Hill, Upland & Crofting Farmer-Led Group
25th February 2021

Precision livestock farming approaches in upland systems

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Department of Integrated Land Management
Hill & Mountain Research Centre






Leading the way in Agriculture and Rural Research, Education and Consulting

McCracken, D. 2019 Don't do woolly thinking, collect the data and act. *Press & Journal*, 6th January 2020.
https://www.pressreader.com/uk/the-press-and-journal-inverness-highlands-and-islands/20200106/282308207032422

Don't do woolly thinking, collect the data and act

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And we are constantly emphasising the need to collect data to make best use of the opportunities and innovations we are demonstrating on the farms.

Although the term 'data' sends shivers up many folks spines, it actually refers to a wide range of metrics that should be familiar to hill farmer and crofters.

Things such as soil pH and nutrient status, grass growth and fodder quality, livestock performance and health, and soil temperature and moisture content.

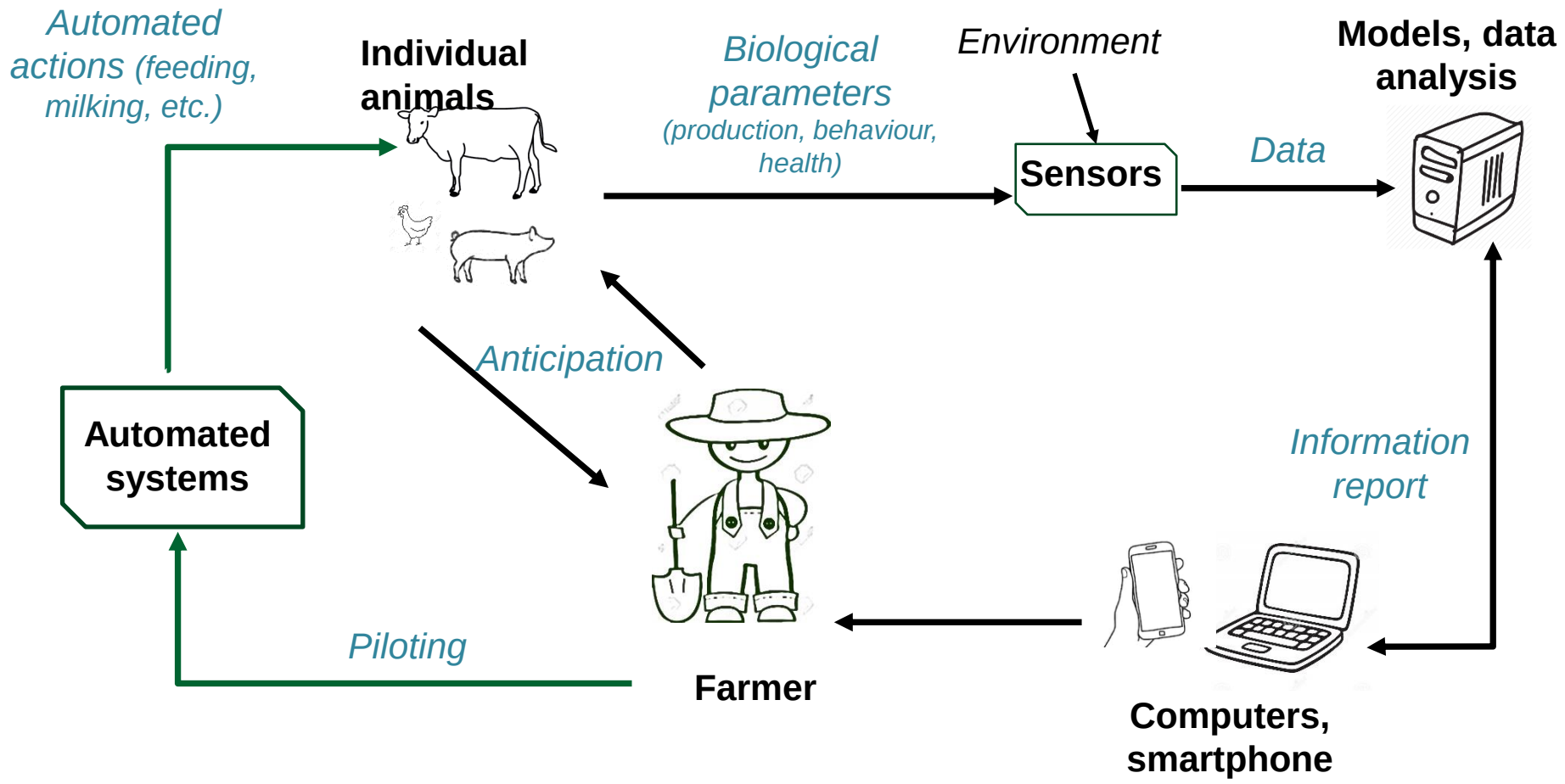
These metrics can be obtained in a variety of ways — from simply writing things down in a notebook through to employing 'fancy' sensors to collect information automatically from livestock or the land they are grazing.

But irrespective of how the data is collected, simply having that data is not enough.

It is also essential to look at and interpret what the data is indicating. And even more importantly, to then act on that information and, if necessary, change something on the farm or croft.

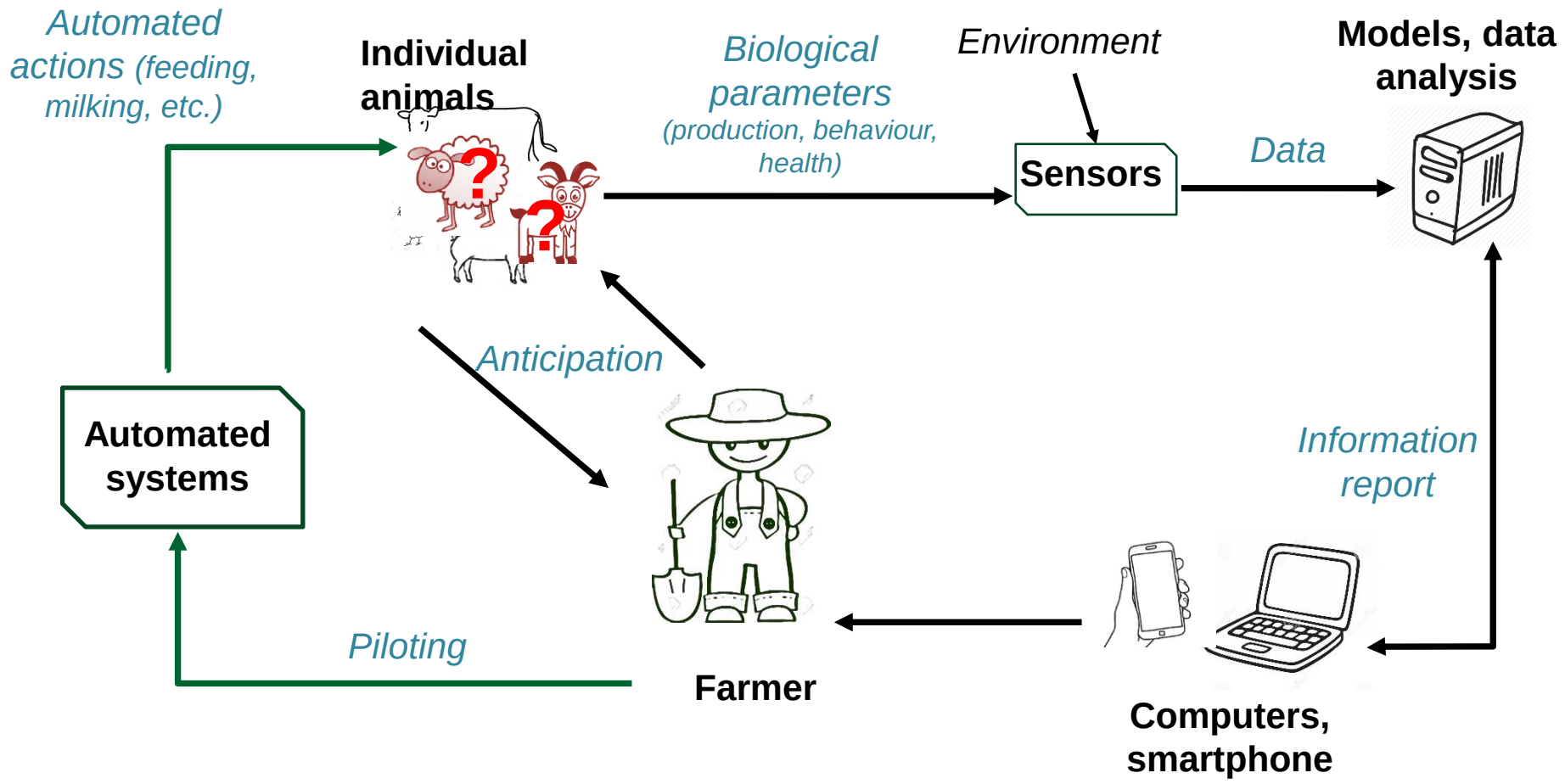
Or to put it another way. Without such data, how can individual hill farmers and crofters know how cost-effective their management is currently, what benefits are arising from changes in farming practices they have implemented, or how their farms and crofts are performing environmentally?

Precision Livestock Farming



Adapted from Ingrand et al., 2018 (69th EAAP: European Federation of Animal Science)

Precision Livestock Farming



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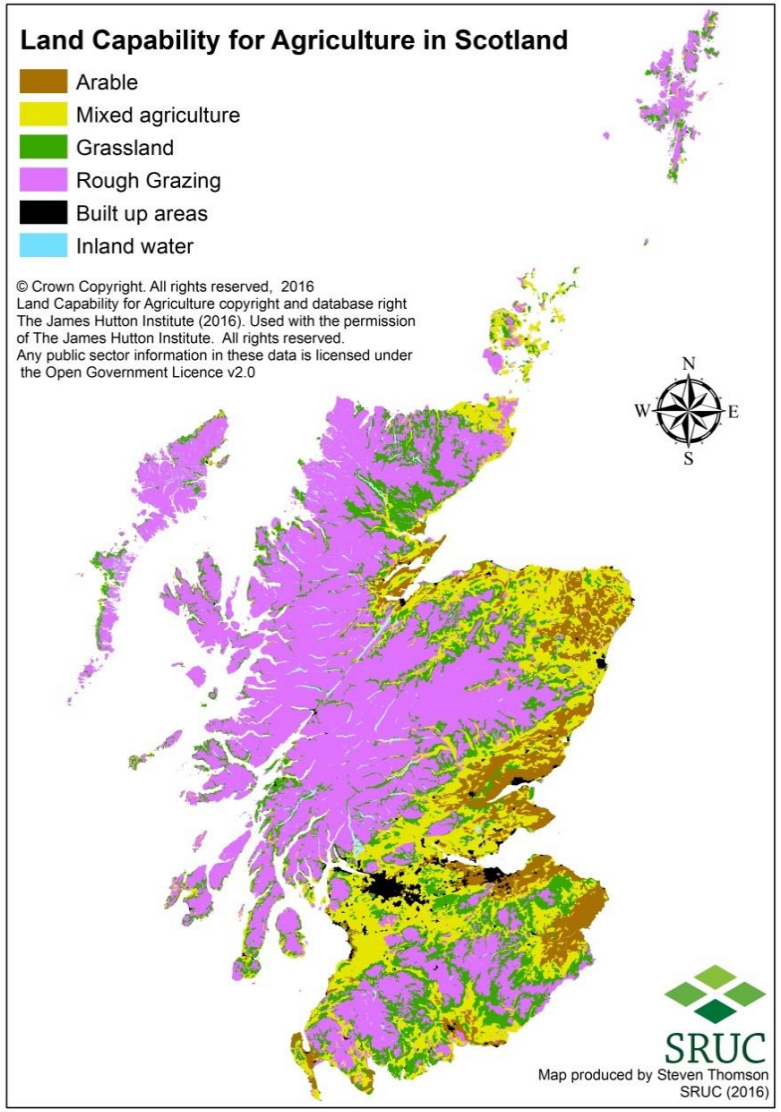
Challenges and Opportunities



- Rangeland/remote
- Harsher environment/survival issues
- Welfare
- Diversity of systems
- Flock/Herd level
- Sector less organised
- More traditional/ageing sector
- Lack of labour
- Less efficiency/low productivity
- Low level of income






Challenges and Opportunities

- Rangeland/remotely based — Monitoring (production, welfare)
- Harsher environment/survival issues — Alerts/warning systems
- Welfare — Alerts/warning systems
- Diversity of systems — Common protocols for collection or monitoring
- Flock/Herd level — Individual monitoring; Data to inform farmer individually
- Sector less organised — Benchmarking; Efficiency gain
- More traditional/ageing sector — Younger generation interest?
- Lack of labour — Better life/work balance; Time saving
- Less efficiency/low productivity — Monitoring; Alerts/warning systems
- Low level of income — Efficiency gain

Challenges and Opportunities

Inbye grasslands
- *Soil pH and nutrients*
- *GHG emissions*
- *Grassland management*
- *Forage & fodder improvements*

Hill grazing
- *Bracken control*
- *Improving hill parks*

Sheep Performance
- *Genetic selections*
- *Blackface and Lleyn*

Flock Performance
- *EID associated kit*
- *TST worming of lambs*
- *Comparison of system trade-offs*

Auchtertyre flock
- *Restocking*
- *Blackloss*
- *Yellowses/Plochteach*

Technology
- *Virtual fencing*
- *Drones for assessments*

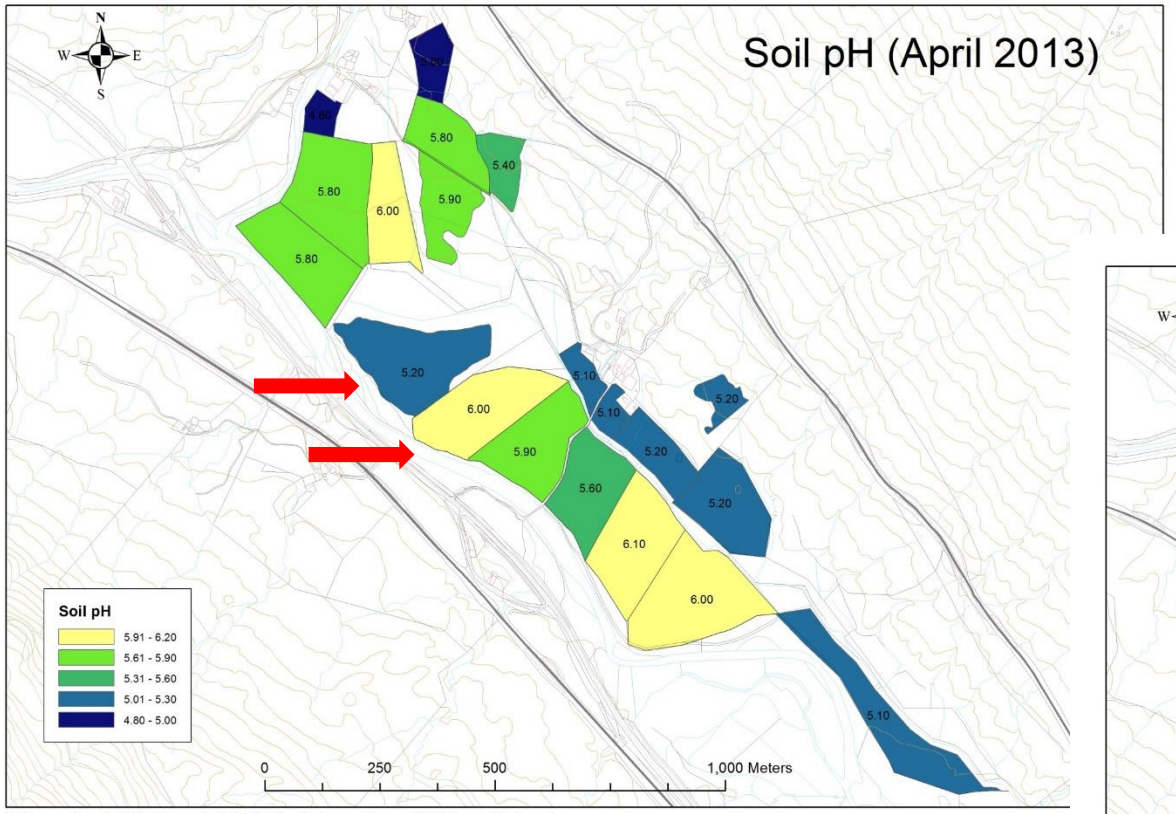
LoRa network
- *Tracking livestock*
- *Sensors*

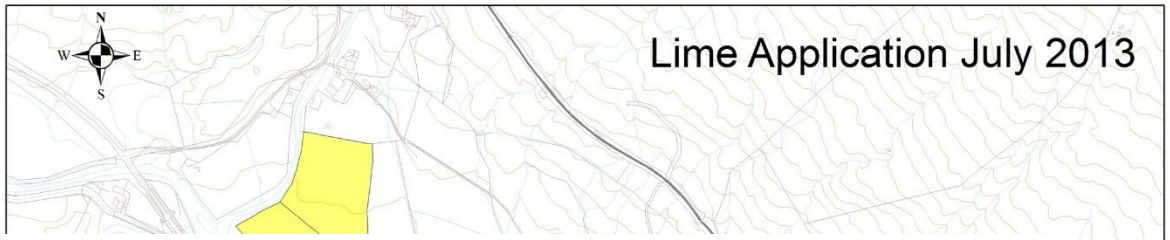
Systems approach to Precision Livestock Farming

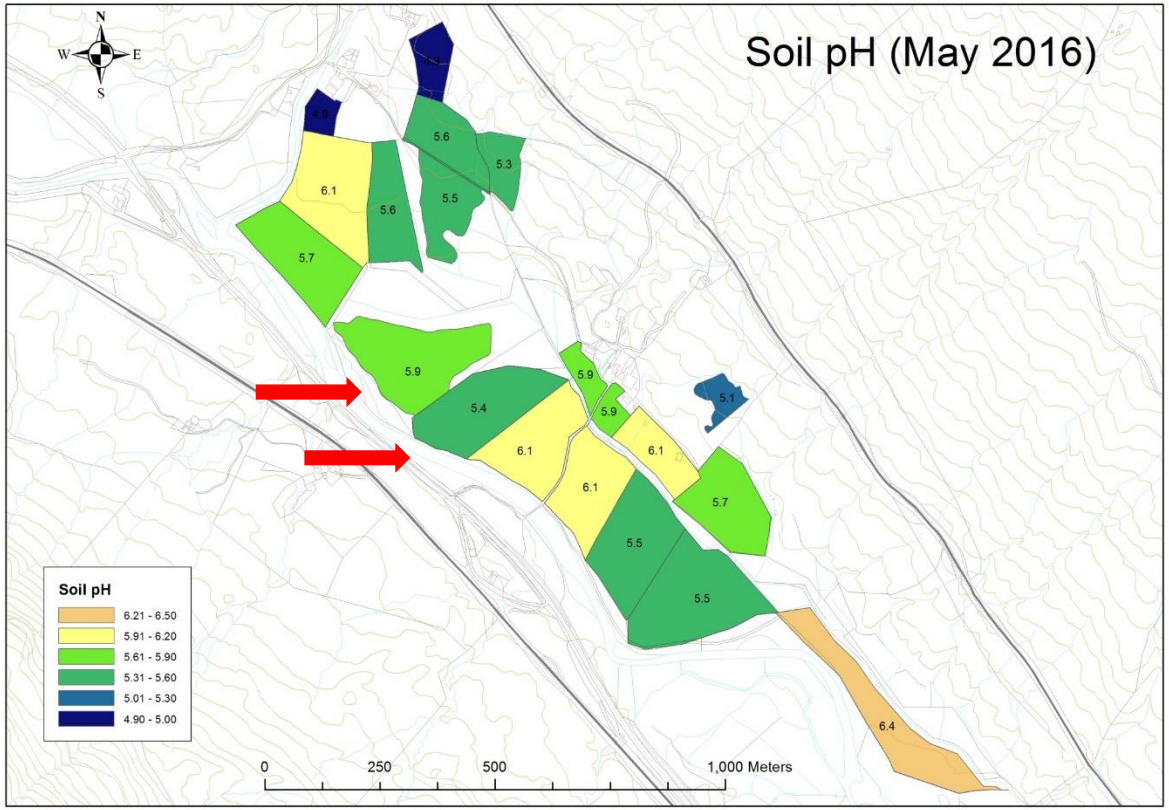




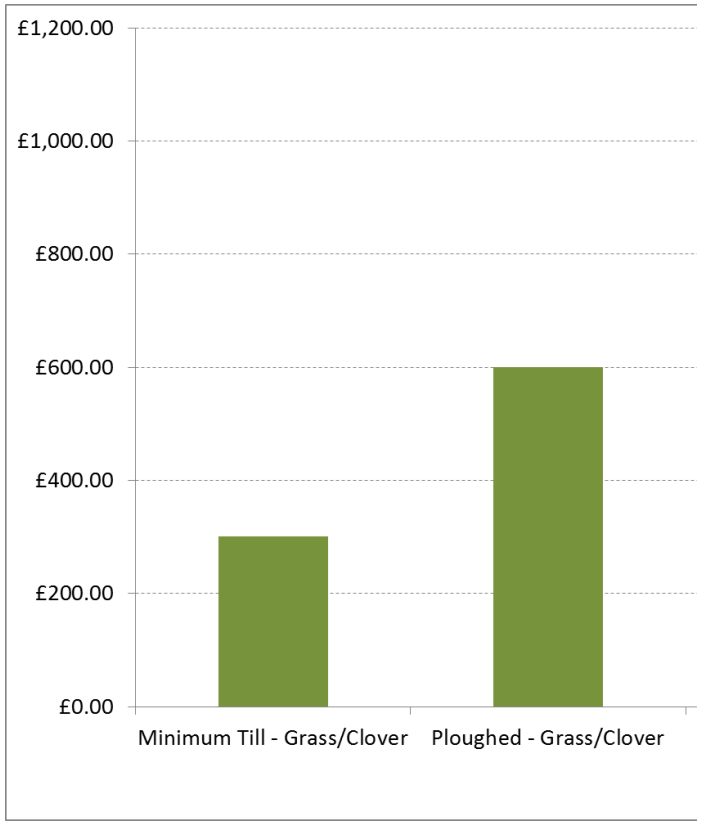

Challenges and **Opportunities**







Challenges and **Opportunities**



Challenges and **Opportunities**

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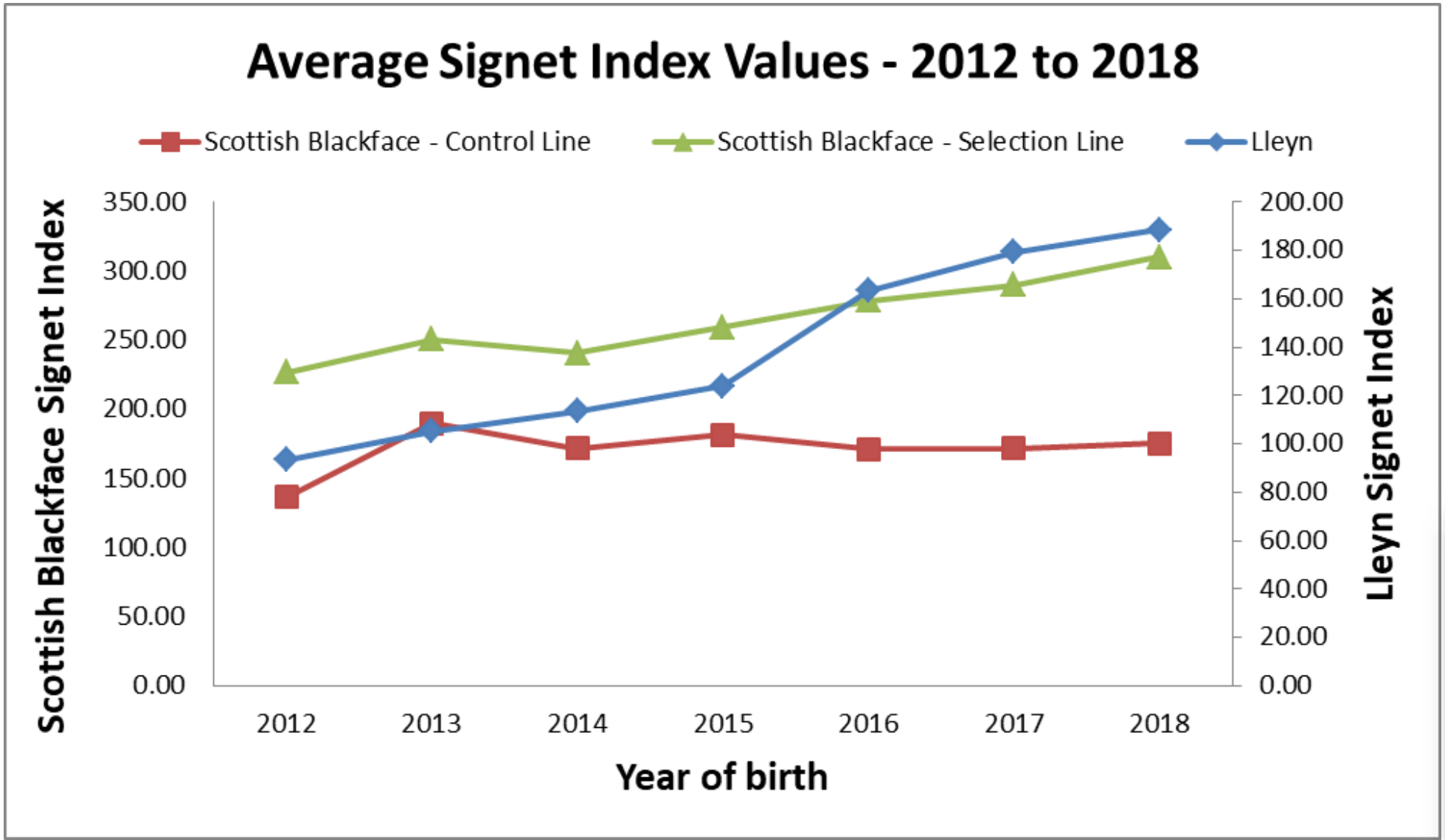
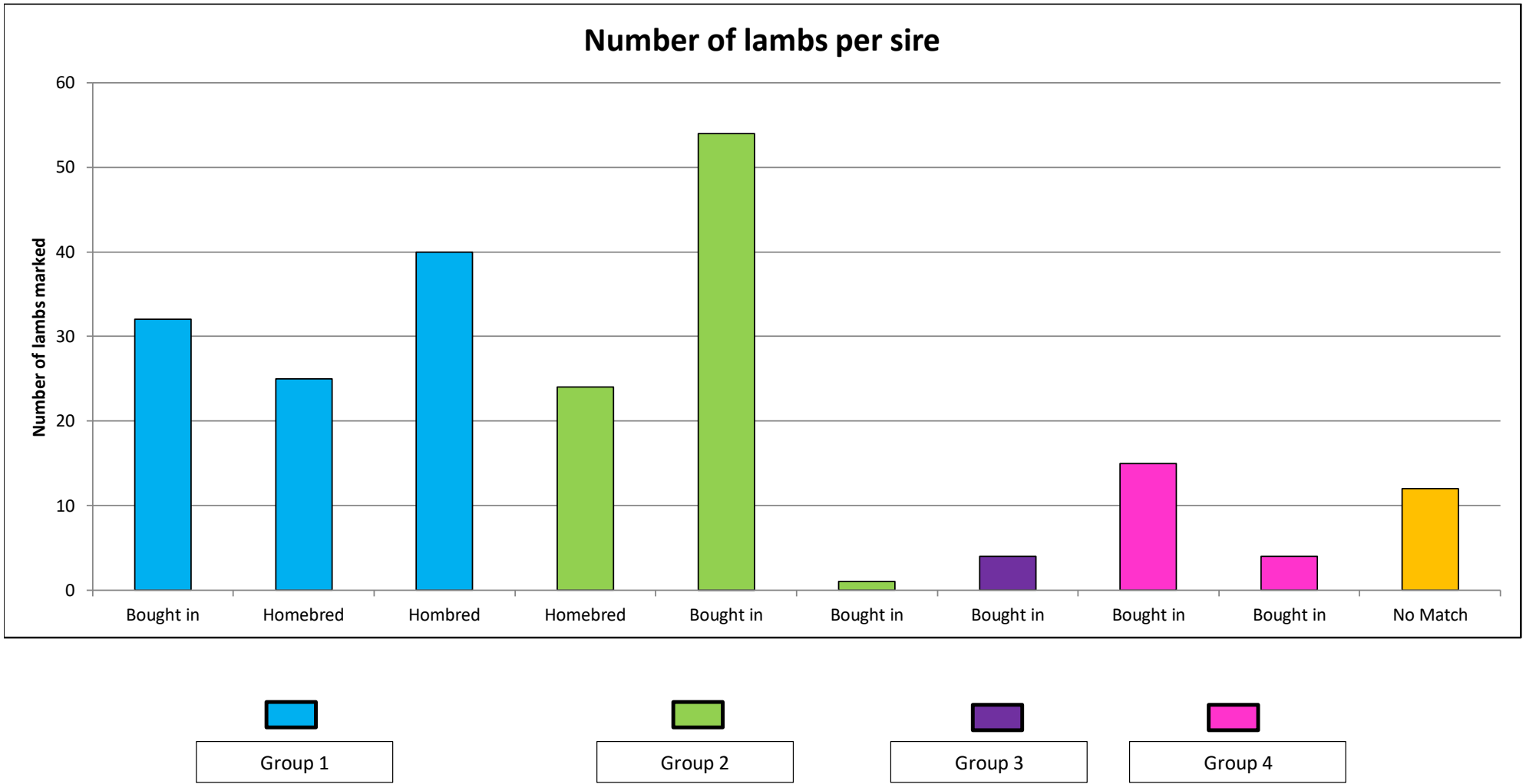


Challenges and Opportunities

McCracken, D. 2018. DNA parentage testing can pick out the finest in the flock. *Press & Journal*, 16th June 2018 https://www.pressreader.com/uk/the-press-and-journal-inverness-highlands-and-islands/20180616/282703342807169



Challenges and Opportunities

				Average over years 2017-19		DLWG of calves		
Cow ID	D.O.B	Origin	Average weaning wt of cow (kg)	Average weaning wt of calves (kg)	Average cow efficiency (%)	DLWG (kg) of calf 2017	DLWG (kg) of calf 2018	DLWG (kg) of calf 2019
UK500842701005	13/03/2012	EG	781	257	33	1.03	1.05	1.19
UK500842101020	10/04/2012	EG	764	280	37	1.23		1.37
UK500842401023	24/04/2012	EG	685	276	40	0.94	1.1	1.23
UK560530301958	03/05/2011	CL	686	278	41	1.23	1.15	1.20
UK542768 500022	07-Mar-15	K&A	514	216	42	0.95	1.21	1.10
UK500842200965	04/05/2011	EG	589	253	43	1.10	1.15	1.05
UK542768 500008	04-Mar-14	K&A	573	249	44	1.14	1.18	1.04
UK500842301022	12/04/2012	EG	641	290	45	1.18	1.24	1.40

Challenges and **Opportunities**

McCracken, D. 2020 Introduction of Beef Shorthorn paid dividends. *Press & Journal*, 20th July 2020.
https://www.pressandjournal.co.uk/fp/business/farming/2348996/introduction-of-beef-shorthorn-paid-dividend

Introduction of Beef Shorthorn paid dividends

We reintroduced a herd of cattle to our Kirkton & Auchtertyre farms seven years ago.

Initially we focused on the 24 Aberdeen Angus cross cows being put to an Aberdeen Angus bull.

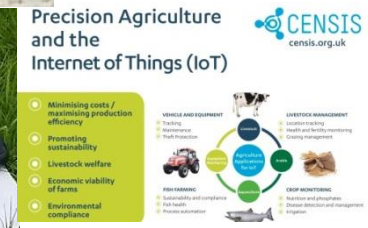
Those Aberdeen Angus cows worked well out on the hill – despite the average 3m of rain per year - for the first four years.

Nevertheless, Ewen Campbell, our farm manager, felt that some of them – especially those with thinner skins - were not coping as well as they should in our extremely harsh environment.

So in 2016, he decided to introduce Beef Shorthorn into the herd. As a result, we now operate a Beef Shorthorn cross Angus criss-cross breeding strategy. And it is working extremely well. So much so in fact that we have now agreed to become one of the Beef Shorthorn Cattle Society's new Focus Farms.

Challenges and **Opportunities**

https://www.youtube.com/watch?v=PJO7-3XSsIU



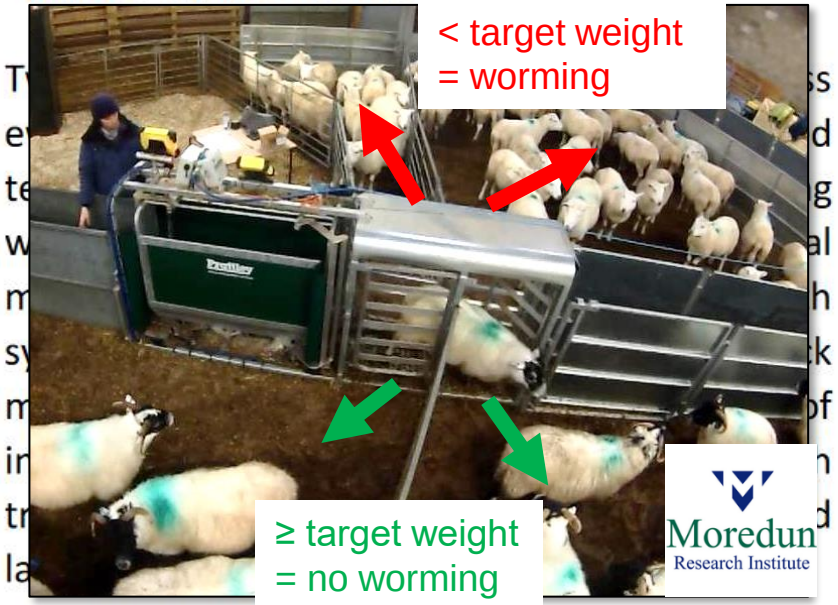
Challenges and **Opportunities**

SRUC

McCracken, D.I. 2017. EID-based equipment helping to improve flock performance. *Press & Journal Farming Supplement*, 10th June 2017.
https://www.pressandjournal.co.uk/fp/business/farming/1260434/undefined-headline-2819/

EID-based equipment helping to improve flock performance

The use of electronic identification (EID) tags has been mandatory in Scotland since 2010 to aid sheep traceability. On SRUC's Kirkton & Auchtertyre upland research farms we have assessed whether the electronic monitoring and logging of information on individual sheep and lambs could provide a powerful management tool.



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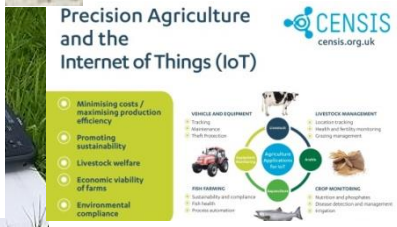

Challenges and **Opportunities**

McCracken, D. 2019 Don't do woolly thinking, collect the data and act. *Press & Journal*, 6th January 2020. https://www.pressreader.com/uk/the-press-and-journal-inverness-highlands-and-islands/20200106/282308207032422

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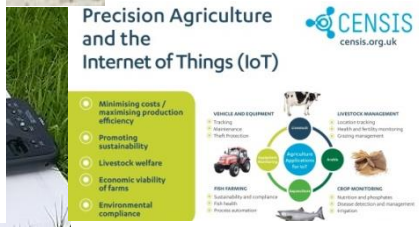
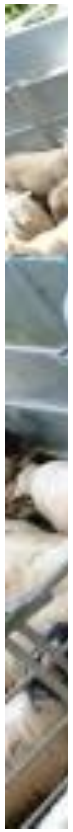


Challenges and **Opportunities**



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Don't do woolly thinking, collect the data and act

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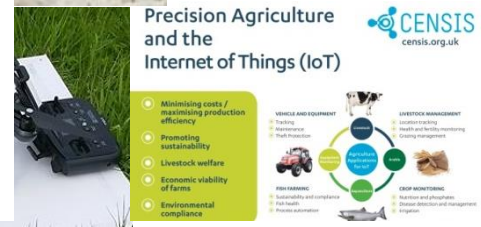


Precision Agriculture and the Internet of Things (IoT)

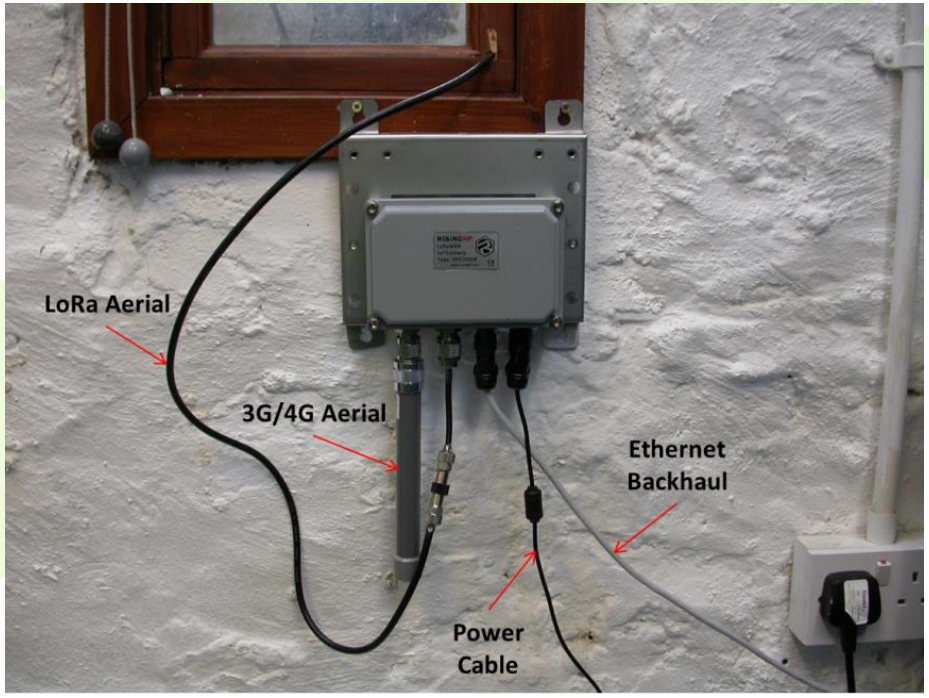
CENSIS
censis.org.uk

SRUC

- **Minimising costs / maximising production efficiency**
- **Promoting sustainability**
- **Livestock welfare**
- **Economic viability of farms**
- **Environmental compliance**

Challenges and Opportunities

- Two indoor ethernet connected gateways, plus two new off-grid 4G connected gateways have been established at Kirkton, enabling data from a range of sensors deployed across the farm to be accessed in near real-time via “The Things Network”.



Indoor ethernet connected LoRa Gateway

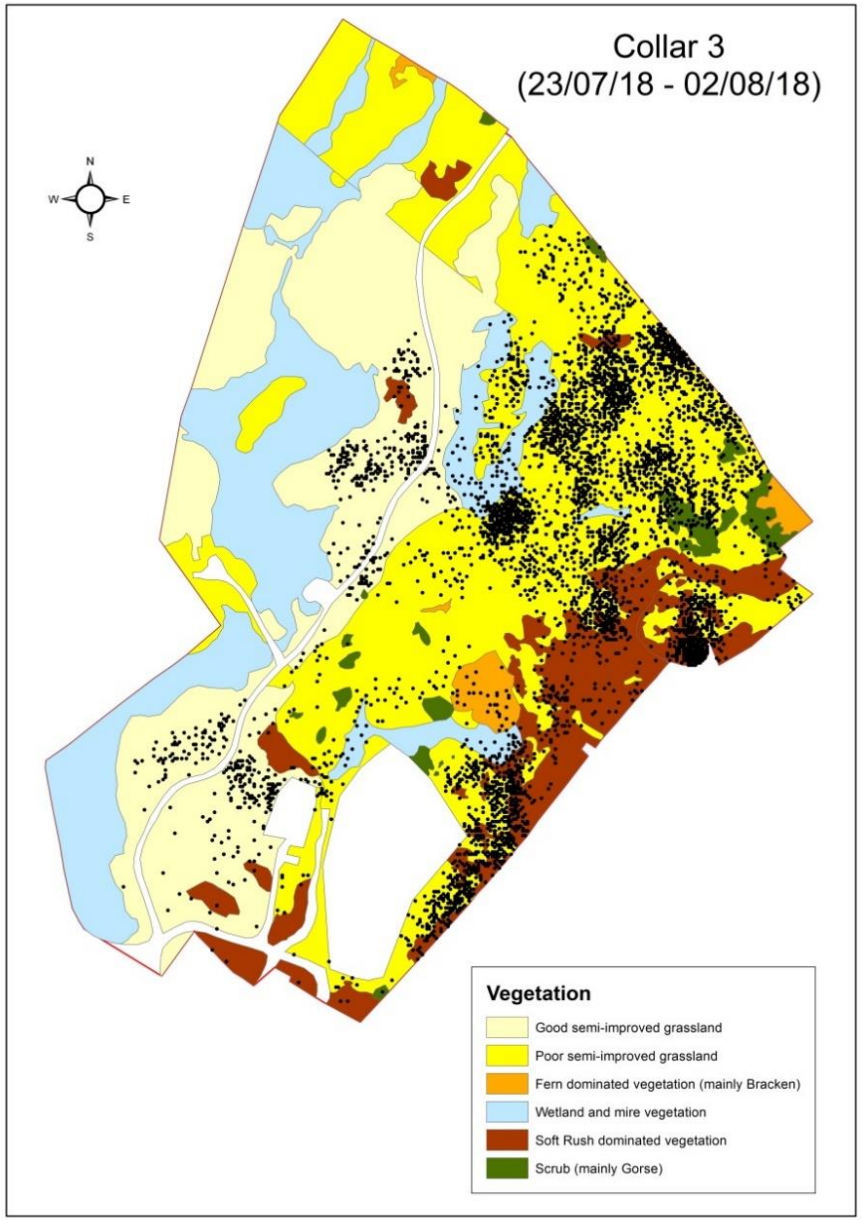
Off-grid 4G connected LoRa Gateway

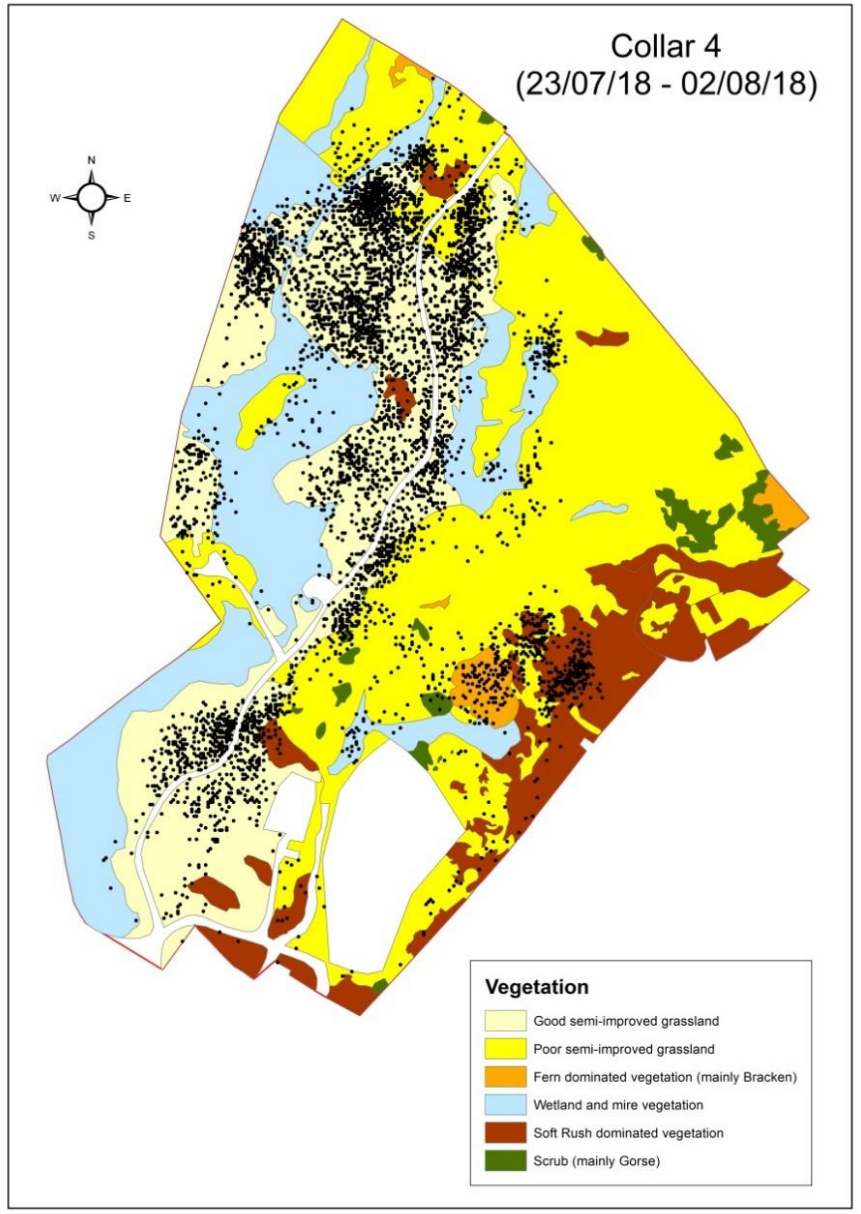
Challenges and **Opportunities**

“Hoofprints” LoRa enabled GNSS unit with three sets of tri-axial motion sensors

Collar and housing

Challenges and Opportunities

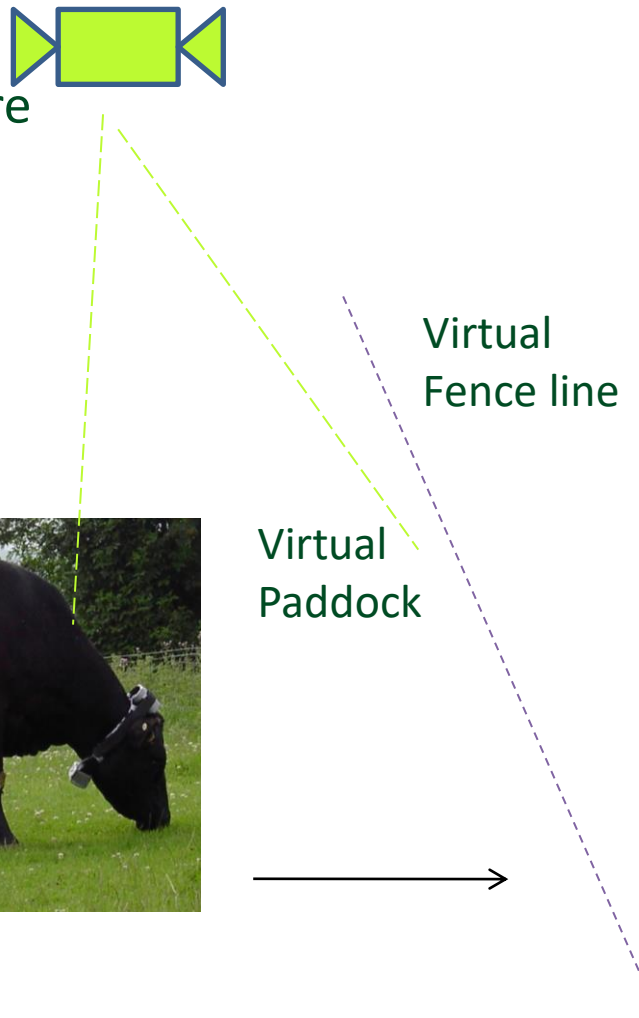




Challenges and Opportunities

- Cattle location (GNSS - GPS) on cow
- Cattle aversive stimulus (e.g. electric shock in collar)
- Geographical information System (GIS) software to create virtual fence line. ‘Geofence’
- Warning signal (sound)

  in buffer area, then shock
- Manage by App/computer
- Part autonomous
- Dots on maps/motion sensors
- Other developments (VH) ;
  - Moving fence muster
  - Strip/paddocks
  - Segregating cattle



Challenges and Opportunities

https://nofence.no/en/

Categories

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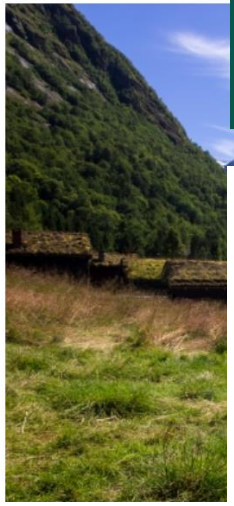

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TECH CARE

Challenges and **Opportunities**

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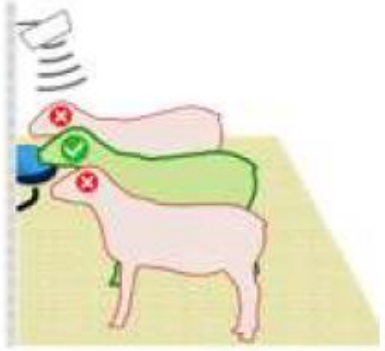
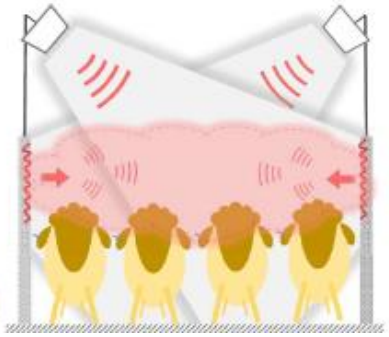
TECH CARE

Challenges and **Opportunities**

RFID UHF – hear tag page up

- Simultaneous multiple readings
- reading distance up to several meters
- Uses :
  - Estimated time spent outdoors
  - monitoring the attendance of area of interest: e.g. water trough
  - monitoring in which order the animals pass through
  - Traceability and counting the number of animals





Challenges and Opportunities

Walk Over Weigh (WoW)

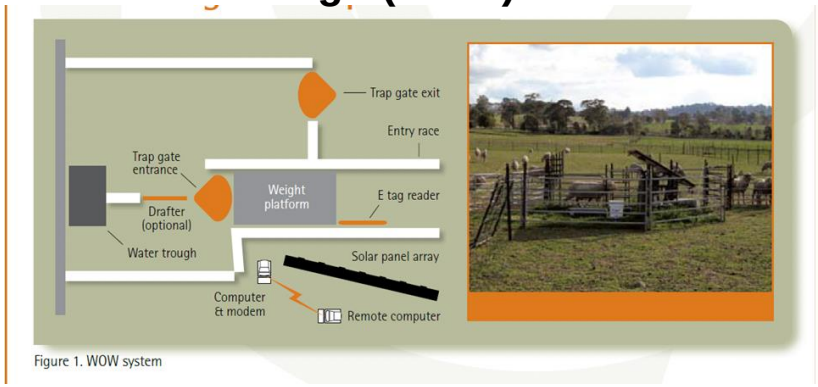
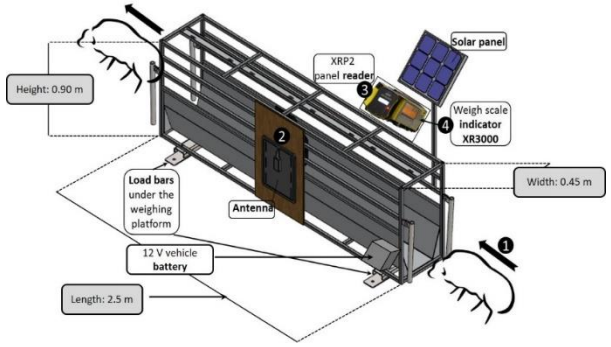
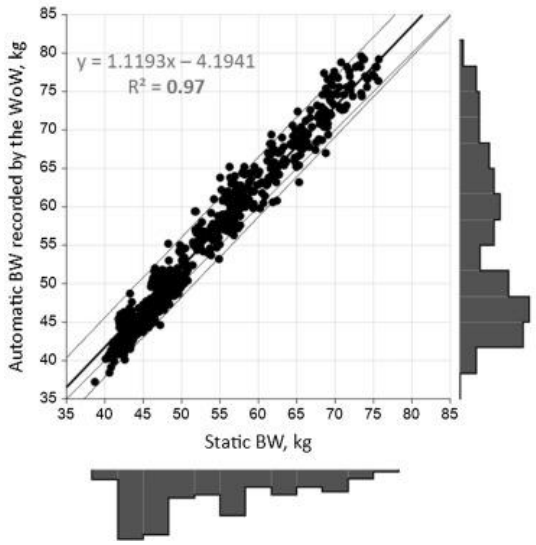


Figure 1. WOW system

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





González-García et al, 2018 (INRA, France)

Blackloss: 1953 (sheep not lambs)

NB Ewe mortality – with 30%-40%+ of mortality attributed to Blackloss

SURVEY OF
BLACKFACE SHEEP

with Special
their Ha

By J. F. ROBI
Animal Breeding Researc

67. BLACK LOSS

One of the notable points of contrast in the records between Central and South Scotland is that in the former area a much higher proportion of the mortality is ascribed to "black loss." The latter comprise the sheep which are missing after accounting for those which are known to be dead (or strayed). The causes of death or disappearance are unknown. This kind of loss is heavier on the wild or "extensive" type of grazings. In these situations, there are more risks of the sheep being lost accidentally through falling into streams or moss-holes. In any case, the ground may be so wide in area that whatever the cause of death, many of the losses are unlikely to come to the notice of the shepherds.

Information to show th

EDINBURGH : HER MAJESTY'S STATIONERY OFFICE






Blackloss: Veterinary Record 2016

Research, Short communication
Preliminary survey of lamb losses (black loss) in Highland sheep flocks
S. C. Tongue, I. Pritchard, D. Watson and B. D. Hosie

In the period 2010–2013, annual lamb mortality estimates for Scottish, less-favoured area, hill, breeding flocks varied from 7 per cent to 17 per cent. These estimates were derived from purebred Blackface and Cheviot flocks. The preliminary investigation aimed to explore the level of losses experienced by a wider population of sheep farmers in the Highlands and Islands areas of Scotland. There were two components: first, a **questionnaire survey** and, second, **a more detailed study of five holdings:**






Blackloss: Live lamb losses

	Year 1 -Actual EID Tagged Lambs Black Loss Project					
Reported Total Lambs Tagged	392	295	536	233	600	2056
Unaccounted Lamb Losses	86	31	88	60	135	400
BLACK LOSS	**21.9%**	**10.5%**	**16.4%**	**25.8%**	**22.5%**	**19.5%**
	Year 2 - Actual EID Tagged Lambs Black Loss Project					
Reported Total Lambs Tagged	437	346	520	201	1503	3007
Unaccounted Lamb Losses	55	29	69	40	348	541
BLACK LOSS	**12.6%**	**8.38%**	**13.27%**	**19.90%**	**23.15%**	**18%**

Challenges and **Opportunities**

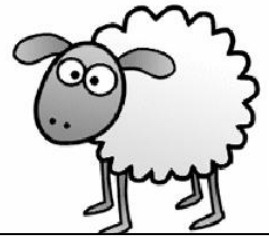
Who?

When?

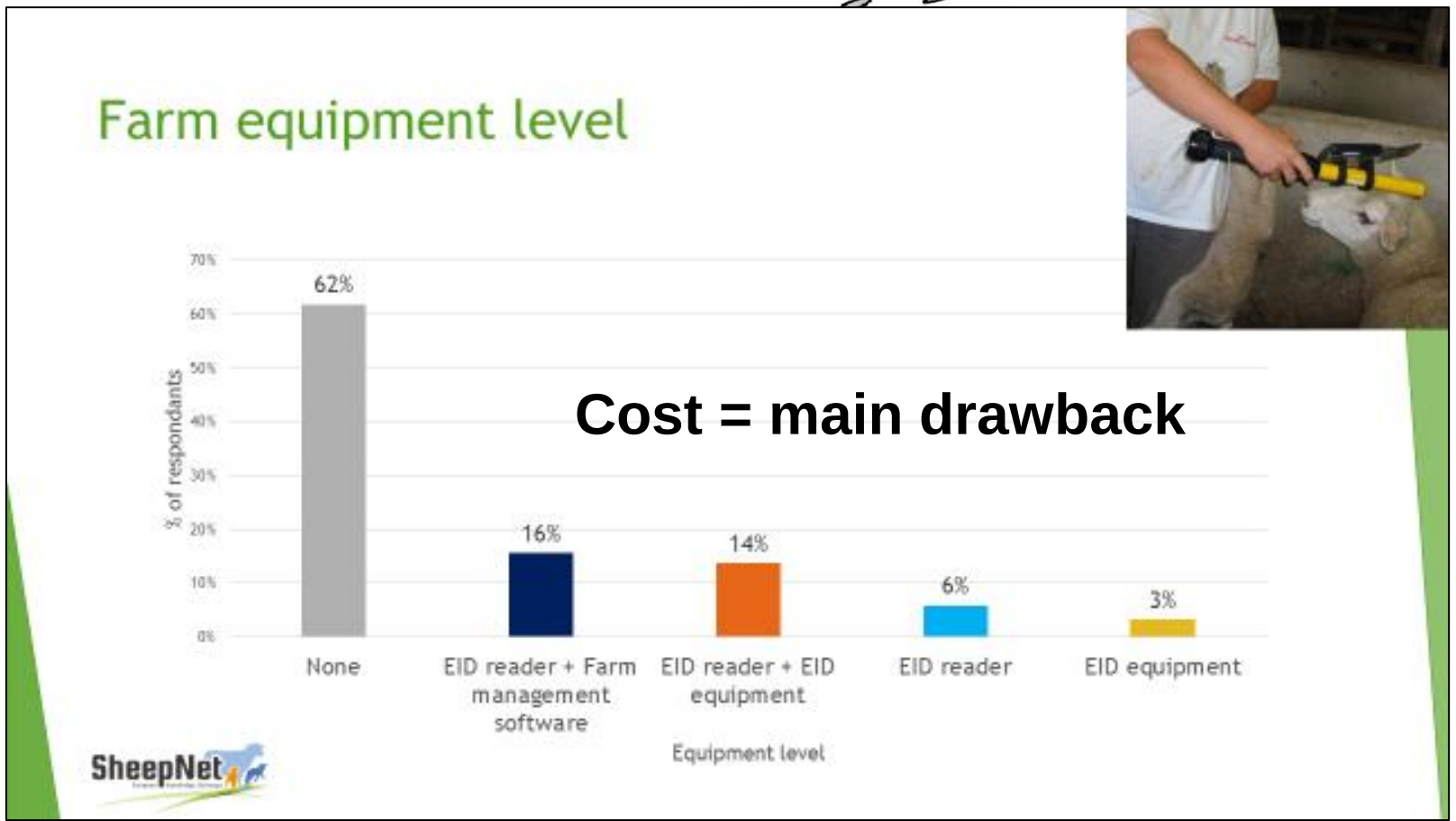
Why?

Challenges and Opportunities

- Acceptability (incl. price)
- Affordability for farmers



PLF??



Gautier et al. 2019, SheepNet project

SheepNet European Knowledge Exchange

EuroSheep European Knowledge Exchange

https://eurosheep.network/

TECH CARE

https://www.facebook.com/TechCareproject/

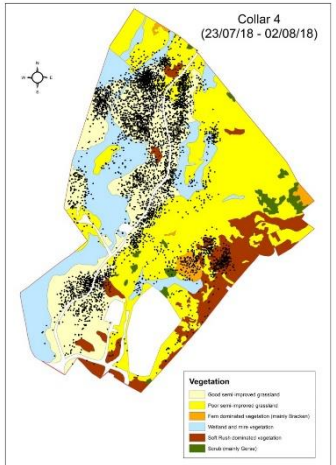
Challenges and Opportunities

McCracken, D. 2020 New flock technology is worth training support. *Press & Journal*, 26th September 2020. https://www.pressreader.com/uk/the-press-and-journal-inverness-highlands-and-islands/20200926/282540135777672

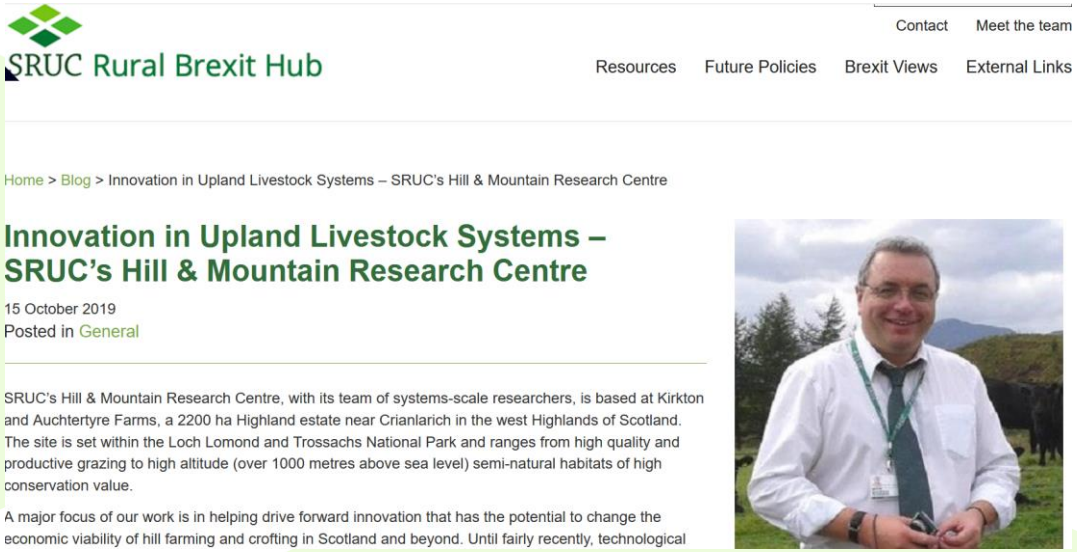
New flock technology is worth training support

Six years ago we hosted a visit to the farms by Scottish Government officials and farmers from around Scotland delivering the first round of Farming for a Better Climate Monitor Farms.

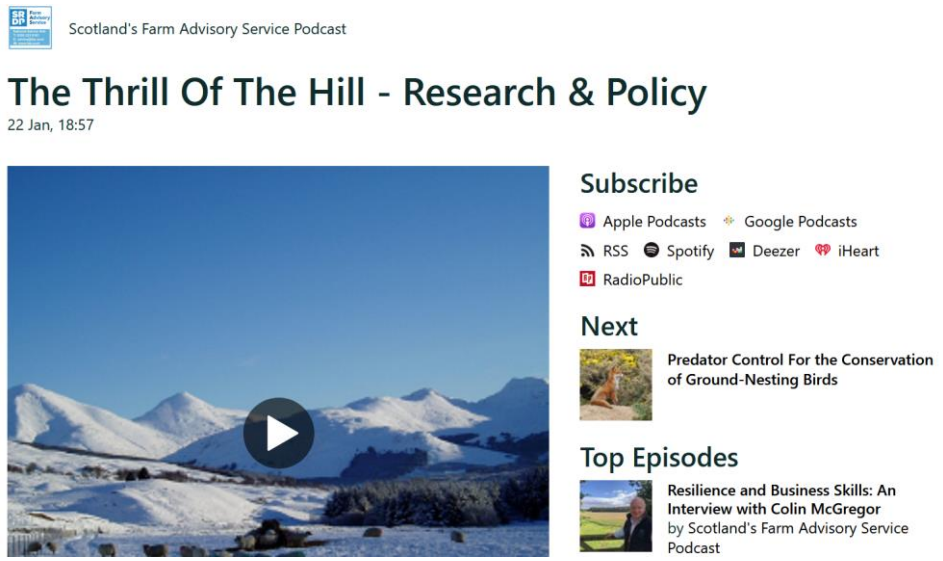
During that visit – as with all farmer and consultant visits to the farms – we demonstrated the use of our weigh-crate and autodrafter.



More detailed information available at:



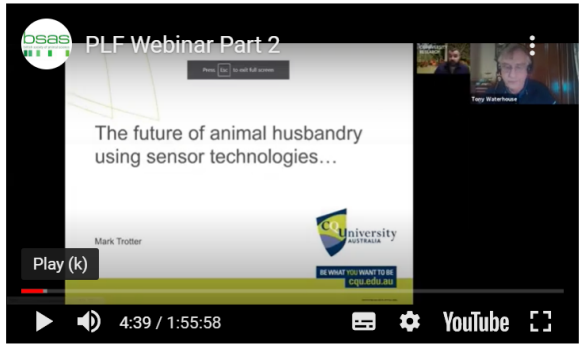
Articles: https://www.ruralbrexit.scot/innovation-in-upland-livestock-systems-srucs-hill-mountain-research-centre/



Podcast: https://audioboom.com/posts/7751837-the-thrill-of-the-hill-research-policy

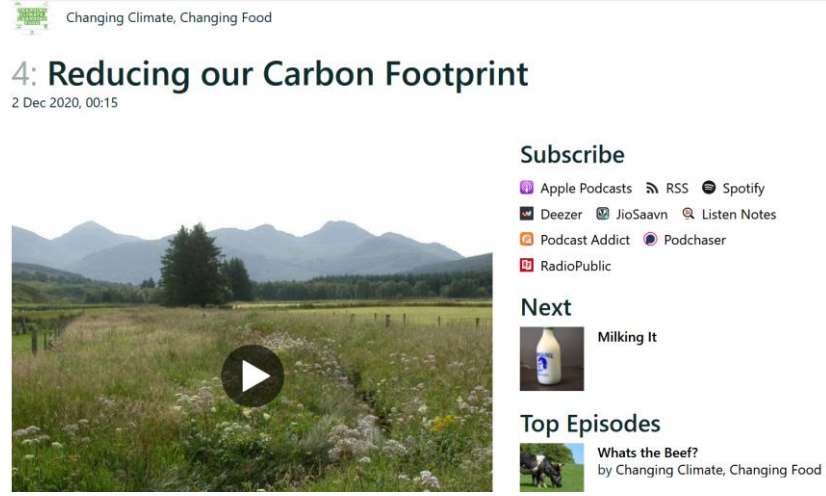
Presentations: https://youtu.be/PbeAV7K-5zM

19 NOV 2020 PLF WEBINAR PART 2



PRECISION LIVESTOCK FARMING AND SENSING TECHNOLOGY IN EXTENSIVE GRASSLAND SYSTEMS WEBINARS

Presentations: https://youtu.be/5odQjJMKsQY5zM



Podcast: https://audioboom.com/posts/7741480-reducing-our-carbon-footprint

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