies
  - WP3 - Sustainability
  - WP4 - Tools to optimise economic efficiency
  - WP5 - Dissemination

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Introduction

- Within WP2 – New technologies
  - Task 2.2. Evaluate technologies to support the integration of grazing and AM systems
  - Aim: Use sensor data to develop practical tools for farmers that can be used
    - to maintain high milk yield
    - to improve grassland management
    - to detect problems, e.g. cow health
    - to detect cows in heat

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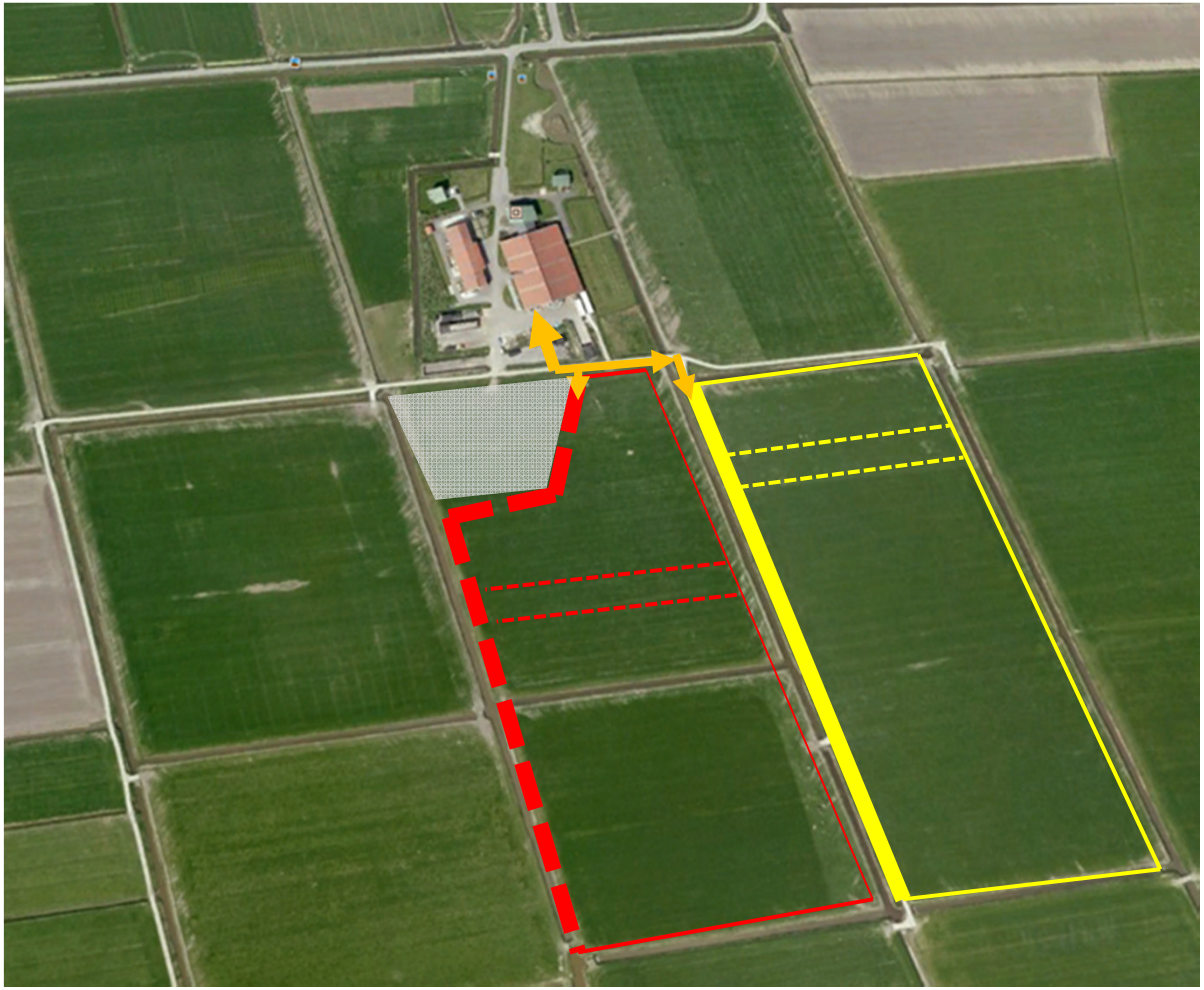
Materials and methods

- Experiment on research farm Dairy Campus in 2013

  - Grazing system: strip grazing
    - Herd size: ~55 HF-cows
      - Additional silage in barn: 8 kg d.m./cow/day
      - At least 8 kg d.m./cow/day from grazing
    - 2 blocks for grazing: 8 ha per block
      - 2x 6 hours daily during at least 120 days
      - Daily grazing periods:
        - Strip 1 from 06:00~12:00h
        - Strip 2 from 12:00-18:00h

Materials and methods



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Materials and methods

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Materials and methods

- Available real time information
  - Milking robot
    - **Milk yields**
    - Milking intervals
    - Milking refusals

  - Cow activity
    - **Walking (Steps)**
    - **Lying**
    - Standing
    - (Eating/grazing)

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Materials and methods

- Further available information for analysis
  - Management actions
    - Grassland management
    - Grazing regime
    - Additional feeding in barn
  - Weather conditions
    - Temperature
    - Precipitation (amount and duration)
    - Sunshine
    - ……

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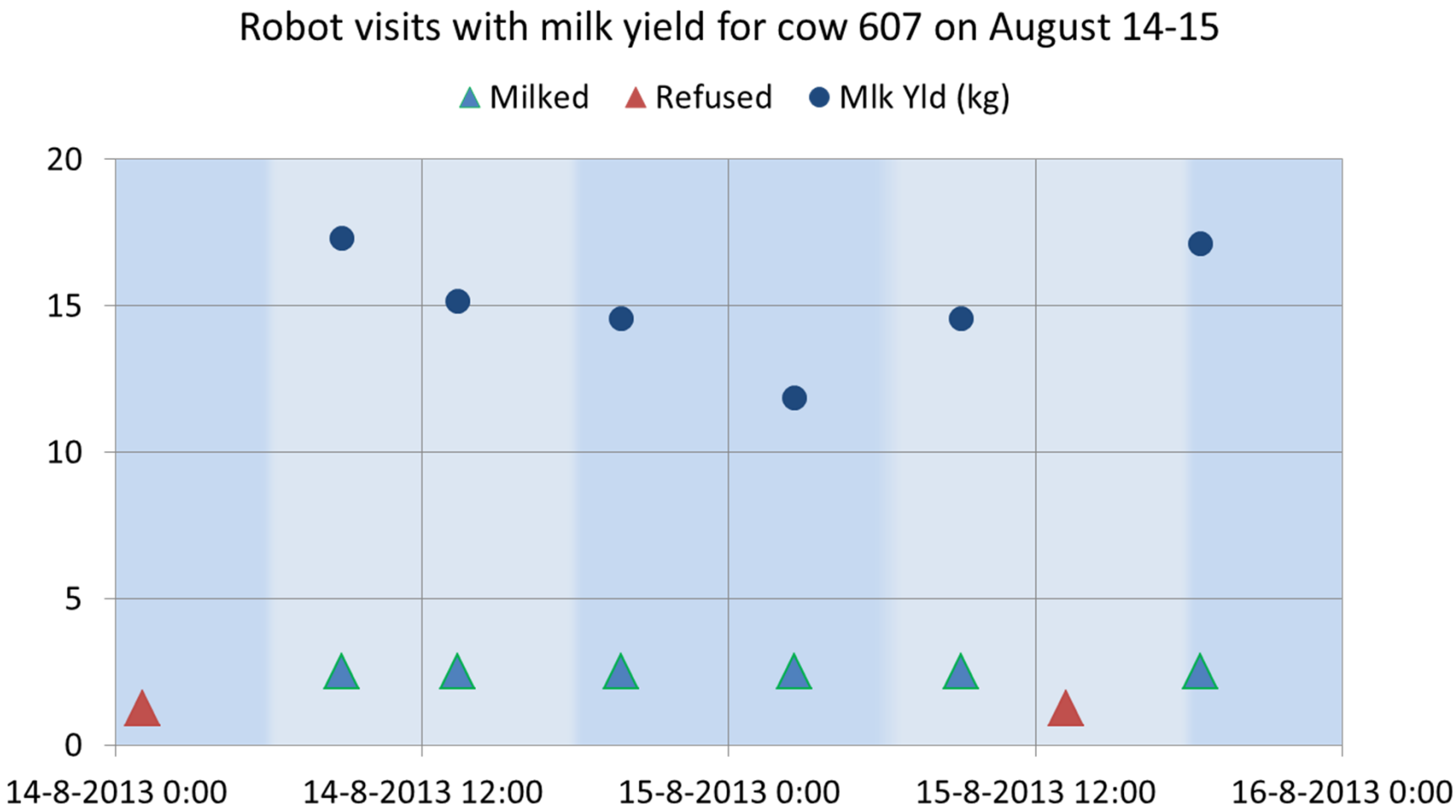
Real time information for grazing management

Source: milking robot



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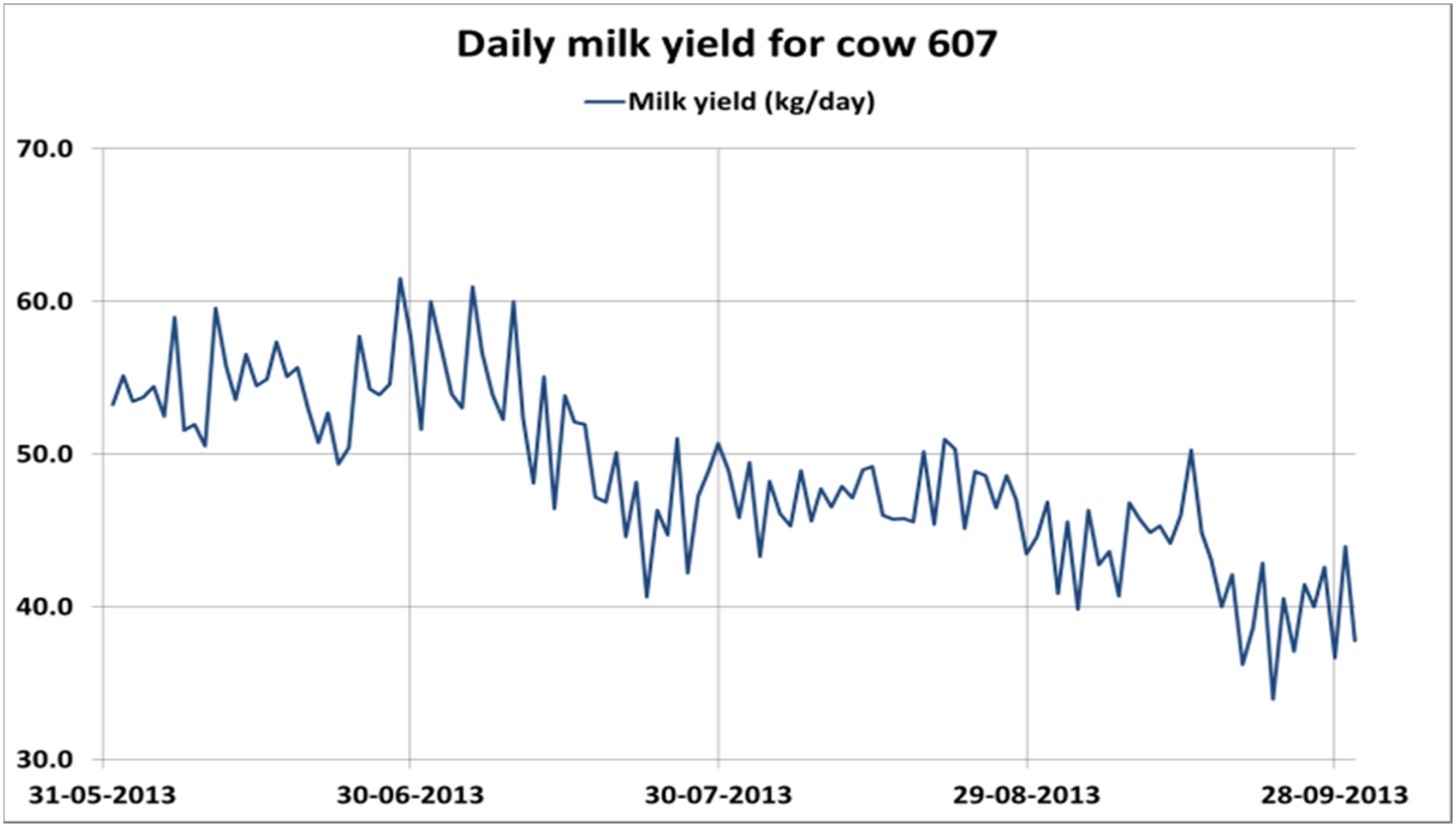

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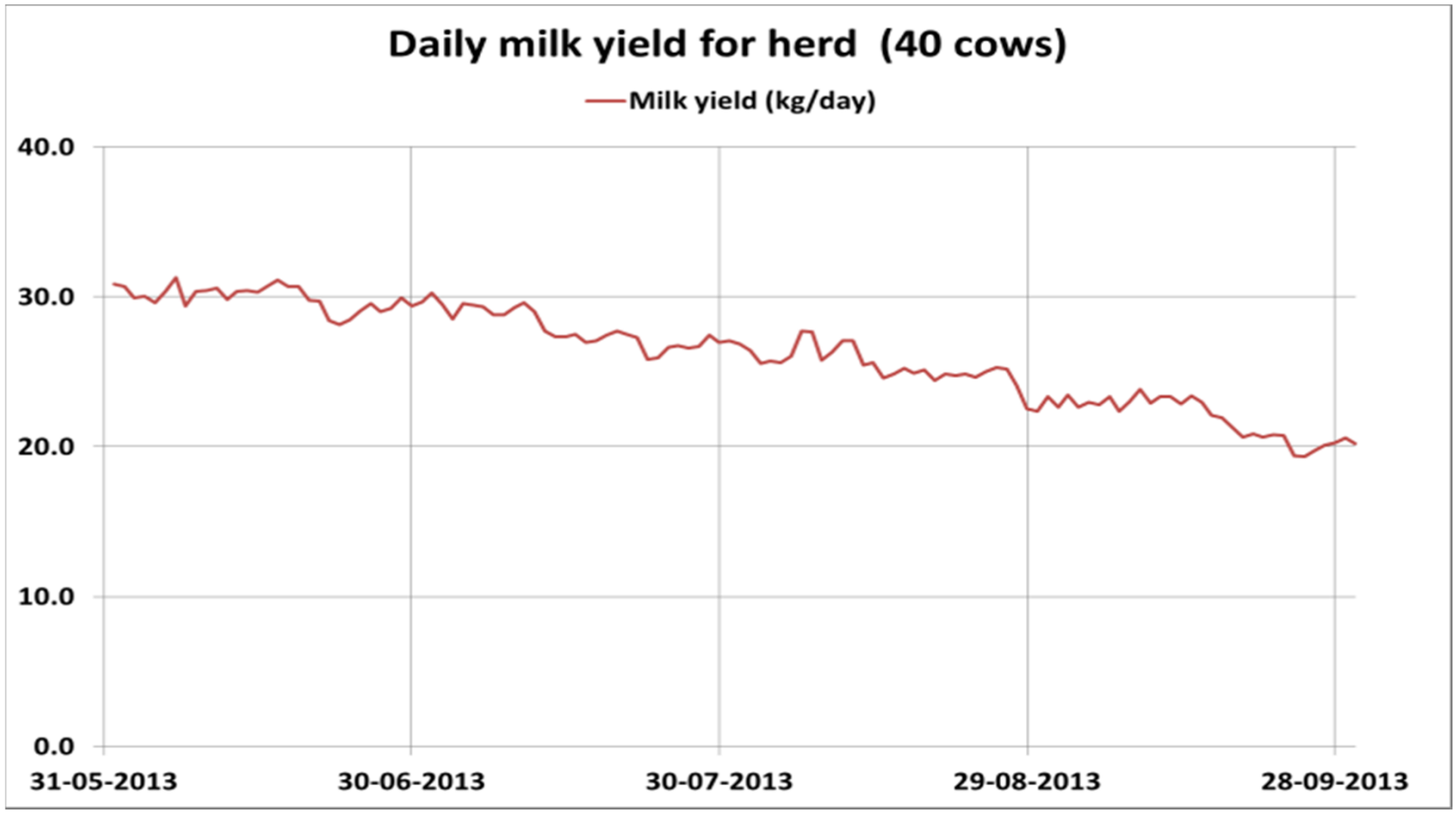

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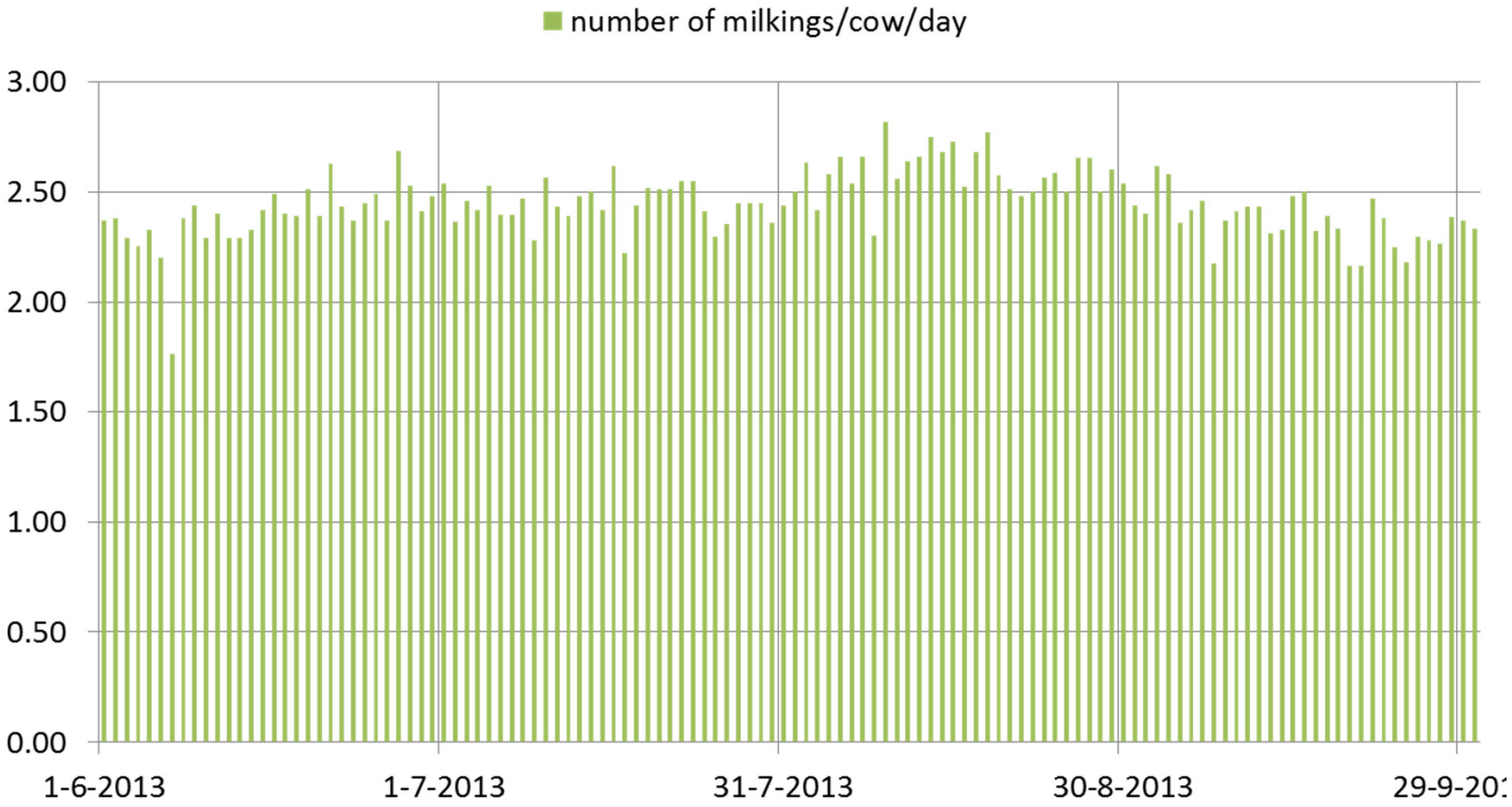

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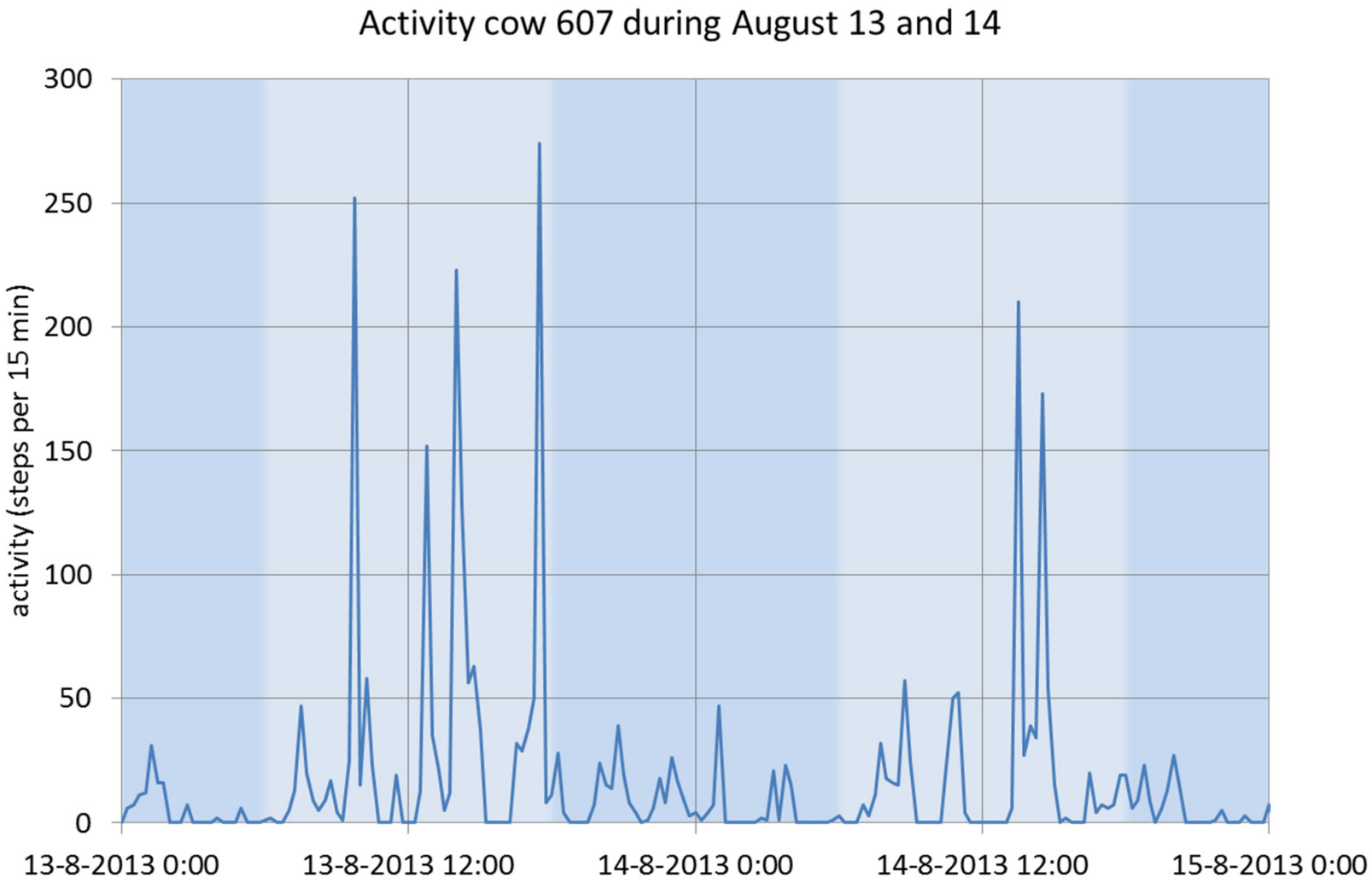

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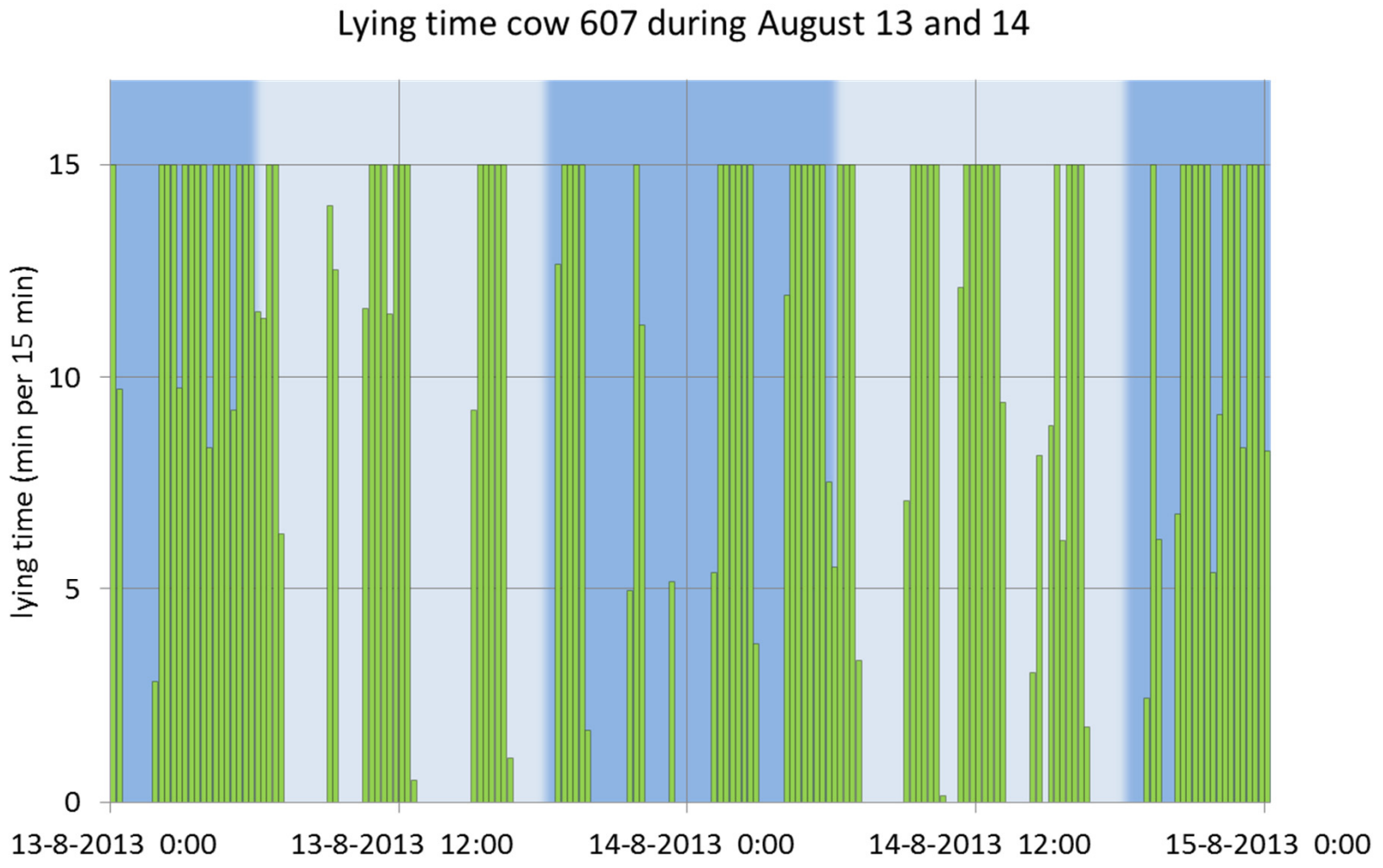

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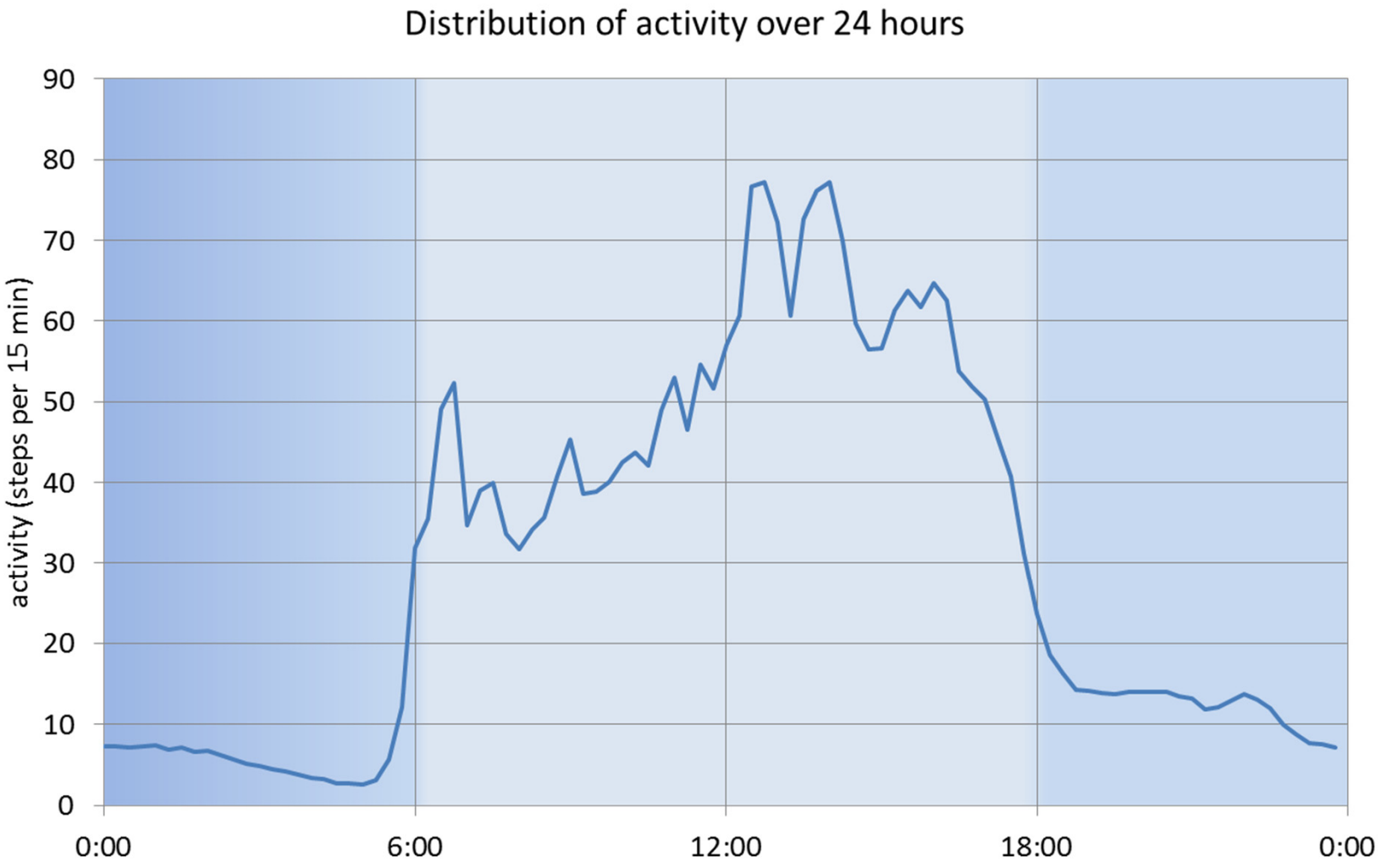

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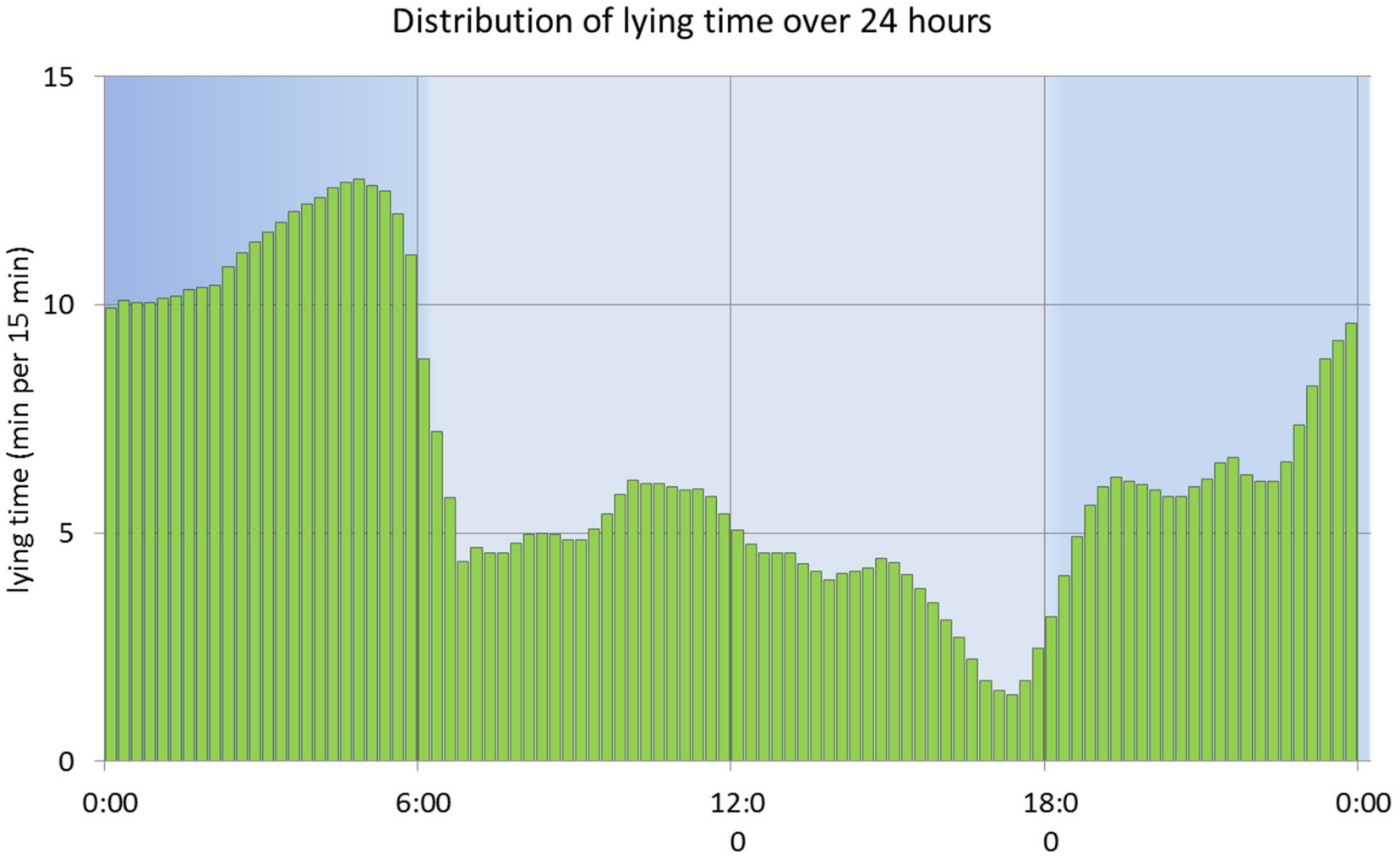

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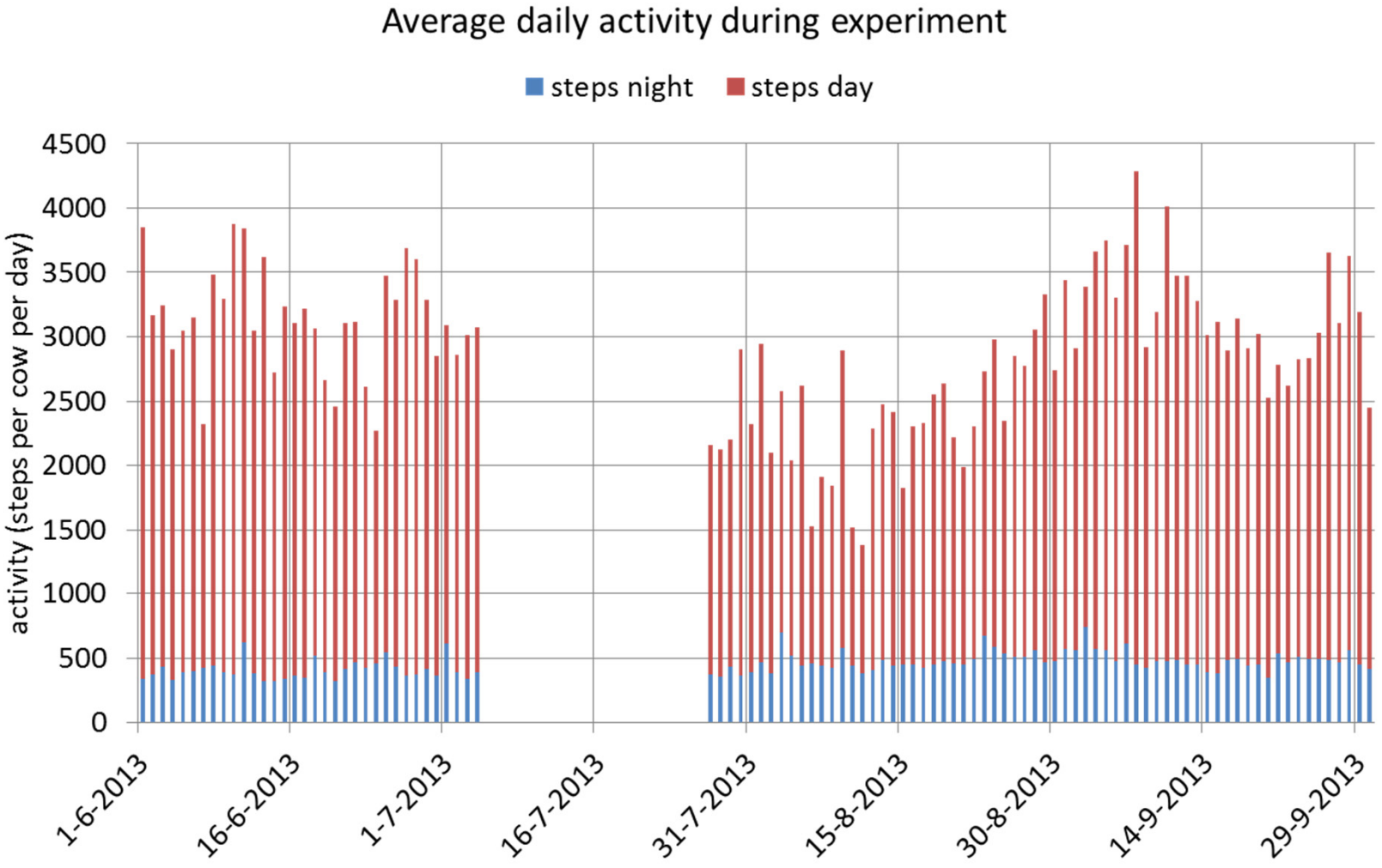

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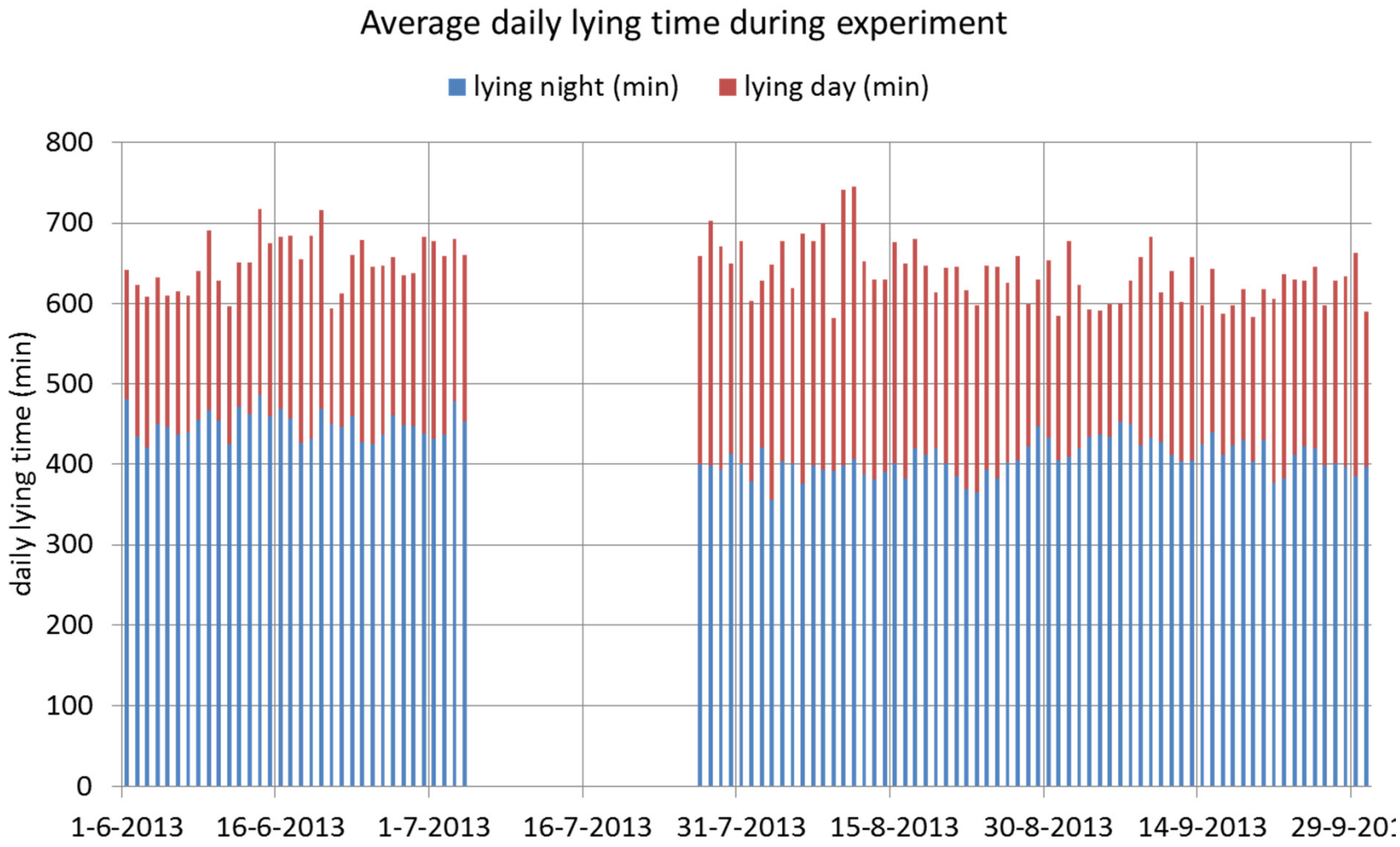

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Alerting deviating cows

- Used data for analysis of alerts
  - Milk yields: 4400 cowdays – 29 heat cases
  - Activity: 3750 cowdays – 21 heat cases

- Alerts analysed for significant
  - **decreased** milk yield
  - **decreased** lying duration
  - **increased** activity (total or maximum number of steps)
  - **increased** number of lying bouts

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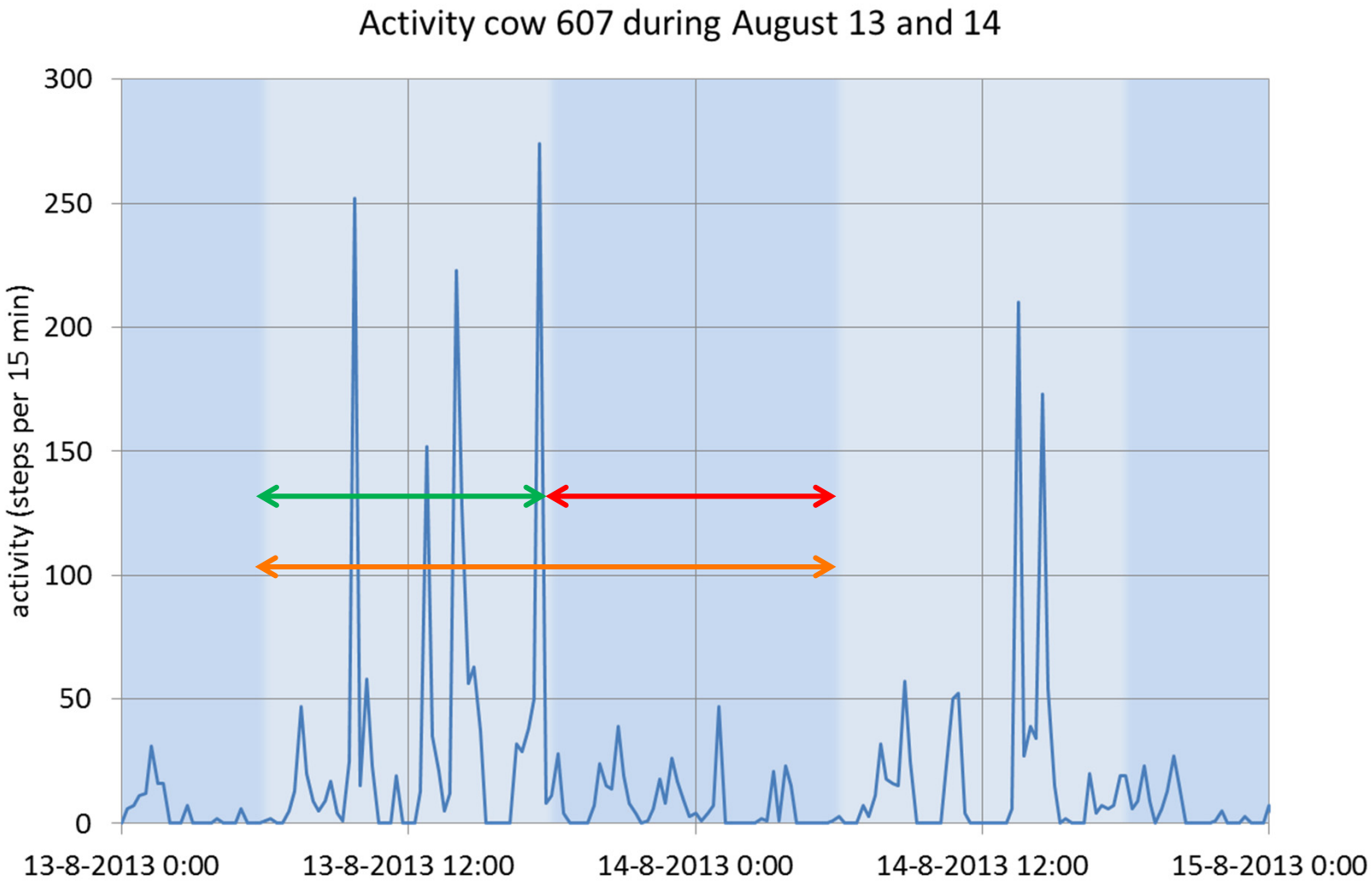
Alerting deviating cows



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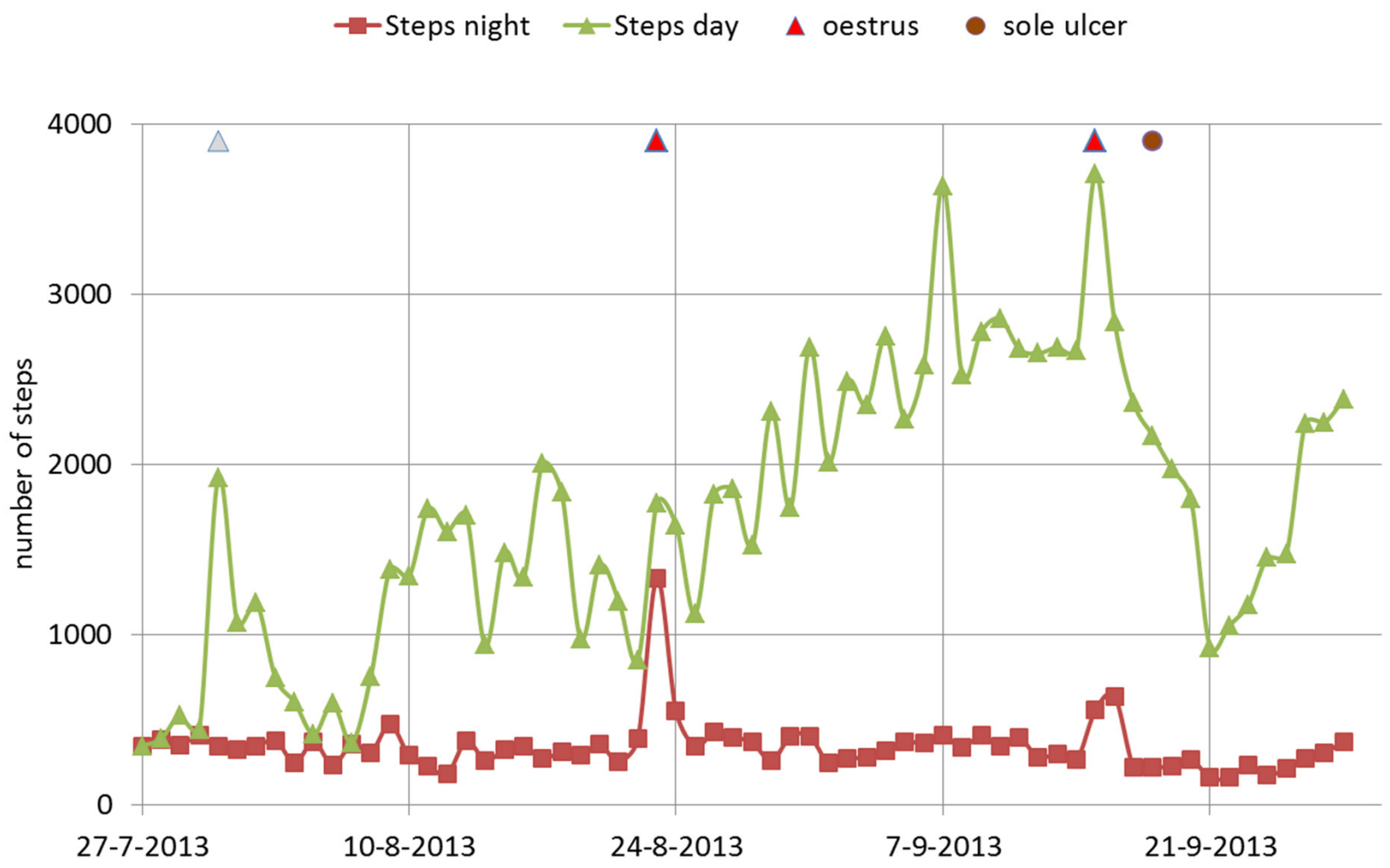
Cow 603 – activity days and nights (2 months)



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Results heat detection (1)

24 hrs (18:00-18:00h) periods

	lying duration	lying bouts	total steps	maximum steps	milk yield
Sensitivity	57.1	28.6	42.9	52.4	31.0
Specificity	86.0	87.5	86.0	85.2	80.7

days (06:00-18:00h = grazing) periods

	lying duration	lying bouts	total steps	maximum steps	milk yield
Sensitivity	23.8	28.6	38.1	47.6	37.9
Specificity	88.5	86.3	86.0	85.1	81.1

nights (18:00-06:00h = in barn) periods

	lying duration	lying bouts	total steps	maximum steps	milk yield
Sensitivity	57.1	14.3	81.0	47.6	20.7
Specificity	84.5	87.6	80.9	82.3	80.9

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Results heat detection (2)

	over night (18:00-06:00 h = in barn) periods			
	total steps	maximum steps	log total steps	log maximum steps
Sensitivity	81.0	47.6	76.2	38.1
Specificity	80.9	82.3	84.0	86.2

- Steps – not normally distributed
  - Log transformation
    - Sensitivity decreases
    - Specificity increases
- Further improvements to be explored
  - Correction of individual parameters by group mean
  - Combining alerts of different parameters
  - Ideas ?

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Real time information for grazing management

- Output from model
  - Alerts for individual cows
    - **In heat**
    - Health problems
  - Alerts for herd
    - **Milk yield decreases**
    - Milking frequency decreases
    - **Activity changes**

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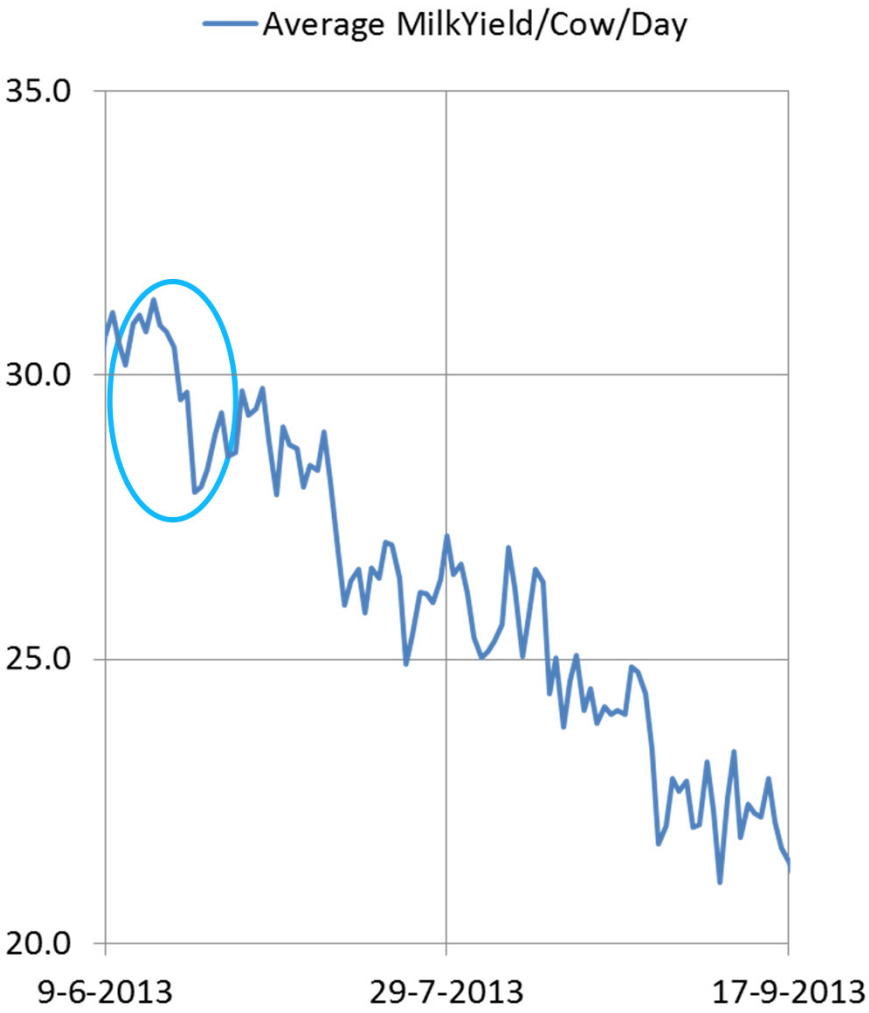
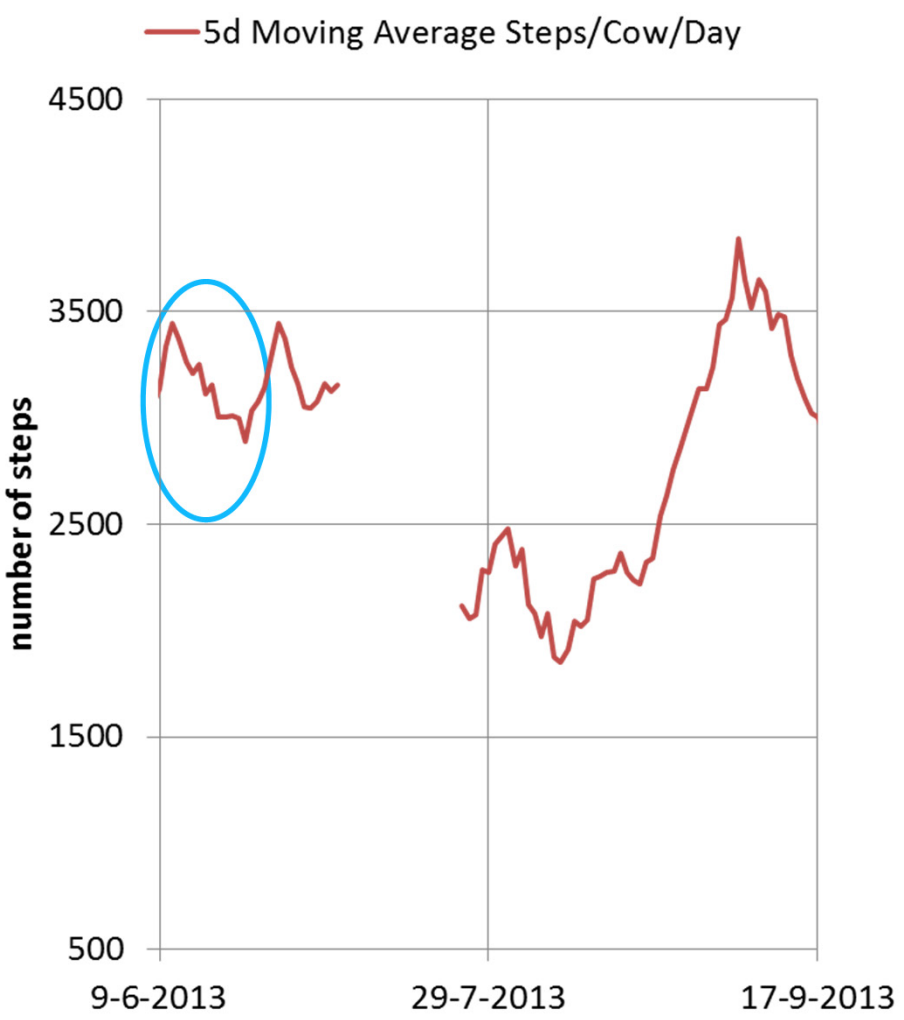
Effects of management and weather





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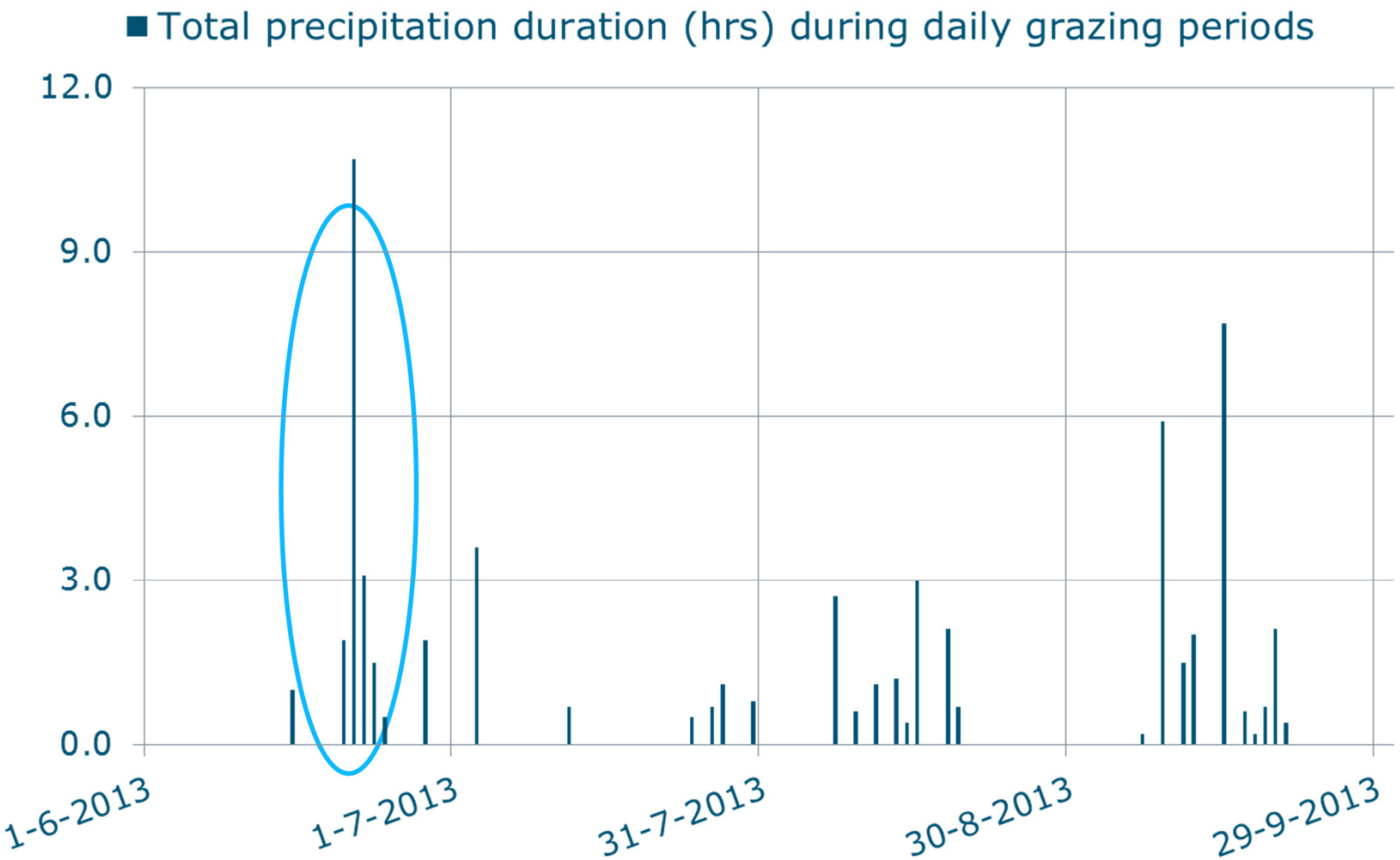
Effect of weather conditions – precipitation duration



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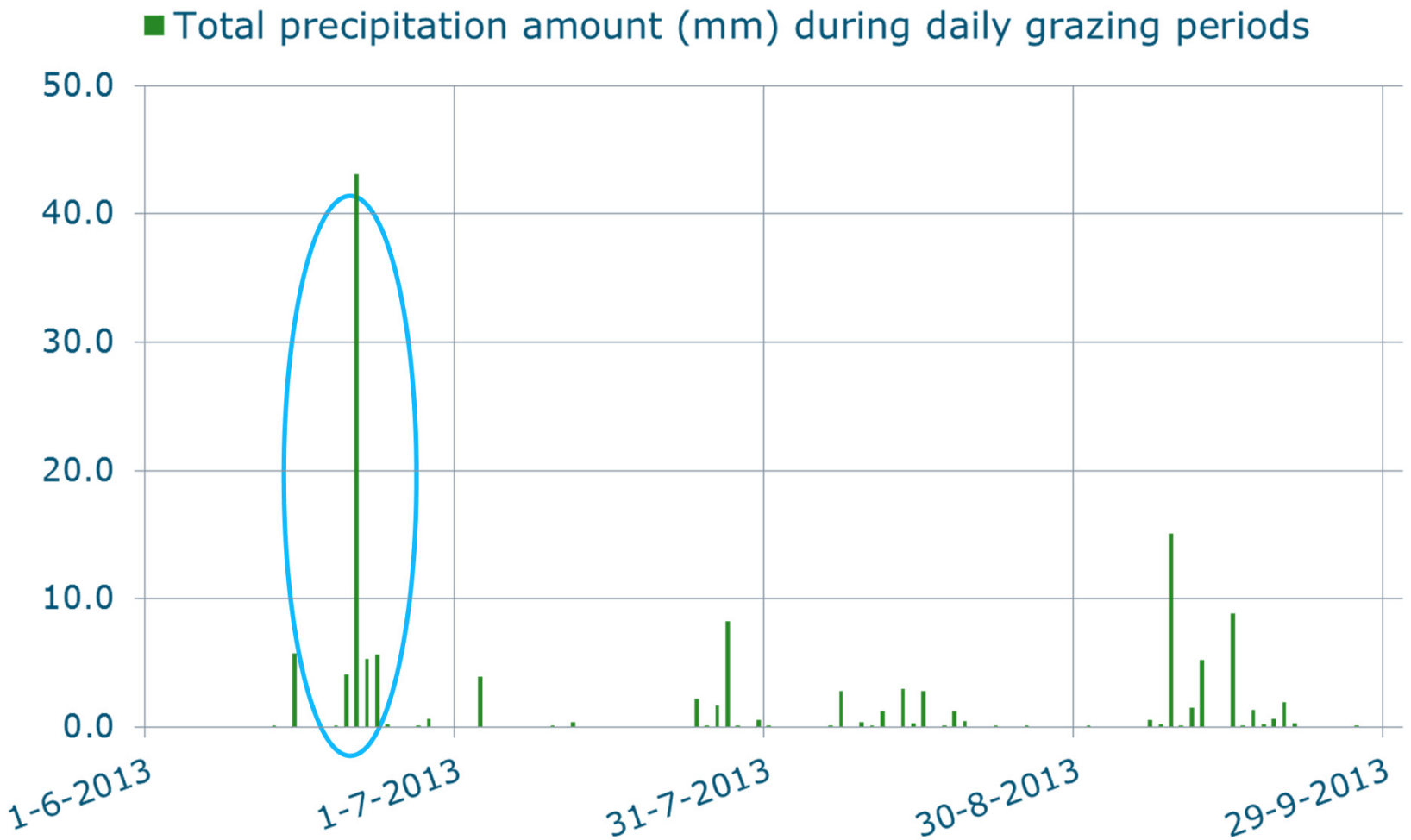
Effect of weather conditions – precipitation amount



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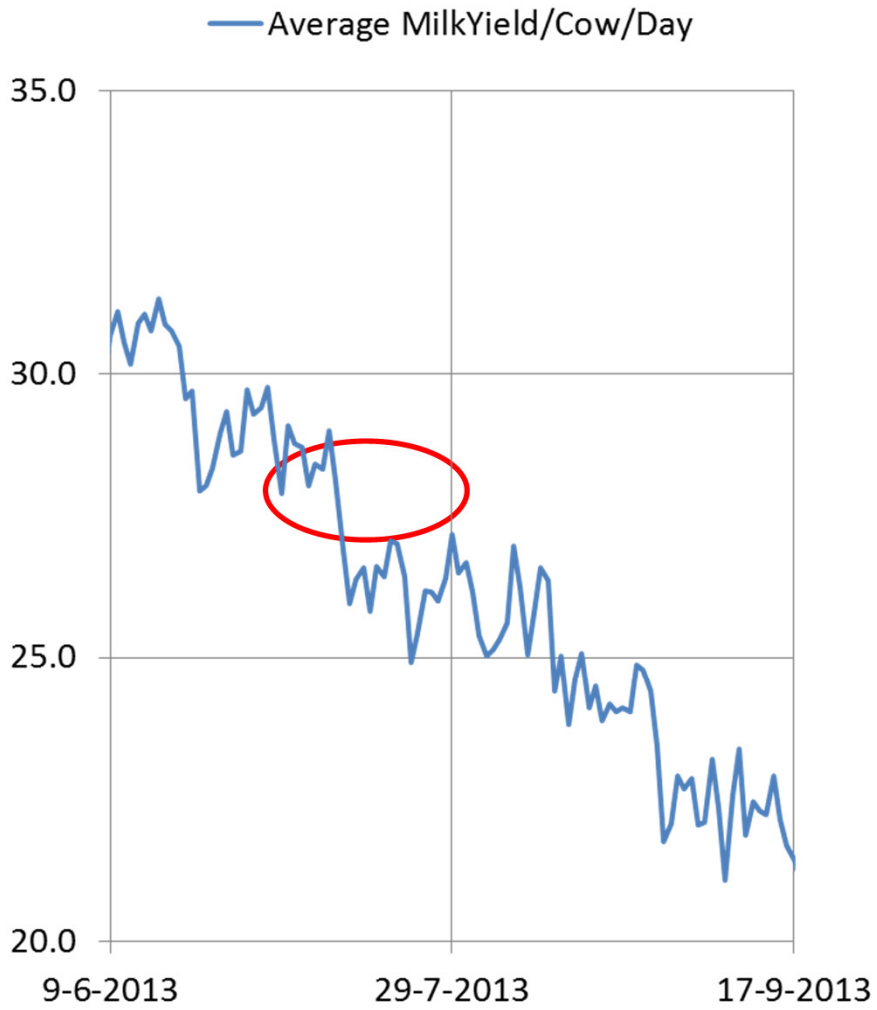

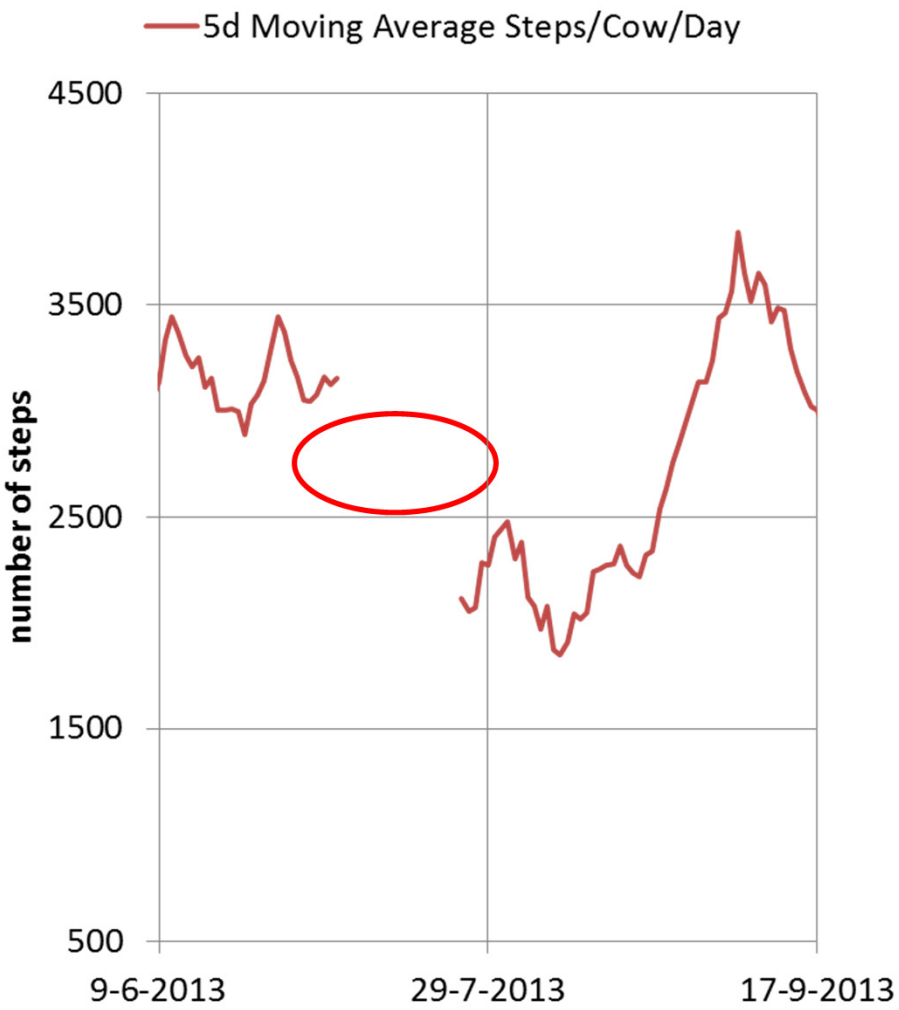

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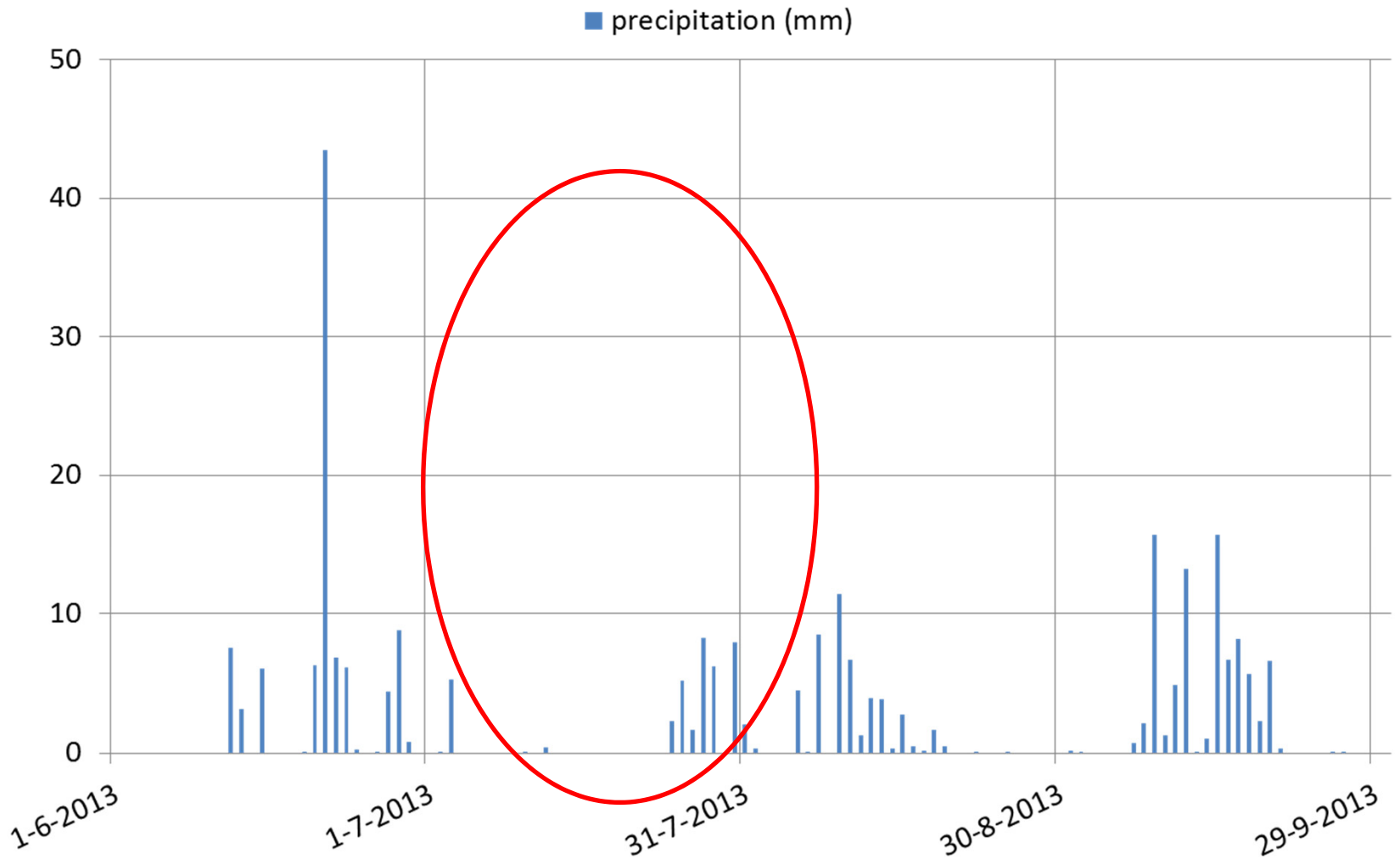
Effect of weather conditions - precipitation



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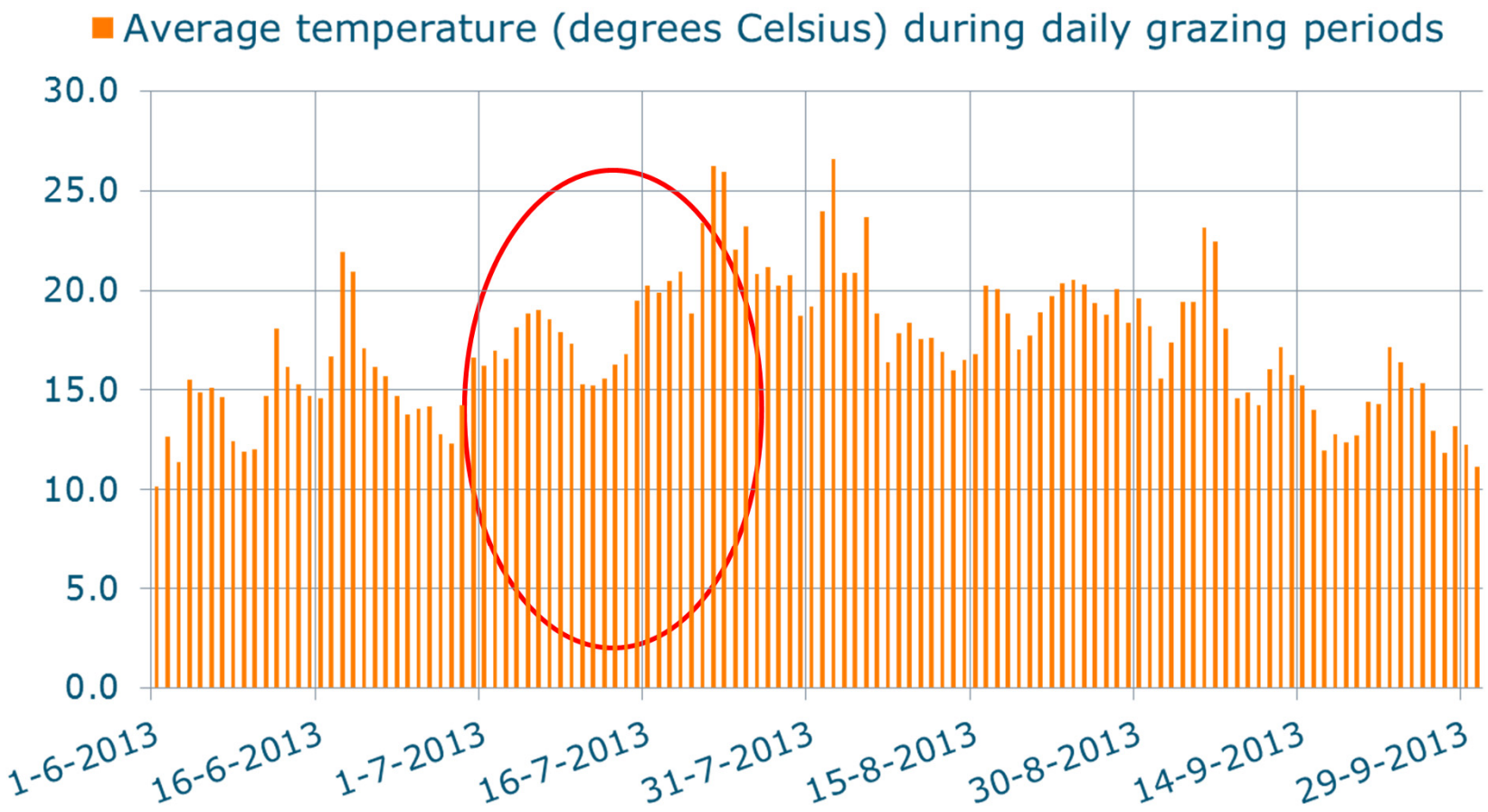
Effect of weather conditions - temperature



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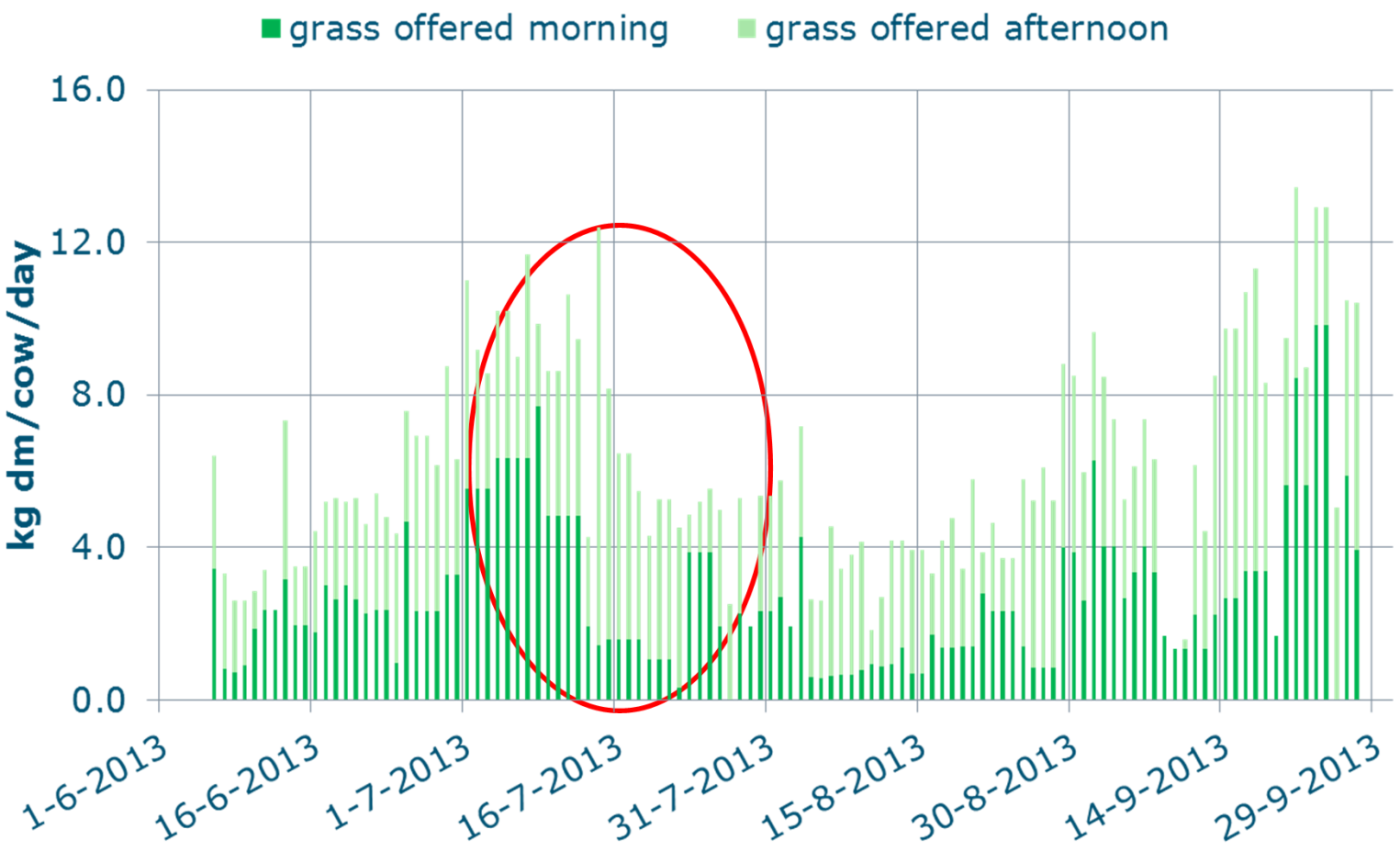
Effect of grazing management

Daily grass allowance



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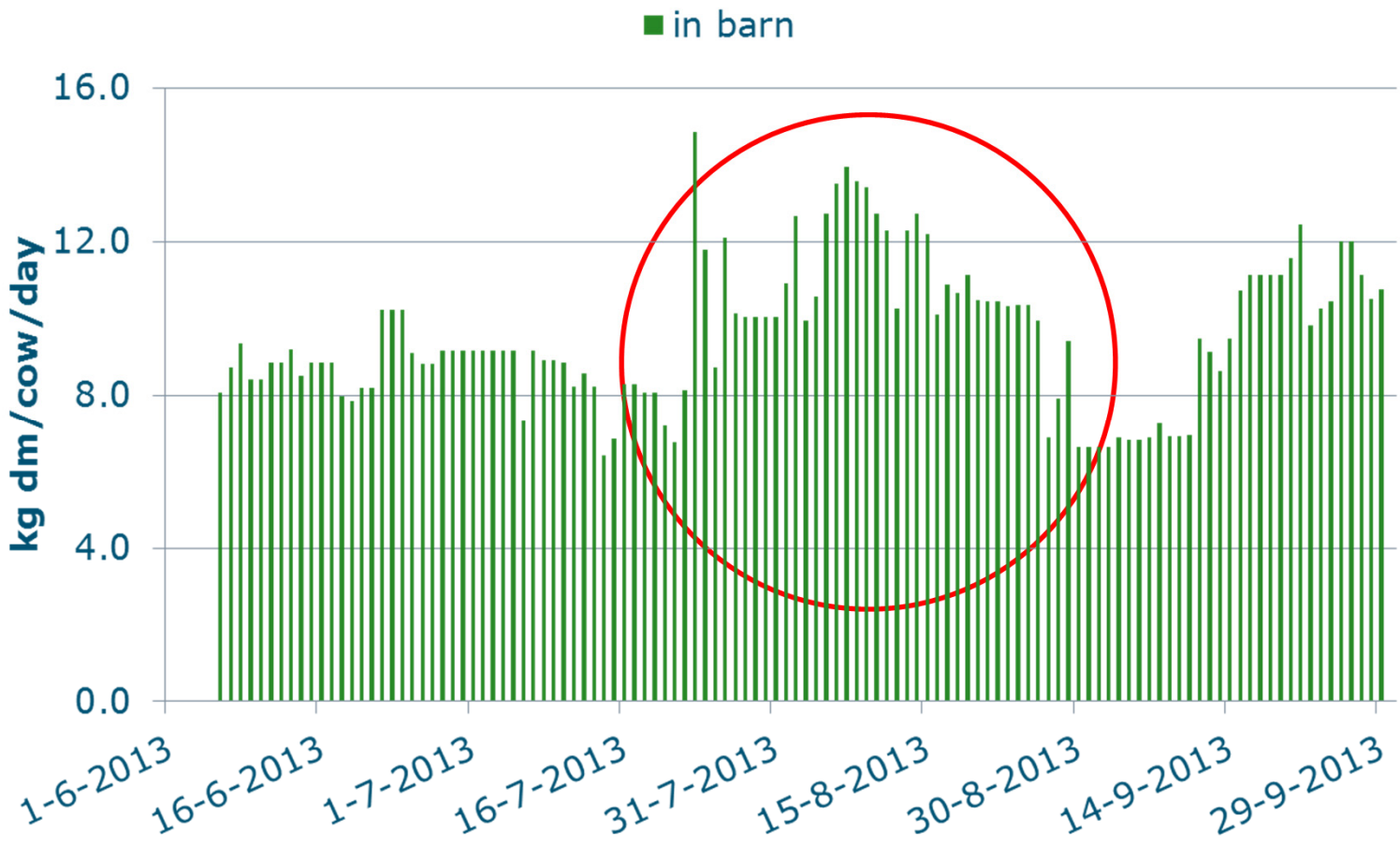
Effect of feeding management

Daily feed intake



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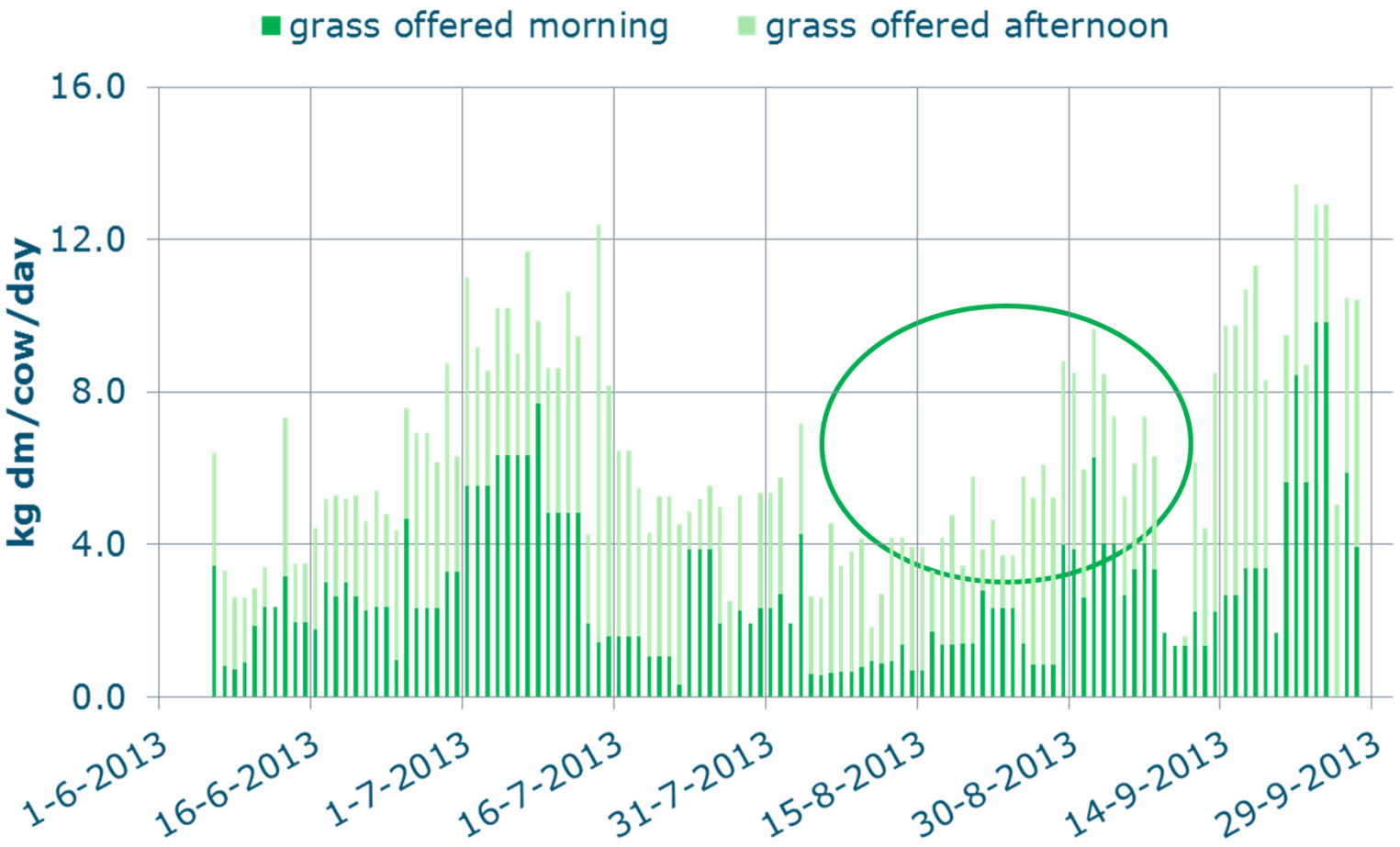

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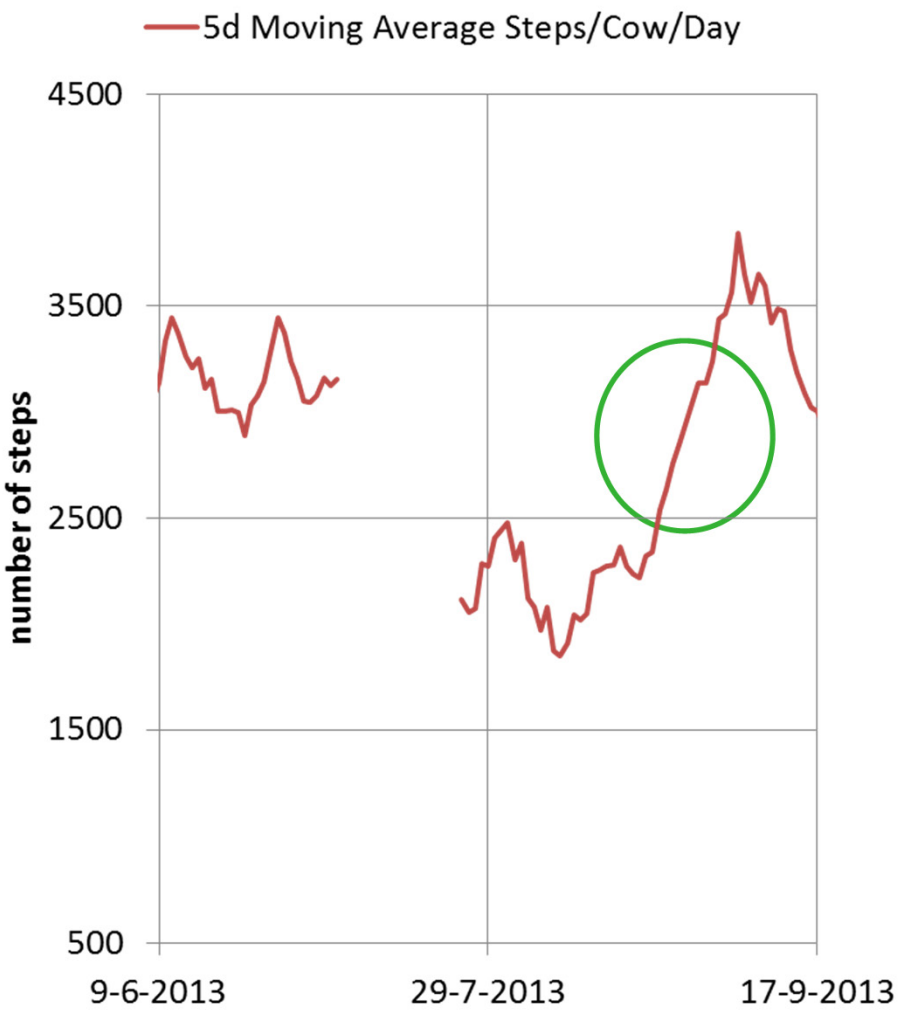

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Conclusions for herd level

- Sensor information
  - Early detection of effects of weather conditions and feeding/grazing management on cow behaviour and milk yield are realistic
  - **Question?** What to do when information signals lower activity and milk yield?
    - Increase supplementary feed in barn !
      - Detrimental effect would be less grazing
        - **Solution:** Improve grassland management
  - *Have always good quality fresh grass available*

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Conclusions individual cow level

- Heat detection
  - Sensitivity and specificity are too low
    - Currently used sensor information and detection models need further development
      - Other sensors?
      - Better models?

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