Potential of Precision Livestock Farming in small ruminant farming systems


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Outline

1. Definition of PLF
2. Small Ruminant systems
3. PLF & SR?
4. What exists already
5. Issues
6. The future?
Precision Livestock Farming

• “The ‘sensor-based’ individual animal approach” (Halachmi, 2019)

• Management of livestock by continuous automated real-time monitoring of production/reproduction, health, welfare and environmental impact (Berckmans, 2017)

• Farming using equipment, data or software which allows the use of information at an individual level for targeting decisions, inputs and treatments more precisely (Morgan-Davies et al., 2015).
Precision Livestock Farming

Adapted from Ingrand et al., 2018 (69th EAAP)
PLF applications?

• Widely adopted in management of high-value animals and/or more industrialised farming systems
  – Pigs
  – Dairy cows
  – Beef cattle

BUT…. what about species where animals are considered to have a lower individual value or with less economic interest, or in extensive management systems?
Small Ruminant Systems

% of livestock in Europe (heads) – Eurostat 2015

- all bovine (dairy + beef): 21%
- all goats: 26%
- all sheep: 44%
- all pigs: 4%

% of livestock in the world (heads) – FAOSTAT 2015

- all bovine (dairy + beef): 22%
- all goats: 25%
- all sheep: 32%
- all pigs: 4%

Excluding poultry
Type of production

- Dairy vs meat vs wool + multi-purpose
- Intensive / semi-intensive / extensive
Small Ruminants in the world?

Number of sheep & goats in world – FAOSTAT 2015

- Africa: 35%
- Americas: 5%
- Asia: 48%
- Europe: 7%
- Oceania: 5%
In Europe?
In Europe
In Europe – High Nature Value

Estimated High Nature Value (HNV) farmland presence in Europe, 2012 update

- **HNV farmland**
- **No data**
- **Outside coverage**

Data sources:
- Corine 2006, Natura 2000 IBAs: BirdLife International
- PBAs: De Vlinderstichting (NL)
- National biodiversity data (UK, CZ, LT, SE, ES)
- National HNV contributions (HR, SR, CH)

Cartography: Umweltbundesamt
Methodology: EEA & JRC 2007 adapted by: ETC-SIA 2012

© EuroGeographics for administrative boundaries
Important aspects of SR

• Environment/biodiversity
• Social/Cultural
  – Employment – 1.5 million (7%)
  – High-quality traditional products
• In Europe – rangeland-based/natural feed resources
• Perceived as more welfare friendly/naturally reared
Challenges

- Rangeland/remotely based
- Harsher environment/survival issues
- Welfare
- Diversity of systems
- Batch level
- Sector less organised
- More traditional/ageing sector
- Lack of labour
- Less efficiency/low productivity
- Low level of income
Challenges

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PLF tools for...

- Monitoring (production, welfare)
- Monitoring
- Alerts/warning systems
- Alerts/warning systems
- Common protocols for collection or monitoring
- Individual monitoring
- Data to inform farmer individually
- Benchmarking
- Efficiency gain
- Younger generation interest?
- Better life/work balance
- Time saving
- Alerts/warning systems
- Monitoring
- Efficiency gain
- Diversification
So...do current PLF tools exist for Small Ruminants?

- 2004 EU legislation on EID – RFID
- Wearables, sensors, EID readers, weighcrates, algorithms, etc.

2 main types:
- RFID tags/bolus with fixed/mobile readers
- Wearables (eg. collars, sensors on/in animals)
Potential for PLF applications

- Feed & water intake, growth
- Grazing behaviour
- Fencing
- Health/disease management
- Reproduction management
- Social behaviour
Potential for PLF applications

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Wishart & Lambe, 2019 (SRUC, UK)

Oliver et al. 2016; 2018 (UAB, Spain)
Outdoor weight monitoring

Walk Over Weigh (WoW)

Brown et al., 2012; 2014 (Sheep CRC, Australia)

González-García et al, 2018 (INRA, France)
Body Condition, Growth

Gautier et al. 2019 – Institut de l’Elevage, France

Supplementation

Wishart et al., 2015, SRUC, UK
Potential for PLF applications

• Feed & water intake, growth
• Grazing behaviour
• Fencing
• Health/disease management
• Reproduction management
• Social behaviour
Grazing behaviour – efficient pastoral resource management

Grisot et al. 2018, Institut de l’Elevage, France

Umstätter et al. 2008, SRUC, UK

Grazing behaviour – efficient pastoral resource management

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Potential for PLF applications

- Feed & water intake, growth
- Grazing behaviour
- Fencing
- Health/disease management
- Reproduction management
- Social behaviour
Virtual fencing

VigiFence (sensor and phone alert)

https://nofence.no/en/
Potential for PLF applications

• Feed & water intake, growth
• Grazing behaviour
• Fencing
• Health/disease management
• Reproduction management
• Social behaviour
Disease/Health management

Targeted Selective Treatment - Happy Factor™ algorithm

< target weight = worming

≥ target weight = no worming

Morgan-Davies et al., 2018, SRUC, UK
McBean et al., 2016; Greer et al., 2009
Moredun Institute, UK
Circadian rhythms

Sarout et al. 2018, SRUC, UK

Grøva et al. 2018, NIBIO, Norway
Potential for PLF applications

• Feed & water intake, growth
• Grazing behaviour
• Fencing
• Health/disease management
• Reproduction management
• Social behaviour
Reproduction management

Alhamada et al. 2016; Bocquier et al. INRA, France

Lambing behaviour

Schmoezlz et al. CSIRO, Australia
Potential for PLF applications

- Feed & water intake, growth
- Grazing behaviour
- Fencing
- Health/disease management
- Reproduction management
- Social behaviour
Social behaviour

Pedigree matchmaker

Sheep CRC, Australia

Menassol et al. 2018, INRA, France
Pedigree matchmaker – with collars

Waterhouse et al., 2019, SRUC, UK

Example – proximity contacts of one ewe with 18 potential offspring

![Graph showing contacts recorded by Lamb Collar ID number](image1)

Lamb proximity – RSSI

RSSI – Received signal strength indication

![Graph showing proportion of contacts recorded by distance](image2)
Potential of PLF for small ruminants?

- Range of research/applications exists
- Not exhaustive
- Available on market/research prototype
- Potential for alert & warning systems
  - Disease/health
  - Predators
  - Pasture management
  - Animal management

BUT... issues remain that need to be addressed
Issues

- Acceptability (incl. price)
- Affordability for farmers

Cost = main drawback

Gautier et al. 2019, SheepNet project
Issues

• Acceptability (incl. price)
• Affordability for farmers
• Funding for research
• Foster collaboration
• Lack of integration
• Data issues
  • Storing/collating
  • Sharing
  • Processing
  • Understanding – warning systems that farmers & technicians can use
• Business models
• SR = model for other species?
Conclusions

• There is potential for PLF to make a difference in small ruminant systems

• What needs to be addressed:
  – Acceptability of technologies
  – Economic relevance/affordability
  – Industry engagement
  – TRL of existing prototypes/technologies (‘cheap and small’)
Acknowledgments
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