

*Rural Futures: Adaptation to Challenges faced by  
Scotland's and Ireland's Rural Communities*  
13<sup>th</sup> March 2018, SRUC-Teagasc Conference, Edinburgh



# Hill farming in Scotland: a fragile farming system?

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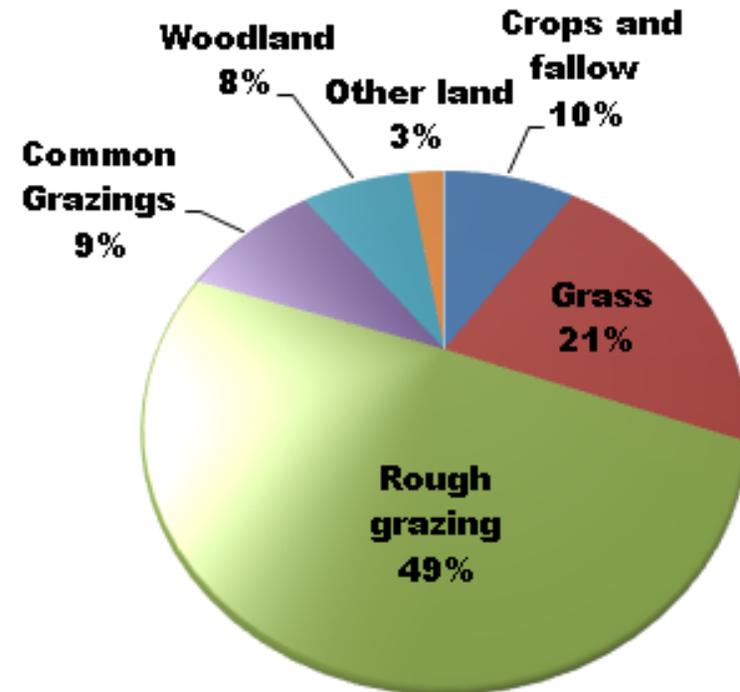


*Leading the way in Agriculture and Rural Research, Education and Consulting*

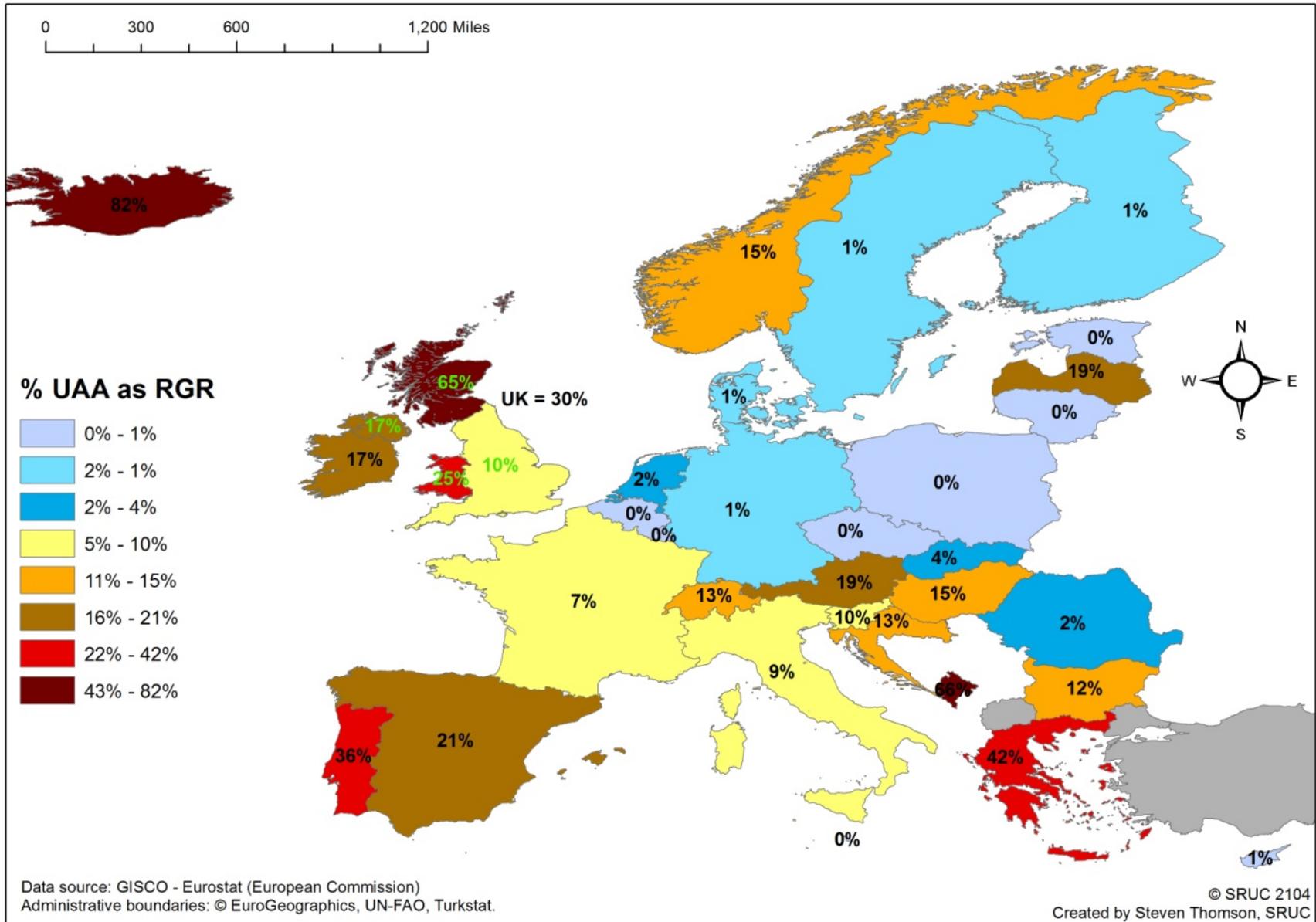
# General Introduction



- Around 60% of Scottish farmland is rough grazing
- Only 10% is used for cropping
- A fifth of agricultural land is grassland
- Government drive to increase Scotland's woodland cover from 18% to 25%....farmland has a role to play as trees not allowed to be planted on deep peatlands



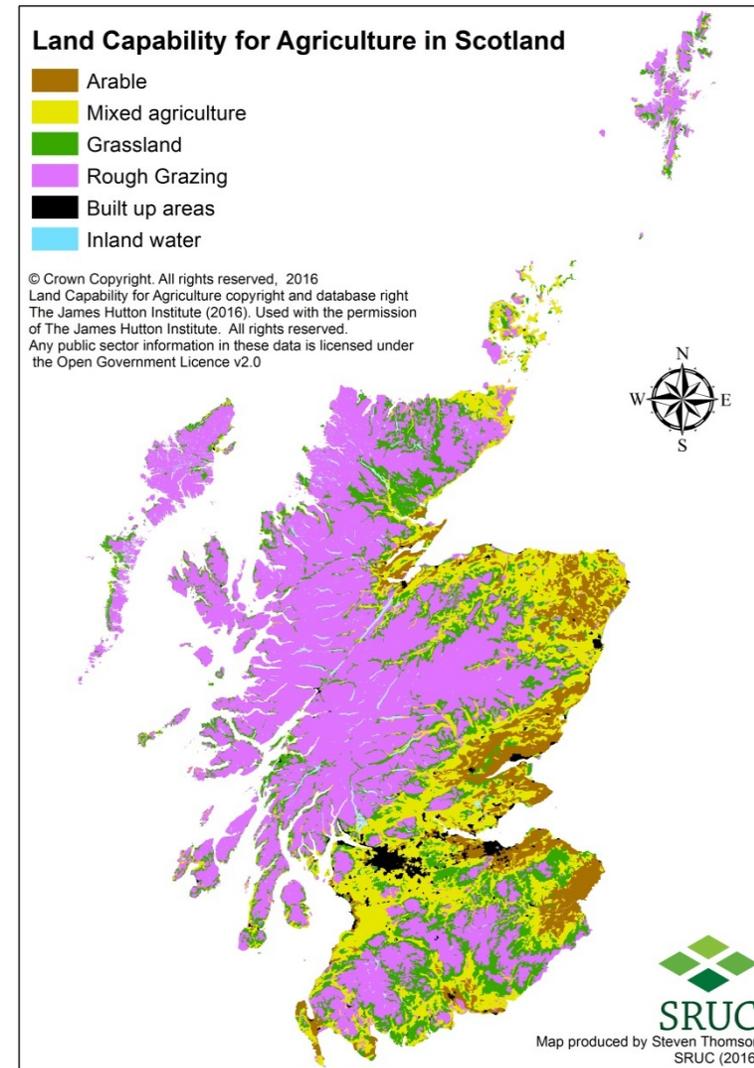
# Scotland & Rough Grazing



# Constrained Farming Systems



- Scottish farming is significantly constrained by poor land (85% classed as Less Favoured Area)
- About 54,000 agricultural holdings in Scotland covering 5.7 million ha
- Around 20,000 farm businesses claiming direct CAP support
- Around 19,400 registered crofts (about 13,000 crofters) with about 1,100 common grazings (covering 584,000 Ha)



# The importance of CAP



- CAP remains important for the profitability of much of Scottish agriculture, but particularly so in the uplands

2014-15	LFA Sheep	LFA Cattle	LFA Cattle & Sheep	Cereal	General Cropping	Dairy	Lowland Cattle & Sheep	Mixed	All Types
Costs as % Output	140%	118%	125%	116%	106%	93%	110%	118%	<b>113%</b>
CAP as % of Output	60%	38%	48%	20%	17%	8%	28%	24%	<b>27%</b>
CAP as % of FBI	282%	184%	201%	204%	123%	53%	143%	339%	<b>173%</b>

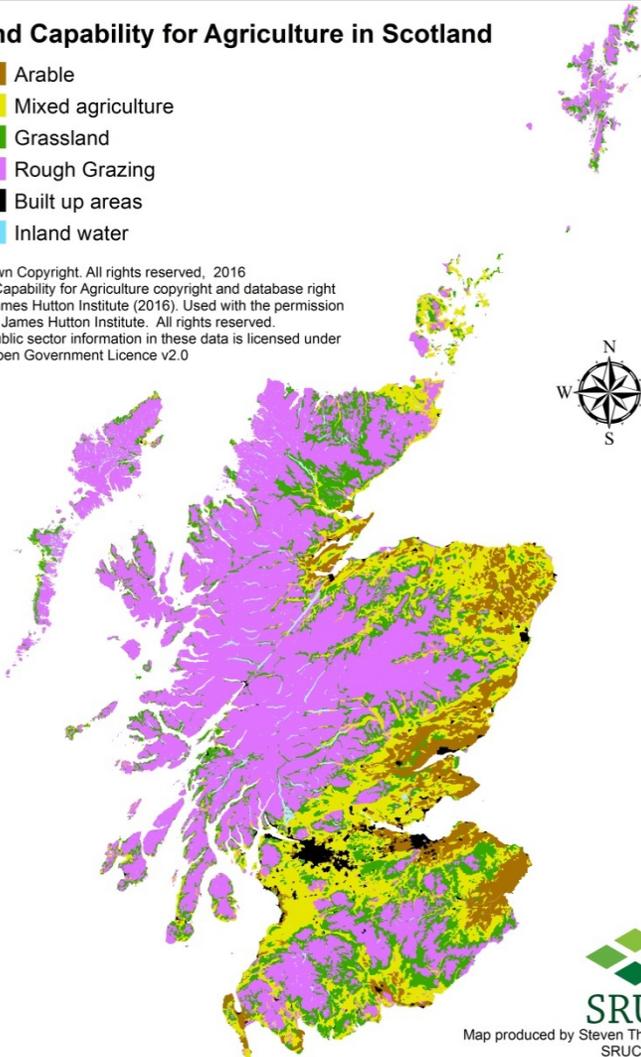


# Scottish uplands not just topographical!

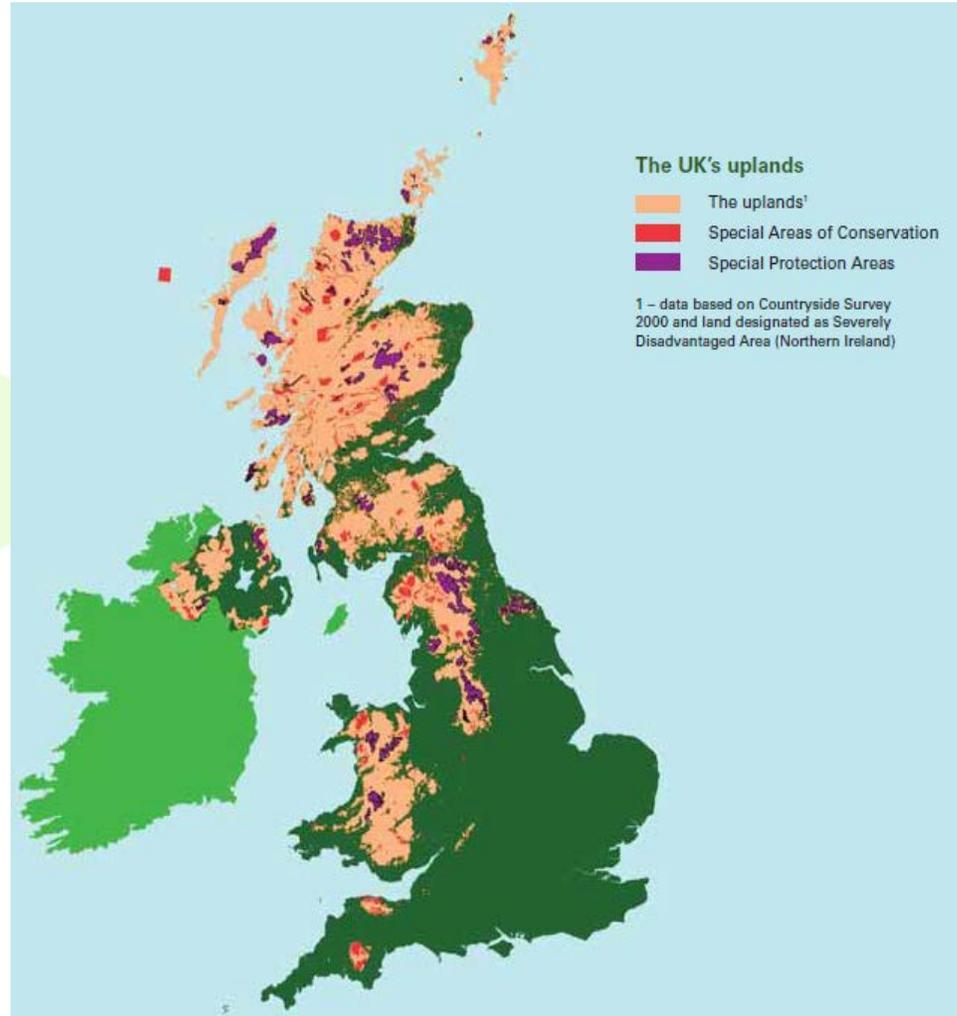
## Land Capability for Agriculture in Scotland

- Arable
- Mixed agriculture
- Grassland
- Rough Grazing
- Built up areas
- Inland water

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Land Capability for Agriculture copyright and database right  
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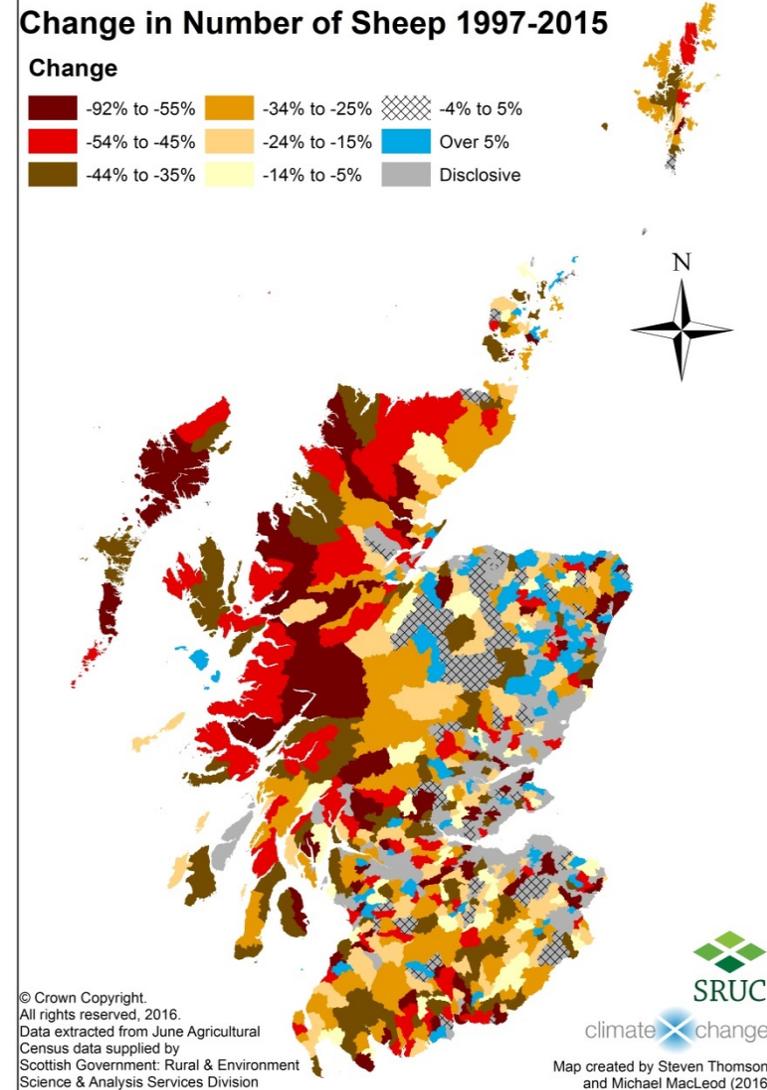
Map produced by Steven Thomson  
SRUC (2016)



# Sheep: a changed landscape



- Large reduction in sheep population - particularly in the West Coast
- Some farms/crofts reducing sheep numbers altogether
- Other farms/crofts reducing flock sizes and concentrating on only part of the grazing resource

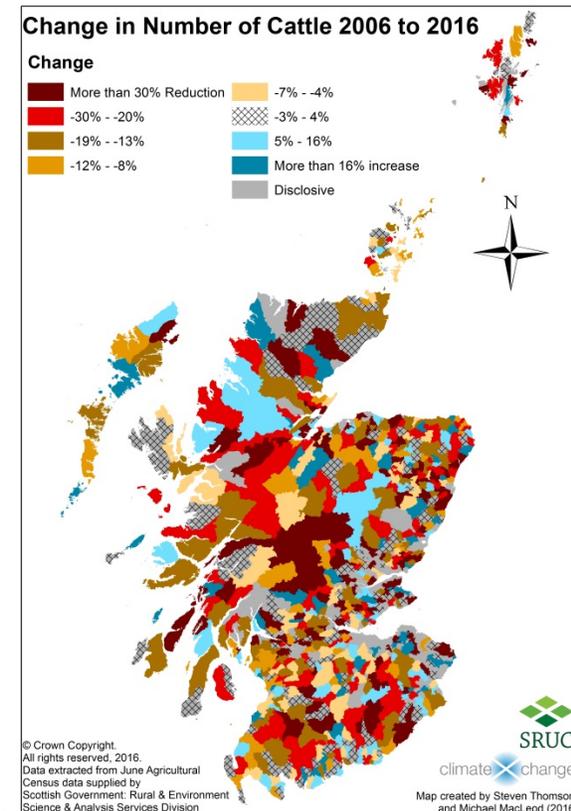
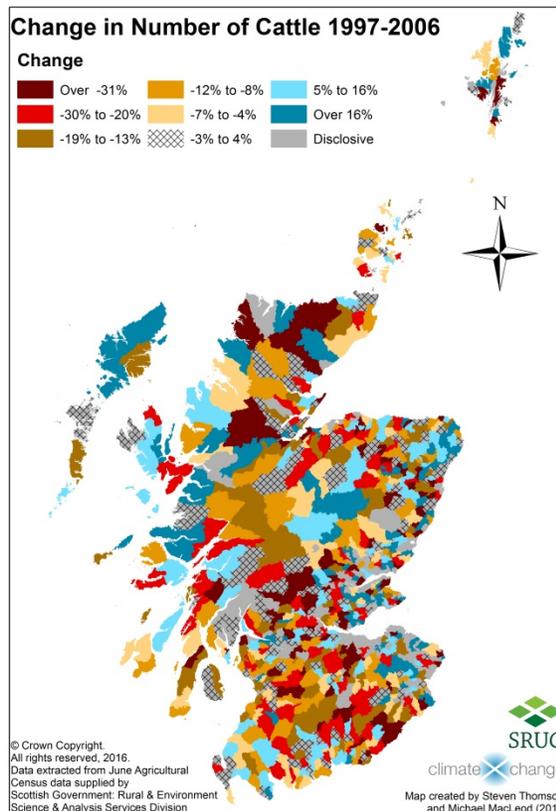
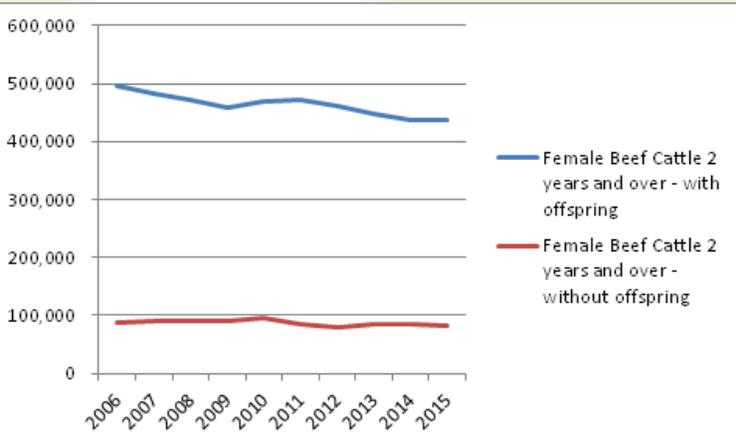


# Beef – a gradual decline



- *Suckler herd well spread across the country*
- *North East has higher concentration of finishing animals*
- *11% decline since 2006*

Region	Holdings with Beef	
	Cows (over 2)	Beef Cows over 2
Eastern Scotland	2,129 21%	133,103 25%
Highlands & Islands	3,879 37%	139,164 27%
North Eastern Scotland	1,493 14%	83,395 16%
South Western Scotland	2,861 28%	167,120 32%
Scotland	10,362	522,782

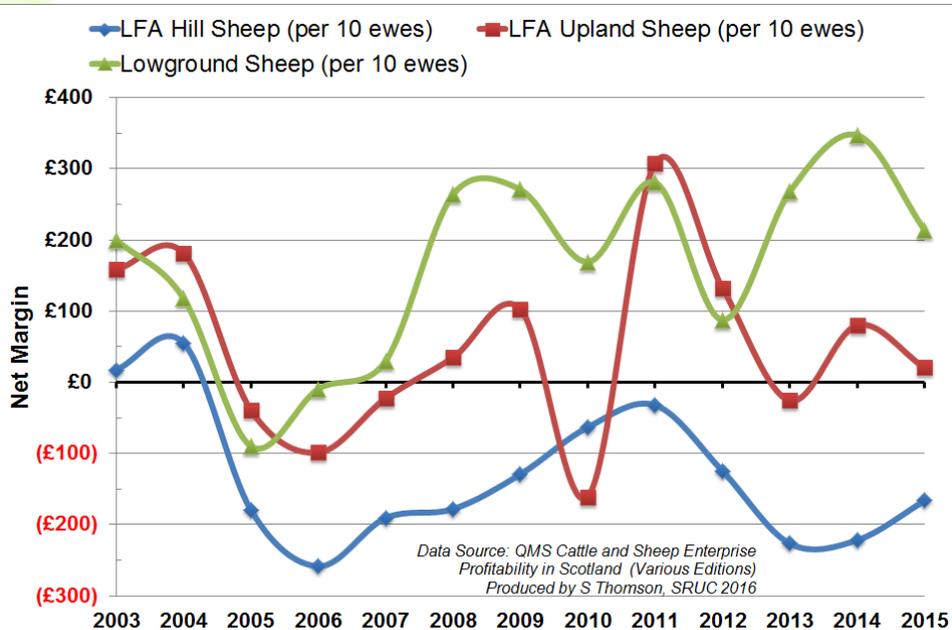


# Financial Performance

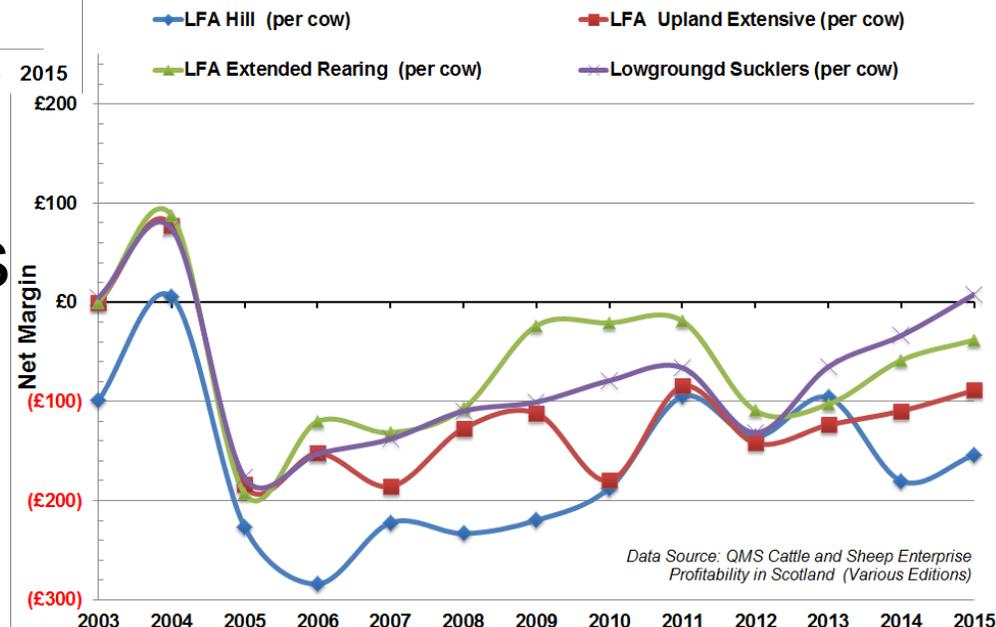


SRUC

- Despite good prices in recent years, hill sheep remain largely unprofitable



- Despite good beef prices suckler cows remain largely unprofitable



## Range of agricultural production challenges, e.g.:

- Low productivity
- Poor nutrition
- Pests and Disease
- Climate change
- Predation
- Blackloss

Low lambing percentages in spring and/or Low survival of lambs through to autumn



# Range of public goods which hill farming & crofting has a role in providing:



# Loch Lomond and The Trossachs National Park Boundary

## Legend

-  National Park boundary
-  Local Authority boundary

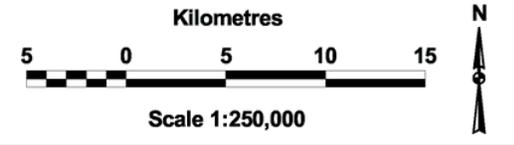
**Argyll & Bute**

**SRUC Kirkton and Auchtertyre**

**Perth & Kinross**

**Stirling**

**West  
Dunbartonshire**



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# Innovation = Doing Things Differently



## Inbye grasslands

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

## Systems approach to Precision Livestock Farming



### Precision Agriculture and the Internet of Things (IoT)



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



# Innovation = Doing Things Differently



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## Sheep Performance

- *Genetic selections*
- *Blackface and Lleyn*

## Hill grazing

- *Bracken control*
- *Improving hill parks*

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**Precision Agriculture and the Internet of Things (IoT)**



**Minimising costs / maximising production efficiency**

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- Environmental compliance

**VEHICLE AND EQUIPMENT**

- Tractors
- Harvesters
- Field sensors

**LIVESTOCK MANAGEMENT**

- Location tracking
- Health and fertility monitoring
- Grazing management

**IoT ADDRESSING**

- Sustainability and compliance
- Risk reduction
- Precision agriculture

**CSM MANAGEMENT**

- Nutrition and phytotherapy
- Disease detection and management
- Irrigation

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

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**EID**



**EID  
readers**



# Innovation = Doing Things Differently



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



**Precision Agriculture and the Internet of Things (IoT)**

**CENSIS**  
censis.org.uk

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

**VEHICLE AND EQUIPMENT**

- Tractors
- Harvesters
- Field sensors

**LIVESTOCK MANAGEMENT**

- Health and fertility monitoring
- Genetic management

**DATA ANALYSIS**

- Accessibility and compliance
- Big Data
- Process automation

**ON-FARM INFRASTRUCTURE**

- Networks and algorithms
- Control structures and management
- Integration

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## Auchtertyre flock

- *Restocking*
- *Blackloss*
- *Yellowses/Plochteach*

## Technology

- *Virtual fencing*
- *Drones for assessments*

## LoRa network

- *Tracking livestock*
- *Sensors*

# Systems approach to Precision Livestock Farming



## Precision Agriculture and the Internet of Things (IoT)



- *Minimising costs / maximising production efficiency*
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# Innovation = Doing Things Differently



## Precision Agriculture and the Internet of Things (IoT)



Sensors > Gateway > Cloud > Mobile/Laptop



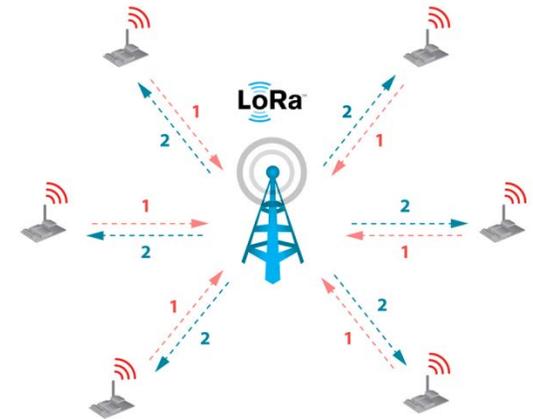
## Precision Agriculture and the Internet of Things (IoT)



# Internet of Things



- LoRaWAN ?
  - long range/low power communications platform
  - >10 miles range in rural areas
  - ideal for
    - deployment of sensors and devices where small amounts of data are transmitted periodically
    - when a given event occurs.
- LoRa network :
  - established at SRUC Kirkton & Auchtertyre
  - covers most of the 2,200 ha of the upland research farms.
  - First LoRa network covering a remote, rural location in the UK and as such is a unique resource.



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# Systems approach to Precision Livestock Farming

## Diversification

- *Wigwam business*
- *Peatland Restoration & Environmental management*
- *Woodland creation*

## Of direct relevance to:

- UK & Ireland
- Europe & International



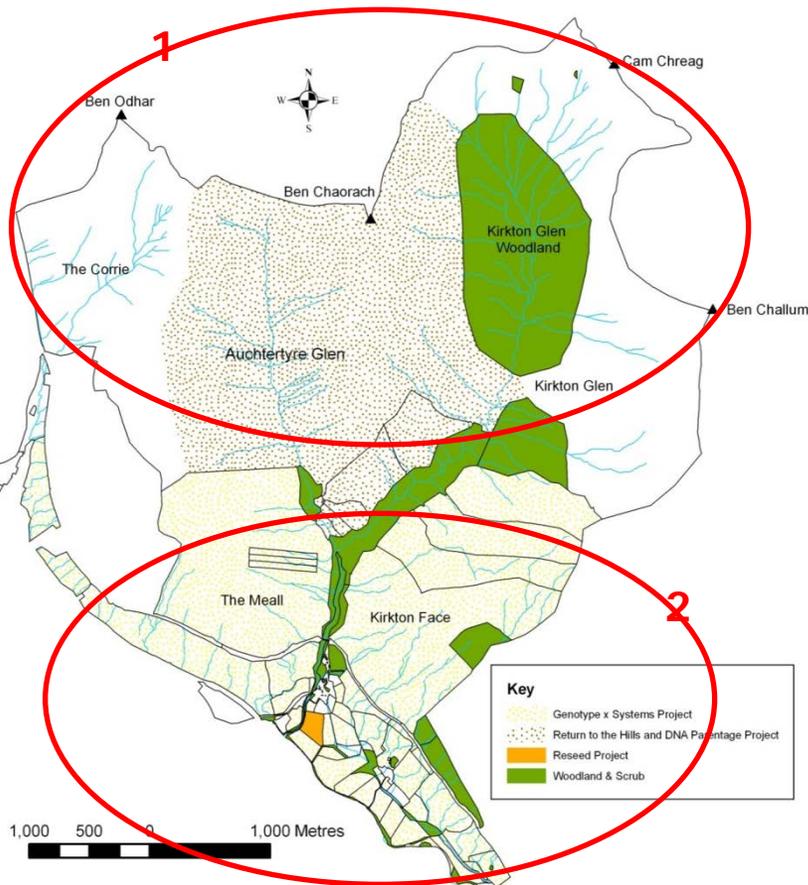
# Ongoing Research at SRUC Kirkton & Auchtertyre



(1) Ecosystem services stocks and flows – compare and contrast ‘rewilded’ area with continuous grazed upland moorland pastures. With Moredun Research Institute and University of Stirling

(2) Compare and contrast production, economic, animal health, animal welfare, wider sustainability of two new alternative systems – building on previous good practice, optimising use of grazing resource versus maximising outputs

(3) Increasing research collaborations with local (e.g. LLTNP, SNH) and wider European (e.g. Idele, INRA, University & Limerick, Teagasc) and International (e.g. AgResearch, CIRAD)



# Scottish Government funded 2016-21: Compare and contrast two alternative sheep systems



## Complementary work:

BBSRC Resilience of UK food systems in a global context 2017-2021: *Livestock's role in food system resilience in remote, upland regions*

Scottish Government funded 2017: *Quantifying the impact of hill sheep farming on the wider economy and social fabric of rural areas*

ERA-NET SusAn funded 2017-2020: *Animal Futures – Steering Animal Production Systems Towards a Sustainable Future*

[https://www.submission-era-susan.eu/lw\\_resource/datapool/items/item\\_253/susan\\_cofundedcall\\_results-list\\_published.pdf](https://www.submission-era-susan.eu/lw_resource/datapool/items/item_253/susan_cofundedcall_results-list_published.pdf)

ERA-NET SusAn funded 2017-2020: *SusShep – Sustainable Sheep Production*

[https://www.submission-era-susan.eu/lw\\_resource/datapool/items/item\\_253/susan\\_cofundedcall\\_results-list\\_published.pdf](https://www.submission-era-susan.eu/lw_resource/datapool/items/item_253/susan_cofundedcall_results-list_published.pdf)

H2020 funded SheepNet 2016-2019: *Sharing Expertise and Experience towards sheep Productivity through NETWORKING*

<https://ec.europa.eu/eip/agriculture/en/content/sheepnet-sharing-expertise-and-experience-towards-sheep-productivity-through-networking>



# Scottish Government funded 2016-21: Compare and contrast 'rewilded' area with continuous grazed upland moorland



## Complementary work:

Scottish Government (Seeking funding opportunities): *Blackloss in Sheep - Investigating timing of occurrence and potential causes*

Innovate UK funded 2016-17: Geolocation tracking of livestock in extensive systems

National Sea Eagle Stakeholders Group 2017 onwards

[https://www.sruc.ac.uk/news/article/1718/video\\_davy\\_mccracken\\_joins\\_national\\_sea\\_eagle\\_stakeholder\\_group](https://www.sruc.ac.uk/news/article/1718/video_davy_mccracken_joins_national_sea_eagle_stakeholder_group)

Scottish Government funded 2017: Working for Waders

<http://www.moorlandforum.org.uk/working-for-waders>

Scottish Government funded 2015-16: Understanding Predation

<http://www.moorlandforum.org.uk/understanding-predation-report-launch>

University of Stirling and SRUC funded PhD 2016-2020: *A catchment-based approach to determine environmental controls of Cryptosporidium transfer from land to water*



# Innovation = Doing Things Differently



Precision Agriculture and the Internet of Things (IoT)



## Engineering & Technology

Systems & ecology

Knowledge Transfer



## Biological Sciences



For more detail see: [http://www.sruc.ac.uk/news/120252/hill\\_and\\_mountain\\_research\\_centre](http://www.sruc.ac.uk/news/120252/hill_and_mountain_research_centre)

# Acknowledgements

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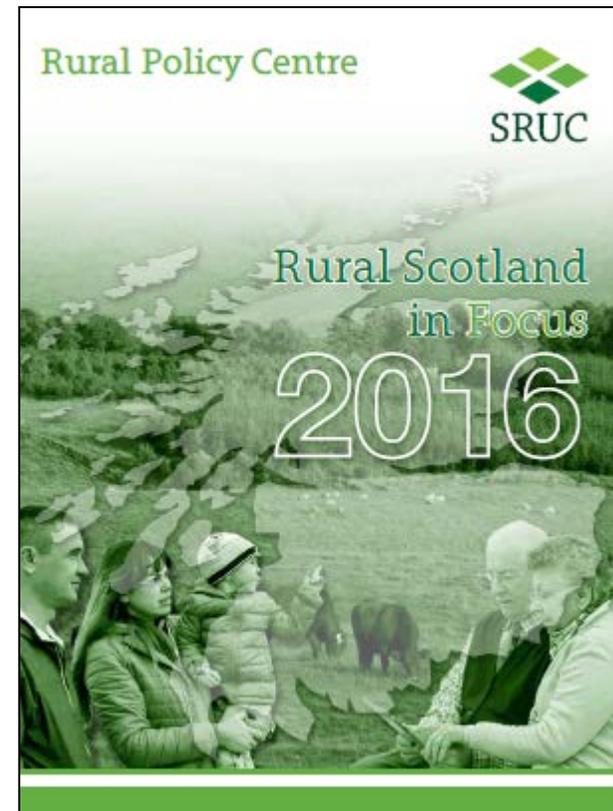
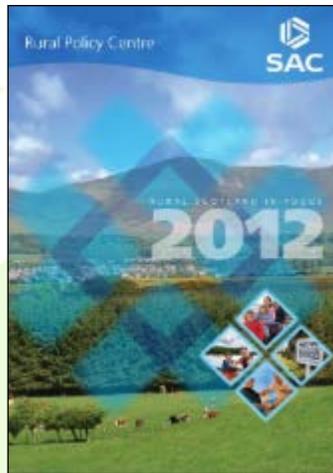
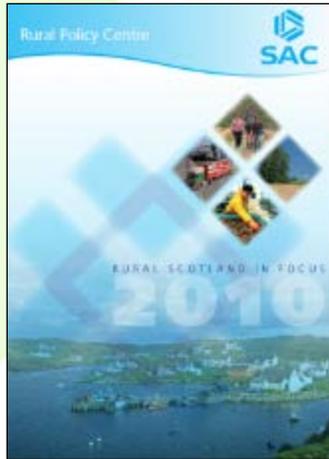


Much of the research presented here was funded by the **Rural & Environment Science & Analytical Services Division** of the **Scottish Government** through their **2011-2016** and **2016-2021 Strategic Research Programmes**

Additional funders of research from 2016 onwards include:

- **The European Commission's H2020 Research & Innovation Programme**
- **Defra under the ERA-NET SusAn (Sustainable Animal Production) Programme**
- **Global Food Security's 'Resilience of the UK Food System Programme'**, with support from **BBSRC, ESRC, NERC and Scottish Government.**

# *Rural Scotland in Focus Series*



1. Fast-track to evidence
2. Commentary on key themes
3. Compendium of resources
4. Insight into changes over time



## Changing Land Management

### Agriculture – time for change?

- Scottish agriculture is constantly **changing**. However, the farming sector is in the midst of the most **fundamental reforms** of the Common Agricultural Policy in over a generation.
- **Uncertainty** leads to a drop in investment; important long-term system changes are postponed.
- Farmers need to grasp the nettle and **make changes** to improve technical **efficiency**, business **viability**, and improve the **vibrancy** of the sector – increasing the attractiveness of farming as a career choice..
- The farming population is ageing. There is a need to allow the **younger generation** to implement **new ideas** and take new approaches to farming, by stimulating quicker **intergenerational transfer** of farms and profits.
- It is time to revisit the Scottish Government's *Future of Scottish Agriculture: A Discussion Document* and create a **roadmap for success** during this unprecedented period of policy transition.

### Outcomes from different landownership models:

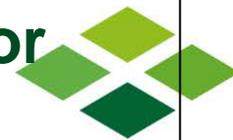
- Policy shifts have increased pressure on landowners to deliver **public benefits** and involve **communities**. All landowners face **challenges**: financial pressures, public and political perceptions and expectations, uncertainty and conflict.
- Some diversification of landownership types has occurred, with different outcomes: **Private estate owners** emphasise long-term estate viability and deliver economic impacts. **NGO landowners** play a key role in conservation, delivering economic and social outcomes. **Community landownership** rebuilds community capacity, confidence, increases employment, investment, housing and reduces out-migration.
- 'New' landownership models can increase **rural resilience**. Pro-active **community engagement** and **partnership** by private landowners can enhance community outcomes.

### What future for woodland and forestry in Scotland?

- A **goal** exists to increase Scottish woodland and forest cover from **18% to 25% by 2050** to achieve economic, environmental and social **benefits**.
- This goal faces **practical** and **climate change-related challenges**.
- Existing **planting targets** of 10,000 ha of new woodland and forest each year between 2012 and 2022 are currently **falling short** of the goal.
- Information and guidance exists to address these challenges. However, **leadership is needed** to change attitudes and perceptions on the ground towards woodland and forest management and creation.
- Scottish Government, its Divisions and agencies will need to work even more in **partnership** with forestry and wider rural land use representatives to achieve the desired increase in woodland and forestry.



## • Agriculture – Time for Change?



SRUC

- Steven Thomson with
- Andrew Barnes
- Julian Bell
- Gavin Hill
- Robert Logan
- David Keiley

## • Outcomes from different land ownership models

- Rob McMorran

## • What future for woodland and forestry in Scotland?

- Davy McCracken

# Sheep



- 28% of Scottish holdings have sheep enterprises
- Scotland has about 21% of the UK's breeding flock and nearly 5% of EU flock
- Rear over 3 million lambs per year with about ¼ retained for breeding flock
- Scotland slaughters around 1.3 million lambs p.a. in 19 abattoirs
- High concentration: 29% of breeding flock on 4% (514) of the holdings with sheep & 58% on 1,500 holdings (12%)

Region	Holdings with Breeding Ewes	Breeding Ewes
Eastern Scotland	2,208 17%	874,791 34%
Highlands & Islands	7,016 55%	834,114 32%
North Eastern Scotland	1,069 8%	166,022 6%
South Western Scotland	2,421 19%	729,258 28%

Flock Size	Holdings with Breeding Ewes	Breeding Ewes
less than 10	1,699 13%	8,657 0.3%
10-50	4,119 32%	101,746 4%
50-100	1,679 13%	118,435 5%
100-250	2,146 17%	346,959 13%
250-500	1,478 12%	529,576 20%
500-1,000	1,079 8%	751,410 29%
Over 1,000	514 4%	747,402 29%
<b>Scotland</b>	<b>12,714</b>	<b>2,604,185</b>

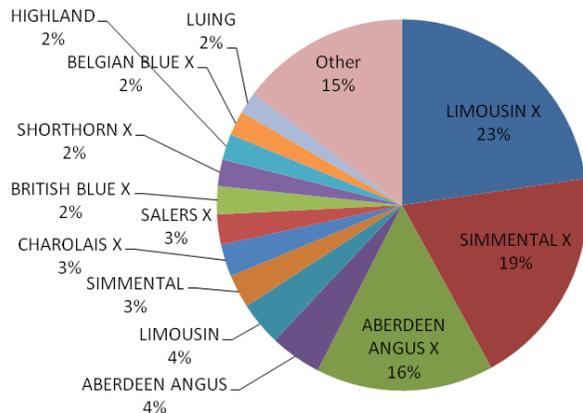
*Data Extracted from June Agricultural Census*

# Beef

- Over 28% of Scottish agricultural output from beef at £827m inc. £681m from finished livestock.
- Scotland has 28% of UK breeding herd
- 10,788 holdings with 709,000 beef cows with 11,880 with 1.8 million cattle
- 22 beef abattoirs
- Beef industry dominated small number of breeds

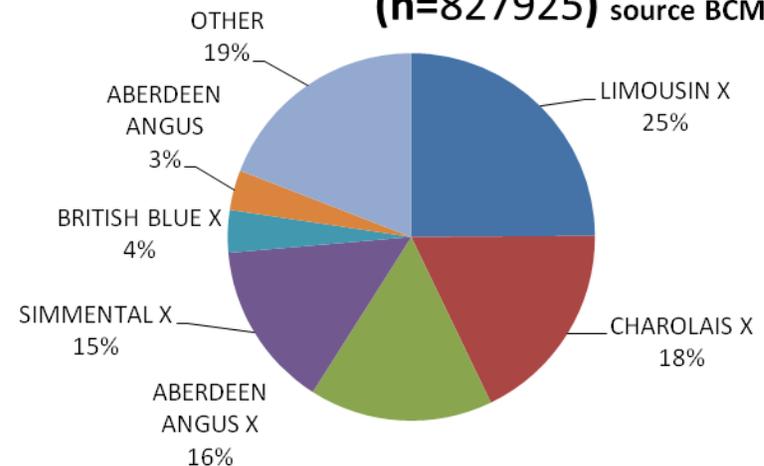
**Beef Cattle Over 3yrs, 2016**

(n=827925) source BCMS



**Beef Cattle Under 2, 2016**

(n=827925) source BCMS



# Beef: a lot doing it but highly concentrated



- Highly concentrated
  - 54% cows on 15% holdings with herds > 100 cows
  - 31 holdings have 10% of the male animals >1yr
  - 577 (6%) holdings have 45% of the male cattle > 1yr

	Holdings	Beef Cows over 2
<10	3,416 33%	13,250 3%
10-50	3,414 33%	88,024 17%
50-100	1,940 19%	139,407 27%
100 - 200	1,185 11%	160,419 31%
200-500	379 4%	101,231 19%
>500	28 0.3%	20,451 4%
Scotland	10,362	522,782

	Holdings	Males > 1
<10	5,151 53%	17,375 6%
10-50	3,194 33%	76,415 27%
50-100	877 9%	60,498 22%
100 - 200	383 4%	51,582 18%
200-500	163 2%	46,767 17%
>500	31 0.3%	26,528 10%
Scotland	9,799	279,165



# SheepNet

Sharing Expertise and Experience towards  
sheep Productivity through **Networking**



**6 EU countries – 80% EU sheep flocks**

**1. France**

- Idele
- INRA
- Efficient Innovation

**2. United Kingdom**

- Scotland – SRUC

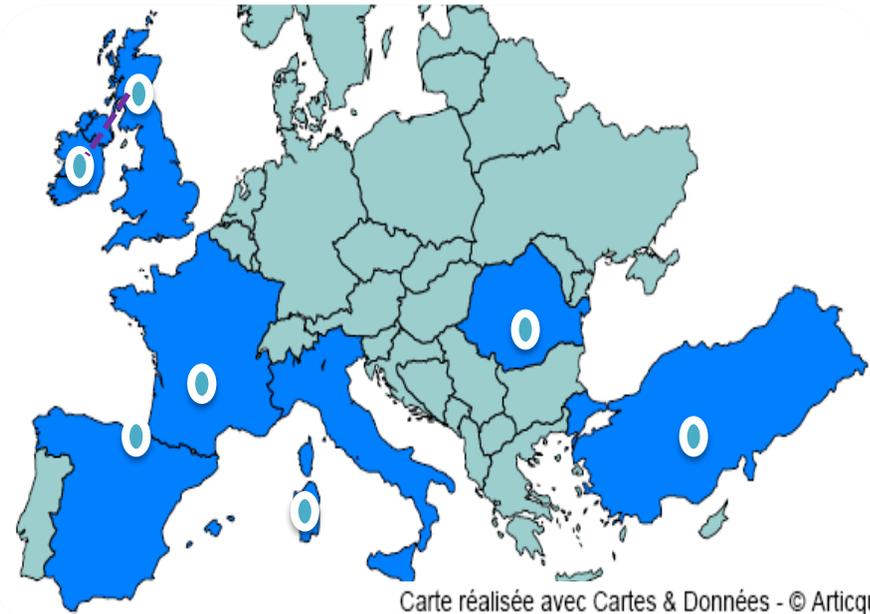
**3. Ireland – Teagasc**

**4. Spain - NEIKER-Tecnalia**

**5. Romania - Banat's University of Agricultural Sciences  
and Veterinary Medicine "King Michael I of Romania" -  
Timisoara**

**6. Italy – AGRIS-Sardegna**

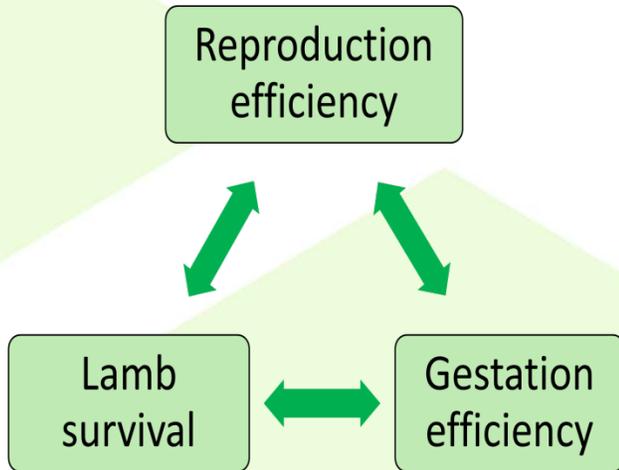
**+ Turkey – TOGEN**



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 727895.



# Main aims of network



- Produce a reservoir of scientific, technical, practical information & best practices
- Encourage knowledge exchange and interactive participation with the sheep community through national and international workshops.
- Develop simple tools for communication:
  - learning materials, web-based tools, interactive platform, designed to help scientists, farmers and advisors/consultants share knowledge and experience.

# SusSheP

## Sustainable Sheep Production



SusSheP



**SusShep is a 3 year ERA-NET European project (2017-2020), with 4 European partners:**

**Norway, France, Ireland & UK.**

*Overall aim: to increase the sustainability and profitability of European Sheep Production by addressing key industry focused problems.*



### Key objectives :

- ❖ Provide **new genetic tools** for farmers to increase **longevity** of ewes.
- ❖ **Quantify labour input and carbon hoofprint in contrasting sheep systems.**
- ❖ Develop more socially acceptable **methods of AI**, looking at **ewe breed effects** (for oestrus, cervical mucus, sperm transport).
- ❖ Maximise **knowledge transfer** and uptake of methods by farming community.

# Animal Future: Steering animal production systems to a sustainable future

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**Animal Future is a 3 year ERA-NET European project (2017-2020), with 8 European partners: Austria, France (x2), Germany, Netherlands, Portugal, Spain & UK.**

*Overall aim: to design innovative strategies for assessing and enhancing the sustainability of animal production systems.*

## **Key objectives :**

- ❖ To quantify at farm level the impact & cost-benefit portfolio when adopting innovative practices
- ❖ To identify the trade-offs between costs and benefits at regional, national and EU levels
- ❖ To develop an evidence-based and easy-to-use tool enabling animal production actors to select the most appropriate innovative practices to achieve sustainable animal production
- ❖ To promote sustainable practices amongst animal production actors

**SRUC HMRC will conduct case studies of hill sheep systems in Scotland to identify innovative opportunities and ways to address any constraints to doing that.**

**SRUC economists will investigate institutional innovative capacity at partner MS level.**